PSYCHOPATHOLOGY AMONG YOUTH IN THE 21ST CENTURY: EXAMINING INFLUENCES FROM CULTURE, SOCIETY AND TECHNOLOGY

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PSYCHOPATHOLOGY AMONG YOUTH IN THE 21ST CENTURY: EXAMINING INFLUENCES FROM CULTURE, SOCIETY AND TECHNOLOGY

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Hidden Drug Abuse in Hong Kong: From Social Acquaintance to Social Isolation

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The present paper examines the issue of hidden drug abuse in Hong Kong. Although official statistics show that the reported number of drug-abuse cases has been in decline in recent years, it has been reported that drug abusers tend to hide themselves at home to take drugs; thus, they are not discovered easily by the law enforcement and social control agents who report drug abuse cases to the Central Registry of Drug Abuse, resulting in the decrease in the reported number of drug-abuse cases. This "dark figure" phenomenon is a reflection of the official figure and reporting behavior, not the actual situation of drug abuse in Hong Kong. Through in-depth interviews of 30 ex-drug addicts, the majority of them started drug taking in early youth, the present paper identifies five stages of drug taking from social acquaintance to social isolation. It argues that although drug taking among abusers is a kind of social activity in their initial stage of drug use, they become socially isolated when their drug use is prolonged. Several reasons are identified, including users' easy accessibility to drugs and changes in the popularity of drugs and use of drug equipment. Most importantly, the hidden process is triggered and aggravated by numerous negative drug effects, such as decline in physical health, weak physical appearance leading to self-perceived discrimination, co-occurrence of psychiatric symptoms of increased anxiety and suspicion, and decline of trust among peers due to prolonged drug abuse. Possible solutions associated with clinical interventions, legislative policies, and law-enforcement operations are proposed.

Keywords: drug abuse, social withdrawal, methamphetamine, cocaine, ketamine, Hikikomori, nighttime economy, psychiatric symptoms

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INTRODUCTION

According to the Narcotics Division of the Hong Kong Security Bureau, the total number of reported drug abusers has been on a steady decline since 2008, a 40% drop was recorded from 14,241 in 2008 to 8,777 in 2015. This number was further dropped to 8,239 in 2016 and 6,725 in 2017 (1–3). Despite this overall downward drug trend, a worrying shift to hidden drug abuse was observed given the continual rise in the age and drug history of newly reported cases in recent years. Factors led to this hidden drug trend are complicated and mutually interactive. On the one hand, tightened government and police measures might disperse large-scale parties into smaller scale, upstairs and difficult to be detected. On the other hand, when psychotropic substances replaced heroin as the most abused options, its less apparent

dependence symptoms and bodily signs might also lower their motivation to seek help until prolonged drug abuse has caused serious harms to their health or everyday life (4). As a result of demand-focused prohibitive actions by law enforcement agencies and increasing supplies of drugs over the years, shifts from public to home-based drug activities, gradual decreases in help-seeking tendencies, and changes in drug preferences have been observed and have all contributed to a far more concealed and hidden drug-abuse problem.

These unintended consequences may be explained as a kind of displacement, which is one of the most prevalent criticisms of "hot spots policing" and related measures launched by the authorities (5). Although quantifying displacement effects require intricate measurements, this phenomenon is often prominently observed to be a result of highly focused police activities (6, 7). In truth, the unintended adverse consequences of implementing anti-drug initiatives and drug control mechanisms are not new concepts. Spatial displacement, substance displacement, policy displacement, creation of black markets, and marginalization of drug users are some of the unintended adverse consequences that have been reported globally (8–10). Studies have discovered that tighter control over several drugs has prompted drug abusers to switch to taking other drug alternatives (11).

Despite being one of the safest and most developed societies in the world, Hong Kong has also experienced some of the worst-case scenarios. In line with research findings in other countries, local studies have observed a sequential relationship between government interventions and police operations as antecedents and changes in drug patterns and nature of drug problems as consequents. In 1990, the Government's Pharmacy and Poisons Board's reclassification of flunitrazepam and triazolam as dangerous drugs resulted in increasing sales of five other unrestricted benzodiazepines (12). In the late 1990s, the legislations and operations that were used to tackle the illegal drug use at rave parties and discos were argued to have inadvertently driven the parties and discos underground (13). The above-reported incidents are mere tips of the iceberg illustrating the effects of displacement and possibly hinting at far worse unreported cases in Hong Kong.

In an attempt to halt the pressing drug-abuse problem that was taking place between 2006 and 2007, the Task Force on Youth Drug Abuse initiated a series of anti-drug strategies and measures that have been adopted by both governmental and non-governmental parties. In 2010, the government injected HK$3 billion (roughly US$380 million) into the Beat Drugs Fund, which was established to help promote community awareness and efforts in fighting against drug abuse (14). In addition, the government spent an additional HK$140 million (roughly US$18 million) on treatment and rehabilitation services and anti-drug initiatives. The services include: (a) expanding the network of counseling centers for psychotropic substance abusers; (b) enhancing the outreach and school social-work services; (c) increasing the capacities of drug treatment and rehabilitation centers; (d) increasing the number of clinical sessions at the substance-abuse clinics; and (e) implementing the Trial School Drug Testing Scheme in the Tai Po District (4, 15). With these resources being invested into undertaking the above countermeasures, the total number of reported drug abusers has significantly dropped more than 50% from 14,241 in 2008 to 6,725 in 2017 (3).

Despite such seemingly promising figures, recent statistics have also indicated that the once "detectable" drug use scenes have only gone "undetectable." It was discovered that newly reported abusers have an average age of 29 years in 2015 compared with 23 years in 2006; they also have an average drug history of 5.8 years in 2015, which is three times that of the 1.9 years recorded in 2008 (1). These figures suggest that enhanced government measures may defer drug abusers to report their situations and received rehabilitation services. At the end, they may become even hidden and harder-to-reach. According to the Survey of Drug Use among Students conducted in 2014/2015, only one in five of the drug abusers sought help from others, and this figure has in fact been dropping disturbingly ever since 2004/2005 (16). More than 80% of drug abusers took drugs at home or at their friend's home; and 56% took drugs at home or at a friend's home only, which was a significant increase in comparison with the 38% recorded in 2006 (1). Moreover, it was repeatedly recorded that drug abusers often perceive drugs as non-addictive and that they are capable of controlling their drug-use behaviors (17). These data not only suggest that the drug abuse problem in Hong Kong still persists but also that abusers' help-seeking tendencies have been diminishing, and they often chose not to report their addictions until their lives were significantly impacted by prolonged substance abuse.

These figures do not suggest a causal relationship between prevention and intervention by various parties and the delayed reports of drug abusers (18). However, they do suggest that the number of drug abusers has not simply decreased but has in fact been distorted due to drug taking by more concealed methods; and that police detection and interventions by social workers are becoming increasingly difficult, if not impossible. In light of these adversities, the present study seeks to (a) review Hong Kong's historical development that led to the present-day hidden drug abuse situation, (b) gain a first-hand understanding of hidden drug abuse from qualitative data, and (c) propose possible solutions associated with clinical interventions, legislative policies, and law-enforcement operations.

History of Drug Abuse in Hong Kong

According to the World Drug Report in 2016, a gradual shift was observed over time on a global level from taking traditional hard drugs to psychotropic substances (19). Similar findings have also been documented locally in Hong Kong. In 2016, while heroin was the local major traditional drug and/or narcotics analgesic (4,036 or 50% of reported abusers), 5,145 or 64% were reported psychotropic substance abusers. Methamphetamine (commonly known as "Ice") was the most common psychotropic substance abused (30%), followed by ketamine (15%), triazolam/midazolam/zopiclone (12%), cocaine (10%), cannabis (5%) and cough medicine (5%) (2). To compare with around 700 million population in Hong Kong (20), only 0.1% were reported drug abusers. Of course, its detrimental

effects to abusers, their families, and society as a whole cannot be measured by the reported number of abusers only.

The following section reviews different periods of drug abuse in Hong Kong since the Action Committee Against Narcotics (ACAN) commissioned the Central Registry in the 1970s to officially collect and record data of reported drug abusers and to present its development in four significant periods, each with distinctive characteristics. That said, it is worth mentioning that these periods are not mutually exclusive as overlapping characteristics could, at times, be found in more than one period. Ultimately, this section arrives at the present-day hidden drug abuse stage that began in the early 2000s but was only first mentioned in 2012 in a government report (21).

Traditional Hard Drug Era (Before 1996)

Since the 1960s, heroin in particular has taken over other hard drugs including opium and morphine to become the most abused drugs in Hong Kong (22). Unlike the older generations of immigrant addicts from Mainland China who used to smoke opium, young abusers born in Hong Kong usually started smoking heroin through cigarette smoking (23). Young abusers began smoking cigarettes in their early teens, and they gradually learnt from their friends to add heroin powder to the tips of their cigarettes for better stimulation. After a period of time, some abusers switched to inhalation (also known as "dragon chasing"), and intravenous or intramuscular injection for even stronger sensations (23, 24).

The prevalence of heroin abuse at the time stemmed from multiple factors. Owing to the quick physical dependence on heroin, the abusers would easily spend more money over time on both cigarettes and heroin (23). Besides, psychosocial factors, such as peer drug use, family drug use, susceptibility to peer pressure, sensation-seeking, distorted perceptions of adverse consequences, and intentions to try other substances were all found to be highly associated with heroin use (25).

Although heroin continued to be the most popular drug throughout 1980s to early 1990s, its predominance gradually declined (12, 24), and benzodiazepines, marijuana, barbiturates, pethidine, and methaqualone all emerged as other common drug options that have been reported (12, 23, 25). Since then, polysubstance-abuse began. Along with the rise of rave culture, the popularity of these traditional drugs including opium, morphine and heroin faded over time.

Cultural Rave Party Era (1996–2001)

Rave culture, as a mixture of dance, music, drugs, youth culture, and deviance culture, first appeared in Western countries in the 1980s and came to Hong Kong in late 1990s (17). A "rave" generally refers to a large-scale dance party at a nightclub or dance club, and it typically consists of hundreds of partygoers at once. At the time, the lack of regulations of this newly emerged form of party culture, hence a high degree of freedom, facilitated its rapid growth and popularity among young people. The number of recorded party and disco drug users also increased with this rising rave culture. During this period, the number of reported drug abusers under the age of 21 rose from 18% in 1996 to 22% in 2001. The leap was the most critical from 2,482 (15%) in 1999 to 4,019 (21%) in 2000 (20).

The dance and music elements, as well as the light shows of these large discos and parties, also brought about changes in drug users' preferences for drugs from the previous era's hard drugs to this era's psychotropic substances (often known as "club drugs" or "party drugs") (26, 27). In Hong Kong, while heroin was still the major substance taken at the time, usage of party drugs, particularly ketamine and MDMA ("ecstasy"), grew at exponential rates during this era (20). These psychotropic hallucinogens and stimulants were taken to boost users' energy levels and to enhance their sensory experiences throughout the rave parties (28).

Lam et al. (17), a study commissioned by the Action Committee Against Narcotics, revealed that many young people at the time saw drugs and raves as a pathway to social life; they perceived the act of taking drugs at parties and discos as a recreation, a ritual, and a social activity. As a result, they generally showed greater acceptance of substance abuse and also often went and took drugs at parties and discos with their friends rather than going alone. Under the influence of peer pressure, taking drugs together became a means to bypass social inhibitions, seek social recognition, and gain inclusion with peers (29, 30). Rave partygoers and party drug taking were not unique to marginalized youths (characterized as those without a stable relationship or a full-time job), it also happened among youths from intact and relatively well-off families (31, 32). They treated drugs as a means to cope with frustrations in life and as a substitute for a meaningful lifestyle (32). Other reasons such as curiosity, happiness seeking, boredom avoidance, and expression of anger or unhappiness were also reported (17).

Dispersed Party Era (2001–2007)

In response to the emergence of the drug-related issues associated with rave culture, a range of legislations and operations were undertaken to monitor party and disco events. The Task Force on Psychotropic Substance Abuse and Task Force on Youth Drug Abuse were two of the most influential countermeasures commissioned during the early to mid-2000s to investigate and formulate plans against the increasingly worrying drug-abuse problem. However, it was soon found out that these parties had scattered over the city, transforming into smaller parties, and the regulations by legislative departments and police activities might have ultimately done more harm than good (13).

Since many attendants saw the freedom to use drugs as a significant part in parties, both club/disco owners and partygoers had to adapt to the increasing control of law enforcers over drug use in clubs and discos. Instead of large-scale, licensed clubs and discos, parties were run in small-scale, unlicensed commercial, and private residential apartments. CCTV cameras were installed at the front doors to check visitors' identities, and only those known by the party organizer(s) were permitted entry (17). Although the music, dance, and drug events still occurred as they did in large raves, these parties caused great complications for police's detection because the properties are often commercially or privately owned. Even if the police are authorized to search the premises, party organizers could quickly adapt to other

alternative locations. Such adaptation is often known as "Balloon Effect" (33). When large-scale parties and discos were harshly monitored, party/disco owners moved upstairs and re-opened in other locations with smaller-scale. Hence, it would be an endless search requiring endless resources to yield significant impact on the overall drug-use situation.

During this era, in response to tightened police activities, party organizers and goers dispersed to even hard-to-detect locations including (a) resort house, located in remote locations, in which it is rented and decorated into mini-discos where partygoers are offered a variety of drugs; (b) cyber cafés where normal cafes are turned into a disco and/or party by their staff after their normal opening hours; and (c) "drug buffets" and "drug cocktail parties" at drug dealers' warehouses, where a wide variety of drugs are available for consumption at the same time (17). In comparison with the rave party era, the drug preferences and the reasons for consumption were the same, but the parties' degrees of secrecy, locations, and scales all changed. As a result, control of substance use became even undetectable and uncontrollable.

Hidden Drug Use Era (2007–Present)

In the last decade, commercial and residential rental and property prices in Hong Kong continue to boom to unaffordable levels (34, 35). This might further change drug dealing activities even smaller, localized and dispersed everywhere. Assisted by internet and smart technology development, drug dealing became even more convenient, tailor-made and user friendly with orders through social-media applications and home-based delivery services (36). In that situation, abusers of the current era began to take drugs in even more concealed yet less organized settings. Recent figures have shown drastic changes in localities of drug abuse, from discos, karaoke parties, and public areas to abusers' homes and friends' homes. From 2007 to 2015, the number of drug abusers who took drugs at home and/or at a friend's home increased from 73 to 80.7%. This figure was even more worrying for abusers under the age of 21, as the percentages leaped from 59.8% in 2007 to 80.4% in 2015 (1).

Without parties and dancing, home-based drug abusers sought greater mental stimulations but not as much physical energy enhancement, they began preferring stronger mental stimulants over "party drugs" such as MDMA ("ecstasy"). In line with such observations, statistical figures reveal a rapid rise in the use of methamphetamine (or "Ice") and cocaine among drug abusers (1). Since 2015, "Ice" has taken over ketamine as the most popular drug option by the reported abusers, while ketamine continues to be a common drug in the present era when its supply is still constant (37). Drug demand is likely linked to drug supply. In recent years, drugs taken in Hong Kong are more available cross-border from Mainland China. In particular, "Ice" is a chemical which can easily be made in laboratory setting with mass production. Thus, it is relatively inexpensive and even more affordable especially for younger abusers. However, it is also an addictive stimulant possibly causing for serious psychotic symptoms (38). Long-term abusers likely concentrates on drug taking obsessively to an extent of neglecting other aspects of their everyday living. These abusers also do not wish to be seen using the specific required equipment such as bottles and straws with filter water to consume the above drugs, they are driven further into hiding in home-based locations to abuse drugs.

Due to the accessibility (app-based order and home-based delivery), availability (sufficient supply) and affordability (inexpensive) of psychotropic substances in the present era, factors led to even concealed patterns of drug abuse are complicated and less clear. Until this moment, nearly no research has been done to gain understanding at greater depths. While the Central Registry of Drug Abuse provided yearly reports detailing the drug-abuse situation statistically, one could only hypothesize and indirectly infer the hidden drug problem by reviewing multiple statistics at once, such as increased age of newly reported abusers, longer abuse histories, and rise of psychotropic substances. Thus, the present study also attempts to shed some light into this research void in addition to the study's practical implications as mentioned previously.

MATERIALS AND METHODS

In order to explore the reasons for hidden drug abuse in Hong Kong, a qualitative study involving interviews with a total of 30 ex-drug addicts was conducted in 2017. After the study was approved by the Research Ethics Committee of City University of Hong Kong (9211123), the ex-drug addicts were invited to participate in the study through referrals from a non-governmental organization and a church group, which have provided services for drug abusers. Due to the unique nature of the participants, purposive sampling was used. After receiving written informed consent from the participants, interviews were conducted by a researcher and a research assistant through a semi-structured questionnaire that included socio-demographic data and drug-related questions, such as types of drugs used, age of first drug taking, frequency, reasons, and venues of drug taking. The interviews were conducted in a community-based aftercare counseling center or a university research office. Each meeting, lasting from 1 to 2 h, was audio-recorded. The recordings were later transcribed with anonymity by a research assistant. The transcriptions confirmed by the researcher who conducted the interviews were then read and coded with the method of thematic analysis. Initially, the transcripts were read line-by-line to develop possible themes and patterns, such as different phases of hidden drug abuse, for the later stages of data coding and analysis. When a consistent thematic coding system was developed, the next stage of intensive data reading and coding began. Themes developed (from social acquaintance to social isolation) and quotations selected are used to illustrate the stages of hidden drug abuse happening in Hong Kong in the last decade.

Characteristics of Participants

Among the 30 ex-drug addicts who participated in the study, males accounted for 56.7% while females accounted for 43.3%. As shown in **Table 1**, 40% of the participants were aged 21–30 and another 40% aged 31–40. The frequency of taking drug was serious. The participants who took drugs more than once every day accounted for 62.1%. Crystal methamphetamine (Ice) was the most popular drug abused, accounting for 62.1% in total.

TABLE 1 | Demographic and drug-use data of research participants ($N = 30$).

Variable	%
GENDER	
Male	56.7
Female	43.3
AGE	
11–20	20.0
21–30	40.0
31–40	40.0
FREQUENCY OF TAKING DRUGS	
Less than 3 times per month	10.3
1–2 times per week	13.8
3–6 times per week	3.4
Once per day	10.3
More than once per day	62.1
TYPES OF DRUGS TAKEN	
Crystal methamphetamine (Ice)	62.1
Cocaine	57.1
Ketamine	56.5
Heroin	23.3
Nimetazepam	26.1
Cannabis	20.8
Ecstasy	28.0
Others (Triazolam, Methaqualone, cough medicine)	23.3
AGE OF FIRST DRUG TAKING	
11–20	85.2
21–30	7.4
31–40	7.4
DURATION OF TAKING DRUGS (YEARS)	
<3	30.0
3–5	16.7
6–10	16.7
11–20	30.0
>20	6.7
DURATION OF ABSTINENCE AFTER LAST DRUG TREATMENT (YEARS)	
<1	73.3
1–3	6.7
4–8	13.4
>9	6.7

Cocaine and ketamine were also popular, accounting for 57.1 and 56.5%. When asked about their drug-taking experience, 85.2% of the participants first took drugs when they were between 11 and 20 years of age. The duration of drug-taking varied among the participants: 30% of them had less than 3 years of drug-taking experience, 30% between 3 to 10 years, and another 30% between 11 and 20 years. The majority of them could not keep a long period of abstinence after their last drug treatment. About 73% of them maintained drug free for <1 year before the interview. However, because of the unique feature of drug abuse, drug addicts will normally relapse after drug treatment, and thus it is difficult to assess the period of genuine abstinence.

The majority of research participants took drugs mainly because of peer influence and feeling bored or depressed, and most of them took drugs at home or entertainment places (**Table 2**). The choice of location by participants for their drug use based on their primary reasons are presented on **Table 3**. There was a higher number of participants choosing to use drugs at home when the primary reasoning behind it was attributed to internal factors such as feeling depressed, while the reason for drug use at other locations was seen more often to be external such as peer influence [$\chi^2_{(1,N=30)} = 4.74, p < 0.05$].

RESULTS

Through the thematic analysis, we eventually identified five stages of drug taking. Stage 1: The first exposure to drugs was usually at a social event (entertainment and other public places). Stage 2: The social usage of the drug combined with the events allowed them to meet more people, including the drug dealers. Stage 3: After they know the drug dealers, they gain direct access to the drug supply. They start to take more drugs at a higher frequency. Stage 4: The side effects of drugs start to become apparent, including physical weakness, co-occurrence of psychiatric symptoms, such as anxiety and suspicion of others. Stage 5: They isolate themselves from their peers to attain peace while still dependent on the substance, thus encountering a hidden drug-abuse phenomenon. The five stages are described below:

Stage 1: Passive User—Using Drugs for Social Purposes

Participants often recall their first experience of a substance in relation to social events. During this stage, they are passive and are likely to follow or listen to their peers in the group. They express a desire to conform to drug-taking for the social recognition of their peers. Usually, they watch the other members of the group take the drug and observe for the outcomes. When they see the drug users become high with no apparent adverse effect, they decide the drug is "safe" and they follow.

> I frequented discos with my brothers in 1998. All of them were doing ketamine at that time and gave me some to try. I was doubtful and hesitated because I was afraid I would be addicted to it. But since my brothers asked, I thought I should try it because my brothers would not betray me. It would not be a big deal if I just did it occasionally when I was out with them. (Participant A, > 20 years of drug taking)

> I didn't know what the concept of drugs were at that time, just that my friends took them, so I followed. After taking them, they would act strangely, which was hysterical. During that time, they appeared fine to me after taking it, so I had nothing to be afraid of and took the pills like they did. Drugs to me at that time was just a kind of entertainment to kill my boredom and enjoy a good time with my friends. … After several years, my friends went from pills and weed to heroin, so I followed suit. (Participant B, 11-20 years of drug taking)

During this stage, drug taking was restricted to social events due to the limited access to the drug supply (only through their peers).

TABLE 2 | Reasons and venues for drug taking.

Variable	%	%	%
Reasons for Taking Drugs	**Most important reason (*N* = 30)**	**Second important reason (*N* = 20)**	**Third important reason (*N* = 18)**
Peer influence	46.7	15.0	11.1
Feeling bored or depressed	20.0	35.0	33.3
Release pressure	3.3	15.0	16.7
Refreshing	13.3	5.0	16.7
Curious	6.7	15.0	5.6
Seeking excitement/pleasure	3.3	10.0	5.6
Family influence	0	5.0	5.6
Losing weight	3.3	0	0
Others	3.3	0	5.6
Venues for Taking Drugs	**Most common place (*N* = 30)**	**Second common place (*N* = 17)**	**Third common place (*N* = 13)**
Own home	36.7	29.4	15.4
Friends' home	20.0	29.4	30.8
Entertainment places	30.0	17.6	30.8
Public places	3.3	11.8	23.1
Workplace	3.3	11.8	0
Others	6.6	0	0

The user feels he has control over the drugs, and the drugs are used for mood enhancement (psychedelic effects).

> It was only limited to when I was out partying, never at home nor when I was alone. I took it for the happiness in party, so there was no point doing it alone. (Participant C, 6-10 years of drug taking)

> Frequently after work, we would gather in a karaoke room to party and take ketamine together. Using ketamine made me feel very happy when I was with a group of friends that I could share laughter and joy. (Participant D, 11-20 years of drug taking)

> I started using drugs at age 17 when I frequently partied with my brothers at the disco. They all took ecstasy in order to get high. At first, I didn't want to take it but because they all took it and I wanted to fit in, I tried so they wouldn't treat me as an outsider. Actually, I only took them when I was out partying. When I was around 18 or 19, some people in our triad gang introduced us to ketamine. They said the effect lasts longer than ecstasy, so I started taking ketamine too, but still only limited to parties. (Participant E, 11-20 years of drug taking)

Stage 2: Active User—Expanding the Social Network

This stage is characterized by increased social acceptance by the drug peers. The psychedelic effects of the drug create a sense of emotional warmth toward their peers that shortens their social distance. They described it as feeling very truthful and being able to share their feelings with no worries of discrimination against one another and thereby developing trust. They share a bond and refer to one another as "brothers" and "sisters." Their peers were dear to them, and they were willing to give generously to them and accomplish difficult tasks for them.

TABLE 3 | Participants' drug choice locations by their primary reason for drug use.

Reasons	Home	Other Locations[a]	Totals
External [b]	3 (5.9)	13 (10.1)	16
Internal [c]	8 (5.1)	6 (8.9)	14
Total	11	19	30

$\chi^2_{(1,N=30)} = 4.74, p < 0.05$

Expected values are presented in parentheses.
[a] Any locations not at home were considered as other locations including: friend's home, school, work, public area, entertainment, and others.
[b] External reasons include: peer influence, family influence and others.
[c] Internal reasons include: curious, feeling bored or depressed, relieving stress, refreshing, and seeking excitement/pleasure.

> When we took meth together, we became very honest and told one another truthful feelings deep within our hearts. Therefore, meth more or less had a great value: It helped bond my relationship with my sisters. For one, we needed to chip in together to share the drugs. Two, taking meth gave us a chance to communicate on a deeper level, allowing our relationship to flourish. (Participant F, 3-5 years of drug taking)

> After taking it, I became very high and passionate, and I would start telling my friends truthful words. It felt like my ability to express improved greatly. I became like another person. I became very passionate and talkative because of the drug … Actually, maintaining these friends was just an excuse for me to take drugs. I liked the feeling after taking drugs because drugs made me very courageous, allowing me to have the courage to speak

from the heart and how I felt. (Participant G, < 3 years of drug taking)

The drug users actively use a substance, as it becomes a normal behavior during the party, like opening a bottle of wine.

At first, I only took drugs with a whole bunch of friends down at disco. Taking drugs was part of the partying experience. (Participant H, < 3 years of drug taking)

At first, drugs were like opening a bottle of wine when people have celebrations, where instead of wine, we used drugs. (Participant I, < 3 years of drug taking)

At first, we just treated them like drugs, as a form of entertainment, like when people ordered a bottle of wine at parties; we just used drugs instead. (Participant B, 11-20 years of drug taking)

In this stage, the users feel the drugs reinforce their positive experiences at the parties. They use them more frequently at social events, while also expanding their social network.

I was very happy suddenly gaining many friends, so I continued going to the discos for fun every day. With the help of drugs, I felt like my relationship with others were much closer, and I suddenly had many friends by my side. (Participant G, < 3 years of drug taking)

I felt very happy for this kind of change. Therefore, in order to "extend" this kind of happiness and the greater number of friends that the "drug-induced change" brought, I started becoming addicted to drugs. You may say some people sought out drugs to resolve their unhappiness, but I was the opposite.... During that time, drugs were just a party booster, a necessity for socializing and entertainment. Without drugs, discos weren't actually that fun. But with drugs, emotions would become very high and it would be more fun. Friends would become closer and the atmosphere would be wild. (Participant J, 11-20 years of drug taking)

The *accessibility* to drugs is a factor contributing to their active drug use. They eventually meet the drug dealers and gain direct access to the drug supply network. The drugs can now be acquired whenever the users desire, unlike in the "passive user" stage, where it is acquired only when offered.

Whether you are taking meth, or ketamine, it must start as a group of people taking it together. This is because they need at least one person in the group who knows where to get the drugs. As you take more, you will start to meet people that can buy drugs directly from drug dealers. Now, dealers offer "drug delivery service" anytime, anywhere. (Participant K, < 3 years of drug taking)

Although many triad gang members do not take drugs, they can get drugs from the underworld easily. (Participant E, 11-20 years of drug taking)

The dance school I worked at was in Jordan, and there was a drug den nearby. A friend told me about this place... I went from using a little, when occasionally meeting up with my ex, to several times a day, using more each time. (Participant L, 3-5 years of drug taking)

The drug becomes *affordable* when it is directly obtained from drug dealers. Furthermore, the cost may be shared among the group, making it even more affordable and attractive as an option over other consumables.

I could get the drugs at a cheaper price because I was in a triad gang. (Participant M, 11-20 years of drug taking)

Drinks are so expensive in nightclubs, and sometimes K (ketamine) is cheaper than cola because we can share the drug expenses but we can't share drinks. (Participant N)

The drug also becomes readily *available* to the user. When there is a supply of drugs at their disposal, the users become tempted, thinking there is little harm in taking a small amount.

Whenever I felt wronged at work, I had this great urge to do some meth during lunch hour... Later, I became a part-time escort, I felt even worse and my days were harder to get by. I took meth even more frequently and in greater amounts. Whenever I was unhappy, I instantly bought meth. Since I lived and worked in Mongkok (where triad gang activities are serious), I could easily get an order by a phone call. Whenever a negative emotion struck me, I could cope with it using drugs anytime and anywhere. (Participant H, < 3 years of drug taking)

We had a lot of ketamine in stock to package, so we would take a little each time. However, when you take a little bit yourself every time you package, the amount you take became more... Eventually, it went from simply a party drug to frequent usage. (Participant E, 11-20 years of drug taking)

Little by little, the initially passive users seek to reinforce their positive experiences through actively using substances. At the same time, drugs are readily accessible, affordable, and available.

Stage 3: Regular Abuser—Use of Drugs as a Habit

In this stage, the drug users start developing a patterned usage. They have become addicted. During this stage, they might move on to other drugs (meth and cocaine) to counteract the dependency on the initial drug. They also need a bigger "hit" because they have developed tolerance to the previous ones.

Ever since I became feelingless after taking this problematic ecstasy, I started using meth to enhance my kick out of drug. (Participant J, 11-20 years of drug taking)

Some of these newer drugs (meth) were somewhat inconvenient to use in public because of the tools (glass pipe and snuff kit)

and space required. At first, the drugs (ecstasy and ketamine) were simply something they could take on the spot to elevate the partying mood. Now, they need a "hidden space" that would shield them from the public eye. They commonly use a friend's place to gather and use drugs for this privacy and convenience.

> At first, I took it with a bunch of friends at their house instead of a disco. Meth isn't convenient to use at a public place because you need a set of tools for consumption. That's why when we started using meth, we used it only at a friend's home. (Participant G, < 3 years of drug taking)

> The nightlife places with high privacy are extremely attractive to drug users because it's easier for them to use drugs that require more tools, like meth and cocaine. These venues offer a place for them to set up camp to use these kinds of drugs. Ketamine, on the contrary, can be used anywhere, conveniently. I think these private clubs are just a product of a change in the drug market. (Participant C, 6-10 years of drug taking)

As their drug-taking behavior continues, they start to use drugs alone because they need it frequently to cope with personal problems.

> When I started taking the leftovers home, I slowly got used to taking alone. Most of the time, I hid myself and took it alone when I was unhappy at work or at relationships. Other times I would find my ex or guys who liked me in order to take drugs, so I could express my emotions. (Participant L, 3-5 years of drug taking)

While under psychedelic influence, the participants found themselves performing random menial tasks such as cleaning. They achieve a sense of peace and quietness from shifting their mental focus from personal to unimportant issues. They feel accomplished when the task is completed, which may reinforce drug use. In order to be focused, they need to be undisturbed by their peers.

> Meth made me feel at peace, allowing me to focus, although what I did after taking meth was mostly nonsense. For example, I once disassembled my phone and tried reassembling it. (Participant O, 3-5 years of drug taking)

> After using meth, my brain became very active. I had a lot of problems to worry about, but because my mind wanted to do a lot of things unrelated to those problems, it drew my mind away from the worries. I tended to stay focused on doing nonsense when I was on meth, like washing the toilet repeatedly. Whenever I completed a task while on meth, I would have a sense of achievement. It also helped me pass boredom quickly and shorten my sense of loneliness. (Participant P, 6-10 years of drug taking)

At the same time, other drug peers present are also under the influence. They would be deeply engaged in their own tasks, trying to find peace. Since the effect of the drug varies from person to person, the calming effect on one person might cause disturbance in others. One person might experience slurred speech and bother someone else who is trying to focus on cleaning. At this point, the users seek to take the drugs alone. The drug peers gather together initially to enjoy a social event but now they seek to be at peace alone.

> But you should know, the effect from taking meth differs for everyone. Some will keep talking non-stop, in a mumbling fashion. To be honest, no one can distinguish what he is saying, but because he is one of our brothers, ignoring him seems like a bad thing even when deep inside I find him to be annoying and a nuisance. Maybe my temperament is a bit irritable; emotions would fluctuate very high and low. So, meth gave me sensation of peace. It allowed me to focus in my own world and attain peace. (Participant C, 6-10 years of drug taking)

> Meth is like a loudspeaker, increasing your mood. Everyone's reaction differs; some people will keep talking, others will keep cleaning, so it will more or less create some nuisance. One of the reasons of taking drugs is the hope to have their own space. It is very natural that the drug abusers do not want to be disturbed by the abnormal behaviors incurred by other people's drug taking. Therefore, when we don't need to rely on our friends in getting drugs, the desire to taking it with friends decreases. (Participant Q, 6-10 years of drug taking)

Stage 4: Suspicious Abuser—Loss of Trust

The users start to reduce their social exposure because they prefer the peace associated with being alone. With prolonged periods of drug taking, psychiatric symptoms such as anxiety, high suspicion, and persecutory delusions emerge. They often suspect that other people are discriminating against them.

> After I took drugs frequently, my suspicion towards others increased. I always suspected the hidden meaning behind people's words. Even though it looked like they talked normally to me on the surface, I seemed to hear their deeper thoughts, which were negative and discriminatory. I began to lose trust on others, losing friends one after another. (Participant R, 11-20 years of drug taking)

The original social atmosphere that brought the peers together becomes tense. They would argue with their peers over drugs, whereas they once share a deep bond. They become wary and selfish, suspecting their peers of taking advantage of them. They are not willing to give generously to one another and instead are focused on the portion of drugs they receive. There would be confrontations when the drugs are not evenly distributed.

> At first, I was happy to use it with a bunch of friends, like when we were at a disco taking ecstasy. We became closer to each other. As time goes by, my relationship with meth-using friends worsened. I don't know if it was because of the drug itself or the distribution of it, I started to become skeptical about these friends. Drugs had turned me into a selfish person. In the past, I could take a bullet for my friends. I didn't mind to give. If they didn't have any money, I would steal and mug in order to get money to help them. After taking meth for a while, I started to feel that what I gave was not proportional to what I received. I started to feel these friends only wanted to take advantage of me. I started to stay away from them and rather hid home alone and used meth. I didn't want to see

these friends anymore. Thus, I became used to taking drugs alone, away from the others. (Participant S, 11-20 years of drug taking)

I don't know if drugs would make people become selfish. Meth caused arguments among my friends. I remember that time when a girl friend of mine took some of my meth without paying, I felt very angry. Drugs became like money to us, damaging our relationships whenever it involved "money." Ever since I needed bigger dosages, I had become more selfish and calculating. For example, usually we distributed meth evenly, but if someone got a bigger portion of the drug, we would have a big fight. Drugs were supposed to bring every one of us closer to each other. Ironically, our relationship took a turn for the worse because of drugs. I lost a friend because she took my drugs without paying. She was too embarrassed to show up or find me again. (Participant F, 3-5 years of drug taking)

They lose trust in those drug peers that they are once willing to do anything for. They do not need their social network anymore. They further alienate themselves to avoid the negative feelings.

Stage 5: Hidden Abuser—Complete Social Withdrawal

During this stage, the physiological and psychological damages from prolonged drug usage become apparent. Participants spoke of decline in physical health after prolonged usage to the point where their work and social lives suffered. They had to stay home to avoid social embarrassment. They cut unnecessary social ties and avoided social events resulting in isolation of themselves.

I hid myself even more for this relapse. I couldn't even go out because of my damaged bladder. Sometimes when I went out with my boyfriend, the urine would seep into my pants or dress even though I used panty-liners. I had to get off his car to go to the bathroom frequently. I felt embarrassed when some of my urine seeped through onto my boyfriend's car occasionally. Every day, the greatest challenge when going out was to find a toilet when I was pressed. I was afraid of having urine on my clothes, leaving behind urine on the seat of public transports, or having urine stink to attract the unwanted attention. At this point, I couldn't stand it anymore. (Participant D, 11-20 years of drug taking)

In this stage, they become weak and lethargic. Their physical appearance makes it very clear to the public that they are drug abusers.

My energy has gone a lot worse because of the drugs. I couldn't work. I didn't want my gang brothers to think I was useless so I didn't want to see them either. I used drugs all by myself. (Participant T, 6-10 years of drug taking)

Actually, taking drugs would make the physical appearance look lifeless. People could tell I was a drug addict right away. (Participant E, 11-20 years of drug taking)

Since I needed cocaine anytime or anywhere, I always hid myself and took drugs alone. First, I wanted to avoid others' judgment. I felt like even non-drug-takers could tell who is a user based on a user's physical appearance. (Participant R, 11-20 years of drug taking)

The drug abusers feel that others treat them differently for that reason. They feel they are being judged and discriminated against. The constant negative treatment forces the users to retreat and stay in their hiding places. Their self-esteem suffers because they feel they are always stigmatized. Even their close friends, who are engaged in other non-drug-related illegal activities, seem to be very judgmental on their drug-taking behavior. The drug abusers often choose social avoidance and further alienate themselves in order to escape from this self-perceived discrimination.

I have a big ego, so I cared a lot about how people looked at me. It was also because I identified myself as a big brother in a triad gang. Therefore, ever since I got addicted, I didn't want to be with people who aren't users. I felt they would mind that I am a substance user, and if I would be looked down on, I would rather avoid them. (Participant M, 11-20 years of drug taking)

When I was addicted to cocaine, I felt everyone on the street was judging me. I had to work in a karaoke bar and nightclubs as a sex worker because drugs increased my expenses significantly. Even the other girls who worked with me discriminated me because I was a drug user. Second, when I needed drugs all the time, friends didn't matter to me anymore because whenever I needed drugs, I just hid myself and used it alone. (Participant U, 3-5 years of drug taking)

You know our society discriminates against drug addicts, even gang members discriminated against me. When I started becoming addicted to meth, I always stayed home because I didn't want to be discriminated against by others. This had never happened when I was using ketamine. (Participant A, > 20 years of drug taking)

The symptoms associated with prolonged drug abuse include anxiety, panic, fear, hallucinations, and suspicion of others. This is usually referred to as "dual diagnosis" or "comorbidity," denoting co-existence of any psychiatric and substance-use disorders in the same individual (39, 40). They are always on the edge and feel like they are being followed when they are outside. They avoid going outside and retreat into their safe haven. They continue to depend on the substances but it could be days or even weeks before they leave their home again. As a result, they become hidden from the public while still depending on the substance.

My social withdrawal was because taking meth gave me a sense of panic. I became overly sensitive to my surroundings—even when my neighbor opened their door, I would mistake it as police breaking into my home. This feeling stopped me from wanting to go outside. The streets were full of people. The meth-caused panic made me resist going outside. The longest I stayed inside was a whole month—I did not even open the door for once. (Participant V, > 20 years of drug taking)

Cocaine gave me hallucinations. It didn't when I first started taking it, but after I took more, I was constantly paranoid about being stalked. Furthermore, I felt panic all of a sudden, like police would suddenly arrest me; or my big brother (from triad gang) would know I stole his money and order people to kill me. These

hallucinations occurred every time I took cocaine and they lasted longer the more I took, so I didn't dare going out and stayed home instead. (Participant W, 6−10 years of drug taking)

DISCUSSION

The present study identified within their population five stages of drug taking of habitual drug users. It demonstrates peer influence as the major factor for first exposure to drug use. Positive psychological rewards induced by drug use, such as getting high, the drug sharing and gifting among drug peers, enhance their trust and solidify their relationships. Drugs are initially inaccessible to average people until they "meet" a user. Coupled with peer influence and other factors, the individual tries drugs for the first time. The positive social reinforcements they experience encourage repeated use. Drug access is limited initially, causing the user to take on a passive role, but it changes after the user gains direct access by meeting a drug dealer, thus encouraging the user to use drugs regularly. However, the abuse eventually causes the existence of suspicion and mistrust in peers, damaging the bonds with those drug peers. Furthermore, the continued abuse causes physiological and psychological complications that also force the abuser to retreat into social isolation, resulting in the phenomenon of "hidden drug abuse."

The hidden abusers may not appear to impact society initially as they go into hiding. However, prolonged abuse will induce associated psychiatric symptoms, including persecutory delusions and auditory and visual hallucinations, which further trigger depression, leading to social withdrawal. Social withdrawal may also reduce their desire to seek help, allowing the aforesaid prodromal symptoms to worsen and requiring more resources to manage later. In addition, majority of this sample used "Ice." It has reported that meth users display mental disorders such as depression, attempted suicide, anxiety, and aggressive behaviors, including problems controlling anger, violent behavior, assault and weapons charges (41). Similarly, participants in this study have mentioned hallucinations of being stalked or police trying to break in, which can eventually trigger "self-defensive" responses, leading to tragic outcomes.

The nighttime economy plays a controversial role in drug-taking behavior. On the one hand, the nightclub was an important venue for passive drug users to gain their first drug experience. Consistent with numerous Western drug research studies (42, 43), the popularity of psychotropic drugs, such as ecstasy and ketamine, is highly associated with the dance culture (44, 45). However, the nighttime economy in Hong Kong started to decline in the mid-2000s. A series of police crackdowns on illegal businesses in discos and frequent inspections in nightclubs seriously destroyed the nighttime economy, resulting in the decrease of drug use in public places. On the other hand, the decline of the nighttime economy displaced the drug-taking activities from semi-public to completely private settings, resulting in the emergence of hidden drug users. Unlike the Western night-time economy where drug taking is often found in "semi-open" fashion in clubs (46), the present study reveals that frequent drug abusers tend to buy drugs through their personal networks because of the affordability, accessibility and availability of drugs. The more drug experience they have, the larger their drug social networks.

Therefore, police crackdowns on drug users in the nighttime economy simply do not help in changing drug-taking behavior. An increase in the law enforcement resources targeting drug supply and distributions is necessary. Moreover, the choice of appropriate policing strategies is crucial. While it is generally believed that hotspot policing against drugs and prostitution would result in the reduction of such crimes in public spaces, the reality is that it would result in the displacement of crime (47) or increase the harm to drug users, such as unsafe injections (48). Furthermore, the police crackdowns on the nighttime economy indirectly foster the growth of the hidden drug abuse phenomenon, and such secretive situations in turn increase the vulnerability of the abusers. Therefore, intelligent policing strategies should be used to detect and prosecute importers, suppliers, and traffickers of dangerous drugs (49).

Various management strategies will be required to target the different stages of drug abuse. First, prevention strategies need to target youth to prevent their first exposure. As our data confirms, the teenage years are when they are most likely to be exposed to drugs and face peer influence. Extra care is necessary from teachers to identify teenagers at risk of illicit activities. Guidance and after-school social activities are important for the teenagers to stay engaged in society. Resources will be required to assist youths to reduce the risk of exposure to drug users as they exit the formal educational system to transition into society. It is clear that there is an initial desire (albeit lost later) for social recognition by these drug users as they acknowledge that drug taking is reinforced at social events.

The above findings infer that the abuse of psychotropic substance may be driven by underlying psychological and mental health disorders or promote the development of psychological and mental health disorders (39, 40). It becomes imperative for practitioners in the corrections, health, and substance abuse treatment fields to recognize the dual nature of drug abuse. Treating the underlying mental disorder in addition to substance-use disorder is necessary for full recovery. Integrated and multi-disciplinary treatments that address both conditions simultaneously should combine with social efforts to target the external stress (expressed through performing menial tasks to achieve peace and escape) that may prompt repeated usage (50). Promotional campaigns to raise public awareness of the labeling issues may help address the social stigma associated with drug use and reveal these difficult-to-reach "hidden abusers." This can reduce the fear and discrimination against drug users and encourage them to seek help proactively, thus reducing their social isolation that may contribute to the development of mental disorders.

Policing drug use in the last decade was likely to have contributed to the unintended consequences that drug abusers transitioned from having social events at commercial locations into hidden users at private locations. The resulting hidden and low observable numbers of users make the policing activities seem successful. In reality, the users have simply dispersed into hiding. Their illegal activities continue but remain unnoticed because of slow and progressive social withdrawal.

Though they may "reappear" eventually, it is often already too late because criminal activities are involved. Moreover, hidden drug abusers often have a high prevalence of dual diagnoses (39, 40, 51). The co-occurrence of mental and substance-use disorders only further worsen their frequency of relapse, resistance to drug treatment engagement, high rate of hospitalization, and involvement in crime (52, 53). To stop the high social cost incurred from hidden drug abuse, multi-disciplinary efforts are required by the education, health, social, corrections, and police sectors targeting youths for preventive measures and seamless transitional support services from school-to-work, from incarceration to aftercare, and from hospitalization to community rehabilitation. Last but not the least, resources also need to target raising awareness to reveal these "hidden abusers" and provide them with dual treatments, handling their mental wellness and substance use simultaneously.

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CT is responsible for data collection and paper writing (30%). SK is responsible for data collection and analysis (30%). TL is responsible for data analysis and paper writing (30%). SL is responsible for data analysis (5%). GL is responsible for data collection (5%).

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Personality and Social Context Factors Associated to Self-Reported Excessive Use of Information and Communication Technology (ICT) on a Sample of Spanish Adolescents

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The vulnerability that characterizes adolescents justifies the growing health concern about the impact of excessive use of ICT. Exploring the roll both psychological and social variables in excessive use of ICT in adolescents can help preventing risk behaviors. Examining the ICT use of 1,102 secondary school, baccalaureate and professional training course students (11–18 years old, *M* = 14.42, *Sd* = 1.78; 50.58% boys), we investigate the psycho-social profile of those adolescents who have self – reported an excessive use of ICTs. Personality factors were assessed using the NEO-FFI, and social context factors through the PWI (Personal Well-being Index); AF5 (Multidimensional Scale of Self Concept); SSA (Social Support Appraisals); *ad hoc* questions on self-perception of parental and sibling ICT consumption, and the existence of rules for ICT use in the home. 14.5% (*n* = 160) of adolescents match the criteria of excessive use. The self-reported excessive use is associated as much by personality factors as by family context. Risk factors in self-reported excessive adolescent ICT use are being female, impulsiveness, perceiving a high level of family support and a high use by parents and siblings. The family, academic, emotional and physical self-concepts are factors of protection. This study has provided us with a profile of adolescents who make a self-reported excessive use of ICT, which may be of help in preventing such use. The presence of these specific personality and socio-demographic factors indicate a greater vulnerability and may serve as indicators for parents, teachers and healthcare professionals to intervene and prevent excessive ICT use and other serious psychological problems related.

Keywords: adolescents, personality, social context, excessive ICT use, risk factors

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INTRODUCTION

Adolescents who have been born and raised in the "Information Society" or the "Digital Era" are the age group that most frequently connects to the Internet and makes greatest use of mobile telephones; as such, they are the focus of an increasing amount of research (Sánchez-Carbonell et al., 2008; Batalla et al., 2012). While ICT use increases with age (Devís-Devís et al., 2009),

an increasing number of studies highlight that this begins earlier and earlier, with massive use detected in pre-adolescence (Fernández-Montalvo et al., 2015). Even though adolescent ICT use is massive among both sex, according with Rial et al. (2015) girls use them more frequently and intensively than boys. Recent studies indicate significant differences by gender in the tendencies of use: in the case of girls, a more expressive-communal use related to social interactions, very remarkable in the closest social relationships, and shared in social networks through public channels, with more loaded contents of affectivity and more telling of their daily experiences; while men are more oriented toward an agent-instrumental, more action-related use, playing videogames in ICT applications and with more pragmatic tendencies in its contents. These findings might suggest that females tend, more than males, to prefer indirect communication. The social need more prominent in girls to be always connected to ICTs or Social Networks may suggest that gender can be a risk factor.

While there is no empirical evidence, it has been argued that females show an enhanced vulnerability to Social Networking addiction (Kuss and Griffiths, 2011). Toda et al. (2006) concluded that being female is a risk factor in ICT addiction.

Although there are insufficient criteria with which to diagnose addiction to ICTs, the excessive use of technology is recognized as a public health concern (World Health Organization, 2014). Numerous studies have aimed to calculate excessive use in specific population groups. One study of adolescents in 11 European countries found problematic Internet use to be 13.5% (Durkee et al., 2012); while Weinstein and Lejoyeux (2010) put the rate in the United States at between 0.3% and 25%. Data published in the Spanish Government's Home Office *Survey of Internet Use and Safety* (Instituto Nacional de Estadística [INE], 2014) showed that 60% of children and young people said they connected to the Internet every day, mostly through mobiles and computers. A study carried out by the Fundación Mapfre (2014) concluded that 21.3% are at risk of developing Internet-addictive behavior through their use of social networks.

There is a lack of consensus among the scientific community as to whether excessive ICT use can be considered a similar kind of addictive disorder as that of behavioral addictions. American Psychiatric Association (2013) The authors of the DSM-V (2013) stated that such an addiction cannot yet be considered to exist, although they do include *Internet gaming disorder*, referring to online role-playing games. Authors such as Echeburúa (2012) have argued that while Internet and ICT-related disorders cannot be diagnosed, ever-increasing numbers of adolescents may require psychological treatment to combat excessive use.

Following Šmahel and Blinka (2012), this study uses the term "excessive ICT use" to refer not only to time spent on ICT use but also the impact of this. These authors argue that this term is frequently associated with determining pathological extensive usage of ICTs. Therefore excessive presence online is often defined by components used for determining other kinds of addictive behavior, such as mood change, conflicts and tolerance. According their findings, excessive use may lead to social, mental and physical impairment of adolescents. On the same line, Viñas (2009) ICT use is deemed excessive when the number of hours of use affects the correct development of the adolescent's everyday life. So this term is used when the number of hours of use affects adolescents leading a normal daily life (Castellana et al., 2007; Viñas, 2009), but not only in terms of the time invested in this use but also in the impact that it causes in personal and social areas of adolescent life (Šmahel et al., 2012).

We do not use the term "addiction" in this study, thus avoiding the medical debate as to whether addictions to technologies can be diagnosed or not. All in all, whether diagnostic criteria for addiction to technology can be established or not, the rapid growth in access to ICTs increases problematic use, above all in adolescents, and is something that should be further researched. It is also necessary to teach responsible use of such technologies.

Certain personality traits have been considered to be determiners of an addictive personality (Nakken, 2013). Takao et al. (2009) stated that people with certain personality traits may be more susceptible to developing an addiction to technologies. Following the example of previous research (Schou et al., 2013; Kuss et al., 2014), this study takes the Five-Factor Personality Model, also known as "the Big Five" (Costa and McCrae, 1992), as a basis to explore which personality variables form the personality profile of excessive ICT users. According to this model, personality is formed by neuroticism, extraversion, openness, agreeableness and conscientiousness.

Profiles with high **neuroticism**, have been related to a problematic use of Internet (Öztürk and Özmen, 2011) and social networks (Marino et al., 2016). Recent studies have shown that high scores in this area may be associated with Internet addiction (Kuss et al., 2013), increasing the risk of developing addictive behavior (Wölfling et al., 2010). According to Amichai-Hamburger et al. (2002), those who score low in **extraversion** are more liable to use ICTs to connect to social networks as a way of satisfying their communication needs. Specifically, some studies define the profile of adolescents with problematic Internet use through the following: dissatisfaction with life; limited group cohesion and family support; a propensity to introversion; negative thoughts; discomfort with social relations; and identity conflicts (Echeburúa and de Corral, 2010; Kuss et al., 2013; Gómez et al., 2014). Moreover, **openness** has been linked to frequency of communication media usage (Correa et al., 2010). Schou et al. (2013) concluded that high scores in this dimension may prove to be a factor protecting against addictive behavior. While some studies relate problematic Internet use to high scores in **agreeableness** (Kuss et al., 2013), others conclude that this minimizes the risk of suffering from Internet addiction (Meerkerk et al., 2009). As for **conscientiousness**, Schou et al. (2013) conclude that conscientiousness may act as a protecting factor against such behavioral addictions and Wang et al. (2015) found that it is negatively associated with addictive behavior. As well as these 5 large-scale factors, much research has explored the relationship between **impulsiveness** (a facet of the neuroticism factor) and excessive ICT use. This has been linked to addictive behavior and difficulties in controlling those impulses that characterize addictions (Lee et al., 2012). Impulsive profiles are common in adolescents, who are great seekers of new sensations and instant rewards (Echeburúa et al., 2009).

Previous research shows that those profiles with high levels of impulsiveness are more likely to develop excessive Internet use (Cao et al., 2007) and mobile phone use (Billieux et al., 2010).

Technologies provide a context of constantly gratifying stimulants that, as long as they are used responsibly, may provide adolescents with well-being. While some studies relate Internet use to aspects that may contribute to greater subjective well-being (Valkenburg and Peter, 2009; Malo et al., 2012), others suggest that this may, in fact, lessen it (Meerkerk et al., 2009; Akın, 2012). Excessive use is thought to affect well-being, causing anxiety and other psycho-pathological symptoms, as well as health, educational and social problems (Billieux et al., 2015). Some adolescents seek acceptance or social validation through social networks, and this affects their well-being and self-esteem (Jackson et al., 2010). According to Aydin and Volkan (2011), adolescents with low self-esteem dedicate more time to social network use. Yang and Tung (2007) and Bahrainian et al. (2014) related low levels of self-esteem with the presence of Internet addiction symptoms in adolescents. For Echeburúa (2012), self-esteem acts as a factor of protection against ICT addictions.

Creating and keeping a network of friends is considered vital to development during adolescence (Manago et al., 2012). The rapid growth of social networks has led many adolescents to use a range of technological tools to connect with their friends, create and strengthen interpersonal relationships, support others and receive social support, and cultivate emotional ties (Lenhart et al., 2010). Valkenburg and Peter (2009) argue that Internet use has a positive effect on interpersonal relationships between adolescents. While Echeburúa (2012) concluded that a healthy social environment and family support are protective factors against addiction to new technologies and social networks, family conflicts arising from irresponsible ICT use are ever more frequent. De Leo and Wulfert (2013) concluded that excessive ICT use may lead to an increase in family conflicts.

Family communication, parental control and supervision of online behavior have been considered to be protective factors against Internet addiction, along with family cohesion (Lin et al., 2009). Nonetheless, some research shows that 62% of those aged 15 and 16, surf the Internet without their parents having set limits (Sureda et al., 2010). Families play an important role in fomenting the opportunities that ICTs offer and minimizing their risks. A permissive or unstructured family environment with inexistent or inconsistent rules and a lack of consistency between the mother and father does not aid in forming a group of healthy behavior patterns; neither does it provide adequate self-control or emotional support (Echeburúa and Requesens, 2012). Although parental mediation of ICTs reduces the risk of developing addictive and risk behaviors (Chang et al., 2015), the lack of awareness shown by some parents regarding the risks associated with excessive ICT use, along with a lack of supervision, lead to unlimited access and greater frequency of use and have been linked to irresponsible use and addictive behavior. Sureda et al. (2010) concluded that parents needed to be made media literate, this would provide them with the knowledge needed to accompany their children in responsible use. According to Mayorgas (2009), giving children an example of healthy behavior promotes responsible behavior, which in turn counteracts addictive behavior. The great importance of the example given by parents in ICT use should also be highlighted, as parental ICT habits predict those of their offspring (Connell et al., 2015; Hiniker et al., 2016).

Although aforementioned studies show interesting findings, very few studies have investigated personality traits and social context factors simultaneously in the same investigation. The motivation of the study underlies in the evident lack of consensus in the scientific community to conceptualize if the excessive use of ICT can be considered an addictive disorder of the same nature as behavioral addictions. The excessive use of ICT among adolescents and their relationship with personality variables, among other individual variables, and social context, draws a complex frame, with multiple factors and relationships between them. Although, authors such as Marino et al. (2016) emphasize the importance of analyzing these variables together, the studies that evaluate them separately are more common. This paper aims to explore the set of variables in order to have a more plural view of the complexity of this psychological reality. Thereby, this study has the novelty of exploring both variables together. This study is conducted on adolescents' psychological profile, personality social and context factors, to explore the impact of excessive use of ICTs in this population. Understanding excessive ICT use not only in terms of the time invested in this use but also in the impact that it causes, this study aims to explore the psychosocial profile of those adolescents who self-reported an excessive ICT use. Specifically, we aim to analyze: the socio-demographic characteristics of the group of adolescents identified as having excessive ICT use; the personality and social context variables that comprise the profile of self-reported excessive users; and which variables best predict excessive self-reported ICT use in the age group researched.

MATERIALS AND METHODS

Design

This is a cross-sectional descriptive study. The multi-stage cluster sampling technique was used to define the sample.

Participants

A random sample was chosen (n = 1,218) using the multi-stage cluster sample technique. This type of sampling was selected because it allowed us to obtain a large sample of subjects with relatively homogeneous characteristics and therefore, it would give us the possibility to explore the values of the variables object of our investigation from the creation of subgroups with a sufficient number of subjects. The study population comprised 11 to 18-year-old students (M = 14.42, SD = 1.78) at secondary compulsory education, baccalaureate, and professional training schools in the Alt Empordà region (Girona, Spain) (**Table 1**). The population comprised 5,365 students, 50.58% of whom were boys. 84.53% of the schools were state-run. In Spain compulsory secondary education starts in the first year of ESO when the student would be between 11 and 12 years old (equivalent to Year 7 in the United Kingdom education system) and finish in the fourth year of ESO. Baccalaureate is the university entry level

course which lasts two years (equivalent to a 2-year A level course in the United Kingdom).

In a first stage the educational center was selected and after that, we selected one class of each academic course. Using this sampling technique, a random sample was selected (n = 1218).The final sample was of 1,102 students (90.48% participation). The remaining students were discarded because they were outside the age range or they did not finish answering the questionnaire. We also exclude the questionnaires from the adolescents who copied the answers from their classmates and those who did not show interest in answering the questionnaire. Students from 6 centers took part, 1,009 (91.56%) from state-run centers, and 93 (8.44%) from a semi-private center. The sample is composed of 530 boys (48.1%) and 572 girls (51.9%).

Measures

A protocol was drawn up including standardized scales and *ad hoc* items. Students were first asked to fill in the name of their school, their academic year, age, date of birth, and gender; these data were then used as grouping variables.

The scales used to assess personality and social context were:

- **Personal Well-being Index** (PWI) (Cummins et al., 2003): The PWI consists of 7 items that assess the degree of satisfaction with the following aspects of life: standard of living; health; achievements in life; personal relationships; perception of personal security; security with the groups they belong to; and future security. Each item was assessed on an 11-point scale, from 0 (*Totally unsatisfied)* to 10 (*Totally satisfied*). The translation of the original version of the domains included in the PWI into Catalan and its back-translation from Catalan to English was the work of Casas et al. (2008). The internal consistency of the PWI in the present study was good ($\alpha = 0.86$).
- **Multidimensional Scale of Self Concept** (AF5) (García and Musitu, 2001): The Catalan-adapted version was applied (Malo et al., 2014), consisting of 30 items contemplating the 5 self-concept dimensions proposed by the original authors (academic/professional; social; family; physical; and emotional). An 11-point scale was used, from 0 ("*Never*") to 10 ("*Always*").

The psychometric properties of this scale are very good and similar to the original version. The internal consistency found in this study ranges from 0.75 (social) to 0.91 (academic).

- **Social Support Appraisals** (SSA) (Vaux et al., 1986): The original scale consists of 23 items that explore the perception boys and girls have of the social support they receive from their family, friendships and others in general. This study has used 14 of the items, 7 referring to the family and 7 to friendships. The two dimensions have been calculated using the totals given to each, with responses ranging from 0 (*"Not at all"*) to 10 (*"Very clearly"*). The internal consistency of the *friends* dimension of SSA is 0.91, and that of *family 0*.92.
- **NEO Five Factor Inventory** (Costa and McCrae, 1992, 2004): reduced version of the NEO PI-R, which permits the assessment of five personality traits: *neuroticism; extraversion; openness to experience; agreeableness;* and *conscientiousness.* It consists of 60 items scored on a 0 to 4 point Likert scale (*0 = Totally disagree, 4 = Totally agree*). The internal consistency of the personality trait scales was acceptable, with a Cronbach alpha of 0.64 for neuroticism; 0.61 for extraversion; 0.62 for openness; 0.53 for agreeableness; and 0.69 for conscientiousness. The items from the NEO PI-R (Costa and McCrae, 2008) related to impulsiveness were added. The internal consistency of impulsiveness was good, displaying a Cronbach alpha of 0.74.

In order to examine ICT use, the following were used:

- **ICT use Self-classification scale** (Casas et al., 2007). A single-item scale in which subjects self-classify the type of consumer they are based on the following categories: *1: I never or hardly ever use it; 2: I'm a low consumer; 3: I'm an average consumer; 4: I'm a fairly high consumer; 5: I'm a very high consumer.* The same scale was used to ask adolescents about the kind of ICT users their parents and siblings are. Reliability cannot be evaluated because it is a single item scale and therefore Cronbach's alpha cannot be obtained. Casas et al., 2007 to validate this single item scale made a correlation between the number of hours of the ICTs use and the self-categorization. In their study found a good congruence of answers ($r = 457$, $p < 0.001$).

An *ad hoc* questionnaire was added to ascertain frequency and type of ICT use, which included the following items:

- Frequency of use of mobile phone, tablet, computer, and videogames on a scale of 1-5 (*1: Never, 2: Rarely; 3: Often; 4: Very often; 5: Continually*).
- A dichotomous question (*yes/no*) regarding the existence of rules regarding ICT use.
- A polynomial question (multiple answers), where subjects mark whether ICT use has led to problems related to: *performance at school; relations with friends; relations with parents; relations with teachers; sports activities; reduction in leisure activities; I've used them excessively; I've received threats; I've lied or pretended to be someone else; I've made inappropriate comments; I've spent more money than I should have; I've visited sites with age-inappropriate content*.

Procedure

This research is part of a broader study on the use of ICT in adolescents. In addition to explore adolescents personality and social context factors associated to self-reported excessive use of Information and Communication Technology, we also focused in the impact of social networking and the consequences of media multitasking.

This study was carried out in accordance with the recommendations of Education Department from the Autonomous Government of Catalonia. After obtaining permission from the Autonomous Government of Catalonia's Education Department and the individual schools, the head

teacher of each school was informed of the characteristics and aims of the research. In conducting the study we followed the ethical guidelines of the Helsinki Declaration, with written informed consent obtained by the participants' parents and the school authorities. Schools and participants were guaranteed data confidentiality and anonymity. The data collection for this study was anonymous, voluntary and non-interventionist; therefore, in accordance with local legislation and national guidelines a full review and ethical approval were not required.

Once all scales were included on a single questionnaire, this was split into two parts in order to make it less tiring for participants. The questionnaire was administered in two one-hour sessions on different days during the 2016-2017 school years, and completed in the classroom in school time. Participants received specific, homogenous instructions regarding how the questionnaire should be answered. They were accompanied by instructors who had received prior training in the research to give any help or clarification.

Statistical Analysis

Data were analyzed according to gender and school year using the Student's t-test to compare means, and through the Chi-square test to compare proportions. Given the low number of 11 and 18-year-old students, and in order to adjust data to provide more homogeneous groups, 11 and 12-year-old students were grouped together, as were 17 and-18 year-olds.

Taking into account that excessive use of ICTs not only implies a high use but also interferes with the normal functioning of the subject, a group was created of those adolescents who use ICTs excessively. It should be noted that in addition to the self-categorization, other information has been taken into account to make excessive use if ICTs group. So, adolescents of this group affirmed that they have had problems because of the excessive use of ICTs. This fact implies that the adolescent is aware that his use of ICT has had a negative impact. In addition of the adolescents' responses to self-classification scale (Casas et al., 2007) the frequency of self-informed use of ICT was taken into account.

The group comprises those who answered: "*5: I'm a very high consumer*" on the ICT use self-classification scale (Casas et al., 2007); "*4: Very often"* or *"5: Continually"* for the *ad hoc* ICT use frequency question on: *the mobile phone; tablet; computer;* and/or *videogames;* and those who marked "*I've used them excessively"* for the *ad hoc* polynomial question asking whether they had experienced any problems resulting from ICT use.

Finally, binary logistic regression was used to construct a model of those factors that best predict excessive ICT use.

All analyses were carried out using the SPSS, version 23.0 statistical package. The minimum level of statistical significance required in all tests was $p < 0.05$.

RESULTS

14.5% (n = 160) of the total sample were included in the group of self-reported excessive users. Of these, 49.4% (n = 79) were boys and 50.6% (n = 81) girls; no significant differences were noted between the groups (X^2 (1, N = 1102) = 0.123, p = 0.726). 41.3% (n = 56) of the group of excessive users were 15 or 16. While 60% (n = 86) of self-reported excessive users were in the 3rd and 4th years of secondary school and the 1st year of the university entrance course, no significant differences were found between school years (X^2 (1, N = 1102) = 10.053, p = 0.122) (**Table 2**).

TABLE 1 | Socio-demographic characteristics of sample.

Characteristics		n	%
Gender			
	Male	530	48.1
	Female	572	51.9
	Total	1.102	100
Age			
	11–12	185	16.8
	13	220	20
	14	171	15.5
	15	174	15.8
	16	187	17.0
	17–18	165	15.0
Type of centre	State-run	1.009	91.56
	Semi-private	93	8.44
Academic year*	1st ESO	201	18.2
	2nd ESO	224	20.3
	3rd ESO	191	17.3
	4th ESO	177	16.1
	1st BAT	167	15.2
	2nd BAT	111	10.1
	Professional training cycle	31	2.8

**ESO is compulsory secondary education. A student in the first year of ESO would be between 11 and 12 years old (equivalent to Year 7 in the United Kingdom education system). BAT is the university entry level course (equivalent to a 2-year A level course in the United Kingdom).*

TABLE 2 | Percentage of the group of self-reported excessive ICT use according to gender and age.

Variables	ICT self-reported excessive use group: Yes (n = 160)		ICT self-reported excessive use group: No (n = 942)					
	N	%(*)	n	%	Total	%	χ^2	P
Gender								
Male	79	49.4%	451	47.9%	530	48.1%	0.123	n.s.
Female	81	50.6%	264	52.1%	572	51.9%		
Age								
11–12	18	11.3%	150	15.9%	166	15.1%	8.546	0.129
13	27	16.9%	193	20.5%	220	20%		
14	26	16.3%	145	15.4%	171	15.5%		
15	32	20%	142	15.1%	174	15.8%		
16	34	21.3%	153	16.2%	187	17%		
17–18	23	14.1%	115	15.1%	142	12%		

(*)*% of ICT self-reported excessive use group.*

Personality and Excessive ICT Use

Scores in the group of self-reported excessive use of ICT in the five personality dimensions of the NEO Five Factor Inventory were higher in the *neuroticism* and *extraversion* dimensions and lower in those of *openness to experience, agreeableness* and *conscientiousness* than in the group that does not (see **Table 3**). If we look at impulsiveness, the average scores for self-reported excessive users are higher. These differences are statistically significant in: *neuroticism, agreeableness, conscientiousness and impulsivity*.

Well-Being, Self-Concept and Excessive ICT Use

Average scores were lower in the group of self-reported excessive users (**Table 4**).

In all components bar social self-concept, there are significant differences between those who use ICTs excessively and those who do not. Adolescents in the group of self-reported excessive users score significantly lower in the family; academic; emotional; and physical components (**Table 4**).

Social Context and Excessive ICT Use

When examining results for the dimension on perception of social support from friends, we note that the scores for those who self-reported excessive use of ICTs (M = 7.91, SD = 1.684) are very similar to the ones for those who do not (M = 7.90, SD = 1.702). In contrast, there are statistically significant differences between the groups when it comes to the perception of support from the family ($t(1100) = 1.977$ $p = 0.048$), with scores among the group excessive use of ICTs lower (M = 8.11, SD = 1.764) than among those who do not (M = 8.40, SD = 1.702).

When the group of self-reported excessive use of ICTs was asked about their perception of their parents' ICT use, higher scores were obtained when defining the parents as *fairly* or *very high* ICT users. While 17.7% of adolescents whose ICT use is not excessive said of their mother "*I consider her a fairly high consumer*", and 3.2% "*she is a very high consumer*", the percentages are higher among the group of excessive users: 32.1% and 9.4%, respectively. As for the father, while 11% of the group who do not self-reported an excessive use respond "*I consider him a fairly high consumer*", and 2.9% "*he is a very high consumer*", the respective percentages for the group that self-reported an excessive use are 19.7% and 9.2%. These differences are statistically significant, for both the mother's use (X^2 (1, $N = 977$) = 36.240, $p < 0.001$) and that of the father (X^2 (1, $N = 949$) = 32.747, $p < 0.001$).

In order to explore differences in the categorization of sibling ICT use, a variable was created calculating the mean of such use. Average ICT use among siblings of the group that self-reported an excessive use of ICTs (M = 3.40, SD = 1.7) is higher than among siblings of people who do not belong to the group (M = 2.58, SD = 1.71), these being statistically significant differences ($t(852) = -6.539$ $p < 0.001$).

There are significant differences in the existence of rules on ICT use between the group that self-reported an excessive use and the group that does not. 69% (n = 109) of those in the former group say there are no rules, a percentage that falls to 58.1% for the latter group (X^2 (1, $N = 974$) = 6.544, $p = 0.011$).

Factors That Predict Excessive ICT Use

In order to identify those variables that predict self-reported excessive ICT use among adolescents, a binary logistic regression was carried out using the stepwise method. The group making excessive use was considered to be a dependent variable, and the dimensions of personality, social context and sex covariates. As can be seen from **Table 5**, the model enables the correct classification of 83.1%, (n = 945) of participants; 78.8% of the group that does not make excessive use of ICTs and 58.7% of the group of excessive users. Nagelkerke's R^2 shows that the model explains 18.9% of the variability (Nagelkerke $R2 = 0.189$).

Variables that predict excessive ICT use are, in order of weight: perception of mothers ICT use; responsability; perception of fathers ICT use; academic self-concept; perception of sibling ICT use; and impulsiveness. The factors protecting against excessive ICT use are the perception of parental and sibling ICT use and academic self-concept. Risk factors are impulsiveness and responsibility.

DISCUSSION

Our results confirm an elevated prevalence of self-reported excessive ICT users, 14.5% of the sample studied. This percentage

TABLE 3 | Average scores in the 5 personality dimensions of the NEO-FFI and impulsiveness aspect of the NEO PI-R, depending on whether or not they form part of the self-reported excessive ICT use group.

Variables	Self-reported excessive ICT use							
	Yes		No					
	M	SD	M	SD	$t_{(gl)}$	p	IC 95%	
Neuroticism	1.93	0.732	1.77	0.753	$-2.490_{(1100)}$	0.013	−2.854	−0.033
Extraversion	2.28	0.824	2.22	0.719	$-0.975_{(1100)}$	n.s.	−0.185	0.062
Openness	2.05	0.724	2.09	0.731	$0.668_{(1100)}$	n.s.	−0.081	0.164
Agreeableness	2.09	0.740	2.27	0.674	$3.120_{(1100)}$	0.002	0.068	0.297
Conscientiousness	1.88	0.762	2.19	0.689	$5.092_{(1100)}$	< 0.001	0.187	0.422
Impulsiveness	2.10	0.637	0.709	3.185	$-12.065_{(1100)}$	< 0.001	−1.617	−1.165

TABLE 4 | Average scores for well-being and self-concept depending on whether they form part of the self-reported excessive ICT use group or not

Variables	Excessive ICT use							
	Yes		No					
	M	SD	M	SD	$t_{(gl)}$	p	IC 95%	
PWI – Subjective well-being	76.72	13.942	80.50	14.190	$3.121_{(1100)}$	0.002	1.402	6.151
AF5 – Family self-concept	7.45	2.023	8.149	1.749	$4.091_{(1100)}$	< 0.001	0.360	1.030
AF5 – Academic self-concept	5.72	2.097	6.82	1.835	$6.853_{(1100)}$	< 0.001	0.784	1.414
AF5 – Social self-concept	7.30	1.526	7.282	1.651	$-0.159_{(1100)}$	n.s.	−0.296	0.252
AF5 – Emotional self-concept	4.90	1.999	5.33	1.96	$2.545_{(1100)}$	< 0.011	0.098	0.756
AF5 – Physical self-concept	6.10	2.140	6.75	1.851	$3.583_{(1100)}$	< 0.001	0.289	0.998

TABLE 5 | Binary logistical regression of personality factors, social context variables and gender in self-reported excessive ICT use.

Steps	Variables	B	E.T	Wald	gl	P	OR	IC 95%	
Step 6(g)	Maternal ICT use	0.407	0.107	14.531	1	< 0.001	1.502	1.219	1.852
	Paternal ICT use	0.274	0.100	7.562	1	0.006	1.316	1.082	1.599
	Sibling ICT use	0.139	0.067	4.370	1	0.037	1.150	1.009	1.310
	AF5 Academic	−0.216	0.058	13.709	1	< 0.001	0.805	0.718	0.903
	Impulsiveness	0.099	0.031	10.375	1	0.001	1.104	1.039	1.172
	Conscientiousness	−0.400	0.173	5.364	1	0.021	0.670	0.478	0.940
	Constant	−3.439	0.808	18.128	1	< 0.001	0.032		

is similar to that seen in other studies (Durkee et al., 2012), which situate problematic use of the Internet at around 13.5%. With regard to socio-demographic variables, and in line with research which concludes that ICT use begins at an ever-earlier age (Fernández-Montalvo et al., 2015), it should be highlighted that 11.3% of the group of excessive users were 11 or 12 years old. While previous research shows an age-based increase in ICT use (Devís-Devís et al., 2009), our study found no differences between the age of users. Regarding gender, the percentage of boys and girls who self-reported an excessive use of ICTs was similar. These data differ from research that has found problematic Internet use to be significantly higher among girls (Durkee et al., 2012; Rial et al., 2015).

A psychological profile associated with self-reported excessive use of ICT is provided by the responses given to the various items of the NEO-FFI and in the impulsiveness factor of the NEO PI-R. Those adolescents whose ICT use is problematic describe themselves as emotionally unstable, impulsive and not very conscientious and agreeable. Our results coincide with those of Wang et al. (2015), where conscientiousness is negatively associated with addictive behavior and with Kuss et al. (2014) where problematic Internet use is related to high scores in agreeableness. Along the lines of previous research into problematic use of the Internet (Öztürk and Özmen, 2011), and of social networks (Marino et al., 2016), our study links excessive ICT use with higher scores in neuroticism. The impulsive profile predominates among those young people who self-reported an excessive use of ICTs, matching earlier studies which link high levels of impulsiveness with excessive mobile phone use (Billieux et al., 2010) and problematic Internet use (Cao et al., 2007). These results are similar to those of earlier research, which show that the psychological profile of those with high Internet use is one where negative emotions predominate (Viñas, 2009).

Regarding the social context variables examined the index of subjective well-being and family social support is lower among those who make excessive use of ICTs than among other young people. Previous research also concludes that excessive ICT use reduces well-being (Meerkerk et al., 2009; Akın, 2012) and self-esteem (Yang and Tung, 2007; Bahrainian et al., 2014). Low scores in family social support may be explained by the intrusive nature of the technology and its potential to interrupt or interfere with family life. According with De Leo and Wulfert (2013) and McDaniel and Coyne (2016), the omnipresence of technology may interfere in human relationships, and that this may affect family social support. Regarding the self-assessments of those adolescents who form part of the group of self-reported excessive users, we note that that they are lower than among those not in the group for the following facets: quality of performance in their role as students; emotional state, and their responses in certain situations, with a degree of commitment and implication in their daily lives; their involvement, participation and integration in the family; and physical appearance and condition. Given the close link between the terms *self-concept* and *self-esteem*, the results lead us to conclude that adolescents who use ICTs excessively show lower levels of self-esteem than those who do not. These results would imply that adolescents with lower self-esteem may be more vulnerable to excessive ICT use. This is also confirmed by certain other studies (Bahrainian et al., 2014) which show that self-esteem is one of the best predictors of addictive Internet behavior.

Consistent with previous research, there seems to be little parental mediation in adolescent ICT use. 58.1 % of participants said there were no rules regarding ICT use. This percentage is

similar to that of other research, which places it between 53% and 62% depending on the child's age (Sureda et al., 2010). As family mediation is a determining factor in children's ICT use and a lack of supervision is linked to addictive behavior (Chang et al., 2015), rules regarding ICT use should be promoted. In order to achieve greater parental involvement in establishing such rules, we believe that parents need to be made more media literate, as has been highlighted in earlier research (Sureda et al., 2010). The results obtained regarding perception of ICT use among parents and siblings show that adolescents who form part of the group of excessive users perceive their parents to be higher consumers of ICTs than those of the other group. These results lead us to conclude that the frequency with which children use ICTs is influenced by their parents' example. In the same vein, research into Internet use concludes that parental habits influence those of their children (Connell et al., 2015; Hiniker et al., 2016).

The ultimate aim of our research has therefore been to assess those variables that best predict self- reported excessive ICT use at this age. When all personality and social context variables are included, and through logistical regression analysis, six factors identifying a risk of excessive ICT use have been identified: perception of mother's ICT use; conscientiousness; perception of father's ICT use; academic self-concept; perception of sibling's ICT use; and impulsiveness. These factors enable us to establish a predictive model of excessive ICT users. Perceiving that parents and siblings are high ICT consumers all increase the risk of excessive ICT use, the risk factor that best predicts excessive use is the perception of mother ICT use. These results suggest that parents' ICT use predicts their children's habits (He et al., 2010). The family plays a central role in the transmission of values, and it is for this reason that the prevention of excessive use must include parents as central agents in intervention. To achieve this, families must be literate in the digital world; a lack of knowledge can lead parents to adopt inadequate positions when fomenting ICT use, such as a lack of supervision. We agree with Echeburúa (2012) that ICT use involves parents and adolescents sharing responsibility. The latter should aid their parents to become familiar with the use of technologies, while parents should accompany their ICT use of their children. The family, therefore, plays a fundamental role in minimizing risks associated with ICT use.

Referring to factors of protection, the results show that, while having high scores in responsibility dimension and low scores in impulsivity. These discoveries coincide with previous research concluding that impulsive adolescents are more prone to developing problematic Internet use (Billieux et al., 2010).

This study has provided us with a psychosocial profile of adolescents who self-reported an excessive use of ICT, which may be of help in preventing such use. The presence of specific personality factors such as impulsiveness, of factors related to social context, such as high parental and sibling use, all indicate a greater vulnerability and may serve as indicators for parents, teachers and healthcare professionals to intervene and prevent excessive ICT use and other serious psychological problems related. So, for the detection of excessive use of ICT, professionals must analyze individual differences and contextual realities of the adolescents.

In the same line as Armayones (2016), it is essential that health professionals are able to identify those who have a greater predisposition to develop disorders derived from the use of ICT, although they have not yet expressed problems. It is important to know how to distinguish those problems derived exclusively from the use of ICT, which are actually the result of another psychological disorder. The type of use that is given to ICT and the excessive frequency can affect various facets of life and develop a disorder. However, the presence of psychological disorders (such as anxiety, depression or personality), problems of self-esteem or deficits in social skills can lead to excessive use of ICT. In the first case, the problem that gives rise to excessive use could be related to the frequency or access to inappropriate content. In contrast, in the second case, excessive use would become a type of coping strategy for another problem or disorder of the subject. Therefore, for the detection and approach of the excessive use of ICT it will be essential to carry out an individualized analysis of the personal and contextual reality of each adolescent.

These discoveries have provided a psychosocial profile but future research exploring both factors can also be helpful to solidify these results. The results of this study would allow us to develop new measures for the evaluation of excessive use of ICT to more deeply analyze psychological and social context variables of the adolescents. Our findings can also help to create interventions that take into account the regulation of certain traits of personality, as impulsivity, and the responsible use in family context of the adolescents. Another direction for future research delves further into focusing on identifying the psychological and social profile of adolescents who make responsible use with the aim of creating models of positive socialization in the use of ICT.

Taking into account that the profile of excessive users group is comprised of the combination of personality and the closest social context, we would like to emphasize the need of engaging in further investigations that examine both variables. Our results allow us to propose some feasible interventions with the aim to prevent excessive ICT use among adolescents. Considering impulsiveness as a risk factor and conscientiousness dimension as a protective factor against excessive ICT use, we suggest specific actions to promote the regulation of impulsivity trait. For instance, mindfulness programs with the goal to promote adolescents' full conscientiousness. The results point out parents and siblings consumption of ICT acts as a risk factor. That is the reason why we propose interventions with the family context. Following Gómez et al. (2017), it is necessary to include the immediate social context, family and educators, in the interventions to promote responsible use. Our intervention proposal coincide with Sureda et al. (2010), showing the need for awareness and provision of knowledge and skills to engage parents to assume their responsibilities in the use of ICT of adolescents. Psychoeducation program which include specific actions to: a) promote adolescents' self-conscientiousness of the time spent on ICT use, 2) show the risks of excessive use of ICT, 3) engage parents and educators to work together to promote responsible use among adolescents, 4) emphasize the importance of rules and standards set, not only with temporary restrictions,

and the participations of the adolescents in the decision of these rules.

We must be aware that children from birth to adolescence observe adults at home, imitate behaviors and repeat actions. If our attitude is prohibitive, they will see ICT as negative or harmful tools, and they will not develop the ability to use and criticize the media. If our attitude is carefree, very permissive, or irresponsible, we will not help them know how to manage the use of these tools as they grow. Making an appropriate use of home-based technologies implies not using them just as a babysitter to keep children entertained, but rather to have a proactive attitude of how and how we can use them. Playing, learning, expressing, communicating and creating are the potentialities of these resources. And that is possible implies setting activities and timings to be able to use them. It also implies the need to accompany the adolescents in their use as parents and educators. Not forgetting that each adolescent is different, has different interests, different learning rates and special needs in each case, it is possible to establish general guidelines. From early childhood to adolescence, we have to think that at home we have to take control of children's technology. We must use its potential as a game and learning tool, selecting good resources, establishing habits and rules of use that benefit the development of children and actively participating in the use of ICTs at their side. It is important to bring awareness to the parents that technology is much more than a device that we have to regulate. ICTs can be tools for game and fun, for learning and development. Taking informed decisions about when, how, what, etc. to use ICT will help them to establish healthy habits of ICT usage at home.

There are some limits to this study. Firstly, the sample comprises adolescents of the same age range and geographical location; participants from other regions would be needed for results to be extrapolated. The sample, while representative of a region and age range, does not permit generalization to other population groups. Even though the sample has been chosen randomly, it has been stratified by center and is representative in different socioeconomic levels; we cannot generalize the results to all adolescent population further than the geographical area studied. Some cultural and social differences could exist compared with other areas. A further limitation is the self-reporting nature of the instrument, as participants may show a bias toward social desirability; however, we have attempted to minimize this through the guarantee of anonymity and data confidentiality.

Another aspect to consider is the limitation of identifying adolescents who made an excessive use of ICTs based on self-reports administered in an academic environment. In general terms, teens are good informants although in the collective context it is likely to be bias. Therefore, self-reports should be supplemented with objective measures such as structured clinical interview (Beard, 2005). In future research, the administration of questionnaires could be done in groups with less number of participants than the regular group class.

Future research could include qualitative methodology; discussion groups, for example, in order to increase data validity and further explore the knowledge gained from questionnaires. Since this is a cross-sectional study, we cannot determine causative relations, so future research could include longitudinal perspectives to gain greater depth into the prediction of excessive ICT use.

AUTHOR CONTRIBUTIONS

MM-P, has designed the research work and the questionnaire, collected the data and contributed to the analyses and interpretation of the findings and was accountable for all aspects of this work. FP has designed the research work, conduced the data analyses and interpretation of the findings and contributed to writing methodology and results sections of the paper. SC has designed the research work, collected data and contributed to the interpretation of the findings and contributed to writing the introduction and discussion sections of the paper. All authors listed had made a substantial contribution to the work and have drafted and revised the work and approved the submitted version.

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Influence of Family Processes on Internet Addiction Among Late Adolescents in Hong Kong

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The present study investigated how the quality of the parent–child subsystem (indexed by behavioral control, psychological control, and parent–child relationship) predicted Internet addiction (IA) levels and change rates among senior high school students. It also examined the concurrent and longitudinal influence of the father- and mother-related factors on adolescent IA. At the beginning of the 2009/2010 school year, we randomly selected 28 high schools in Hong Kong and invited Grade 7 students to complete a questionnaire annually across the high school years. The present study used data collected in the senior high school years (Wave 4–6), which included a matched sample of 3,074 students (aged 15.57 ± 0.74 years at Wave 4). Growth curve modeling analyses revealed a slight decreasing trend in adolescent IA in senior high school years. While higher paternal behavioral control predicted children's lower initial level of and a slower drop in IA, maternal behavioral control was not a significant predictor of these measures. In contrast, higher maternal but not paternal psychological control showed a significant relationship with a higher initial level of and a faster drop in adolescent IA. Finally, better father–child and mother–child relationships predicted a lower initial level of IA among adolescents. However, while a poorer mother–child relationship predicted a faster decline in adolescent IA, father–child relationship quality did not. With the inclusion of all parent–child subsystem factors in the regression analyses, paternal behavioral control and maternal psychological control were identified as the two unique concurrent and longitudinal predictors of adolescent IA. The present findings delineate the essential role of parental control and the parent–child relationship in shaping children's IA across senior high school years, which is inadequately covered in the scientific literature. The study also clarifies the relative contribution of different processes related to the father–child and mother–child subsystems. These findings highlight the need to differentiate the following: (a) levels of and rates of change in adolescent IA, (b) different family processes in the parent–child subsystem, and (c) father- and mother-related factors' contribution to adolescent IA.

Keywords: adolescent, Chinese students, internet addiction, father, mother, growth curve modeling

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INTRODUCTION

The use of the Internet has grown rapidly in the past two decades, especially amongst the adolescent population. As the Internet becomes pervasive and increasingly indispensable in young individuals' lives, Internet addiction (IA) has also emerged as a serious public health issue due to its close relationships with adolescent health problems, risk behaviors, and social functioning problems (1–3).

Preventing IA requires efforts taken in various sectors such as family, school, and other social institutions. Family factors, such as positive family functioning, parental monitoring, and healthy parental–child relationship, play a vital role in this process (4–6). Among different parenting characteristics, parental control was intimately related to problematic adolescent behaviors [e.g., (7, 8)].

Parental control includes behavioral and psychological control (9). Behavioral control pertains to the use of disciplinary strategies and supervisory functions to regulate children's behavior, while psychological control attempts to shape children's behaviors through strategies like guilt or anxiety induction, and love withdrawal (10). Research findings have consistently shown that the behavioral control of parents is positively related to favorable developmental outcomes in children, while psychological control harms adolescent health (7, 8, 11). As Barber et al. (11) concluded, higher parental behavioral control is related to higher levels of adolescent competence, self-discipline, and school performance as well as lower levels of problematic behaviors. When parents provide clear regulations regarding children's Internet use or monitor their Internet use in an appropriate way, adolescents have a lower chance to show symptoms of IA. In contrast, parental psychological control tends to harm children's self-esteem, and increase developmental problems and maladjustment, because psychological control hurts adolescents' emotional functioning and the sense of self (12). For example, in a sample of 5,806 seventh graders, Wang et al. (8) found that the psychological control of parents predicted students' dampened emotional functioning in China and the United States.

There are three issues that should be addressed when examining the influence of parents on adolescent developmental outcomes. First, while parental control has been identified as an important determinant of adolescent development, the impact of the parent–child relationship has not been adequately examined. According to Shek (13), adolescents' satisfaction with their parents' control and their willingness to communicate with their parents are important relational qualities that should be considered when examining adolescent adjustment. Primarily, children's satisfaction with their parents' control reflects the quality of the parent-child relationship. Whether adolescents themselves regard parental control as reasonable or not is an important factor to be considered when understanding the influence of parental behavioral and psychological control. Pomerantz and Eaton (14) argued that some adolescents might regard parental control as an expression of care. Hence, these adolescents may gain more positive influence from parental control. This argument was supported by Kakihara (15), who found that adolescents interpreted strong parental behavioral control in specific domains as indicative of competence or intrusiveness. Thus, Kakihara drew attention to the possibility of multiple yet "contradictory" interpretations of parenting reported by adolescents. Hence, it is important to consider the quality of parent–child relationship when examining the impact of parental control.

Besides, parent–adolescent communication also influences adolescent development. Research showed that healthy parent–adolescent communication provides a safe environment for adolescents to comfortably disclose themselves (16), while problematic parent–adolescent communication is often associated with increased adolescent risk behaviors (17). Forehand et al. (18) found that families of adolescents with behavior problems experienced disagreements more frequently and had less supportive parent–child relationships than their counterparts did. Cottrell et al. (19) revealed that open parent–child communication was positively associated with parental monitoring. However, as Burk and Laursen (20) pointed out, little is known about how specific relationship attributes contribute to specific developmental problems such as IA.

The second issue concerns the differential influence of fathers and mothers on adolescent development. Historically, there has been an absence of parenting research examining the relationships between adolescents and their fathers (21). In addition, instead of separating paternal and maternal impacts, many studies just considered overall parenting characteristics (i.e., adolescent perception of their parents), which hinders the understanding of the complex dynamics in this process (22). Some recent studies have recognized the distinction between maternal and paternal factors on adolescent developmental outcomes, but the majority adopted a single perspective focusing on either mother' or fathers' influence. For example, Leung et al. (23) explored maternal control in a sample of 432 poor Chinese single-mother families. Studies on paternal involvement were reviewed in Pleck and Masciadrelli's (24) research, which showed that paternal involvement was related to positive child development. However, to have a holistic picture of how family factors systematically influence adolescent IA, it is important to include both maternal and paternal factors. Hence, it is argued that when examining parental impacts, both maternal and paternal factors should be taken into account.

However, the existing research findings regarding the differential effects of fathers and mothers are equivocal. For example, Giles and Price (25) found that only maternal psychological control positively predicted problematic computer use in children. In contrast, Lansford et al. (26) revealed that only paternal psychological control accounted for specific variance in children's developmental problems. The authors reported a similar result on the unique predictive effect of paternal knowledge on boys' externalizing problems. In Xu's research (2) involving 5,122 Chinese adolescents, results showed that compared to the father–child relationship, the mother–child relationship had a stronger association with children's IA. While these studies illustrated the differences between maternal and paternal impacts, the findings were inconclusive. Furthermore,

they generally focused on a single parenting factor (e.g., psychological control) rather than simultaneously considering different aspects of the parent–child subsystem.

The third issue pertains to research design, in that most of the existing findings in this field are based on cross-sectional studies. Few studies have used longitudinal data to examine the growth rate of IA related to different family factors (4, 6). For example, Wang et al. (17) research using three-year longitudinal data on 913 Bahamian students revealed that parental control during early adolescence predicted a decrease in risk behavior in middle adolescence. Yu and Shek's (27) longitudinal research on students in Hong Kong revealed that good family functioning predicted a lower probability of having IA. Regarding the impacts of parental factors on the growth rate of IA, Shek et al. (28) study involving 3,328 Chinese students indicated that stronger paternal behavioral control was associated with a slower drop in children's IA, and stronger maternal psychological control was linked to a faster decrease in children's IA. Although their findings filled the knowledge gaps in the field, the study only covered early adolescence. More efforts should be made to examine the differences between maternal and paternal parenting styles among late adolescents (29).

In short, longitudinal research focusing on senior high school students' IA is urgently needed to understand how the parent–child relationship qualities shape adolescent IA. First, the dynamics of parenting and the family relationship functioning of senior high school students of IA are different from that of junior students. Students in late adolescence are physically and psychologically mature, demanding more freedom and flexibility. Parental control may not lead to the desired effect to adolescents at this stage. For example, Rogers et al. (30) suggested a stronger association between parental psychological control and internalizing problems for senior high school students than for junior students, because older adolescents might have stronger need for autonomy and more diverse internalizing and externalizing behaviors. Second, as the patterns in which mother- and father-related factors influence adolescents may evolve differently as both parents and adolescents age, longitudinal research would enhance our understanding of the differences between the influence of maternal and paternal factors on adolescent IA.

THE PRESENT STUDY

To fill these three research gaps, the current study investigated how parent–child subsystem factors influence the levels and rates of change in adolescent IA over senior high school years. Specifically, the study addressed the following three research questions. The first question is as follows: "do parental control (behavioral and psychological) and father– and mother–child relationship qualities predict children's initial level of IA at the beginning of senior high school life?" Drawing from extant literature (7, 8, 11) and related findings in early adolescence (28), it was expected that higher paternal and maternal behavioral control would predict a lower initial level of adolescent IA in senior high school years (Hypotheses 1a and 1b), while higher paternal and maternal psychological control would be associated with a higher initial level of adolescent IA (Hypotheses 1c and 1d). Regarding the parent–child relationship, we hypothesized that better relationships between the child and both parents would predict a lower initial level of IA (Hypotheses 1e and 1f).

The second research question is as follows: "how are parent–child subsystem qualities related to the developmental trajectory of adolescent IA across senior high school years?" In this field, only one previous study found that paternal behavioral control, maternal psychological control, as well as relationships between the child and both parents exerted significant predictive effects on the rate of change in IA during junior high school years (28). However, the related findings were at odds with the general expectations that favorable parental factors would be associated with a faster drop in IA as an indicator of positive adjustment in the long run. Given that only limited evidence is available, we still formed the present hypotheses based on the general theoretical expectations that positive parenting and a better parent–child relationship would be related to children's positive development (31). Specifically, it was expected that higher behavioral control of fathers (Hypothesis 2a) and mothers (Hypothesis 2b), as well as better father–child (Hypothesis 2c) and mother–child relationships (Hypothesis 2d), would predict a faster decline in children's IA because these factors were considered as positive aspects of parental impacts. Additionally, as a form of negative parenting, higher paternal and maternal psychological control were expected to predict a slower decrease in adolescent IA (Hypotheses 2e and 2f, respectively).

The third question is as follows: "what is the concurrent and longitudinal influence of paternal and maternal factors on adolescent IA during senior high school years?" While there is support for the relatively stronger influence of paternal parenting (26), other findings suggest a stronger influence for maternal parenting (2, 25). Besides the inconclusive picture, very few studies have distinguished different aspects of parenting practices (e.g., behavioral and psychological control and the relationship between parents and children) and examined the long-term impact using longitudinal data (28). Due to these factors, the following two general competing hypotheses were advanced: fathers are more influential than mothers in influencing adolescent IA (Hypothesis 3a), and mothers are more influential than fathers in influencing adolescent IA (Hypothesis 3b). All the above hypotheses are summarized in **Table 1**.

The present study also considered important demographic characteristics including student gender, family economic status, and family intactness. Specifically, boys often report a higher level of Internet use and a higher interest in online games than girls do (4). Some studies found that parenting effects vary among boys and girls. For example, Shek (32) examined parenting functions among Chinese adolescents with disadvantageous background and found that paternal parenting exerted more influence on boys' mental health and problem behavior, while maternal parenting played a major role in affecting girls' mental health and problem behavior. In contrast, Rogers et al. (30) reported that fathers' psychological control was more influential on daughters than on sons regarding externalizing behavior. Shi et al. (4) examined the relation between family functioning and

TABLE 1 | Summary of hypotheses and findings of the present study.

Research question	Hypotheses	Brief descriptions	Findings		
			Full sample	Male sample	Female sample
NA		A decline trend of adolescent IA over time	Yes	Yes	Yes
One	1a	Paternal behavioral control negatively predicts the initial level of adolescent Internet addiction (IA)	Yes	Yes	Yes
	1b	Maternal behavioral control negatively predicts the initial level of adolescent IA	No	No	No
	1c	Paternal psychological control positively predicts the initial level of adolescent IA	No	No	No
	1d	Maternal psychological control positively predicts the initial level of adolescent IA	Yes	Yes	Yes
	1e	Father–child relationship quality negatively predicts the initial level of adolescent IA	Yes	Yes	Yes
	1f	Mother–child relationship quality negatively predicts the initial level of adolescent IA	Yes	Yes	No
Two	2a	Higher paternal behavioral control will predict a faster decline in adolescent IA	No (opposite direction)	No (opposite direction)	No (opposite direction)
	2b	Higher maternal behavioral control will predict a faster decline in adolescent IA	No	No (opposite direction)	No
	2c	Better father–child relationship quality will predict a faster decline in adolescent IA	No	No	No
	2d	Better mother–child relationship quality will predict a faster decline in adolescent IA	No (opposite direction)	No (opposite direction)	No
	2e	Higher paternal psychological control will predict a slower decrease in adolescent IA	No	No	No
	2f	Higher maternal psychological control will predict a slower decrease in adolescent IA	No (opposite direction)	No (opposite direction)	No
Three	3a	Paternal factors are more influential than maternal factors in shaping adolescent IA	Yes	Yes	Yes
	3b	Maternal factors are more influential than paternal factors in influencing adolescent IA	No	No	No

Opposite direction indicates the a significant but opposite predictive effect compared to hypothesized effect.

children's IA and found that the path from family function to IA (via loneliness) was significant only for girls. By including student gender, this study attempted to contribute to the ongoing discussion about differential parenting influence on IA amongst boys and girls.

MATERIALS AND METHODS

Participants and Procedures

This study was derived from a 6-year longitudinal project that investigated the adjustment of Chinese adolescents in Hong Kong. A cluster sampling method was used. First, based on a school list provided by the Educational Bureau in Hong Kong, we formed a list of candidate schools including 399 government-funded or aided Chinese-speaking secondary schools in different districts of Hong Kong. Second, 30 schools were randomly selected and invited to join the project. If the selected school rejected our invitation, we invited an alternate school randomly selected from the candidate schools in the same district. Eventually, 28 schools agreed to join the project (Hong Kong Island: 5 schools; Kowloon: 7 schools; New Territories: 16 schools). Third, at the beginning of the 2009/2010 academic year, all the students in the first year of high school study (i.e., Grade 7) in the 28 participating schools were invited to complete a questionnaire and were followed up annually through the high school years, resulting in a 6-wave data set.

In 2009/2010, the number of Grade 7 students in the participating schools ($N = 4{,}531$) accounted for 7.12% of the total number of Grade 7 students in all the candidate schools ($N = 63{,}620$). At Wave 1 data collection, 3,328 students completed the questionnaire, suggesting a response rate of 73.45%. As demographic information of non-respondents who did not participate in any wave of data collection was not available, we were not able to compare participating students with non-respondents regarding their background characteristics. However, according to Shek et al. (33), the sample attributes of the project were similar to the demographic profile of the general adolescent population in secondary schools in Hong Kong.

Ethical approval for this project was obtained from the Human Subjects Ethics Sub-committee (HSESC) (or its Delegate) at The Hong Kong Polytechnic University. All involved parties, including participating schools, student participants, and their parents, provided informed written consent. In all occasions of data collection, trained research staff administrated

the questionnaires, using a paper-and-pencil mode, in quiet classrooms at the participating schools. Administrators clearly instructed the student participants to provide honest responses based on their own interpretation of the questions.

The present study utilized Wave 4–6 data collected in the senior high school years (Grades 10–12). While data collection at Wave 5 took place 1 year (i.e., 12 months) after Wave 4, Wave 6 data collection was conducted approximately 10 months after Wave 5. This is because students at Grade 12 in Hong Kong have to concentrate on preparing for the public examination during the last few months of senior high school. The number of participants completing the questionnaire at each wave varied (Wave 4: $N = 3{,}973$, Wave 5: $N = 3{,}683$, and Wave 6: $N = 3{,}498$) due to students' absence at the time of data collection, transferring schools, or dropping out of schools. Among the 3,973 students who completed the survey at Wave 4, 3,397 and 3,237 completed the survey at Wave 5 and 6, respectively. From Wave 4 to Wave 5, were more participants withdrew from the study. One possible explanation is that some students might take vocational education, or they might go to work after reaching Hong Kong's legal working age of 15 years old. Across the three waves, 3,074 participants (aged 15.57 ± 0.74 years at Wave 4) were successfully matched, which included 1,577 (51.30%) boys and 1,497 (48.70%) girls. The matched sample was used in the present study.

Comparisons between the matched sample included in this study ($N = 3{,}074$) and who withdrew from the study after Wave 4 (i.e., N of dropouts = 899) showed no significant differences in family economic status and family intactness. However, the matched sample included a higher percentage of female adolescents ($\chi^2_{(1)} = 10.26$, $p < 0.01$, $\phi = 0.05$). Besides, adolescents in the matched sample (aged 15.57 ± 0.74 at Wave 4) were slightly younger than the dropouts [aged 15.88 ± 0.94, $t_{(3861)} = -9.95$, $p < 0.001$, Cohen's $d = 0.37$]. Regarding the key variables considered in the current study, no significant differences were observed in IA [$t_{(3971)} = -1.61$, $p = 0.11$], paternal psychological control [$F_{(1,\ 3543)} = -3.12$, $p = 0.08$], and maternal behavioral control [$F_{(1,\ 3543)} = -2.69$, $p = 0.10$] measured at Wave 4. However, participants in the matched sample reported a slightly higher level of paternal behavioral control, better relationships with fathers and mothers, and a slightly lower level of maternal psychological control (F values ranged from 5.18 to 9.25, $ps < 0.05$, partial η^2 ranged from 0.001 to 0.003) at Wave 4. However, the effect size was low.

Instruments

Among the multiple measures used in the questionnaire, IA and quality of the parent–child subsystem were the key measures, and gender, participants' family economic condition, and family intactness were the control variables in the present study.

Internet Addiction (IA)

Kimberly Young has developed several questionnaires to assess addicted behaviors related to Internet use, including the brief 8-item questionnaire, 10-item questionnaire, and the 20-item questionnaire. For Young's 8-item IA questionnaire, items were modified from criteria for pathological gambling in the *Diagnostic and Statistical Manual of Mental Disorders—Fourth Edition* (DSM-IV) (34). The 10-item questionnaire included 10 Internet addiction symptoms (35). Shek and his collaborators translated the 10-item scale into a Chinese IA measurement, which exhibited good psychometric properties in previous research (36–38). This study utilized the 10-item Chinese IA questionnaire to assess adolescent IA. Participants responded to 10 items using a dichotomous scale ("Yes" or "No") to indicate whether they demonstrated the listed 10 addiction behaviors related to Internet use in the past year (see **Table 2**). Participants' IA was indexed by the number of "yes" answers they provided in the questionnaire. In this study, the Cronbach's αs of the

TABLE 2 | Participants' answers on Internet Addiction questionnaire across the three waves ($N = 3{,}074$).

Questionnaire items	Wave 4 (%)		Wave 5 (%)		Wave 6 (%)	
	Yes	No	Yes	No	Yes	No
1. Do you feel preoccupied with the Internet or on-line services and think about it while off-line?	27.3	72.7	24.3	75.7	19.6	80.4
2. Do you feel a need to spend more and more time on-line to achieve satisfaction?	21.0	79.0	17.7	82.3	15.7	84.3
3. Have you repeatedly made unsuccessful efforts to control, cut back, or stop Internet use?	18.9	81.1	17.9	82.1	17.8	82.2
4. Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop Internet use?	9.6	90.4	9.3	90.7	7.7	92.3
5. Do you stay on-line longer than originally intended?	47.9	52.1	48.5	51.5	45.3	54.7
6. Have you jeopardized or risked the loss of a significant relationship, job, educational or career opportunity because of the Internet?	20.6	79.4	23.1	76.9	20.9	79.1
7. Have you lied to family members, teachers, social workers	12.4	87.6	11.7	88.3	10.7	89.3
8. Do you use the Internet as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)?	20.4	79.6	21.9	78.1	19.0	81.0
9. Do you keep returning even after spending too much money on online fees?	8.6	91.4	8.6	91.4	7.4	92.6
10. Do you feel depressed, irritable, moody, or anxious when you are offline?	7.1	92.9	7.5	92.5	7.3	92.7

questionnaire ranged from 0.79 to 0.82 across the three waves (see **Table 3**), indicating good internal consistency.

Quality of the Father– and Mother–Child Subsystems

In the questionnaire, different paternal and maternal factors were measured by a reliable and validated scale entitled "Parent–Child Subsystem Quality Scale (PCSQS)" (16, 39). The PCSQS includes two 17-item subscales on paternal and maternal factors, respectively. The 17 items in each subscale can be further grouped into three dimensions. The first dimension includes seven items that assess paternal/maternal behavioral control, as indexed by each parent's expectation (e.g., "my father/mother expects me to exhibit good behavior in school"), knowledge (e.g., "my father/mother asked me about what I did after school"), and monitoring (e.g., "my father/mother actively understands my afterschool activities"). The second dimension comprises four items measuring the father's/mother's psychological control (e.g., "my father/mother often wants to change my mind or feelings about things"). The third dimension comprises six items that assess the quality of the father–/mother–child relationship, indexed by children's satisfaction with their parents' control (e.g., "my father's/mother's discipline of me is reasonable") and children's active communication with their parents (e.g., "I share my feelings with my father/mother"). A 4-point scale (1 = "strongly disagree," 4 = "strongly agree") is used to rate each item. Participants' score on each dimension is indicated by the average score across all items included in it. In the present study, all subscales of the PCSQS demonstrated good reliability, as reflected by the high Cronbach's αs (0.88–0.91) across waves (see **Table 3**).

Family Economic Condition

Participants' family economic conditions were indexed by whether their family was living on welfare received from the "Comprehensive Social Security Assistance (CSSA) Scheme" of the Hong Kong Government. In the current study, the 182 (5.9%) adolescents who reported that their family was living on welfare from the CSSA at Wave 4 were grouped as "having family economic disadvantage," and the other 2,684 (87.3%) participants whose family was not living on welfare from the CSSA at Wave 4 were categorized as "not having family economic disadvantage."

Family Intactness

Parental marital status reported by the participants at Wave 4 was used to index family intactness. Specifically, if parents were in the first marriage, participants ($n = 2{,}528$, 82.2%) were categorized as "having an intact family." Separation, divorce, or second marriage of parents was treated as an indicator of living in a "non-intact family" ($n = 534$, 17.4%).

Plan of Analysis

The statistical analysis plan was the same as that used in Shek et al.'s (28) study involving early adolescents. Specifically, we first analyzed the reliability of measures, descriptions, and correlations among variables. Subsequently, individual growth curve (IGC) modeling was utilized to investigate the predictive

TABLE 3 | Reliability of scales and description of variables across the three waves.

Scale	Number of item	Wave	Cronbach's α	Mean inter-item correlation	Range	*M*	*SD*
Internet Addiction Test	10	Wave 4	0.79	0.29	0–10	1.94	2.22
		Wave 5	0.80	0.30	0–10	1.91	2.25
		Wave 6	0.82	0.33	0–10	1.71	2.23
Father–Child Subsystem Quality Scale	17						
Paternal behavioral control	7	Wave 4	0.89	0.53	1–4	2.48	0.59
		Wave 5	0.89	0.53	1–4	2.46	0.58
		Wave 6	0.90	0.55	1–4	2.44	0.59
Paternal psychological control	4	Wave 4	0.86	0.61	1–4	2.19	0.69
		Wave 5	0.86	0.60	1–4	2.17	0.66
		Wave 6	0.88	0.65	1–4	2.16	0.68
Father–child relational quality	6	Wave 4	0.90	0.61	1–4	2.73	0.62
		Wave 5	0.90	0.60	1–4	2.72	0.61
		Wave 6	0.90	0.62	1–4	2.71	0.60
Mother–Child Subsystem Quality Scale	17						
Maternal behavioral control	7	Wave 4	0.89	0.53	1–4	2.89	0.56
		Wave 5	0.89	0.54	1–4	2.86	0.56
		Wave 6	0.88	0.51	1–4	2.84	0.53
Maternal psychological control	4	Wave 4	0.89	0.67	1–4	2.26	0.73
		Wave 5	0.89	0.68	1–4	2.24	0.71
		Wave 6	0.91	0.71	1–4	2.23	0.72
Mother–child relational quality	6	Wave 4	0.90	0.60	1–4	2.94	0.58
		Wave 5	0.90	0.61	1–4	2.93	0.57
		Wave 6	0.90	0.60	1–4	2.93	0.55

effects of different parenting factors on the initial level of adolescent IA as well as its developmental trajectory across senior high school, to address the first two research questions. In the present IGC analysis, time (i.e., Wave 4 = 0, Wave 5 = 1, and Wave 6 = 1.83), as the Level 1 predictor, was nested into Level 2 predictors, which included both control variables and measures of the parent-child subsystem quality, leading to 2-level hierarchical models.

Testing of the hierarchical models in the present study followed procedures that have been widely adopted in previous research (28, 40–42). Basically, four models were compared. Model 1 was an unconditional mean model. Model 2 was a linear growth model that only involved Level 1 predictors (i.e., time). Model 3 was also a linear growth model, which further involved the control variables as Level 2 predictors in addition to Level 1 predictors. Model 4 further included the different aspects of the parent-child subsystem quality as Level 2 predictors in addition to Model 3 predictors. Using these procedures, any individual variability in the initial level of and the change rate of IA caused by Level 2 predictors could be identified. In this study, the three parental factors (i.e., behavioral control, psychological control, and quality of the parent-child relationship) were investigated as Level 2 predictors in Model 4a, 4b, and 4c, respectively. To explore any potential gender effect regarding parental influence on the initial level of adolescent IA and its change over time, we also tested gender-based IGC models.

Following previous studies (41, 42), we used three indices to index model fit, "−2log likelihood," "Akaike Information Criterion" (AIC), and "Bayesian Information Criterion" (BIC). For these indices, a smaller value indicates a better model fit. Before performing IGC analyses, we dummy coded the three control variables as follows: "female" = "−1," "male" = "1"; "having family economic disadvantage" = "−1," "without family economic disadvantage" = "1"; "non-intact family" = "−1," "intact family" = "1." Meanwhile, parental factors were standardized.

The third research question was addressed by multiple regression analyses examining cross-sectional as well as longitudinal predictive effects of father–related factors, mother–related factors, and all parenting factors on adolescent IA. In short, the present study examined cross-sectional effects of parental factors on children's IA at all three waves. For longitudinal predictive effects, we examined the predictive effects of parental factors at Wave 4 on children's IA at Waves 5 and 6. In addition, to test whether children's gender would moderate parental influence on adolescent IA, we further included the interactions between gender and each factor related to parent–child subsystem quality in regression analyses.

RESULTS

Correlations Among Variables

Table 4 shows the correlation coefficients among the variables examined in the present study. While parental behavioral control and relationships between parents and children were negatively associated with children's IA, there were positive correlations between parental psychological control and children's IA. These results support the general expectations. In addition, compared to female adolescents, male adolescents demonstrated a higher level of IA across all waves.

Developmental Trajectory of Adolescent IA and Predictive Effects of Control Variables

Model 1 (i.e., the unconditional mean model) showed a relatively high intra-class correlation coefficient (ICC; 0.575) (see **Table 5**), indicating that individual differences accounted for 57.5% of the

TABLE 4 | Correlations among variables.

	Variables	1	2	3	4	5	6	7	8	9	10	11
1.	Gender[a]	–										
2.	FES[b]	0.05*	–									
3.	FI [c]	0.04*	0.30***	–								
4.	W4 PBC	0.01	0.10***	0.14***	–							
5.	W4 PPC	0.13***	0.03	0.05**	0.13***	–						
6.	W4 FCRQ	−0.03	0.08***	0.17***	0.66***	−0.17**	–					
7.	W4 MBC	−0.10***	0.07***	0.10***	0.43***	0.03	0.33***	–				
8.	W4 MPC	0.09***	0.01	−0.02	0.03	0.45***	−0.10***	0.06***	–			
9.	W4 MCRQ	−0.11***	0.03	0.08***	0.31***	−0.06**	0.40***	0.63***	−0.26***	–		
10.	W4 IA	0.11**	−0.04*	−0.03	−0.16***	0.09***	−0.14***	−0.10***	0.13***	−0.13***	–	
11.	W5 IA	0.05*	−0.05**	−0.03	−0.11***	0.06**	−0.11***	−0.06**	0.10***	−0.07***	0.60***	–
12.	W6 IA	0.05**	−0.03	−0.03	−0.09***	0.08***	−0.09***	−0.05**	0.09***	−0.06***	0.52***	0.61***

The correlational patterns between parent-child subsystem qualities at different waves and other variables were the same, so only the results on Wave 4 parenting characteristics were presented in the table due to space limit. FES, Family economic status; FI, Family intactness; PBC, Paternal behavioral control; PPC, Paternal psychological control; FCRQ, Father–child relational quality; MBC, Maternal behavioral control; MPC, Maternal psychological control; MCRQ, Mother–child relational quality; IA, Internet addiction; W4, Wave 4; W5, Wave 5; W6, Wave 6.

[a]Female = −1, Male = 1.

[b]Having economic disadvantage = −1, Not having economic disadvantage = 1.

[c]Non-intact family = −1, Intact family = 1.

**p < 0.05; **p < 0.01; ***p < 0.001.*

TABLE 5 | Results of IGC models (Model 1–3) for adolescent Internet addiction (Wave 4–6).

		Model 1		Model 2		Model 3		Model 2 (Male)		Model 2 (Female)	
		Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
FIXED EFFECTS											
Intercept	β_{0j}										
Intercept	γ_{00}	1.851***	0.0341	1.965***	0.0395	2.192***	0.0852	2.176***	0.0609	1.743***	0.0492
Gender[a]	γ_{01}					0.210***	0.0407				
Family economic status[b]	γ_{02}					−0.221*	0.0878				
Family intactness[c]	γ_{03}					−0.051	0.0573				
Linear Slope	β_{1j}										
Time	γ_{10}			−0.1201***	0.0214	−0.164***	0.0465	−0.1902***	0.0329	−0.0469	0.0271
Gender[a]	γ_{11}					−0.070**	0.0222				
Family economic status[b]	γ_{12}					0.025	0.0480				
Family intactness[c]	γ_{13}					0.030	0.0313				
RANDOM EFFECTS											
Level 1 (within)											
Residual	r_{ij}	2.1250***	0.0383	1.8541***	0.0473	1.7818***	0.0472	2.2553***	0.0804	1.4335***	
Level 2 (between)											
Intercept	u_{0j}	2.8759***	0.0923	3.2028***	0.1291	3.1664***	0.1310	3.8946***	0.2194	2.3717***	
Time	u_{1j}			0.3081***	0.0457	0.3415***	0.0466	0.3589***	0.0773	0.2450***	
FIT STATISTICS											
Deviance		38106.22		38024.38		35106.70		20277.69		17489.08	
AIC		38112.22		38036.38		35130.70		20289.69		17501.08	
BIC		38133.61		38079.15		35215.36		20328.45		17539.54	
Df		3		6		12		6		6	

*Model 1, unconditional mean model; Model 2, unconditional linear growth model; Model 3, conditional growth curve model (only with socio-demographic variables). [a]Female = −1, Male = 1;[b] Having economic disadvantage = −1, Not having economic disadvantage = 1; [c]Non-intact family = −1, Intact family = 1. AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion. *p < 0.05; **p < 0.01; ***p < 0.001.*

variance in IA levels. Thus, both Level 1 and Level 2 predictors should be considered (41). Comparison of model fit indices between Models 1 and 2 (i.e., the unconditional linear model) suggested that Model 2 fit the data better [$\Delta\chi^2_{(3)} = 81.85$, $p < 0.001$, $\Delta AIC = 75.85$, $\Delta BIC = 54.46$]. According to Model 2, the level of adolescent IA declined slightly during the senior high school years ($\beta = -0.120$, $p < 0.001$) (see **Figure 1**).

In Model 3, the control variables and time were treated as Level 2 predictors. Results showed that gender and family economic status were significant predictors of adolescents' IA level at Wave 4 (see **Table 5**). More specifically, male participants ($\beta = 0.210$, $p < 0.001$) or those with family economic disadvantage ($\beta = -0.221$, $p < 0.05$) had higher initial levels of IA. Additionally, gender had a significant effect on the rate of change in IA. Specifically, compared with female peers, male adolescents exhibited a faster drop in IA from Wave 4 to Wave 6 ($\beta = -0.070$, $p < 0.01$).

Further gender-based analyses for Model 2 revealed that the level of IA dropped significantly among male adolescents ($\beta = -0.190$, $p < 0.001$) and female adolescents, ($\beta = -0.047$, $p = 0.04$, one-tailed), although the magnitude was lower in female adolescents (see **Table 5** and **Figure 1**). The results suggest that most of the variation in IA over time among the full sample is attributable to male adolescents.

Predictive Effects of Parental Factors on the Initial Level of Adolescent IA

Model 4a, 4b, and 4c considered parental behavioral control, psychological control, and quality of the relationship between parents and children as predictors, respectively. Results of gender-based analyses for Model 4a, 4b, and 4c suggested that parental factors showed similar predictive effects on the initial level of IA among male and female adolescents. Thus, we only elaborated related findings below based on the full sample shown in **Table 6**.

For the full sample, compared to Model 3 shown in **Table 5**, Model 4a ($\Delta\chi^2_{(4)} = 70.64$, $p < 0.001$, $\Delta AIC = 62.64$, $\Delta BIC = 34.42$), Model 4b ($\Delta\chi^2_{(4)} = 55.35$, $p < 0.001$, $\Delta AIC = 47.35$, $\Delta BIC = 19.13$) and Model 4c ($\Delta\chi^2_{(4)} = 64.26$, $p < 0.001$, $\Delta AIC = 56.26$, $\Delta BIC = 28.04$) had better model fits than Model 3 did (see **Table 6**).

According to Model 4a, while paternal behavioral control significantly predicted the initial level of adolescent IA at Wave 4 ($\beta = -0.327$, $p < 0.001$), maternal behavioral control did not ($\beta = -0.037$, $p > 0.05$). Thus, Hypothesis 1a was supported, while Hypothesis 1b was not.

According to Model 4b, while maternal psychological control was a significant predictor of the initial level of adolescent IA ($\beta = 0.247$, $p < 0.001$), paternal psychological control was not

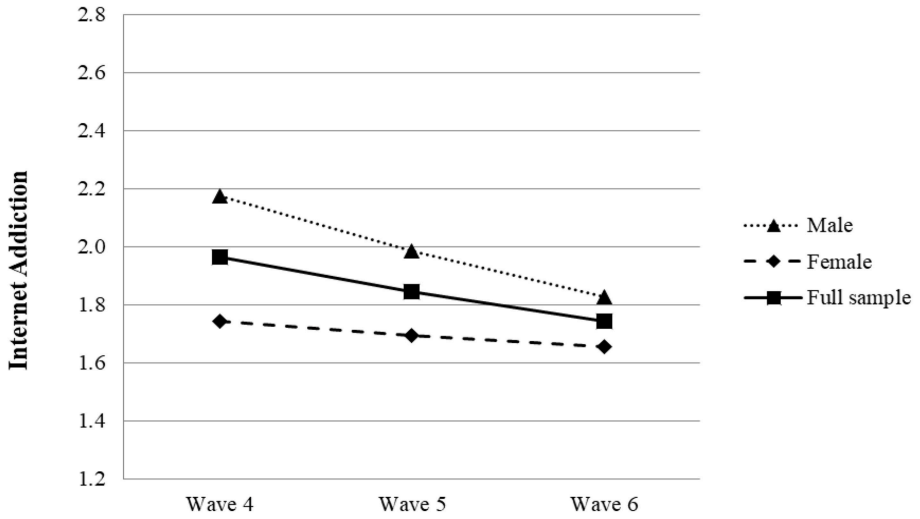

FIGURE 1 | Growth trajectories of adolescent Internet addiction as a function of gender. The figure for the full sample was plotted based on Model 2 shown in **Table 5**. The figures for male and female samples were plotted based on results of gender-based analyses for Model 2 shown in **Table 5**.

($\beta = 0.073$, $p > 0.05$). These results did not support Hypothesis 1c, but they supported Hypothesis 1d.

According to Model 4c, the quality of the relationship between fathers and children ($\beta = -0.258$, $p < 0.001$) and between mothers and children ($\beta = -0.122$, $p < 0.01$) were both significant predictors of children's level of IA at Wave 4. Thus, Hypotheses 1e and 1f were supported.

Predictive Effects of Parental Factors on the Growth Rate of Adolescent IA

It was noteworthy that parental factors generally did not have significant impacts on the change rate of female adolescents' IA. Predictive effects of parental factors on the growth rate of IA based on the full sample were largely contributed by male adolescents (i.e., parental factors showed a similar pattern of predictive effects between the full sample and the male sample). In the following sections, we mainly outline the results based on the full sample (see **Table 6**).

It was found that paternal behavioral control significantly predicted the growth rate of children's IA across three waves ($\beta = 0.082$, $p < 0.01$), but maternal behavioral control did not ($\beta = 0.028$, $p > 0.05$) (see **Table 6**). Results indicated that participants with higher paternal behavioral control showed a lower level of IA at Wave 4 but a slower decrease in IA over time (see **Figure 2**). Although parental behavioral control tended to significantly predict the linear change rate of adolescent IA, the direction was contrary to our hypothesis. Thus, both Hypotheses 2a and 2b were not supported.

Based on the results presented in **Table 6**, while paternal psychological control was not significantly associated with the growth rate of adolescent IA ($\beta = 0.018$, $p > 0.05$), higher maternal psychological control was linked to a faster decrease in children's IA from Wave 4 to Wave 6 ($\beta = -0.052$, $p < 0.05$, see **Figure 3**). The direction of maternal psychological control's predictive effect on the change rate in adolescent IA was opposite to our hypothesis. Hence, Hypotheses 2e and 2f were not supported.

With reference to Model 4c, the quality of relationship between mothers and children was a significant predictor of the growth rate of adolescent IA ($\beta = 0.061$, $p < 0.05$), while father–child relationship quality was not ($\beta = 0.038$, $p > 0.05$) (see **Table 6**). These findings suggested that a better mother–child relationship predicted a slower decline in IA during senior high school years (see **Figure 4**). Thus, Hypothesis 2c and 2d were not supported.

Relative Concurrent and Longitudinal Influence of Paternal and Maternal Factors

Results of the relative concurrent and longitudinal predictive effects of paternal and maternal factors have been present in **Tables 7**, **8**. Further analyses, including interactions between gender and each parental factor, revealed that children's gender did not substantially moderate the concurrent and longitudinal predictive effects of parental factors. In this case, we outlined regression results based on the full sample in sections below.

First, after the three social-demographic factors were controlled, the three concurrent father-related factors explained 3.4, 2.9, and 2.3% of variance in children's IA at Wave 4, 5, and 6 respectively. **Table 7** shows that father–child relationship quality did not show cross-sectional effect in any wave. While paternal behavioral control significantly predicted children's IA negatively (Wave 4: $\beta = -0.16$, $p < 0.001$, Cohen's $f^2 = 0.013$; Wave 5: $\beta = -0.15$, $p < 0.001$, Cohen's $f^2 = 0.012$; Wave 6: $\beta = -0.11$, $p < 0.001$, Cohen's $f^2 = 0.007$). Paternal psychological control positively predicted children's IA at the three time points (Wave 4: $\beta = 0.10$, $p < 0.001$, Cohen's $f^2 = 0.009$; Wave 5: $\beta = 0.14$, $p < 0.001$, Cohen's $f^2 = 0.018$; Wave 6: $\beta = 0.13$, $p < 0.001$, Cohen's $f^2 = 0.014$). For longitudinal effects, paternal factors assessed at

TABLE 6 | Results of IGC models with level-2 predictors for adolescent Internet addiction (Wave 4–6, full sample).

		Model 4a		Model 4b		Model 4c	
		Estimate	SE	Estimate	SE	Estimate	SE
FIXED EFFECTS							
Intercept	$\beta_0 j$						
Intercept	γ_{00}	2.121***	0.0846	2.198***	0.0845	2.132***	0.0846
Gender[a]	γ_{01}	0.209***	0.0404	0.177**	0.0407	0.188***	0.0405
Family economic status[b]	γ_{02}	−0.181*	0.0869	−0.224*	0.0871	−0.199*	0.0869
Family intactness[c]	γ_{03}	0.005	0.0570	−0.050	0.0569	0.016	0.0573
Paternal behavioral control	γ_{04}	−0.327***	0.0448				
Maternal behavioral control	γ_{05}	−0.037	0.0446				
Paternal psychological control	γ_{06}			0.073	0.0453		
Maternal psychological control	γ_{07}			0.247***	0.0452		
Father–child relational quality	γ_{08}					−0.258***	0.0446
Mother–child relational quality	γ_{09}					−0.122**	0.0444
Linear Slope	$\beta_1 j$						
Intercept	γ_{10}	−0.143**	0.0466	−0.163***	0.0465	−0.151**	0.0466
Gender[a]	γ_{11}	−0.068**	0.0223	−0.067*	0.0224	−0.062*	0.0223
Family economic status[b]	γ_{12}	0.013	0.0479	0.025	0.0479	0.020	0.0479
Family intactness[c]	γ_{13}	0.013	0.0314	0.028	0.0313	0.015	0.0316
Paternal behavioral control	γ_{14}	0.082**	0.0247				
Maternal behavioral control	γ_{15}	0.028	0.0246				
Paternal psychological control	γ_{16}			0.018	0.0249		
Maternal psychological control	γ_{17}			−0.052*	0.0249		
Father–child relational quality	γ_{18}					0.038	0.0246
Mother–child relational quality	γ_{19}					0.061*	0.0244
RANDOM EFFECTS							
Level 1 (within)							
Residual	r_{ij}	1.7818***	0.0472	1.7818***	0.0472	1.7818***	0.0472
Level 2 (between)							
Intercept	u_{0j}	3.0525***	0.1282	3.0857***	0.1290	3.0663***	0.1285
Time	u_{1j}	0.3324***	0.0464	0.3393***	0.0465	0.3348***	0.0464
FIT STATISTICS							
Deviance		35036.06		35051.35		35042.44	
AIC		35068.06		35083.35		35074.44	
BIC		35180.93		35196.23		35187.32	
df		16		16		16	

*[a]Female = −1, Male = 1; [b]Having economic disadvantage = −1, Not having economic disadvantage = 1; [c]Non-intact family = −1, Intact family = 1. AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion. *p < 0.05; **p < 0.01; ***p < 0.001.*

Wave 4 explained 1.7 and 1.5% of the variance in children's IA at the latter two time points, respectively. **Table 8** shows that the father–child relationship did not predict adolescent IA over time. While paternal behavioral control was a negative longitudinal predictor of children's IA (Wave 5: $\beta = -0.09$, $p < 0.001$, Cohen's $f^2 = 0.004$; Wave 6: $\beta = -0.08$, $p < 0.01$, Cohen's $f^2 = 0.003$), paternal psychological control was a positive longitudinal predictor of children's IA (Wave 5: $\beta = 0.07$, $p < 0.001$, Cohen's $f^2 = 0.004$; Wave 6: $\beta = 0.09$ $p < 0.001$, Cohen's $f^2 = 0.006$).

Second, the three concurrent maternal factors explained 2.4, 1.6, and 1.8% of the variance in children's IA across Wave 4 to 6 (see **Table 7**), respectively. Specifically, the quality of the relationship between mothers and children was not a significant concurrent predictor of children's IA. Maternal behavioral control had a significant negative predictive effect at Wave 4 ($\beta = -0.07$ $p < 0.01$, Cohen's $f^2 = 0.003$), but not at Waves 5 and 6. In contrast, maternal psychological control positively predicted children's IA (β ranged between 0.12 and 0.13, *ps* < 0.001, Cohen's f^2 ranged between 0.012 and 0.015). The longitudinal effects of maternal factors measured at Wave 4 explained 1.3 and 1.0% of the variance in children's IA at the latter two waves, respectively. **Table 8** shows that mother–child relational quality did not predict children's IA over time. In contrast, the longitudinal effect of maternal behavioral control on adolescent IA was significant at Wave 5 ($\beta = -0.06$, $p < 0.05$, Cohen's $f^2 = 0.002$), but not significant at Wave 6 ($\beta = -0.04$, $p > 0.05$,

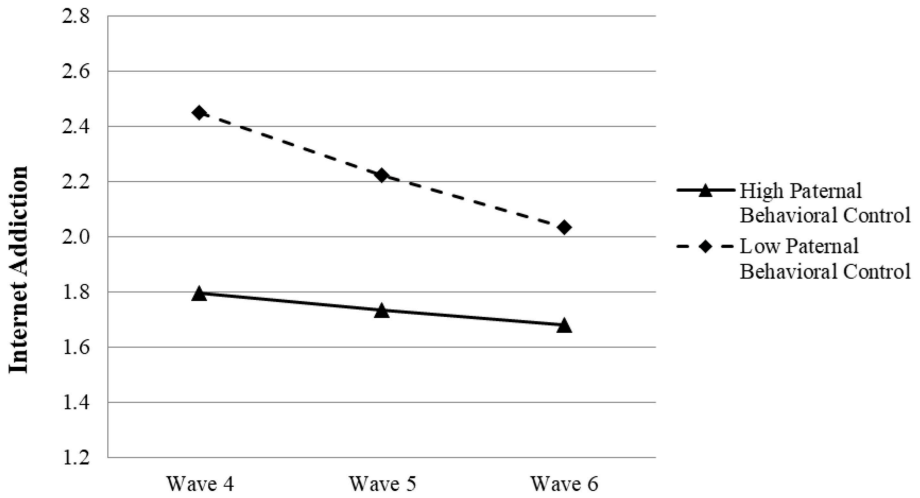

FIGURE 2 | Growth trajectories of adolescent Internet addiction as a function of paternal behavioral control. The figures were plotted based on Model 4a shown in **Table 6**. High level indicates 1SD higher than the mean value; low level indicates 1SD lower than the mean value.

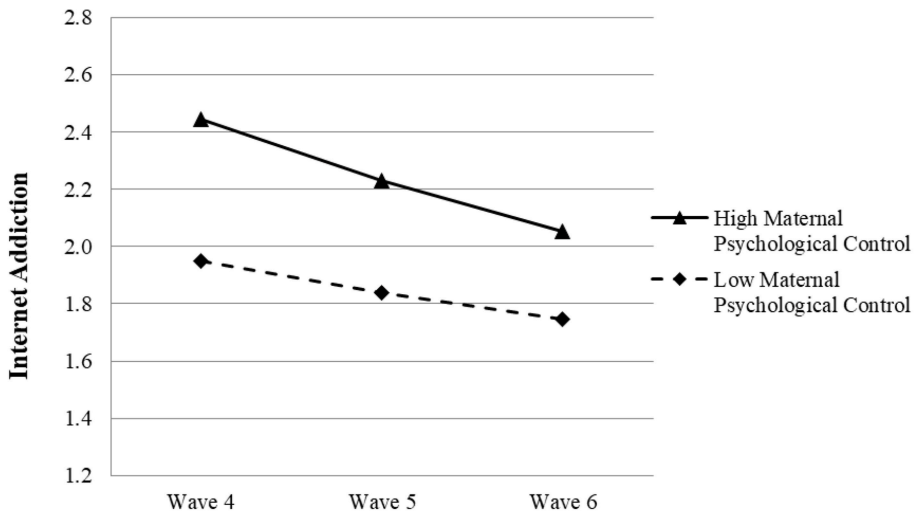

FIGURE 3 | Growth trajectories of adolescent Internet addiction as a function of maternal psychological control. The figures were plotted based on Model 4b shown in **Table 6**. High level indicates 1SD higher than the mean value; low level indicates 1SD lower than the mean value.

Cohen's $f^2 = 0.001$). However, maternal psychological control predicted children's IA at the two waves (Wave 5: $\beta = 0.10$, $p < 0.001$, Cohen's $f^2 = 0.009$; Wave 6: $\beta = 0.10$, $p < 0.001$, Cohen's $f^2 = 0.008$).

The above results indicated that paternal factors explained a larger amount of variance in adolescent IA than did maternal factors. Thus, the findings tended to support Hypothesis 3a rather than Hypothesis 3b.

Third, when the concurrent paternal factors and maternal factors were investigated simultaneously, they uniquely explained 4.4, 3.5, and 2.9% of the variance in children's IA at the three waves, respectively (see **Table 7**). Specifically, while father– and mother–child relationship quality and maternal behavioral control did not show cross-sectional effects, paternal behavioral control (β ranged between -0.15 and -0.12, $ps < 0.001$, Cohen's f^2 ranged between 0.006 and 0.011) and psychological control (β ranged between 0.05 and 0.11, $ps < 0.05$, Cohen's f^2 ranged between 0.002 and 0.009), as well as maternal psychological control (β ranged between 0.07 and 0.10, $ps < 0.01$, Cohen's f^2 ranged between 0.004 and 0.007) were significant concurrent predictors in the three waves. Regarding longitudinal effects, parental factors measured at Wave 4 explained 2.3% and 1.8% of the variance in children's IA measured at the latter two waves, respectively (see **Table 8**). Among the six parental factors, only paternal behavioral control and maternal psychological control showed robust longitudinal effects on children's IA. While paternal behavioral control exerted negative effects on children's IA over time (Wave 5: $\beta = -0.08$, $p < 0.01$, Cohen's $f^2 = 0.003$;

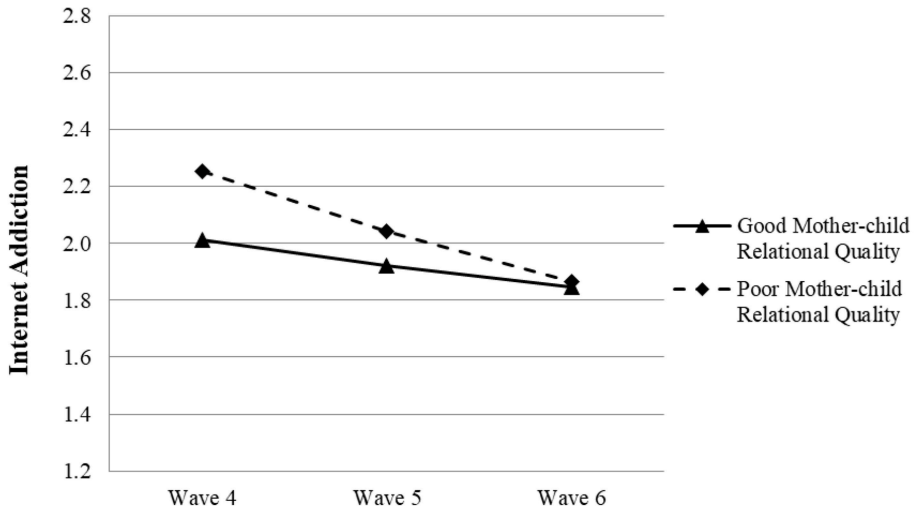

FIGURE 4 | Growth trajectories of adolescent Internet addiction as a function of mother–child relational quality. The figures were plotted based on Model 4c shown in **Table 6**. Good quality indicates 1SD higher than the mean value; poor quality indicates 1SD lower than the mean value.

Wave 6: $\beta = -0.07$, $p < 0.01$, Cohen's $f^2 = 0.003$), maternal psychological control showed positive longitudinal effects (Wave 5: $\beta = 0.09$, $p < 0.001$, Cohen's $f^2 = 0.005$; Wave 6: $\beta = 0.07$, $p < 0.01$, Cohen's $f^2 = 0.004$).

The present findings are summarized in **Table 1** with reference to the hypotheses.

DISCUSSION

The present study examined parental influence on the development of Internet Addiction (IA) among Chinese adolescents. Three research questions were focused upon in this study. First, by separating paternal and maternal factors, our study examined the impacts of multiple parenting factors and quality of the relationship between parents and children on the initial level of children's IA. Second, the predictive effects of parental factors on the growth rate of children's IA were also investigated. Third, we also examined and compared the influence of different parental factors on adolescent IA at a single time point and over time. While a recent study has addressed these questions in early adolescents (28), the present study involved late adolescents in senior high school. In addition, gender-based analyses were conducted to further explore the effects of children's gender.

While most of the present findings are similar to the observations reported on early adolescents, some are different from these previous findings (28). For the first research question, male adolescents showed a higher initial level of IA than did females, which is in line with previous findings (28, 43). In addition, we observed a decline trend in adolescent IA. It is plausible that students in the higher grade will be less devoted to activities related to the Internet as they must prepare for the university entrance examination. Additionally, the magnitude of decline in IA was greater among male adolescents than that among female students. This gender difference may be attributed to female adolescents' relatively low level of initial IA, which was unlikely to decline substantially (i.e., floor effect). Furthermore, we did not observe a significant effect regarding children's gender and parental impacts on IA levels, which is inconsistent with the previous findings that parental psychological control was more influential on girls' than on boys' externalizing behaviors (26, 30). Nevertheless, as no previous research has tested gender effect regarding change in IA over time, more research is needed to portray a conclusive picture.

Regarding the parental influence on the initial level of IA that was addressed by the first research question, four hypotheses (1a, 1d, 1e, and 1f) were supported, whereas Hypotheses 1b and 1c were not. Specifically, when each aspect of the quality of the parent–child subsystem was examined separately in individual growth curve (IGC) models based on the full sample, higher paternal but not maternal behavioral control, and better relationships with both parents, were significantly associated with lower levels of initial adolescent IA. Additionally, higher maternal but not paternal psychological control predicted a higher level of initial adolescent IA. Gender-based IGC models showed similar findings for male and female adolescents. On the one hand, these findings suggested that parents' behavioral control and better parent-child relationships are positive parenting factors, whereas psychological control is a negative factor, regardless of children's gender. This conclusion echoes the previous findings observed in both Chinese and Western contexts (7, 28, 44).

On the other hand, the observations shed light on the differential influence of fathers' and mothers' factors. Specifically, paternal parenting had a closer association with adolescent IA via behavioral control, while mothers exerted stronger influence through psychological control. These findings seem to be different from the results reported in Shek et al.'s (28) research,

TABLE 7 | Concurrent predicting effects of parent–child subsystem qualities on Internet addiction.

Model	Predictors	Wave 4 Internet addiction[a]			Wave 5 Internet addiction[b]			Wave 6 Internet addiction[c]		
		β	*t*	Cohen's f^2	β	*t*	Cohen's f^2	β	*t*	Cohen's f^2
1	Gender[d]	0.10	5.525***	0.011	0.05	2.43*	0.002	0.05	2.48*	0.002
	FES[e]	−0.04	−2.21*	0.002	−0.05	−2.76**	0.003	−0.03	−1.64	0.001
	FI[f]	−0.02	−0.77	0.000	−0.01	−0.60	0.000	0.00	0.19	0.000
	R^2 change	0.013	0.005	0.003						
	F change	12.08***	5.00**	2.879*						
2	PBC	−0.16	−6.14***	0.013	−0.15	−5.89***	0.012	−0.11	−4.39***	0.007
	PPC	0.10	4.94***	0.009	0.14	7.09***	0.018	0.13	6.40***	0.014
	FCRQ	−0.02	−0.56	0.000	0.03	1.15	0.000	0.02	0.80	0.000
	R^2 change	0.034	0.029	0.023						
	F change	36.75***	28.87***	21.43***						
3	MBC	−0.07	−2.83**	0.003	−0.04	−1.42	0.001	−0.03	−1.31	0.001
	MPC	0.13	6.25***	0.014	0.12	5.89***	0.012	0.13	6.48***	0.015
	MCRQ	−0.02	−0.92	0.000	−0.02	−0.69	0.000	0.00	0.04	0.000
	R^2 change	0.024	0.016	0.018						
	F change	23.21***	15.87***	17.18***						
4	PBC	−0.15	−5.53***	0.011	−0.15	−5.74***	0.012	−0.12	−4.16***	0.006
	PPC	0.05	2.37*	0.002	0.11	4.99***	0.009	0.09	3.81***	0.005
	FCRQ	−0.01	−0.35	0.000	0.04	1.33	0.001	0.02	0.83	0.000
	MBC	−0.01	−0.34	0.000	0.03	1.03	0.000	0.02	0.63	0.000
	MPC	0.10	4.57***	0.007	0.07	3.23**	0.004	0.09	4.08***	0.006
	MCRQ	−0.02	−0.66	0.000	−0.03	−1.08	0.000	−0.01	−0.28	0.000
	R^2 change		0.044			0.035			0.029	
	F change		22.00***			17.49***			14.32***	

*For Model 2–4, social-demographic variables were controlled. [a]Parent–child subsystem qualities measured at Wave 4 were used; [b]Parent–child subsystem qualities measured at Wave 5 were used; [c]Parent–child subsystem qualities measured at Wave 6 were used; [d]Female = −1, Male = 1; [e]Having economic disadvantage = −1, Not having economic disadvantage = 1; [f]Non-intact family = −1, Intact family = 1. FES, Family economic status; FI, Family intactness; PBC, Paternal behavioral control; PPC, Paternal psychological control; FCRQ, Father–child relational quality; MBC, Maternal behavioral control; MPC, Maternal psychological control; MCRQ, Mother–child relational quality. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.*

which found that paternal and maternal factors tend to function in the same way in predicting the initial level of adolescent IA in early adolescence. However, as indicated by the estimated coefficients of predictors in Shek et al.'s (28) research, paternal behavioral control in comparison to maternal behavioral control, and maternal psychological control in comparison to paternal psychological control, tended to have a stronger association with the initial level of adolescent IA. Taken together, these findings suggest that fathers and mothers might contribute to the development of adolescent IA through different parental behaviors at different stages of adolescence. Such an assumption can help explain the existing mixed findings on paternal vs. maternal impacts on adolescent development. This will be discussed with reference to regression analyses below.

For the second research question, all the hypotheses based on general theoretical models were not supported. However, the findings are consistent with the previous observations among early adolescents (28). It was found that higher paternal behavioral control and better mother–child relationship predicted a slower decline in adolescent IA during senior high school years. Meanwhile, higher psychological control was linked with a faster decrease in adolescent IA. In short, these findings suggest that—similar to the situation in early adolescence—parental impacts also gradually diminish over time during late adolescence. These observations coincide with the decreasing amount of variance in adolescent IA explained by parental factors, as revealed by regression analyses. For example, the percentage of adolescent IA accounted by all concurrent parental factors decreased from 4.4% at Wave 4 to 2.9% at Wave 6. As suggested by Shek et al. (28), this finding may be attributable to adolescents' decreasing dependence on parents and increasing devotion to other types of social relationships (e.g., peer relationships). Additionally, at later stages of senior high school, all students in Hong Kong must invest most of their time and energy into preparing for the public examination. Thus, adolescents would generally be less different from each other in terms of their IA behaviors. Furthermore, those with IA problems may have dropped out from the study. Therefore, parental influence on adolescent IA may become less significant. Nevertheless, as the present study is a pioneering attempt, these findings need to be confirmed in future replication studies.

Regarding the contribution of fathers and mothers to children's IA levels (i.e., the third research question), the present study revealed that paternal factors accounted for a higher percentage of adolescent IA than did maternal factors, both concurrently and longitudinally. The general greater paternal impact vs. maternal impact on children's IA is in line with previous studies involving different developmental

TABLE 8 | Longitudinal predicting effects of parent–child subsystem qualities on Internet addiction.

Model	Predictors	Wave 5 Internet addiction			Wave 6 Internet addiction		
		β	*t*	Cohen's f^2	β	*t*	Cohen's f^2
1	Gender[a]	0.05	2.43*	0.002	0.05	2.48*	0.002
	FES[b]	−0.05	−2.76**	0.003	−0.03	−1.64	0.001
	FI[c]	−0.01	−0.60	0.000	0.004	0.19	0.000
	R^2 change		0.005			0.003	
	F change		5.00**			2.88*	
2	PBC	−0.09	−3.53***	0.004	−0.08	−2.96**	0.003
	PPC	0.07	3.56***	0.004	0.09	4.29***	0.006
	FCRQ	−0.03	−1.19	0.000	−0.02	−0.70	0.000
	R^2 change		0.017			0.015	
	F change		16.88***			14.09***	
3	MBC	−0.06	−2.47*	0.002	−0.04	−1.51	0.001
	MPC	0.10	5.10***	0.009	0.10	4.82***	0.008
	MCRQ	0.01	0.35	0.000	0.01	0.42	0.000
	R^2 change		0.013			0.010	
	F change		12.13***			9.22***	
4	PBC	−0.08	−2.97**	0.003	−0.07	−2.72**	0.003
	PPC	0.03	1.43	0.001	0.05	2.39*	0.002
	FCRQ	−0.04	−1.38	0.001	−0.03	−0.89	0.000
	MBC	−0.02	−0.90	0.000	0.00	−0.09	0.000
	MPC	0.09	3.88***	0.005	0.07	3.19**	0.004
	MCRQ	0.02	0.79	0.000	0.02	0.60	0.000
	R^2 change		0.023			0.018	
	F change		11.14***			8.93***	

*For Model 2–4, social-demographic variables were controlled; parent–child subsystem qualities measured at Wave 4 were used as predictors; [a]Female = −1, Male = 1; [b]Having economic disadvantage = −1, Not having economic disadvantage = 1; [c]Non-intact family = −1, Intact family = 1. FES, Family economic status; FI, Family intactness; PBC, Paternal behavioral control; PPC, Paternal psychological control; FCRQ, Father–child relational quality; MBC, Maternal behavioral control; MPC, Maternal psychological control; MCRQ, Mother–child relational quality. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.*

outcome measures. For example, using global treatment style, responsiveness, and demandingness to index parenting qualities, Shek (45, 46) reported that, relative to maternal parenting qualities, paternal parenting qualities had a greater impact on Chinese adolescent morbidities such as hopelessness and psychological well-being indexed by self-esteem, purpose of life, and life satisfaction. One recent study also identified that paternal, but not maternal, expectations regarding children's future significantly affected children's well-being (47). Generally speaking, fathers are less involved in parenting tasks than mothers are, especially in Chinese society (48). In the present study, fathers were less controlling and had a poorer relationship with the children as compared to mothers. However, as fathers occupy a superior and controlling role in Chinese families, fathers may be more influential in their children's developmental outcomes although they are less involved and more detached. This interpretation is consistent with other findings in early adolescents (49).

Different from the present study, Shek et al. (28) found that paternal and maternal factors had equal impacts on children's IA levels. One possible explanation is that the age of the adolescents may have served as a moderator. Specifically, Shek et al.'s (28) study involved early adolescents (mean age = 12.59 years old) who were younger as compared to the present participants. A recent study in Korea supported the potential moderating effect of children's age on parental impacts (50). The study showed that, while parental affection negatively predicted children's problematic mobile game use in the elementary school group, parental monitoring lead to less problematic mobile game use in the high school group. Future research could directly compare paternal impacts on adolescent IA with reference to different age groups to test the possibility that paternal factors might have generally greater impacts as compared to maternal factors among older adolescents.

Differential parental impacts should also be discussed with reference to specific aspects of parenting. As mentioned earlier, when each dimension of the parent–child subsystem was considered in the IGC models, paternal behavioral control but not maternal behavioral control, and maternal psychological control but not paternal psychological control, were significantly linked with the initial level of children's IA. Basically, these findings are consistent with the concurrent and longitudinal predictive effects derived from the regression analyses. When paternal and maternal factors were examined simultaneously in regressions, paternal behavioral control and maternal psychological control were the two most robust predictors of adolescent IA, both concurrently and longitudinally. The consistent findings obtained from

different analytical approaches informed the reliability of these findings.

Based on the findings, it can be conjectured that the impact of paternal factors is greater in terms of behavioral control, while maternal parenting is more influential in terms of psychological control over time. In previous studies, while some findings suggested stronger paternal impacts on adolescent development, some others supported stronger maternal impacts. One possible explanation for the mixed findings is that most of these studies focused on overall parenting without considering different dimensions of parenting or only referred to one dimension of parenting. For example, in studies that identified greater impacts of maternal psychological control on adolescent development outcomes, behavioral control or other parental factors were not examined simultaneously (25, 51). Chen et al. (52) identified stronger influence of fathers' indulgence, but they did not take psychological control into account. In fact, the results in a few studies that considered different domain-specific parental factors showed that both parents' influence differed from each other on specific aspects. For example, while maternal control showed a greater impact on children's achievement motivation and positive youth development than did paternal control, paternal sacrifice exerted a stronger influence than did maternal sacrifice on adolescents' positive youth development (53, 54). Thus, our findings suggest that it is important to distinguish between different processes of parenting in examining and comparing paternal and maternal influences.

There are two additional observations which deserve attention. First, the concurrent negative impacts of both parents' psychological control on adolescent IA are consistent with findings on early adolescence (28). Researchers advocated that parental psychological control would ruin children's age-appropriate sense of autonomy, which in turn results in adolescent misbehaviors and damaged psychological well-being. However, most of the findings were derived from samples of adolescents in Western cultures, which value autonomy and independence. Some scholars argued that in Asian countries, including China, parental psychological control may not be so detrimental as cultural norms in these areas emphasize children's obligations to the family and interdependence rather than independence (8, 55). Nevertheless, recent studies showed that in Chinese adolescents, parents' psychological control was concurrently associated with children's maladjustment, such as depression and anxiety as well as hopelessness (56). Thus, the present study adds to the extant literature by showing that the negative impacts of parents' psychological controlling behavior may be universal.

Second, the present longitudinal findings suggest that, during senior high school years, maternal psychological control might be more influential than paternal psychological control is. This observation is not consistent with the general view that negative paternal parenting is especially detrimental due to the greater authority and power of fathers in the family and the related attributes of the father–child dyad (30). For example, paternal psychological control was more closely associated with early adolescents' externalizing behaviors over time than maternal psychological control was (26, 30). Likewise, in early adolescence, paternal psychological control served as a more robust longitudinal predictor than maternal psychological control did for adolescent IA (28). Among university students, paternal, but not maternal, negative parenting in terms of denying and overprotectiveness resulted in a higher level of children's problematic Internet use (57). Nevertheless, it is possible that paternal and maternal negative parenting impact different adolescent developmental outcomes. For instance, Shek (58) found that paternal—but not maternal—psychological control showed a significant predictive effect on adolescents' life satisfaction in 1 year. Meanwhile, maternal—but not paternal—psychological control was a significant predictor of changes in adolescents' self-esteem. The present findings suggest the importance of examining this issue with reference to different measures of development outcomes among different age groups of adolescents.

The present study sheds light on the differential parental impacts on the concurrent and future levels and the growth rate of adolescents' IA during senior high school years. However, several limitations should be noted. First, the present study employed a quantitative design, which was unable to reveal the subjective feelings of participants and delineate potential mechanisms behind the quantitative findings. To portray a comprehensive picture and to triangulate the present findings, it is necessary to further investigate differential parental impacts using qualitative research strategies, such as focus group interview and case study.

Second, the utilized data were obtained only from adolescent participants' self-report. Although social desirability is a major shortcoming of self-report methodology, self-report data have commonly been collected in adolescent research, especially in longitudinal studies [e.g., (59)], possibly due to ethical and practical concerns. Besides, it is efficient and cost-effective, and it can be argued that adolescents themselves know their own experiences and lives much better than others. In the present study, to reduce social desirability bias as much as possible, anonymity was emphasized, and the participants were clearly instructed to provide answers based on their true perceptions without communicating with others. Nevertheless, future research could employ individual interviews in addition to self-report or involve different informants such as parents and teachers.

Third, the present study surveyed Chinese adolescents in a single region (i.e., Hong Kong). To verify and expand the generalizability of the present findings, future studies will benefit from investigating related questions among adolescents in other Chinese communities, such as those from mainland China, and adolescents from other ethnicities. Fourth, from Wave 4 to Wave 6, 899 participants withdrew from the study. In particular, more than 500 students withdrew from the study after Wave 4. This fact might affect the present findings. However, comparisons between the matched sample and dropouts suggested that there were no substantial differences in key variables between the two groups. Thus, the present findings were unlikely to be significantly affected by systematic attrition. Finally, as a control variable, family intactness was indicated by parental marital status. Since there were other factors related to family intactness, such as

family members' residential status (e.g., whether children are living with their parents) (60), future studies could consider more comprehensive measures of family intactness.

DATA AVAILABILITY

The datasets generated for this study are available on request to the corresponding author.

AUTHOR CONTRIBUTIONS

DS designed the project and contributed to all steps of the work. XZ contributed to the development of the idea and data interpretation. XZ and DD drafted the work and revised it based on the critical comments and editing provided by DS. All authors approve of the final version of the manuscript and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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The Psychometric Properties and Clinical Utility of the Korean Version of GAD-7 and GAD-2

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Generalized anxiety disorder (GAD) is a common but serious form of anxiety disorder. Despite this, the rate of GAD recognition in primary care remains low in both Western and Eastern countries. The GAD-7 and GAD-2 were developed to efficiently identify people with GAD, and their reliability and validity have been well-documented in Western countries. The GAD-7 and GAD-2 have also been widely utilized to screen for other anxiety disorders; however, their diagnostic utility has not been fully justified with empirical support, especially in East Asian samples. In this study, we examined the diagnostic sensitivity and specificity of these screening tools for identifying individuals with GAD or other anxiety disorders, and recommended screening cutoff scores for GAD and other anxiety disorders for use in Korea. Based on the rigorous standard suggested by the Quality Assessment of Diagnostic Accuracy Studies-2, a total of 1,157 participants randomly recruited from the community completed the GAD-7, GAD-2, and other anxiety and depression measures in a counter-balanced order. All participants were assessed, and their psychiatric diagnosis confirmed through a structured clinical interview conducted by independent clinicians blinded to the results of the self-report questionnaires. The GAD-7 and GAD-2 both showed excellent reliability and validity. Notably, both the GAD-7 and GAD-2 demonstrated acceptable diagnostic accuracy in detecting GAD with similar recommended cut-off scores as those reported in Western countries, but unacceptable diagnostic accuracy for other anxiety disorders. We conclude that given their brevity, the GAD-7 and GAD-2 can be well-utilized to identify people with GAD for preventative evaluation and treatment in Korea. Use of the GAD-7 and GAD-2 for screening other anxiety disorders should be cautioned.

Keywords: generalized anxiety disorder, GAD-7, GAD-2, screening instruments, sensitivity, specificity

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INTRODUCTION

Generalized anxiety disorder (GAD) is one of the most common yet serious forms of anxiety disorder, characterized mainly by pervasive, uncontrollable, and long-lasting worries. According to a global review on the prevalence of anxiety disorders, the lifetime prevalence of GAD was estimated to be 6.2% (95% confidence interval [CI]: 4.0–9.2%) (1) and 2.2% among adolescents (2). GAD often follows a chronic course and deteriorates overall quality of life and subjective well-being (3–5). Given the chronic nature and adverse functional outcomes of GAD, early diagnosis and

timely intervention are essential for individuals with GAD. However, due to frequent comorbidities and the nature of the disease, which is accompanied by various physical symptoms, approximately half of individuals with GAD consulted their primary care physicians rather than mental health professionals when seeking treatment for anxiety symptoms (6). Unfortunately, the rate of GAD recognition in primary care remains between 29.0% and 34.4% in Western countries (6, 7) and at 33.3% in non-Western countries (8, 9). Given this, a valid and reliable diagnostic tool for GAD in a brief format (i.e., a minimum number of questions) would facilitate early detection and proper timely intervention, not only in primary care institutions but in mental health settings as well.

The generalized anxiety disorder 7-item scale [GAD-7; (10)] was developed with the clear purpose of screening patients with GAD. The scale has also been widely used in both clinical and research settings to monitor the severity of GAD symptoms. It was proven to be a reliable and valid instrument, and its seven items reflect most of the GAD diagnostic domains in the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* (DSM-IV) (11). Further, the GAD-7 has been found to have clinical utility in screening for other anxiety disorders in several studies, although its sensitivity and specificity were lower than for GAD (12, 13). GAD is highly comorbid with other anxiety disorders and typically precedes the onset of the comorbidities, which contributed to the conceptualization of GAD as the "basic" anxiety disorder (14, 15). In sum, as GAD also shares common features of other anxiety disorders including uncontrollable worry and accompanying somatic symptoms (16), a screening tool for GAD may potentially detect other anxiety disorders as well.

A diagnostic meta-analysis of the GAD-7 reported its sensitivity and specificity for screening GAD as 0.83 (95% CI: 0.71–0.91) and 0.84 (95% CI: 0.70–0.92), respectively, at the cut-point of 8 or greater (17). For identifying anxiety disorders, sensitivity and specificity values ranged from 0.77 to 0.91 and 0.74 to 0.83, respectively, at the same cut-point (17). However, to use the GAD-7 as a screening tool for anxiety disorders, the cutoff score should be studied further (17).

Among its seven items of the GAD-7, items 1 and 2 represent the core anxiety symptoms. These thus comprise the GAD-2, an ultra-brief version of the GAD-7 questionnaire, which can be used in primary care settings with limited time and resources (12). Plummer et al. (17) reported acceptable sensitivity and specificity values for screening GAD at a GAD-2 cut-point of 3 [sensitivity: 0.76 [95% CI: 0.55–0.89], specificity: 0.81 [95% CI: 0.60–0.92]]. However, empirical evidence for GAD-2 is also insufficient to determine a cutoff score for identifying any other anxiety disorders, because sensitivity and specificity values were varied (17).

Therefore, the purposes of this study were (1) to examine the psychometric properties and diagnostic sensitivity and specificity of these screening tools for identifying individuals with any anxiety disorder, and (2) to determine cutoff scores for identifying both GAD and other anxiety disorders.

METHOD

Participants

The present study was carried out as part of a large nationally funded research project entitled, the Development and Validation of the Korean Depression and Anxiety Scales, conducted from September 2015 to August 2018. The ethical approval was accepted by Korea University Institutional Review Board. A total of 1,228 individuals were recruited for this study through two routes: online recruiting advertisements and introduction to potential research participants by hospital staff. All individuals voluntarily opted to participate in the study. The only inclusion criterion was being age of 19 years or older. Exclusion criteria were not specified to minimize sampling bias. For rigorous evaluation of the accuracy of the screening tools, the methodology of the Quality Assessment of Diagnostic Accuracy Studies-2 (QUADAS-2) (18) was applied. The QUADAS-2 evaluates the quality of screening tools in four domains: patient selection, index test, reference standard, and flow and timing. To avoid bias in participant selection, the samples in this study were randomly recruited and minimal exclusion criteria were specified. However, 71 individuals (5.78%) were excluded either because they did not complete the questionnaire or because they could not answer questions properly as a result of their psychiatric or medical symptoms. A final total of 1,157 participants were included in the present analysis.

Measures

Mini-International Neuropsychiatric Interview-Plus Version 5.0.0 (MINI)

The MINI is a structured clinical interview used to diagnose psychiatric disorders according to the DSM-IV and the *International Classification of Diseases, 10th Edition* (ICD-10). The Korean version of the MINI (19), which showed overall good agreement between MINI based and expert diagnoses, was used in this study. The MINI was utilized as a reference standard (i.e., criterion). The one-on-one, in-person clinical diagnostic interview took ∼30–50 min per participant. The MINI was administered by licensed clinical psychologists, psychiatrists and supervised clinical psychology senior students. The inter-rater reliability of the MINI was 0.92. Final psychiatric diagnoses were confirmed by licensed clinical psychologists and the psychiatrist.

GAD-7 and GAD-2

The GAD-7 is a simple, 7-item self-administered instrument designed to screen for GAD and used to assess the intensity of symptoms. Subjects are asked to rate the frequency at which they have been disturbed by each symptom over the past 2 weeks using a 4-point Likert scale. The Korean version of the GAD-7 (20), which is available on the Patient Health Questionnaire website (http://www.phqscreeners.com), was used in the present study. In the previous research (21), the items of the Korean version of the GAD-7 were translated and then back-translated by an independent bilingual speaker. The original version and back translated versions were compared by another native English speaker who concluded that both were identical. Korean version of GAD-7 showed excellent internal consistency ($\alpha = 0.93$).

The first three items of the GAD-7 relate to two core criteria of GAD (A and B) defined in the DSM-IV (10, 11). Therefore, use of a short-form version consisting of only the first two items was proposed, resulting in the GAD-2 scale. The GAD-2 is reported to be a reliable and valid tool for screening GAD, both when performed alone or when extracted from previous GAD-7 results (22). The two items showed the highest correlation with the GAD-7 total score (Pearson's $r = 0.94$, $p < 0.01$).

Anxiety Measures

Beck Anxiety Inventory (BAI)

The BAI (23) scale is widely used to assess the severity of anxiety and track treatment progress. This 21-item self-report inventory covers the affective, cognitive, and physical domains of anxiety. The measure asks respondents to indicate the extent to which they have suffered from each symptom over the past week using a 4-point Likert scale. The Korean version of the BAI (24) was used in this study, and showed excellent internal consistency ($\alpha = 0.96$).

Penn State Worry Questionnaire (PSWQ)

The PSWQ (25) is a 16-item self-administered instrument designed to measure the frequency and intensity of pathological worry. Each item is assessed on a 5-point Likert scale. In this study, the Korean version of the scale (26) was used, and showed very good internal consistency ($\alpha = 0.85$).

Depression Measures

Beck Depression Inventory-II (BDI-II)

The BDI-II (27) is a well-accepted self-report inventory consisting of 21 items that assess the affective, cognitive, motivational, and physiological severity of depressive symptoms. Subjects rate each item using a 4-point Likert scale. The Korean version of the BDI-II (28) was used in this study, and showed excellent internal consistency ($\alpha = 0.95$).

Center for Epidemiologic Studies Depression Scale (CES-D)

The CES-D (29) is a 20-item self-report measure developed to easily identify depression in the general population. Subjects are asked to indicate how often they have experienced emotional and physical symptoms and interpersonal difficulties over the previous 7 days. Each item is rated on a 4-point Likert scale. In the present study, the Korean version of the CES-D (30) was used, and showed very good internal consistency ($\alpha = 0.85$).

Research Design

When individuals indicated their intention to participate verbally or by the response to an e-mail, research assistants coordinated their dates for participation. Participants were invited to a University research lab or two other general hospitals and received a detailed explanation of the current study. After obtaining a signed written informed consent from each participant, they were asked to complete a self-report assessment battery consisting of a demographic information questionnaire, the GAD-7, and other anxiety or depression measures. In most cases, the questionnaires were immediately retrieved, but for some participants who needed additional time for completion, the remaining items were completed at home and returned within a week at the latest. Licensed clinical psychologists, psychiatrists, and trained and supervised clinical psychology graduate research assistants administered face-to-face diagnostic interviews using the MINI (31) before or after participants completing the self-report assessment battery. All procedures, including the questionnaires and interview, took approximately 45–75 min. Participants were compensated for their participation, as specified in the approved Institutional Review Boards protocol. According to the recommendation of the QUADAS-2, to avoid bias in sampling and evaluation, all participants were treated the same way regardless of patient or non-patient. The self-report assessment battery and the MINI were conducted, scored, and interpreted separately by independent evaluators without knowing the results of the assessment battery or psychiatric diagnoses from the MINI.

Analysis

The internal consistency of responses in the GAD-7 was examined using Cronbach's alpha and item-total correlation. Validity evidence was collected not from a single source but from several, following the recommendations of the *Standards for Educational and Psychological Testing* provided by AERA, APA, and NCME (32). Convergent validity was assessed by calculating correlations of the GAD-7 and GAD-2 with other anxiety scales, namely the BAI and PSWQ. Discriminant validity was assessed by examining correlations of the GAD-7 and GAD-2 with depression measures, namely the BDI-II and CES-D. Discriminant validity was also assessed by independent *t*-test. The mean scores of the GAD-7 and GAD-2 in participants with GAD were compared to the scores of the individuals without GAD. To avoid multiple comparison problems, we use Bonferroni correction, and the *p*-value was 0.0125 in these independent *t*-tests. The examination of diagnostic criterion validity included receiver operating characteristic (ROC) analyses and investigation of diagnostic sensitivity and specificity, positive and negative predictive values (PPV and NPV), and positive and negative likelihood ratios (PLR and NLR) at various cutoff scores concerning the diagnosis of GAD or any anxiety disorder based on the MINI. The optimal cutoff points for the GAD-7 and GAD-2 were determined where both diagnostic sensitivity and specificity were maximized. Data analysis using the Statistical Package for the Social Sciences (SPSS) version 24.

RESULTS

Demographics

The total sample (N = 1,157) had a mean age of 37.31 (SD = 14.76, range 19–85), and 772 (66.7%) of the subjects were women. The mean years of education was 14.63 (SD = 2.98). All participants were South Korean.

Of the 1,157 participants, 90 (7.7%) met the DSM-IV criteria for current GAD, and only 15 (1.3%) were GAD only. Additionally, 128 (11.1%) met the criteria for any current anxiety disorder without GAD, 132 (11.4%) for any depressive disorder without GAD, and 56 (4.8%) for MDD without GAD. A total of

TABLE 1 | Baseline characteristics.

Characteristics	GAD only (*n* = 15) *M (SD)*	GAD (*n* = 90) *M (SD)*	AD wo GAD (*n* = 128) *M (SD)*	DD wo GAD (*n* = 132) *M (SD)*	MDD wo GAD (*n* = 56) *M (SD)*	No mental disorder (*n* = 684) *M (SD)*
Age *(SD)* [range]	34.87 (11.74) [22–61]	39.65 (14.37) [19–80]	39.60 (15.09) [19–82]	43.78 (17.33) [19–82]	42.63 (16.01) [20–78]	35.72 (13.87) [19–85]
Women (%)	12 (80.0)	65 (72.2)	85 (66.4)	85 (64.4)	35 (62.5)	455 (66.6)
Education *(SD)*	15.13 (2.00)	13.63 (3.28)	13.73 (2.98)	13.09 (3.32)	13.19 (3.75)	15.07 (2.77)
GAD-7 *(SD)*	10.07 (5.74)	13.29 (5.43)	6.66 (5.52)	7.88 (5.56)	10.13 (5.51)	2.34 (2.96)
GAD-2 *(SD)*	3.27 (1.75)	4.01 (1.73)	2.06 (1.83)	2.33 (1.82)	3.07 (1.81)	0.68 (1.02)
BAI *(SD)*	14.67 (7.17)	26.03 (14.89)	14.27 (13.08)	17.02 (12.60)	20.64 (11.75)	4.22 (5.29)
PSWQ *(SD)*	61.29 (12.31)	65.25 (10.76)	52.55 (13.57)	53.16 (12.81)	56.85 (12.03)	41.82 (11.02)
BDI-II *(SD)*	23.27 (8.35)	32.11 (12.43)	20.89 (12.93)	23.85 (12.52)	29.04 (11.35)	8.71 (7.13)
CES-D *(SD)*	28.67 (12.02)	37.54 (12.14)	24.20 (13.32)	27.22 (11.87)	33.96 (9.67)	12.43 (7.98)

GAD only, generalized anxiety disorder without the comorbid disorder(s); GAD, generalized anxiety disorder with or without the comorbid disorder(s); AD wo GAD, anxiety disorder without general anxiety disorder; DD wo GAD, any depressive disorder without general anxiety disorder; MDD wo GAD, major depressive disorder without general anxiety disorder.

684 (59.1%) participants did not meet the DSM-IV criteria for any mental disorders (**Table 1**).

Reliability and Divergent Validity

Cronbach's α for the GAD-7 was 0.93, indicating excellent internal consistency in this study sample. The GAD-7 score was well-correlated with other anxiety measures: BAI score, $r = 0.78$ (95% CI:0.74–0.81), $p < 0.001$, PSWQ score, $r = 0.72$ (95% CI:0.68–0.75), $p < 0.001$. The GAD-7 score was also significantly correlated with the depression scales: BDI score, $r = 0.80$ (95% CI:0.77–0.83), $p < 0.001$; CES-D score, $r = 0.83$ (95% CI:0.80–0.85), $p < 0.001$.

Cronbach's α for the GAD-2 was 0.86, also indicating excellent internal consistency. The GAD-2 score was well-correlated with the BAI score, $r = 0.72$ (95% CI:0.68–0.76), $p < 0.001$, and the PSWQ score, $r = 0.68$ (95% CI:0.65–0.72), $p < 0.001$. The GAD-2 score was also significantly correlated with the depression scales: BDI score, $r = 0.74$ (95% CI:0.70–0.77), $p < 0.001$; CES-D score, $r = 0.79$ (95% CI:0.76–0.81), $p < 0.001$.

Table 1 shows the means and standard deviations of the GAD-7 and GAD-2, other anxiety scales, and depression scales for the distinct psychiatric diagnoses groups. Independent *t*-test showed that subjects with GAD had significantly higher means on the GAD-7 and GAD-2 than those without GAD [i.e., GAD vs. other anxiety disorders without GAD on GAD-7, [$t_{(216)} = 8.80$, $p < 0.001$]; GAD vs. other anxiety disorders without GAD on GAD-2, [$t_{(216)} = 7.91$, $p < 0.001$]; GAD vs. depressive disorders without GAD on GAD-7, [$t_{(220)} = 7.18$, $p < 0.001$]; GAD vs. depressive disorders without GAD on GAD-2, [$t_{(220)} = 6.91$, $p < 0.001$]; GAD vs. MDD without GAD on GAD-7, [$t_{(144)} = 3.40$, $p = 0.001$]; GAD vs. MDD without GAD on GAD-2, [$t_{(144)} = 3.14$, $p = 0.002$]; GAD vs. no mental disorders on GAD-7, [$t_{(770)} = 29.22$, $p < 0.001$]; GAD vs. no mental disorders on GAD-2, [$t_{(770)} = 26.49$, $p < 0.001$]].

Accuracy of the GAD-7 and GAD-2

ROC analyses were conducted to examine the accuracy of the GAD-7 and GAD-2 questionnaires in identifying GAD or any anxiety disorder. The ROC curves are illustrated in **Figure 1**.

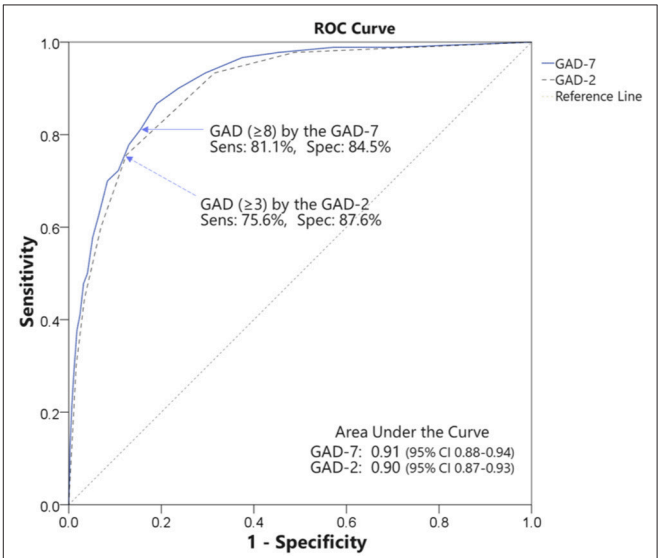

FIGURE 1 | ROC curves for detection of GAD by GAD-7 and GAD-2.

ROC analysis of the GAD-7 for identifying GAD exhibited an area under the curve (AUC) of 0.91 (95% CI: 0.88–0.94, SE = 0.02, $p < 0.001$), indicating high accuracy (33). At a cutoff score of 8 or greater, the balance of sensitivity and specificity reached its maximum. Sensitivity was 0.81 (95% CI: 0.72–0.88) and specificity was 0.85 (95% CI: 0.84–0.85) with a PPV of 0.31 (95% CI: 0.25–0.37), an NPV of 0.98 (95% CI: 0.97–0.99), a PLR of 5.25 (95% CI: 4.42–5.93), and an NLR of 0.22 (95% CI: 0.14–0.34) (**Table 2**).

ROC analysis of the GAD-2 showed an AUC of 0.90 (95% CI: 0.87–0.93, SE = 0.02, $p < 0.001$), indicating high accuracy (33). At a cutoff score of 3 or greater, the balance of sensitivity and specificity reached its maximum. Sensitivity was 0.76 (95% CI: 0.66–0.83) and specificity was 0.88 (95% CI: 0.87–0.88) with a PPV of 0.34 (95% CI: 0.27–0.41), an NPV of 0.98 (95% CI: 0.97–0.99), a PLR of 6.11 (95% CI: 5.00–7.12), and an

TABLE 2 | Diagnostic sensitivity, specificity, positive and negative predictive value, and positive and negative likelihood ratio of GAD-7 and GAD-2.

	Cutoff score	Sensitivity (95% CI)	Specificity (95% CI)	PPV (95% CI)	NPV (95% CI)	PLR (95% CI)	NLR (95% CI)
GAD-7							
GAD	≥5	0.933 (0.857–0.972)	0.706 (0.699–0.709)	0.211 (0.171–0.251)	0.992 (0.986–0.998)	3.172 (2.851–3.342)	0.094 (0.039–0.204)
	≥6	0.900 (0.817–0.950)	0.764 (0.757–0.768)	0.243 (0.197–0.289)	0.989 (0.982–0.996)	3.811 (3.361–4.096)	0.131 (0.065–0.242)
	≥7	0.867 (0.779–0.925)	0.811 (0.803–0.816)	0.279 (0.226–0.331)	0.986 (0.979–0.994)	4.578 (3.961–5.020)	0.164 (0.091–0.275)
	≥8	**0.811 (0.718–0.881)**	**0.845 (0.838–0.851)**	**0.307 (0.248–0.365)**	**0.982 (0.973–0.990)**	**5.245 (4.418–5.926)**	**0.223 (0.139–0.337)**
	≥9	0.778 (0.683–0.853)	0.871 (0.863–0.877)	0.337 (0.272–0.401)	0.979 (0.970–0.988)	6.014 (4.971–6.937)	0.255 (0.167–0.368)
	≥10	0.722 (0.625–0.804)	0.893 (0.885–0.900)	0.363 (0.293–0.434)	0.974 (0.964–0.984)	6.760 (5.435–8.049)	0.311 (0.217–0.424)
	≥11	0.700 (0.604–0.783)	0.917 (0.908–0.924)	0.414 (0.336–0.493)	0.973 (0.963–0.983)	8.392 (6.597–10.252)	0.327 (0.235–0.436)
AD	≥4	0.780 (0.723–0.829)	0.663 (0.650–0.675)	0.350 (0.307–0.392)	0.928 (0.909–0.948)	2.317 (2.069–2.549)	0.332 (0.254–0.425)
	≥5	**0.725 (0.667–0.777)**	**0.744 (0.731–0.757)**	**0.397 (0.349–0.445)**	**0.921 (0.902–0.940)**	**2.836 (2.478–3.192)**	**0.370 (0.295–0.456)**
	≥6	0.661 (0.602–0.715)	0.799 (0.785–0.811)	0.432 (0.379–0.486)	0.910 (0.891–0.930)	3.282 (2.801–3.792)	0.425 (0.351–0.507)
	≥7	0.606 (0.547–0.661)	0.842 (0.829–0.855)	0.471 (0.413–0.530)	0.902 (0.882–0.922)	3.842 (3.200–4.561)	0.468 (0.397–0.546)
	≥8	0.564 (0.508–0.618)	0.878 (0.864–0.890)	0.517 (0.453–0.580)	0.897 (0.877–0.916)	4.607 (3.744–5.622)	0.497 (0.429–0.570)
GAD-2							
GAD	≥2	0.933 (0.857–0.972)	0.686 (0.680–0.689)	0.200 (0.162–0.239)	0.992 (0.985–0.998)	2.973 (2.675–3.130)	0.097 (0.040–0.210)
	≥3	**0.756 (0.659–0.834)**	**0.876 (0.868–0.883)**	**0.340 (0.274–0.406)**	**0.977 (0.968–0.987)**	**6.107 (5.001–7.122)**	**0.279 (0.188–0.392)**
	≥4	0.600 (0.504–0.689)	0.931 (0.923–0.938)	0.422 (0.336–0.507)	0.965 (0.954–0.976)	8.651 (6.501–11.142)	0.430 (0.331–0.538)
AD	≥1	0.830 (0.777–0.874)	0.546 (0.534–0.557)	0.298 (0.262–0.335)	0.933 (0.912–0.954)	1.830 (1.666–1.972)	0.311 (0.226–0.418)
	≥2	**0.743 (0.686–0.794)**	**0.726 (0.713–0.738)**	**0.387 (0.340–0.433)**	**0.924 (0.905–0.943)**	**2.715 (2.388–3.035)**	**0.354 (0.278–0.441)**
	≥3	0.495 (0.441–0.548)	0.902 (0.889–0.914)	0.540 (0.471–0.610)	0.885 (0.865–0.905)	5.056 (3.982–6.386)	0.559 (0.495–0.629)

AD, anxiety disorders; GAD, generalized anxiety disorder; PLR, positive likelihood ratio; NLR, negative likelihood ratio; PPV, positive predictive value; NPV, negative predictive value; CI, confidence interval. Recommended cut-off scores were indicated in bold.

NLR of 0.28 (95% CI: 0.19–0.39) (**Table 2**). Both cutoff scores identified were consistent with previous meta-analysis of the GAD-7 and GAD-2 (17).

For identifying any anxiety disorder including GAD, ROC analysis of the GAD-7 revealed an AUC of 0.80 (95% CI: 0.76–0.83, SE = 0.02, $p < 0.001$), indicating moderate accuracy (33). At a cutoff score of 5 or greater, the balance of sensitivity and specificity reached its maximum. Sensitivity was 0.73 (95% CI: 0.67–0.78) and specificity was 0.74 (95% CI: 0.73–0.76) with a PPV of 0.40 (95% CI: 0.35–0.45), an NPV of 0.92 (95% CI: 0.90–0.94), a PLR of 2.84 (95% CI: 2.48–3.19), and an NLR of 0.37 (95% CI: 0.30–0.46) (**Table 2**).

ROC analysis of the GAD-2 showed an AUC of 0.78 (95% CI: 0.75–0.82, SE = 0.02, $p < 0.001$), indicating moderate accuracy (33). At a cutoff score of 2 or greater, the balance of sensitivity and specificity reached its maximum. Sensitivity was 0.74 (95% CI: 0.69–0.79) and specificity was 0.73 (95% CI: 0.71–0.74) with a PPV of 0.39 (95% CI: 0.34–0.43), an NPV of 0.92 (95% CI: 0.91–0.94), a PLR of 2.72 (95% CI: 2.39–3.04), and an NLR of 0.35 (95% CI: 0.28–0.44) (**Table 2**).

DISCUSSION

This study was conducted to determine whether the GAD-7 and GAD-2 were able to detect GAD specifically and any anxiety disorder including GAD. The results suggested that the Korean versions of the GAD-7 and GAD-2 are reliable and valid

measures for detecting GAD. However, use of the GAD-7 and GAD-2 to screen for any anxiety disorder should be cautioned.

The GAD-7 and GAD-2 showed excellent internal consistency and good convergent validity with other anxiety measures. The total GAD-7 score was strongly correlated with the scores of the BAI and PSWQ. The total GAD-2 score, which was not statistically different from that of the GAD-7, was also significantly correlated with both BAI and PSWQ scores. These results mean that GAD-7 and GAD-2 have a good convergent validity with anxiety measures.

Both the GAD-7 and the GAD-2 were correlated with the depression scales. Specifically, the correlations between the GAD-7 and the depression measures were stronger than with the PSWQ. Correlations of the GAD-2 with the CES-D were higher than that of the PSWQ. High correlations between GAD-7/2 and depressive symptoms measures were not hypothesized, but interesting results since some of the previous studies reported similar correlational patterns (10, 34, 35). In addition, Watson (36) argued that GAD is more similar to depressive disorders than to the other anxiety disorders. More importantly, it has been reported that Asians with GAD and depressive disorders have more physical symptoms than cognitive symptoms (i.e., pathological worries) (8). Despite the high correlations between GAD-7/2 and depressive symptoms measures, participants with GAD had the highest means on the GAD-7/2 than those with other anxiety disorders or depressive disorders, providing evidence for discriminant validity of GAD-7/2, and their clinical utility as a screening tool for GAD. Therefore, after obtaining GAD-7 or GAD-2 results, clinicians should also gather additional information about depressive symptoms for differential diagnosis or treatment planning.

The Korean versions of the GAD-7 and GAD-2 detected GAD with excellent accuracy. ROC analysis showed high accuracy for both the GAD-7 and GAD-2 in detecting probable cases of GAD. These AUC values are relatively high compared with previous research (17). The optimal cutoff score for GAD, at which the balance of sensitivity and specificity was maximized, was 8 or greater for the GAD-7 and 3 or greater for the GAD-2. These cutoff points were consistent with the scores suggested by previous meta-analysis (17). Additionally, both the GAD-7 and GAD-2 showed low NPV, indicating a false negative rate of about 2% when detecting GAD with the GAD-7 and GAD-2. These characteristics indicate that the GAD-7 and GAD-2 are a useful screening tool for GAD patients in various settings. However, it should be noted that as in previous studies, PPV was quite low for detecting GAD using the GAD-7 or GAD-2 (10, 37, 38). The low PPV indicates that the GAD-7 and GAD-2 could detect too many false positives. At a cutoff score 8 or greater for the GAD-7, 69% of participants were not actual GAD patients, and at a cutoff score 3 or greater for the GAD-2, 66% of subjects were not actual GAD patients. This issue is partially due to the low prevalence of GAD (7.7% in this study) because PPV drops with a prevalence rate (33). We thus calculated PLR and NLR to compensate for the prevalence effects. PLR for the GAD-7 was 5.25, meaning that GAD-7 scores exceeding 8 are obtained approximately five times more often in subjects with GAD than subjects without GAD. PLR for the GAD-2 was 6.11, meaning that a GAD-2 score exceeding 3 is obtained approximately six times more often from subjects with GAD than subjects without GAD. These results indicate that both the GAD-7 and GAD-2 could provide "clinically useful information" in identifying GAD (33).

We also investigated whether the GAD-7 and GAD-2 could be used to detect any anxiety disorder. ROC analysis of the GAD-7 and GAD-2 indicated moderate accuracy; the cutoff score was 5 or greater for the GAD-7 and 2 or greater for the GAD-2. The GAD-7 cutoff score was quite lower than in previous meta-analysis (8 or greater) (17). In the case of the GAD-2, sensitivity and specificity varied throughout previous studies, and thus GAD-2 cutoff scores could not be drawn from the previous meta-analysis (17). Although NPV was high for both the GAD-7 and the GAD-2, PPV was quite low. Using the GAD-7 and GAD-2 cutoff scores, about 60% of subjects detected were not actual anxiety disorder patients. Moreover, the low PLR and high NLR were more problematic when detecting anxiety disorders using the GAD-7 or GAD-2. A PLR of <3.00 and an NLR of more than 0.33 rarely alter clinical decisions (33), and thus the GAD-7 and GAD-2 do not provide additional information in detecting any anxiety disorders. Thus, to prevent misdiagnosis and unnecessary costly intervention when screening for any anxiety disorders, it is recommended that the GAD-7 or GAD-2 be used in combination with additional clinical interviews or other screening tools specifically designed to diagnose anxiety disorders (17).

The limitations of the current study are as follows. First, participants were not recruited by stratified random sampling. Although subjects were recruited randomly, with minimal exclusion criteria, from online advertisements and introduction by hospital staff, age and gender quotas were not applied. Many subjects of this study were women (66.7%), were in their 20s (42%), and were highly educated (an average of 14.63 years of education). Therefore, future study should be conducted with subjects with equal gender and age distribution. Second, it was unclear why the results of this study (low PLR and high NLR of the GAD-7 and GAD-2 in detecting anxiety disorders) differed from those of previous study (12). These discrepancies might be due to cultural factors. All of our subjects were Asian (i.e., South Korean), whereas about 97% of subjects in previous study reported white, Hispanic, and Black ethnic backgrounds. In a previous study, patients with anxiety disorders in Asia tend to report somatic symptoms as emotional distress (8). It is speculated that since the GAD-7 and GAD-2 items do not reflect or measure various somatic symptoms, GAD-7/2 in the current study might be poorer in identification of anxiety disorder in our study sample than previous studies. Cultural differences (or consideration) while administering and interpreting the GAD-7/2 scores have been reported in a previous study (39) in which Parkerson et al. (39) indicated that individuals who defined themselves as Black/African American endorsed significantly lower on some items (e.g., feeling nervous, irritable, restless, etc.) of the GAD-7 than other ethnic (i.e., White and Hispanic) group. Thus, these discrepancies, which are not yet fully understood, should be a subject of future study.

Despite these limitations, the current study provides evidence on the psychometric properties and clinical utility of both the

GAD-7 and the GAD-2 as reliable and valid screening tools for people with GAD. Because the GAD-2 is an ultra-brief measurement, it can be a useful tool for various clinical settings (e.g., primary care) with limits on time and resources. It is expected that both measures could be widely used to detect GAD in many clinical settings, and thus provide optimal and timely intervention in community.

DATA AVAILABILITY

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of Korea University Institutional Review Board [1040548-KU-IRB-15-92-A-1(R-A-1)(R-A-2)(R-A-2)] with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Korea University Institutional Review Board [1040548-KU-IRB-15-92-A-1(R-A-1)(R-A-2)(R-A-2)].

AUTHOR CONTRIBUTIONS

J-KA interpreted the results and drafted the manuscript. J-KA and YK analyzed data. YK collected data, and drafted introduction and method. K-HC designed the study, supervised clinical and research assistants, and reviewed manuscript. All the authors approved the final manuscript and significantly contributed to the current study.

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Technology and College Student Mental Health: Challenges and Opportunities

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In recent years, there has been an increase in symptoms of depression, anxiety, eating disorders, and other mental illnesses in college student populations. Simultaneously, there has been a steady rise in the demand for counseling services. These trends have been viewed by some as a mental health crisis requiring prompt investigation and the generation of potential solutions to serve the needs of students. Subsequently, several studies linked the observed rise in symptoms with the ubiquitous rise in use of personal computing technologies, including social media, and have suggested that time spent on these types of technologies is directly correlated with poor mental health. While use of personal computing technologies has dramatically shifted the landscape in which college students connect with one another and appears to have some detriments to mental health, the same technologies also offer a number of opportunities for the enhancement of mental health and the treatment of mental illness. Here, we describe the challenges and opportunities for college student mental health afforded by personal computing technologies. We highlight opportunities for new research in this area and possibilities for individuals and organizations to engage with these technologies in a more helpful and wellness-promoting manner.

Keywords: mental health, college students, digital mental health, health services, smartphones

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The college years represent an important period with regard to mental health and health behaviors. Nearly 70% of Americans enroll in college immediately following high school (1), and roughly three-quarters of lifetime cases of psychiatric disorders begin by age 24 (2). In recent years, there has been an increase in reported symptoms of mental illnesses in college student populations. A large, epidemiological study recently demonstrated that mental health diagnoses have risen from 22% to 36% among college student respondents over the last 10 years (3). In a survey of college counseling center directors, more than 95% reported that the number of students with significant psychological problems was a growing concern on their campus (4). Across the country, more and more college students appear to be suffering.

The clinical importance of this phase of life is compounded by the fact that college students report numerous barriers to mental health treatment. Many students do not recognize a treatment need, believing that clinically significant symptoms of depression and anxiety are typical of college life (5). Students recognizing a need for treatment often report difficulties accessing care, perceive available care as inconvenient, and are skeptical about the efficacy of care (6, 7). However, over the last 10 years

as mental health diagnoses have risen and stigma has decreased, there has been a dramatic rise in students seeking mental health services (from 19% to 34%) (3). Many campus communities find themselves unable to keep up with this demand (8).

Some people have viewed the observed increases in symptoms of mental illness and demand for services as a "campus mental health crisis" (8, 9). Many have begun to speculate on causes of this presumed crisis. A portion of these increases might be due to mental health support offered prior to college, which has assisted students in getting to college (10), and due to reductions in mental health stigma, which may result in students being more willing to disclose and seek assistance for mental health difficulties (3, 11).

As personal computing technologies, such as smartphones with their easy accessibility to social media outlets, have become increasingly ubiquitous, they have increasingly been the subject of examination as a potential cause of poor mental health or as a trigger of this mental health crisis (12, 13). The ubiquity of smartphones has presented a shift in how people communicate. According to the latest Pew Research Center study in early 2018, approximately 91% of Americans aged 18–29 now own smartphones (14). A cultural norm of young people being constantly connected to the Internet has been established, with traditional college-aged Americans (ages 18–24) estimating that they look at their phones more than 80 times per day (15).

There are a number of challenges and opportunities for college student mental health afforded by personal computing technologies such as smartphones. We are living in a time of unprecedented social connection and access to educational resources. Some may argue that we are simultaneously living in a time of unprecedented awareness of social exclusion and information overload. This has been made apparent by the emergence of "fear of missing out" or FoMO, which was first discussed by a marketing strategist (16), and since has become the subject of several empirical investigations on mental health and social media use (17–19).

Given that the rise in use of personal computing technologies and social media has occurred concurrently with a rise in young adults reporting mental health symptoms, one may be tempted to conclude that these types of tools are unhealthy. Some have proposed that the high level of connectivity associated with these tools, combined with a decrease in the quality and quantity of face-to-face social interactions, is a large contributor to the observed rise in distress among youth (20, 21). While several studies have found that time spent on social media and use of multiple social media platforms is associated with poor mental health (22–24), a more recent, particularly rigorous examination of three large datasets found that while the association between personal computing technology use and adolescent well-being was negative, it explained at most 0.4% of the variation in well-being (25). Further, these studies have been correlational and thus cannot assert causality. Rather than thinking of social media as inevitably causing poor mental health, it may be more useful to distinguish between healthy and unhealthy use of social media. For example, some evidence suggests that Facebook use is only harmful to mental health when it is passive viewing of other people's posts (26) as opposed to more active engagement in social connections (see **Table 1** for a review of these findings).

It is clear that the rise in personal computing technology usage has dramatically shifted the landscape in which college students connect with one another. While misuse appears to have some detriments to mental health, the same technologies offer a number of opportunities for the enhancement of mental health and the treatment of mental illness. As with nearly every behavior, moderation is key. It would be irresponsible to conclude that smartphone usage and social media are inherently bad, as they serve as pathways to connect individuals with their existing social support networks, and as pathways for individuals to build new social support networks. Indeed, social media platforms, such as Facebook and Instagram, are increasingly seen as venues for personal disclosures and for establishing and maintaining social connections (27–29).

Further, continuous access to personal computing *via* one's smartphone brings with it a host of opportunities for mental health intervention programs. Technology-enabled mental health services, including those delivered online and *via* apps, offer the possibility to expand treatment options and reduce barriers to mental health services. Among multiple subpopulations (from children to older adults) and for many presenting problems (including depression and anxiety), technology-enabled mental health services have demonstrated efficacy (30, 31).

A body of literature on technology-enabled mental health interventions specifically for college students demonstrates that website- and computer-delivered programs can be effective for improving depression, anxiety, and well-being outcomes (32). This is not surprising, as students are living an increasing portion of their lives online, and thus, it may be wise to meet them where they are. To date, most research on technology-enabled mental health programs for college students have been on programs delivered *via* website and

TABLE 1 | Summary of findings.

Proposed negative effects of personal computing technology use on mental health	Proposed positive effects of personal computing technology use on mental health	Existing technology-enabled interventions
• Fear of missing out • Hyper-connectivity with peers • Peer comparison • Decreased face-to-face social interactions • Impairment of social skill development • Decreased inhibition of anti-social behavior	• Active engagement with peers • Expanded social networks • Venues for personal disclosures • Peers can serve as "gatekeepers" • Access to mental health intervention programs	• Online support groups and message boards • Module-based web interventions (e.g., MoodGYM, Beating the Blues) • Skill-building apps (e.g., Headspace, Pacifica) for resilience, coping skills, mindfulness

based on cognitive–behavioral therapy principles, such as MoodGYM (33–35) and Beating the Blues (36, 37). As college students spend an increasing portion of their online lives connected *via* smartphones rather than desktop or laptop computers (38), technology-enabled mental health programs need to be designed for smartphone accessibility, and the use of native apps and web apps should be considered. Smartphone apps, when well-designed, are increasingly seen as effective for delivering mental health interventions (39). Early trials of mobile programs designed specifically for college students are promising and have demonstrated improvements in users' stress, depression, anxiety, and productivity (40, 41).

While there appears to be significant potential for both web-based and app-based programs, the majority of technology-enabled mental health programs for college students have not been examined outside the context of tightly controlled research studies of interested (i.e., self-selecting) student participants. There appears to be a significant research-to-practice gap such that technology-enabled mental health intervention programs are largely underutilized on college campuses (42, 43) and few research studies have focused on the implementation of such programs within college counseling centers (37, 44).

Administrators and health professionals on college campuses have already shown some degree of openness to providing technology-enabled mental health resources. Perhaps most notably, technology-enabled mental health screening programs have been well received (45, 46) and have been implemented on campuses across the country. Technology-enabled mental health screening programs have typically been tools available on campus websites, in which students can complete standardized screening measures for common mental health and behavioral problems (e.g., depression, anxiety, disordered eating, and alcohol misuse) and receive feedback regarding the results of the assessment completed. These programs have shown promising evidence of effectiveness as a way to identify students in distress and link them to services (47, 48). Where the research-to-practice gap exists prominently is for technology-enabled mental health services, in which students could access self-guided or coached therapeutic programs *via* the web or apps. While students could theoretically access these types of programs without involvement from their campus community, counseling centers are unlikely to see reductions in their ever-increasing workload without coordinated efforts to educate students on, and direct them to, technology-enabled programs. Because college counseling centers across the United States are frequently understaffed, have limited budgets, and operate on waitlists for much of the year (8), it may be in their best interest to support the incorporation of technology-enabled mental health programs into routine practice, as a supplement to their core services.

The integration of technology-enabled services into routine practice will not be without challenges to clinical providers, including challenges related to ethics, accountability, duty of care, and privacy. Provided that technology-enabled mental health services are not part of standard practice in most settings, campus mental health providers may not have proper education on the ethical use of these tools. While there are no nationally sanctioned guidelines, there remains a need for continuing education on the unique set of ethical considerations that go into use of these tools (49).

To address concerns about accountability and duty of care, we recommend that providers develop written consent for treatment forms that highlight the appropriate uses of and limitations of a particular technology-enabled service. Specifically, students who are consenting to using technology-enabled mental health services should be made aware of how their data (including, but not limited to, anything they type into a program) will be used and monitored, and how they are to contact and communicate with clinical staff. If students are able to send messages to a clinical provider, or if a clinical provider has access to information that students type into a program, there must be clearly agreed-upon expectations regarding how frequently this information will be reviewed, and about what student users are to do in the event of a mental health emergency (e.g., present to the emergency room or call the campus crisis number, rather than messaging the mental health provider). The process of developing these consent forms, and having them approved by the appropriate administrators within a campus health system, is a valuable opportunity to clarify, or perhaps establish, university policies on technology-enabled services.

Privacy is also an important concern that deserves to be thoroughly addressed. Some clinicians may shy away from using technology-enabled tools for fear of poor privacy protections. Indeed, recent studies have found that the majority of commercially available mental health apps had insufficient privacy policies (50) and that these privacy policies are frequently incomprehensible (51). Campus mental health providers may find it useful to collectively generate a list or library of technology-enabled tools that meet their agreed-upon standards for privacy. In our interactions with campus mental health providers, we repeatedly hear requests for more education regarding which digital programs are most helpful for particular issues and guidance around privacy standards. Fortunately, user-friendly resources (e.g., PsyberGuide, an online mental health app guide available at www.psyberguide.org) are continually being developed and refined and are freely available to the public.

To move the field forward and to begin to offer more resources to alleviate student suffering, there must be better integration between services available on campus and services available in students' digital lives. At a basic level, there continues to be a significant need for research to identify best practices for supporting students to use personal communication technologies in a prosocial manner. While college counseling center staff around the country may be guiding students toward more healthful use of these technologies, we are not aware of any research on effective strategies for intervening with students at this level. The development of protocols for supporting students in making healthier choices in their digital lives (e.g., maximizing appropriate social support seeking, minimizing unhelpful social comparisons) and in their physical lives (e.g., exercising, spending time with friends in face-to-face settings) could

be a first step in guiding students toward improved mental health. These types of protocols may be modeled off of a harm-reduction approach consistent with what Veissière and Stendel recently proposed (52), as we recognize the normal, healthy need for social connection that these technologies offer and would be very hesitant to recommend anything that would require full abstinence from these technologies.

At a more advanced level, we need to identify best practices in designing technology-enabled mental health programs that students will want to use, and best practices for implementing these types of programs on campuses.

User engagement is a major challenge for technology-enabled mental health services, even more so than for traditional in-person services. However, college communities have key advantages: a population with high comfort using the technologies, and also a range of in-person points of connection that could enhance engagement with the technologies. Thus, the key question is how to leverage those advantages most effectively. As campus professionals determine programs that are appropriate for their needs, they may implement these programs in a variety of ways, including blended models of therapy, with both in-person and digital components (for both individuals and groups), and stepped care approaches, in which students may first receive digital interventions and those who do not respond are stepped up to traditional in-person care. Additionally, colleges may begin integrating mental health resources into the digital services that students are already using regularly, such as posting content about digital mental health tools directly onto course software programs.

If current trends continue (i.e., rising prevalence of symptoms, increasing rates of help-seeking, particularly of campus counseling center resources), demand will continue to outpace supply. The stakes for this are very high, given the epidemiological vulnerability of the college years and the still largely missed opportunity for early intervention, prevention, and treatment (i.e., all levels of public health programming). Personal communication technologies and the technology-enabled services that can be made available through them are undeniable parts of this landscape, and much of the potential remains untapped.

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EL, SL, and DE contributed to the conception of the manuscript. EL wrote the first draft. SL and DE wrote sections of the manuscript. All authors contributed to manuscript revision and read and approved the submitted version.

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Hikikomori Is Most Associated With Interpersonal Relationships, Followed by Suicide Risks: A Secondary Analysis of a National Cross-Sectional Study

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There have been few population studies of *hikikomori* (that is, prolonged social withdrawal and isolation), and the basic correlating factors of hikikomori are yet to be identified. Therefore, this study aimed to identify the associated basic characteristics and psychiatric factors of hikikomori. Data were obtained from the Survey of Young People's Attitudes of 5,000 residents (aged 15–39 years) who were randomly selected from 200 urban and suburban municipalities in Japan in February 2010. The chi-square test and multiple logistic regression were used in the analysis. The data contained 3,262 participants (response rate: 65.4%); 47.7% were men (n = 1,555) and 52.3% were women (n = 1,707). Its prevalence was 1.8% (n = 58), and 41% had been in the hikikomori state for more than 3 years. There were fewer hikikomori people in neighborhoods filled with business and service industries. Significantly more men were in the hikikomori group (65.5%) than in the non-hikikomori group (47.3%). The hikikomori group was more likely to drop out of education ($p < .001$) and to have a psychiatric treatment history compared with non-hikikomori (37.9% vs 5%, $p < .001$). The multiple logistic regression analyses revealed that interpersonal relationships were significantly associated with hikikomori across three models (Model 1 adjusting for all basic characteristics, OR = 2.30, 95% CI = 1.92–2.76; Model 2 further adjusting for mental health-related factors, OR = 2.1, 95% CI = 1.64–2.68; Model 3 further adjusting for a previous psychiatric treatment history, OR = 1.95, 95% CI = 1.52–2.51). Additionally, the hikikomori group was more likely to have suicide risk factors (Model 1: OR = 1.85, 95% CI = 1.56–2.20; Model 2: OR = 1.33, 95% CI = 1.05–1.67), obsessive–compulsive behaviors (Model 1: OR = 1.57, 95% CI = 1.20–2.05), and addictive behaviors (Model 1: OR = 1.93, 95% CI = 1.37–2.70). This is the first study to show that hikikomori is associated with interpersonal relationships, followed by suicide risks. Hikikomori people are more likely to be male, have a history of dropping out from education, and have a previous psychiatric treatment history.

Keywords: hikikomori, social withdrawal, interpersonal difficulties in hikikomori, suicide risk factors in hikikomori, anxieties in hikikomori, Japan, psychiatric treatment

Abbreviations: CI, confidence interval; SYPA, Survey of Young People's Attitudes; OCBs, obsessive–compulsive behaviors.

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INTRODUCTION

The term *hikikomori* refers to a social condition in which people avoid social participation and having relationships with people besides family members by confining themselves to a room or the house for 6 months and more. The term refers to both the condition itself and the people who suffer from it. Although the phenomenon is thought to be distinguishable from mental illness, new guidelines have warned that mental health problems, such as schizophrenia, may have been underdiagnosed (1).

There have been few epidemiological studies of hikikomori that use community samples. In Japan, there have been three national surveys of hikikomori among the general population. The first was a nationwide cross-sectional mental health study in 2002–2006 that estimated that 0.56% of all households had at least one ongoing hikikomori case. The same study also reported that 1.2% of the interviewees had a lifetime prevalence of hikikomori (age 20–49 years, response rate: 55.1%, n = 4,134), and that 54.5% of them had also experienced a psychiatric disorder (mood, anxiety, impulse control, or substance-related) in their lifetime (2). The second and third surveys, which were the Survey of Young People's Attitudes (Fact-finding Survey on Social Withdrawal) (SYPA) conducted by the Cabinet Office of Japan, revealed that the prevalence of hikikomori among people aged 15–39 years was 1.79% in 2009 (response rate: 65.7%, n = 3,287) and 1.57% in 2015 (response rate: 62.3%, n = 3,115). Among the hikikomori people, approximately 67% were reported to be unemployed. In both Cabinet Office surveys, people with schizophrenia, who were pregnant, or who were a homemaker and who shared the hikikomori definition of staying at home for 6 months or longer due to family responsibilities were not counted as hikikomori (3, 4).

Although hikikomori was once thought to be a culture-bound syndrome unique to Japan (5), cases have subsequently been reported in Oman (6), Spain (7–9), South Korea (10, 11), Canada (12, 13), Hong Kong (14–16), India (11), France (17), Austria (18), China (18, 19), the United States (11), and Brazil (20). Aside from these case reports, surveys of psychiatrists from countries as diverse as Australia, Bangladesh, Iran, Taiwan, and Thailand suggest that hikikomori cases have been observed and examined in all these countries, and that psychological factors are common causes of hikikomori (21). The same study also shows that various diagnoses were given, indicating that many of the psychiatrists believe that hikikomori is an outcome behavior of a given disorder that requires treatment.

In fact, in Japan, almost half of the limited cases presented to health centers get diagnosed. Among these, one-third of the subjects are diagnosed with schizophrenia, mood disorders, or anxiety disorders, suggesting that pharmacotherapy is needed. Others are diagnosed with personality disorders or pervasive developmental disorders, indicating that psycho-social support is more appropriate (22). Half of the people with lifetime hikikomori were found to have a comorbid mood disorder (2). Some consider that hikikomori is a result of conflicting demands and the reduced autonomy of the individual (18), which is trigged by stressful events and combined with a predisposed introverted personality (12). Others think that the hikikomori phenomenon may be a preferred lifestyle among the younger generations (14) and that it is more common in urban areas (21). Despite the ambiguous findings about hikikomori that have mainly been collected from the specialists' opinions and psychiatric referrals, the hikikomori phenomenon has greatly affected the health, labor power, and welfare of Japan as the youth unemployment rate has been a concern since the 1990s (23). Therefore, it is important to identify the associated sociodemographic and psychiatric factors of being a hikikomori.

As there have been few epidemiological studies of hikikomori, many of its factors remain unknown. Thus, population studies are necessary to identify the basic characteristics of hikikomori as well as its correlations with general mental health risk factors. To fill this gap, we conducted a secondary analysis using the SYPA data (3) to identify the factors associated with hikikomori. The SYPA data are well-designed, randomized, and contain much valuable information about the sociodemographic and psychiatric factors.

METHODS

This study was approved by the ethics committee of Akita University Graduate School of Medicine. The SYPA 2010 data (3) were obtained from the Social Science Japan Data Archive, and the variables were re-categorized for secondary analysis. As the data are not individually identifiable, the written informed consent of the participants was not required.

Sampling

A total sample size of 5,000 was estimated for the population of 15–39-year-olds. Multistage stratified randomized sampling was used to ensure that the samples represented all areas in Japan. Firstly, 200 locations were randomly selected from 198 municipalities stratified by area and population size. Secondly, in each location, 25 samples were randomly selected from the municipality registration list. A set of self-administered questionnaires was distributed and collected by hand between February 18 and February 28, 2010. The response rate was high (65.7%): 3,287 participants responded to the study and, after excluding missing data, 3,262 samples were effective for analysis (**Figure 1**).

Outcome Variable

The outcome variable was hikikomori, for which there were three major screening questions. Firstly, the participants were asked to choose one item from the following multiple-choice question about the frequency of going out: "How frequently do you leave your house?" The multiple-choice answers were 1) "I go out every day for work or school"; 2) "I go out 2–4 days per week for work or school"; 3) "I go out frequently for fun and so on"; 4) "I sometimes go out to mingle with others"; 5) "I stay at home most of the time, and I only go out when there is something that interests me"; 6) "I stay at home most of the time, but I may go out to the convenience stores nearby"; 7)" I do leave my room but do not go out of the house"; and 8) "I stay only in my room."

Those who selected options 5–8 then proceeded to the next question that asked about the duration of their behaviors. Those who gave a duration of 6 months and above were

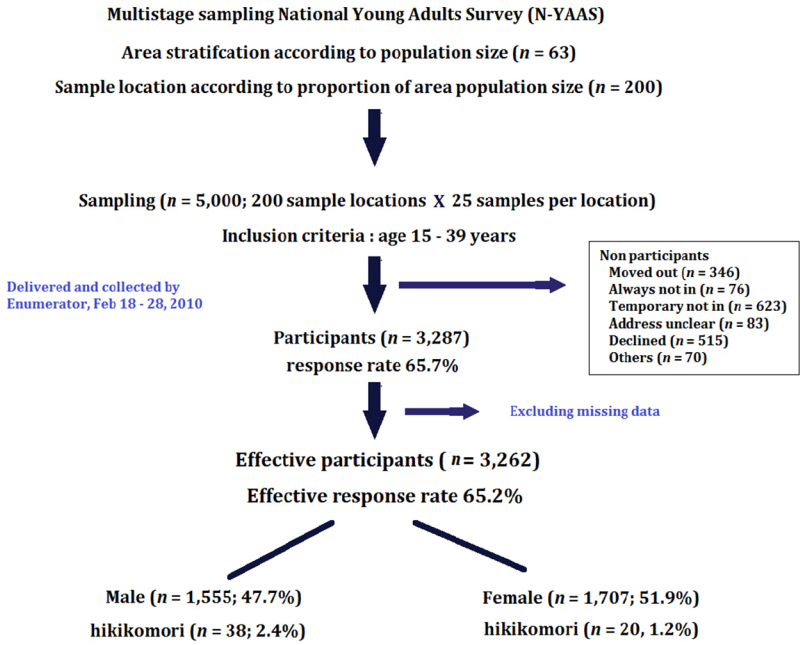

FIGURE 1 | Flow chart of the sampling procedure.

classified as belonging to the hikikomori group. Then, they were screened for the exclusion criteria in the third question that asked for the reasons for their social disengagement. Those who declared that the reason for staying mainly at home was because of pregnancy, doing housework, being a homemaker, or being diagnosed with schizophrenia were excluded from the classification.

Exposure Variables

The exposure variables included personal demographics and psychiatric factors. The personal demographics included sex, age, city size, region, number of household members, social class, neighborhood characteristics (the housing area, shops and service industries, factories, agriculture/forestry/fishery, if people lived there for many years, close neighborhoods, rich social activities, rich local events, and others), and educational status.

We measured psychiatric factors with 20 simple yes/no questions (**Table 2**). These items were further grouped into five different psychiatric factors [suicide risks, violent tendencies, interpersonal difficulties, obsessive–compulsive behaviors (OCBs), and dependency behaviors] to assess the risks of the different groups. A "yes" for a single item counted as 1 point. The items assessing suicide risks (0–5 points) were as follows: "I often feel guilty towards family," "I often feel that my life is suffocated," "I wish to die," "I always feel hopelessness," and "I hurt myself (e.g., cut my wrist)." The items assessing violent tendencies (0–4 points) were as follows: "I hit my family members," "I hit the walls or windows," "I throw and destroy things occasionally (e.g., dishes)," and "I occasionally yell at others." The items assessing interpersonal difficulties (0–4 points) were as follows: "I am afraid of meeting others," "I am anxious about the possibility of meeting people that I know," "I am anxious about what others might think of me," and "I cannot blend into groups." The items assessing OCB (0–4 points) were as follows: "I cannot stand it if meal and bath times are slightly different than usual," "I pay excessive attention to my own cleanliness," "I excessively double-check things and have repetitive thoughts," and "I repeat the same act over and over." Finally, dependency behaviors were assessed with the following items (0–3 points): "I cannot stop drinking," "I depend heavily on medications," and "I am anxious if I am away from my phone or computer for even a moment."

Statistical Analysis

The basic characteristics and variables of interest were compared between the groups with and without hikikomori using the chi-square test of independence (with the Yate's continuity correction). Effect sizes were calculated using phi coefficient (small = .10, medium = .30, large = .50) and Cramer's V (small = .06, medium = .17, large = .29) (24). *Post hoc* analysis was performed to determine the association between hikikomori and the exact individual items. Considering the possibility of the multiple comparisons problem of the multi-item test for the psychiatric factors, significance levels were adjusted for the number of items. Logistic regression was performed to identify the factors associated with being hikikomori, and the odds ratios were estimated along with the 95% confidence intervals (95% CI). Three models were employed in the multiple logistic regression analysis: Model 1 was adjusted for all the basic characteristics, Model 2 was further adjusted for all the tested psychiatric factors, and Model 3 was adjusted for the history of psychiatric treatment

in addition to the factors tested in Model 2. All analyses were performed using SPSS v. 17.0 (SPSS Inc., Chicago, IL, USA), and the significance level was $p < .05$.

RESULTS

The data contained 3,262 participants (effective response rate: 65.4%) of whom 47.7% were men (n = 1,555) and 52.3% were women (n = 1,707). The prevalence of hikikomori was 1.8% (n = 58: men n = 38, women n = 20). Among them, 41% had been in a hikikomori state for more than 3 years. There were significantly fewer people in the hikikomori group living in an area that is filled with business and service opportunities (3.4% vs 13.3%, $p = .045$, $phi = -.039$), whereas the numbers according to the city size, region, number of family members, and social class were not significantly different. The chi-square test showed that there were significantly more men in the hikikomori group than in the non-hikikomori group (65.5% vs 47.3%, $p < .001$, $phi = .05$), and significantly more hikikomori had dropped out of the education system (19% vs 3.2%, $p < .001$, *Cramer's V* = .195). A further analysis was performed to determine the exact differences between the participants of different educational statuses; because of the small numbers in each group, people who dropped out and were taking time off were combined for analysis, and people who had not answered were excluded. This *post hoc* analysis showed that the people who had dropped out or were taking time off from their studies were mostly in the hikikomori group rather than in the non-hikikomori group (standard residuals = 8.2). Significantly more hikikomori had a previous history of psychiatric treatment (37.9% vs 5%, $p < .001$, $phi = .19$; **Table 1**). In **Table 2**, the chi-square test showed

TABLE 1 | Basic characteristics of the participants (N = 3,262).

		Hikikomori (n = 58)	Non-hikikomori (n = 3,204)	p-value
Sex	Male	38 (65.5%)	1,517 (47.3%)	.009[b]
Age	15–19 years old	9 (15.5%)	588 (18.4%)	.808[a]
	20–24 years old	12 (20.7%)	498 (15.5%)	
	25–29 years old	11 (19%)	584 (18.2%)	
	30–34 years old	13 (22.4%)	687 (21.4%)	
	35–39 years old	13 (22.4%)	847 (26.4%)	
City size	Metropolitan cities	13 (22.4%)	811 (25.3%)	.252[a]
	Medium cities (population ≥ 200,000)	12 (20.7%)	864 (27.0%)	
	Smaller cities (population ≥ 100,000)	15 (25.9%)	526 (16.4%)	
	Town and villages (population < 100,000)	18 (31.0%)	1,003 (31.3%)	
Area	Hokkaido	6 (10.3%)	115 (3.6%)	.087[a]
	Tohoku	7 (12.1%)	223 (7.0%)	
	Kanto	19 (32.8%)	1,056 (33.0%)	
	Chubu	8 (13.8%)	644 (20.1%)	
	Kinki	8 (13.8%)	486 (15.2%)	
	Chugoku/Shikoku	5 (8.6%)	275 (8.6%)	
	Kyushu	5 (8.6%)	405 (8.6%)	
Neighborhood characteristics	Residential housing area	39 (67.2%)	2,256 (70.4%)	.705[b]
	Shops and service industries	2 (3.4%)	426 (13.3%)	.045[b]
	Factories	1 (1.7%)	138 (4.3%)	.524[b]
	Agriculture/forestry/fishery	7 (12.1%)	207 (6.5%)	.149[b]
	Residents have lived there for many years	31 (53.4%)	1,649 (51.5%)	.868[b]
	Close neighborhood	15 (25.9%)	670 (20.9%)	.450[b]
	Rich social activities	5 (8.6%)	445 (13.9%)	.337[b]
	Rich local events	9 (15.5%)	679 (21.2%)	.375[b]
	None of the above	2 (3.4%)	85 (2.7%)	>.999[b]
	No response	0	3 (0.1%)	>.999[b]
Education status	Currently studying	8 (13.8%)	733 (22.9%)	<.001[a]
	Finished studying	36 (62.1%)	2,355 (73.5%)	
	Dropout	11 (19.0%)	102 (3.2%)	
	Time off	3 (5.2%)	3 (0.1%)	
	No answer	0	11 (0.3%)	
Number of family members	Staying alone	5 (8.6%)	171 (5.3%)	.178[a]
	Staying with others (2–4 people)	43 (74.1%)	2,172 (67.8%)	
	Staying with others (5 people and above)	10 (17.2%)	861 (26.9%)	
Social class	Upper class	2 (3.4%)	147 (4.6%)	.615[a]
	Middle class	45 (77.6%)	2,589 (80.8%)	
	Lower class	11 (19%)	468 (14.6%)	
History of psychiatric treatment	Yes	22 (37.9%)	160 (5%)	<.001[b]

[a]*p-value derived using the Pearson's chi-square test.*

[b]*p-value derived using the continuity correction computer only for a 2 × 2 table chi-square test.*

TABLE 2 | Psychiatric factors of the participants (*N* = 3,262).

	Hikikomori (*n* = 58)	Non-hikikomori (*n* = 3,204)	*p*-value
Suicide risks (one risk or more)	47 (81.0%)	1,397 (43.6%)	<.001
I often feel guilty toward my family	42 (72.4%)	1,046 (32.6%)	<.001*
I often feel that my life is suffocated	28 (48.3%)	649 (20.3%)	<.001*
I wish to die	21 (36.2%)	340 (10.6%)	<.001*
I always feel hopeless	19 (32.8%)	438 (13.7%)	<.001*
I hurt myself (e.g., cut my wrist)	5 (8.6%)	32 (1.0%)	<.001*
Violent tendencies (one risk or more)	10 (17.2%)	470 (14.7%)	.584
I hit my family members	3 (5.2%)	81 (2.5%)	.4
I hit the walls or windows	6 (10.3%)	224 (7.0%)	.465
I throw and destroy things occasionally (e.g., dishes)	5 (8.6%)	35 (1.1%)	<.001*
I occasionally yell at others	5 (8.6%)	329 (10.3%)	.848
Interpersonal difficulties (one risk or more)	43 (74.1%)	1,155 (36.0%)	<.001
I am afraid of meeting others	21 (36.2%)	260 (8.1%)	<.001*
I am anxious about the possibility of meeting people that I know	28 (48.3%)	227 (7.1%)	<.001*
I am anxious about what others might think of me	30 (51.7%)	906 (28.3%)	<.001*
I cannot blend into groups	31 (53.4%)	467 (14.6%)	<.001*
OCB (one risk or more)	23 (39.7%)	769 (24.0%)	.006
I cannot stand it if my meals and bath times are slightly different than usual	1 (1.7%)	45 (1.4%)	>.999
I pay excessive attention to my own cleanliness	8 (13.8%)	236 (7.4%)	.111
I excessively double-check things and have repetitive thoughts	17 (29.3%)	493 (15.4%)	.007*
I repeat the same act over and over	14 (24.1%)	324 (10.1%)	.001*
Dependencies (one risk or more)	15 (25.9%)	479 (15.0%)	.022
I cannot stop drinking	5 (8.6%)	204 (6.4%)	.671
I am heavily dependent on medications	7 (12.1%)	61 (1.9%)	<.001*
I am anxious if I am away from my phone or computer for even a moment	9 (15.5%)	291 (9.1%)	.147

p-value derived using the continuity correction computer only for a 2 × 2 table chi-square test.

** = p-values that meet the significance level after being adjusted for the number of items. OCB, obsessive–compulsive behavior.*

that there were significantly more hikikomori than non-hikikomori who had one or more suicide risk factors (81.0% vs 43.6%, $p < .001$, $phi < .001$), one or more interpersonal difficulties (74.1% vs 36.0%, $p < .001$, $phi < .001$), one or more OCBs (39.7% vs 24.0%, $p = .006$, $phi = .006$), and one or more dependency behaviors (25.9% vs 15.0%, $p = .022$, $phi = .022$). The *post hoc* analysis revealed that the chi-square test results also showed that significantly more people in the hikikomori group had suicide risk factors (all $p < .001$,$.073 \leq phi \leq .111$) and interpersonal difficulties (all $p < .001$,$.069 \leq phi \leq .203$), but an association was only partially observed in those with OCBs and violent tendencies. Furthermore, significantly more hikikomori people had a dependency on medications (12.1% vs 1.9%, $p < .001$, $phi = .094$).

The multiple logistic regression analyses using the psychiatric factors as continuous variables revealed that interpersonal relationships were consistently and significantly associated with being hikikomori across the three models (Model 1, OR = 2.30, 95% CI: 1.92–2.76; Model 2, OR = 2.1, 95% CI: 1.64–2.68; Model 3, OR = 1.95, 95% CI: 1.52–2.51; **Table 3**). In addition, Model 1 revealed that the hikikomori group was more likely to have more suicide risks (OR = 1.85, 95% CI: 1.56–2.20), more OCBs (OR = 1.57, 95% CI: 1.20–2.05), and more dependency behaviors (OR = 1.93, 95% CI: 1.37–2.70). In Model 2, only suicide risk factors (OR = 1.33, 95% CI = 1.05–1.67) remained significant. The significance of suicide risks was no longer observed in Model 3. Among the baseline characteristics that were input into the multiple

TABLE 3 | Association between the hikikomori condition and psychiatric factors.

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Suicide risks	1.85 (1.56–2.20)	1.33 (1.05–1.67)	1.24 (0.98–1.57)
Violent tendencies	1.29 (0.91–1.83)	0.87 (0.59–1.28)	0.95 (0.64–1.41)
Interpersonal difficulties	2.30 (1.92–2.76)	2.10 (1.64–2.68)	1.95 (1.52–2.51)
OCB	1.57 (1.20–2.05)	0.78 (0.55–1.09)	0.80 (0.56–1.14)
Dependencies	1.93 (1.37–2.70)	1.16 (0.79–1.72)	0.96 (0.64–1.45)

Model 1 = Odds ratio (OR) adjusted for age, sex, number of family members, and social class.

Model 2 = Odds ratio adjusted for age, sex, numbers of family members, social class, and all psychiatric factors.

Model 3 = Odds ratio adjusted for age, sex, numbers of family members, social class, all psychiatric factors, and history of psychiatric treatment.

logistic models, only sex was significantly associated with being hikikomori. Males were more likely to become hikikomori ($p < .01$ in Model 1 and Model 2, $p < .001$ in Model 3). In addition, a history of psychiatric treatment was significantly associated with being hikikomori ($p < .001$ in Model 3). The multiple logistic regression analyses results of one or more of the different psychiatric factors are shown in **Supplementary Table 1**. The results are consistent with the results in **Table 3** in terms of the direction of the association and significance.

DISCUSSION

This is the first study to show that being hikikomori is closely associated with interpersonal relationships followed by suicide risks. Hikikomori are more likely to be male, have dropped out from school, and have a history of previous psychiatric treatment. In addition, Japanese hikikomori are less likely to reside in a neighborhood filled with business and service industries.

Influence of Psychiatric Factors on Hikikomori

Interpersonal Difficulties Expressed as Anxieties

Our results showed that interpersonal difficulties were the most significant and strongest indicator for hikikomori. The items related to interpersonal difficulties included questions about anxiety toward specific objects (namely, people that the person knows). One item, "I cannot blend into a group," implies that hikikomori have difficulties blending in with others and fitting into a group. This particular difficulty may be governed by a lack of communication skills or consequent feelings of alienation if their communication skills are not the problem. Another item, "I am anxious about the possibility of meeting people that I know," indicates that the fear of familiar people is a unique characteristic of hikikomori. Combined with two other items, "I am afraid of meeting others" and "I am anxious about what others might think about me," it appears that the fear of not meeting expectations may govern these anxieties. These anxieties may be related to a sense of humiliation, which suggests that they are afraid of being seen in their current situation. This echoes the findings of previous studies that have identified that anxieties in hikikomori may be related to poor self-identity that developed during early adolescence (1, 18). Unlike anxieties found in social phobias or generalized social anxieties (25), in which the fear is of a wide range of objects (and not specific objects), our finding of an association between hikikomori and interpersonal difficulties indicates that hikikomori fear people and the community that they know. By carefully assessing the types of fears that they may have, our data suggest the possibility that improving communication skills and managing expectations may be helpful for combating hikikomori. In fact, encouraging their sense of belonging to the community and helping them to reason with their fears have been shown to be effective for improving communication skills among the hikikomori, thus leading to recovery (26).

Higher Suicide Risk May Be Confounded by a Previous History of Psychiatric Treatment

Our study shows that people with one or more suicide risk factors have 2.8 times higher chances of being a hikikomori. Moreover, with the number of suicide risks, the risk of becoming hikikomori significantly increases. However, the difference was not significant after controlling for previous history of psychiatric treatment, suggesting that the suicide risks in the hikikomori are related to other factors associated with the previous history of psychiatric treatment, or to the effect of an existing psychiatric disorder other than the OCBs, violence, and addiction. However, we cannot ignore the suicide risk among the hikikomori, and it should be noted not only that suicide is the leading cause of death among people aged 20–39 years in Japan but also that almost one-third of suicides occur in the undefined unemployed group, which may indicate hikikomori (27). In addition, the previous literature reports that hikikomori have low self-worth that often leads to suicidal thoughts (28); thus, the condition of hikikomori requires active intervention (15, 16, 29) instead of the passive attitude stating that it is merely a lifestyle choice (14).

Other Significant Factors Associated With Being Hikikomori

The only significant difference between the hikikomori and non-hikikomori groups regarding violent tendencies was occasionally throwing and destroying things, such as dishes, although the numbers were low. This suggests that the expression of violence is more inward. Moreover, in our study, a larger proportion of hikikomori had self-harming behavior, which is further evidence of violence toward the self. An association between hikikomori and OCBs was observed in responses to the items "repeatedly checking on meaningless things or thoughts" and "repeating the same act over and over," yet this influence was not observed after adjusting for other mental health indicators. Thus, OCBs are weakly associated with being hikikomori.

Psychiatric Treatment: Harmful or Beneficial?

In this study, 37.9% of the hikikomori had a previous history of psychiatric treatment, which suggests that mental health comorbidities are prevalent in the hikikomori. The higher proportion of hikikomori who are dependent on medication is also alarming. These findings indicate that psychiatric treatment does not guarantee social participation. We were unable to clarify if such dependency on medication is driven by existing psychiatric disorders, but we also cannot ignore the fact that the hikikomori symptoms may be related to the psychological factors associated with the treatment process, communication, and use of prescribed medications. Our data raise the simple question of "can psychiatric treatment elevate the hikikomori symptoms?" In the treatment guidelines for hikikomori, physicians are advised to carefully consider possible psychiatric diagnostic options (1), and in view of the fact that there is no evidence for whether psychiatric treatment promotes or prevents

hikikomori, we suggest that a psychiatric treatment plan should be considered more carefully.

Other Characteristics of Hikikomori

Are There More Men Than Women Who Are Hikikomori?

Our study provides the first epidemiological evidence of sex differences in hikikomori, which echoes the mainstream idea that there are more hikikomori men than women (5). In contrast, Koyama et al. did not find a significant difference between men and women who had identified themselves as having a lifetime prevalence of hikikomori (2). However, as the sample in Koyama's study (2010) was people who had recovered from hikikomori, it does suggest that women tend to recover from the hikikomori situation better than men. By contrast, Yong et al. found no significant differences between the prevalence of hikikomori in men and women in rural areas (30). The current evidence is still limited regarding whether there is a gender difference in becoming hikikomori. More studies need to be conducted, and their results should be interpreted with extra caution, considering the characteristics of the samples.

More Dropouts

Our study provides the first epidemiological evidence for the influence of educational status on hikikomori. High school and university students who have dropped out from the education system may have a higher chance of becoming hikikomori. The positive adjusted residual value also further confirms that people who drop out or take time off from their studies are significantly more likely to be hikikomori than those who graduate or continue their studies. There are various reasons for dropping out, which we failed to explore in detail in this study. Financial difficulties, academic difficulties, sickness, and maladjustment have been found to be the major reasons for dropping out of university (31). It has been found that maladjustment in students is related to difficulties in the transition from high school to university (32, 33), that moving to a new city and away from the family environment is stressful (34), and that the varying and superficial relationships promote loneliness (35). Early prevention, such as providing advice, information, financial support, or companionship during the first year of college, may be helpful (34).

Possible Influence of the Residential Characteristics

Our study does not support the idea that hikikomori is more common in urban areas (21), as no association between the city size, region, and hikikomori was identified. Instead, hikikomori was found to be less common in residential areas that have many business and service industries. As these residential areas may contain diverse people and cultures, and more outdoor options and job opportunities, future studies should clarify if these factors are associated with hikikomori.

Limitations and Strengths

There were several limitations in this study. Firstly, as self-reporting was used in this study, a misclassification bias may exist. We are also unsure if schizophrenia was really excluded from the classification of hikikomori. Secondly, we had no proper documentation of other psychotic disorders or data for depression. The simple yes/no response pattern to questions about mental health-related behaviors may not be a sufficient evaluation. Thirdly, psychological behaviors are often influenced by social events in the daily lives of individuals. However, as this Cabinet Office study focused more on the prevalence of hikikomori, it did not include questions about social and life events that might have influenced mental health-related behaviors. Another disadvantage of the secondary analysis of an existing dataset is that we lacked the variables of interest that we wished to study in more depth. Yet, there were also many advantages of using the existing data set. The SYPA is a large-scale population-based survey that would be difficult to conduct at an individual level. The identification of the variables, such as city size and region, is well-preserved and well-documented, which allowed us to examine the factors associated with hikikomori at different levels. The data collection process was also well-documented, which enabled us to consider more details during the analytic process.

CONCLUSIONS

Our study is one of the very few population studies that have aimed to identify the social and health characteristics associated with being hikikomori. At a glance, people with hikikomori symptoms can also have other psychiatric symptoms, such as a suicide risk, OCBs, and addictive tendencies, and many of these psychiatric symptoms can be explained by interpersonal difficulties and a previous history of psychiatric treatment, if we are willing to make a closer examination. In contrast to some specialists' opinions, hikikomori is not more common in urban areas than in rural areas. Being a man, having a history of dropping out from the educational system, and having a history of psychiatric treatment are contributing factors for hikikomori. By contrast, living in residential areas with many business and service industries can be a protective factor for hikikomori. Future studies should seek to verify the consistency of these findings, possibly using a cohort design.

ETHICS STATEMENT

This study was approved by the ethics committee of Akita University Graduate School of Medicine.

AUTHOR CONTRIBUTIONS

RY contributed to the conception and design of the study, organized the database, performed the statistical analysis, and wrote the first draft of the manuscript. KN edited sections of

the manuscript. All authors contributed to the manuscript revision and read and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2019.00247/full#supplementary-material

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The Effect of Employment on Delinquent Behavior Among Youth in Hidden Situation

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This study examines the effect of employment on delinquent behavior among young people in "hidden situations". Both quantitative and qualitative methods were used, and 588 young people in these hidden situations were investigated. Results showed that some of them had employment; their employment status constituted a mediating effect on preventing them from being involved in delinquent behavior. Also, participants who had work explained the reasons for not being involved in delinquent behavior. These results reflect that whether young people in hidden situation involve in delinquent behavior depends on their employment rather than their hidden behavior itself. The implication is that practitioners should respect the youths' self-preferred choice of employment and even advocate a revision of the definition of employment in Hong Kong.

Keywords: youth, hidden, employment, delinquent behavior, social withdrawal

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INTRODUCTION

Traditionally, it is stated that employment and delinquent behavior are related (e.g., 1–3). Stability in work can reduce young people's delinquent behavior (e.g., 4, 5). Similar results were also found among high-risk youth (6, 7) and people with criminal records (8, 9). For youth in hidden situations, it appears to be possible that they have a high likelihood to engage in delinquent behavior such as drug-taking and drug-trafficking (10) because of their employment situations such as NEETs (i.e., "not in employment, education, or training"), freeters (i.e., "youth floating between dead-end, part-time jobs") (11, 16), three-lows (i.e., having low education level, skill level, and motivation level) (12), failing to fit into the societal standards for education or career (13, 14), and being reluctant to engage into society (15). Also, from a clinical perspective, under limited social support, youth in prolonged hidden situations are prone to experiencing mental health issues such as sense of loneliness and low self-esteem (16, 17), and even a gradual loss of social skills and initiation to build social relationships, which further hinder their social connections and engagement in school or work (18). However, as society changes, flexibility in work arrangements is promoted and the Internet is used as a platform for handling work arrangements; this leads to the mushrooming of non-typical forms of employment, such as freelance, home-based work and Internet-based work (19–21). The increasing prevalence of such forms of work definitely triggers a rethinking of whether the traditional concept of employment still applies in current society. According to the study conducted by Chan (22) on youth in hidden situations in Hong Kong, these youth do have employment, which is one of the significant life transitions predicting a decreased likelihood delinquent behavior. This demonstrates that these youth are not jobless, only that their jobs do not match the official definitions of employment that requires a "formal job attachment" (23) and an "outside workplace" (24: 4). In this sense, youth in hidden situations are not necessarily delinquent-prone in light of their

employment situation. Against this backdrop, this study seeks to further explore these youths' nature of employment, and how their employment influences their engagement in delinquent behavior in the local context. It is expected that the study will not only help uncover the real situation of these youth in terms of their employment and its effects on their delinquent behavior but will also generate implications regarding how the concept of employment can be understood in contemporary society.

To provide support for the research aims, in the following, literature about the relationship between employment and delinquent behavior will first be reviewed.

Employment and Delinquent Behavior

While deviant behavior refers to behavior that violates societal norms and behavioral standards, or triggers negative reactions from others (25), delinquent behavior is referred to as law-breaking behavior (26). Some behavior can be deviant but not law-breaking, while some behavior can be both deviant and law-breaking (27). In other words, deviant behavior and delinquent behavior are conceptually different but, at the same time, have overlaps.

Reviewing existing literature, there are theories supporting the significant negative relationship between employment and delinquent behavior [e.g., Refs. (28–31)]. To begin with, according to General Strain Theory (28, 29), strain (e.g., lack of financial resources) serves as a state of discomfort that triggers delinquent behavior. In this sense, employment will act as a legitimate "conventional opportunity structure" for youth to earn money, thus reducing the pressure to turn to delinquent behavior (32, 33, 301). Next, according to Routine Activities Theory (30), it is posited that environmental contexts (e.g., presence of guardianship, available opportunities for committing delinquent behavior) affect the likelihood of delinquent behavior. In the case of youth, having a job brings about a change in how they spend their time (34, 35). Since employment helps one earn income (29, 36), occupies his/her idle time (37), and modifies his/her routine activities (38), it helps discourage delinquent behavior (39). Also, according to Social Control Theory (31), strong bonds to social institutions likely increase one's sense of responsibility and restrict him/her from engaging in delinquent behavior. In this sense, employment can be viewed as a social bond, an informal social control that helps alter his/her delinquent trajectory and decreases his/her engagement in delinquent behavior [e.g., Refs. (38, 40, 41)]. Besides, according to Life Course Theory (38, 39, 42), successful completion of life events, such as having completed high school, having been married, and parenthood, can alter one's life trajectory and subsequent engagement in delinquent behavior. Getting a job is one of the transitional events that imposes an effect on one's likelihood of engaging in delinquent behavior. All of the above sociological theories provide theoretical foundations for the significant link between employment and decrease in delinquent behavior.

Subsequent scholars also provided support for the association between employment and decrease in delinquent behavior. As stated by some scholars [e.g., Refs. (1, 2, 43)], stable work can be regarded as a form of informal social control that helps one desist from delinquent behavior. Employment encourages social conformity, since delinquents are provided with opportunities to interact with others who are conventional in work situations; this enhances their tendency to conform (38, 44). Further elaborated by Sampson and Laub (38), 141), similar to marriage, employment is "characterized by an extensive set of obligations, expectations, and interdependent social networks," meaning that employment helps generate new situations where supervision and monitoring are possible. Supported by Ploeger (37), employment discourages delinquent behavior, as it introduces positive work ethics and helps establish bonding to conventional society. For Caspi et al. (45), employment might even promote the chances of experiencing other types of transitions, such as fertility, which may strengthen other forms of informal social bonds that further steer young people away from delinquent behavior (i.e., earning money to support a child's living). In addition, as stated by Cullen and Travis (46), as well as Phillips and Sandstrom (47), employment helps bring about healthy development of young people, which reduces their delinquent behavior. Employment enhances one's self-esteem (37, 48); it provides new opportunities for people to receive social support and changes in routine activities, which might promote transformations in identity (38, 48). Summarizing the above illustrations, employment reduces the likelihood of engaging in delinquent behavior by helping one socialize to adaptive norms, increase bonding to social bonds and life transitions, as well as establish a positive identity.

There is a view positing that the relationship between employment and delinquent behavior is a spurious one (e.g., 33, 49, 50) because the relationship is intervened by various preexisting factors. Possible factors are one's level of self-control (e.g., having low self-control leads to engagement in delinquent behavior due to the urge for enjoying immediate satisfaction at the expense of behavioral consequences) (49) and predisposition for delinquent behavior (50). Some scholars pointed out that one's perceived meaningfulness of the transitional events, reflective ability, and his/her sense of control over life events affect the change in delinquent trajectories (51, 52). Some scholars even pointed out that employment might increase delinquent behavior [e.g., Refs. (53–55)]. For example, intensive work (e.g., long working hours) likely displaces engagement in schooling and weakens social control (31, 56), which in turn leads to a number of detrimental effects for adolescents including lower level of academic achievement (55, 57), dropping out of school (56, 58), poorer relationships with peers and family, and even poorer health and psychological well-being [e.g., Refs. (55, 59)]. Also, employment may bring about financial resources and increased autonomy (60), which encourage one's participation in unstructured socializing activities (e.g., partying with friends without the presence of authoritative figures) that serve as opportunities for engaging in delinquent behavior (35). On the other hand, some scholars highlighted the significance of the quality of employment, such as stability (42), salary (4, 61), benefits (62), degree of satisfaction (62, 63), length of working hours [e.g., Refs. (54, 64)], and level of innovation and complexity (65), in the effect on delinquent behavior. Full-time jobs or higher-quality jobs lower the likelihood of recidivism [e.g., Refs. (63, 66–68)]. Explained by Wadsworth (69), (p. 1044),

good career development and high-quality jobs encourage one to become more conforming, as they are more "at stake" and had "more to lose." It enhances one's engagement and investment to his or her work and brings about high level of satisfaction (50). Also, Agnew (66) pointed out that prestige from occupation reduced delinquent behavior. Besides, according to Agnew (28), jobs that do not create too much stress or psychological burden can reduce delinquent behavior among adolescents, since these situations are more likely to reduce feelings of frustration or anger that might provoke delinquent behavior. Suggested by Mortimer (64), the quality of employment affects youths' psychosocial well-being; poor quality work likely brings about poor mental health and induces delinquent behavior. In addition, some scholars even stated that good jobs were related to other factors, such as housing and affective relationships, which helped further decrease the likelihood of engaging in delinquent behavior (70, 71). All these notions show that the quality of employment, in terms of career development and sense of satisfaction that it brings, matters when discussing its effect on desistance.

On the contrary, unemployment increases the likelihood of delinquent behavior due to the cumulative disadvantage of long-term distance from the labor market (72). Low-quality work increases the likelihood of delinquent behavior (50). As stated by Crutchfield and Pitchford (43), individuals who have unstable jobs are more likely to engage in delinquent behavior, as they are less likely to be confined by work and have more freedom to linger in places like bars and street corners, which induce the commitment in delinquent acts. Besides, having low aspirations and expectations in work heightens the chance of engaging in delinquent behavior, because there is not much to lose (73).

To summarize, although the relationship between employment and delinquent behavior is inconsistent, there are a number of theoretical notions supporting the idea that employment can help one desist from delinquent behavior. Employment, especially stable employment, brings about a number of positive effects, such as 1) heightening one's risk involved with offending, increasing his/her pressure to conform; 2) increasing opportunities for monitoring his/her delinquent behavior; 3) decreasing his/her idle time for engaging in delinquent behavior; 4) facilitating his/her experience in other transitional events; 5) experiencing new opportunities for social support and developing new identity; and 6) enhancing his/her self-esteem. Moreover, employment with higher quality and less pressure has a higher effect on desistance.

Insights from the Above Literature to the Context of Youth in Hidden Situations

Young people in hidden situations, known as hikikomori in Japan (74), are commonly described as having retreated from social participations and connections, including school or work, for at least 6 months (74–76). As suggested by Saito (74), it might not be suitable to attribute youths' hidden situations to mental illnesses. Although this group of youth is related to NEET (11), they are different from Otaku who are referred to as "notoriously obsessive fans of manga, anime, video games, and other forms of Japanese popular culture" (11, 12). When the phenomenon was uncovered in Hong Kong in 2004, the definitions of these youths were generally similar (77). According to Wong and Ying (12), the hidden situations of these youths are provoked by the inability to fit into the education system or labor market, leading to a lack of social status and becoming Three-lows. Regarding their characteristics, there exist two perspectives of illustrations, namely, the clinical perspective and the nonclinical perspective (77). Scholars supporting the clinical perspective stated that being hidden was associated with psychiatric disorders such as Internet addiction (78), social anxiety (79, 80), autism (81), schizophrenia, and affective disorder (82), while those supporting the nonclinical side held that the culture of society (e.g., rigid expectations on youth regarding their school-to-work transitions, rigid employment practices to which young people find it difficult to conform) [e.g., Refs. (13, 14, 83)] was an important cause of being hidden. Although there are notions that hikikomori or youths in hidden situations lack the ability to maintain a long-term job (84) due to their fear of encountering failures (85), it is also possible that young people actively withdraw because they perceive a mismatch with the employment structure and mainstream standards in society [e.g., Ref. (86)].

On the other hand, in Hong Kong and Japan, these youths have been reported as having committed delinquent behavior, such as killing (87) and violence (88). Based on the relationship between employment and delinquent behavior as described previously [e.g., Refs. (63, 66–68)], it implies that youth in hidden situations have a high tendency to engage in delinquent behavior due to their unemployment. However, researchers found that, from previous practice experience with youths in hidden situations, some of these youths engage in home-based work; also, they have low propensity to engage in delinquent behavior. This suggests that these youth are not homogenously jobless and delinquent-prone as portrayed in society. In fact, as society changes, home-based, Internet-based work and freelance work have become increasingly prevalent in contemporary society (19–21). This means that jobs nowadays are no longer restricted to traditional, typical forms of work arrangement (e.g., requiring a workplace outside home) (24, 4). It is plausible for young people in hidden situations to work at home with their computers during prolonged seclusion. Owing to the lack of previous studies that investigate these youths' employment situations and the subsequent effects on their delinquent behavior, this study aims to fill this research gap. It is expected that this study can 1) de-stigmatize these youth as "lacking social status" and "being unable to work" and 2) refine the meaning of employment so as to respond to the societal changes nowadays.

METHOD

Participants

There were 540 participants in this study, who were recruited through purposive sampling. This sampling method is useful for locating "unusual" extreme or deviant cases (89, 182), such as young people in hidden situations who only appear online but are *invisible* in social situations. Eligible participants should be residents of Hong Kong, be within the age range of 12–30, have retreated from society for at least 6 months, and have received no

psychiatric diagnosis or treatment. The criteria for youth in Hong Kong in the context of social service provision is 12–29 years old. Hence, the participants in the study were termed as "youths" or "young people" in hidden situations.

Of the total participants, 64.1% (N = 346) were male, while the rest (35.9%, N = 194) were female. More than half of them (61.7%, N = 333) were 21 or older. Participants in this study had withdrawn for 1 to 8 years; 51.7% (N = 279) had been hidden for 1–2 years, while 48.4% (N = 261) had been hidden for longer than 2 years. For their level of hidden situation, 15.9% (N = 86) of participants were identified as being in a level 1 hidden situation (i.e., the lowest level); 73.0% (N = 394) were at levels 2 to 4, and 11.1% (N = 60) were at level 5 (i.e., the highest level). Regarding their education level, 53.1% of them reported to have achieved senior secondary qualification (N = 287), while 29.4% (N = 159) and 17.4% (N = 94) of them had achieved the education qualification of college/university or above and junior secondary, respectively. With respect to their family income, only 37.2% (N = 201) received a family income of HK$20,000 or less; more than half of them (62.7%, N = 339) had a family income of HK$20,000 or more (US$1 = HK$7.8). For their employment status, although most of them (83.5%, N = 451) reported to have no employment, there were some (15.1%, N = 89) who had work, with most of them (87.6%, N = 78) having Internet-based jobs and a few of them (10.1%, N = 9) being self-employed. This reflects that young people are not necessarily lacking in social status (11) or refusing social participations (76), but they have working ability and employability. For their criminal records, all of the participants had no history of committing delinquent behavior.

Data Collection and Procedure

Participants were own cases from a local service center established by the researcher, who were mainly located via Internet platforms (e.g., forums and online gaming platforms). Due to prior understanding of the participants, researchers were able to understand their employment situations and delinquent behavior.

Informed consent from participants was achieved by directly giving consent forms to those who had reached 18 years of age and giving the forms to their parents if they had not reached 18. Researchers also met them face-to-face, to explain the aim, topic, and process of the study, and assess their eligibility for participating in the study. Once all of the aforementioned procedures were completed, the questionnaire was administered to them.

On the other hand, 56 participants participated in the qualitative study. The interviews were conducted in a face-to-face manner.

Measurement Scales

Employment

In this study, the transitional event of employment was examined to see if it affected participants' involvement in delinquent behavior in life. This piece of information was collected from participants by asking them to self-report whether they had a job in the questionnaire.

In this study, participants who had full-time work and earned a living from their work were considered as employed. Among the youths in hidden situations, Internet-based work and freelance jobs, which are non-typical work arrangements, are common.

Period and Level of Hidden Situation

Period of hidden situation refers to the duration of being hidden. This piece of information was obtained from a question about how long they had retreated from society in the questionnaire. For the level of hidden situation, according to Oiwa (90), there are five levels of hidden situation, with item 1 representing the lowest level of hidden situation (i.e., "In the past six months, I have not gone outside") and item 5 representing the highest level (i.e., "In the past six months, I have not talked to anybody"). One's level of hidden situation indicates the amount of social relationships and social support that one possesses during hidden situation. Prolonged seclusion does not necessarily mean that the youths will not maintain online connections or participate in online work.

Delinquent Behavior

The Youth Deviant Behavior Scale of Yang (91) was used to assess participants' engagement in any type of delinquent behavior in the past year. This scale was used owing to its suitability for Asian contexts like Hong Kong. This scale consists of three subscales, including externalizing deviant behavior (30 items, e.g., fighting and drug-taking), internalizing deviant behavior (18 items, e.g., engaging self-harm behavior and having suicidal attempts), and difficulty in academic adaptation (12 items, e.g., sleeping in class). Considering the applicability of the scale, only subscales of externalizing deviant behavior and internalizing deviant behavior were used, and only items relevant to delinquent behavior were included in the analysis. All items adopt a five-point Likert scale (1 = never; 2 = 1 to 3 times; 3 = 4 to 6 times; 4 = 7 to 9 times; 5 = more than 10 times).

Delinquent behavior, by definition, is law-breaking behavior (26). Not all self-reported delinquent behaviors cause official arrests and are included as criminal records (92). In this study, participants' self-reported delinquent behavior was adopted because the study aims at investigating the social determinants of delinquent behavior among youth in hidden situations (i.e., employment status). The details of the participants' self-reported delinquent behavior are presented in **Table 1**.

Quantitative Analysis

SPSS for Windows 19.0 was the program used for conducting the statistical analyses, in which $p < .05$ was the significance level of the study. Analyses included the following: 1) cross-tabulation analysis was conducted to see the distribution of participants in employment in different periods and levels of hidden situation; 2) Spearman's rank correlation was performed to investigate whether employment was associated with participants' period and level of hidden situation, as well as their engagement in

TABLE 1 | Sample characteristics (*N* = 588).

Variables	%	*N*
Gender		
Male	64.1	346
Female	35.9	194
Age		
16–20	38.3	207
21–25	60.0	324
26–27	1.7	9
Education		
Junior secondary (Years 7–9)	17.4	94
Senior secondary (Years 10–11)	39.6	214
Matriculation (Year 13)	13.5	73
College/university or above	29.4	159
Family income (USD$1 = HK$7.8)		
Below HK$10,000	16.1	87
HK$10,001–20,000	21.1	114
HK$20,001–30,000	23.1	125
HK$30,001 or above	39.6	214
Earning ability		
Yes	49.3	266
No	50.7	274
Criminal records		
Yes	0.0	0
No	100.0	540
Period of hidden situation		
1 year	27.8	150
2 years	23.9	129
3 years	8.3	45
4 years	15.4	83
5 years	11.7	63
6 years	5.6	30
7 years	5.0	27
8 years	2.4	13
Level of hidden situation		
1	15.9	86
2	14.1	76
3	30.2	163
4	28.7	155
5	11.1	60
Holding full-time employment		
Yes	16.5	89
No	83.5	451
Types of full-time employment (*N* = 89)		
Internet-based work	87.6	78
Self-employed	10.1	9
Unknown	2.2	2
Types of delinquent behavior committed		
Theft	1.5	8
Drug taking	5.9	32
Fraud	0.9	5
Online fraud/theft	4.1	22
Hacking	10.9	59
Spreading virus online deliberately	17.8	96
Reading pornography	11.1	60
Online gambling	7.8	42
Others	3.9	21

Reading pornography includes downloading and distributing pornographic materials.

delinquent behavior; and 3) mediation analysis was undertaken to examine whether participants' employment contributes to the link between hidden behavior and delinquent behavior, so as to shed light on the importance of employment in affecting their engagement in delinquent behavior.

Qualitative Analysis

Other than the quantitative analyses, qualitative verbatim accounts of the participants were analyzed to examine how their jobs influenced their involvement in delinquent behavior. To conduct the qualitative analysis, the recordings of the interview were first transcribed, and then the verbatim data of the participants were summarized in terms of the reasons for not engaging in delinquent behavior.

RESULTS

Employment and Hidden Situation

Figure 1 shows the distribution of employment of participants in the different periods and levels of hidden situation. With respect to the period of hidden situation, about one-fourth of participants (25.8%) who had a job had 1 year of hidden experience; although only a small number of participants (11.2%) with 2 to 3 years of hidden experience had a job, over 40% (47.2%) of the participants who had a job had been hidden for 5 years or more. This reflects that although young people retreat from social participation when they start to become hidden, they will have jobs again when they stay in a prolonged hidden situation. On the other hand, regarding the level of hidden situation, results showed that as the level of hidden situation increased, the number of participants engaging in employment decreased. This reflects that fewer young people who are in a deeper level of hidden situation have jobs.

The above results suggest that young people in hidden situations engage in employment. In the following, correlation analysis was performed to investigate whether participants' employment is related to their engagement in delinquent behavior.

Employment and Delinquent Behavior

Employment was negatively correlated to delinquent behavior ($r = -.41$). This shows that having a job is related to a decrease in delinquent behavior. Additionally, period of hidden situation was negatively correlated to delinquent behavior ($r = -.38$) but positively correlated to employment ($r = .17$), while level of hidden situation was positively correlated to delinquent behavior ($r = .74$) but negatively correlated to employment ($r = -.39$). These findings reflect that as young people progress to a hidden situation, they are more likely to hold jobs and their involvement in delinquent behavior may decrease, while as the level of hidden situation increases, young people are less likely to hold jobs and their involvement in delinquent behavior may increase.

The results above show that youths in hidden situations can attain jobs, and they show lower engagement in delinquent behavior. At the same time, for those having a higher level of hidden situation, fewer of them get into employment and they exhibit more involvement in delinquent behavior. In order to further explore the effect of employment on the tendency to engage in delinquent behavior in terms of period and level of hidden situation, mediation analysis was conducted in the following section.

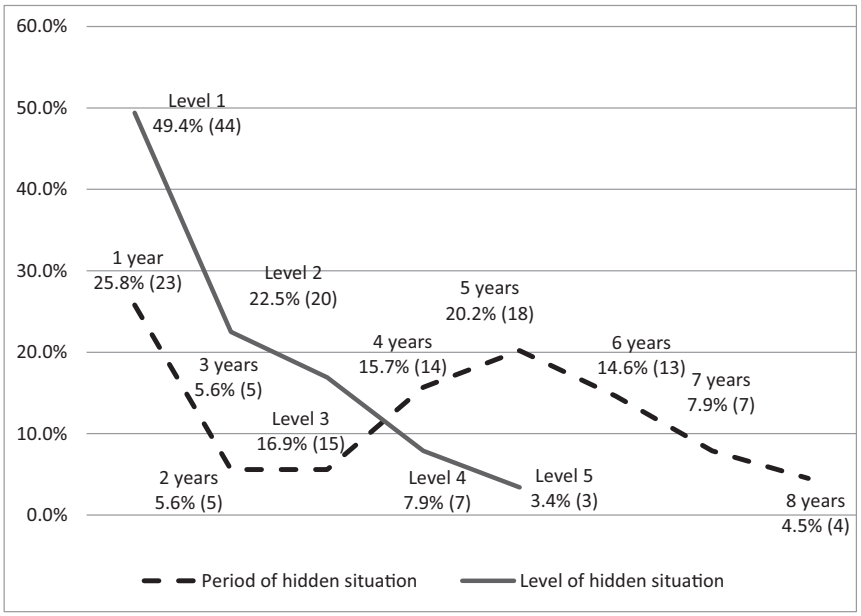

FIGURE 1 | Participants' employment status in different periods of hidden situation (in terms of year) and levels of hidden situation (N = 89).

The Role of Employment in the Relationship Between Hidden Behavior and Delinquent Behavior

In this analysis, the proposed mediation path was "hidden behavior → employment → delinquent behavior." Both period and level of hidden situation were tested. To assess the mediation properties of outcome expectancies, *PROCESS Macro for SPSS* (93) was used. The proportion of indirect effect on total effect was derived by expressing the ratio of indirect to total effect of X on Y as performed by the Macro (93). Also, to test the significance of the proposed mediation paths, Sobel tests were undertaken (94).

The indirect effect in each mediation path was found to be significant. Results are shown in **Table 2** and **Figures 2** and **3**.

As shown in **Figure 2**, period of hidden situation negatively predicted delinquent behavior (β = −.40). With employment having existed as the mediator, the effect of period of hidden situation on delinquent behavior diminished (β = −.33). In the relationship between period of hidden situation and delinquent behavior, employment was a significant mediator, accounting for 17% of the relationship. Period of hidden situation displayed a positive expectancy of employment (β = .20), while employment displayed a negative expectancy of delinquent behavior (β = −.34). This shows that as participants withdraw for a longer period, their engagement in delinquent behavior decreases; employment contributes to lowering the engagement in delinquent behavior among these young people.

As shown in **Figure 3**, level of hidden situation showed a positive expectancy of delinquent behavior (β = .74). With employment included as the mediator, the impact of level of hidden situation on delinquent behavior was attenuated (β = .69). Employment was a significant mediator in the relationship between level of hidden situation and delinquent behavior, explaining 7% of the relationship. Level of hidden situation negatively expected employment (β = −.40), and employment negatively predicted delinquent behavior (β = −.13). This suggests that participants at a higher level of hidden situation show a higher likelihood of involving in delinquent behavior; this is because fewer of these young people become employed.

The results of the mediation analyses suggest that although fewer young people at a higher level of hidden situation have jobs, those who stay in hidden situations hold employment. Work prevents them from engaging in delinquent behavior. Besides, comparing the two mediation analyses, the mediating effect of employment is slightly more prominent in the relationship between period of hidden situation and delinquent behavior than that between level of hidden situation and delinquent behavior. This means that the prohibiting effect of employment on delinquent behavior is slightly larger among young people who have a lower level of hidden situation.

TABLE 2 | Standardized estimates of direct and indirect effects on delinquent behavior and mediator (Paths 1 and 2).

	Effect	% Explained of total effect	Sobel Test
Hp→Em→Delin be (total effect)	−.398		
Hp→Em→Delin be (indirect effect)	−.068	17%	−6.833****
Hl→Em→Delin be (total effect)	.742		
Hl→Em→Delin be (indirect effect)	.051	7%	3.186**

*Hp, period of hidden situation; Hl, level of hidden situation; Em, employment; Delin be, delinquent behavior. **p < .01. ****p = .0000.*

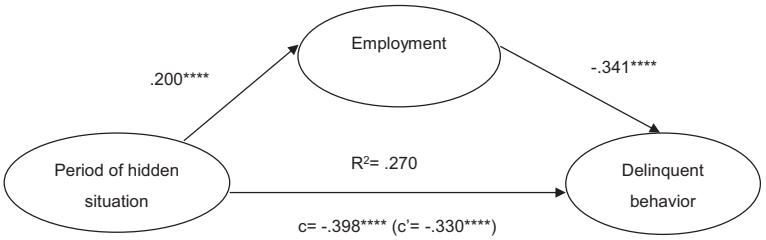

FIGURE 2 | Mediation model of period of hidden situation, employment, and delinquent behavior (Path 1). ****p = .0000.

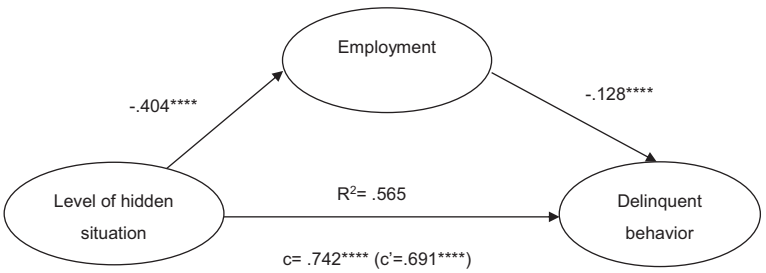

FIGURE 3 | Mediation model of level of hidden situation, employment, and delinquent behavior (Path 2). ****p = .0000.

The following qualitative verbatim accounts of participants illustrated different reasons of not engaging in delinquent behavior when holding employment:

Not Engaging in Delinquent Behavior due to the Structured Environment of Work Where Supervision Is Allowed

No (not engaging in delinquent behavior anymore). Although I don't need to go to work, drawing graphics is time-consuming and I need to pay much attention to this. If I take drugs, I will not be able to concentrate on my work, and will be scolded. (Youth b)

…now I work for 14 hours every day (as a shop assistant in an online store). I won't do those meaningless things (taking drugs) again. In the past, I did this (drug-taking) to kill my time. Now I need not do this anymore. (Youth c)

I love my job (working as a translator)…I don't want to do anything which makes me lose my job. (Youth j)

As stated by Youth b and Youth c, jobs reduced their idle time to commit delinquent acts. At the same time, the verbatim accounts of Youth b reflected that work situations had a supervising effect on their behavior, which prohibited them from becoming involved in delinquent behavior, such as drug-taking. Delinquent behavior could affect work performance. Also, Youth j reported that having a job increased his cost for engaging in delinquent behavior, as he feared that being delinquent would make him lose his job.

Not Engaging in Delinquent Behavior due to the Establishment of a New Self and New Life Resulted From Employment

Now I have different social circles. My friends become different. So I no longer engage in hacking activities and set cheating programmes… (Youth a)

…in the past, I fooled around in BBS (Bulletin Board System) with my peers, criticizing and teasing other people as a pastime. At that time, I thought that I had status on the Internet. However, when I have a job, I think that BBS becomes no longer important. I think that my value can be found elsewhere. (Youth e)

In the past, I used the same skill (stealing passwords from other players' accounts in online games) to find money, but it's illegal; now I use the same skills and experience in my work (as a game manager), and it's legal. I feel great! (Youth g)

I love my job (working as a translator), and I can enjoy my beloved lifestyle while being able to support my life… (Youth j)

As stated by Youth a, the job created opportunities for him to build new social networks, which drove him away from delinquent behavior. As expressed by Youth e, jobs brought them a new identity, value, and meaning of life. As expressed by Youth g and Youth k, having legal jobs increased their self-esteem (Youth g). Besides, the verbatim accounts of Youth j reflected that he enjoyed his work, as it brought him a high quality of life. This implies that work of high quality helps prevent one from becoming helpful in delinquent behavior.

Other Reasons for Not Engaging in Delinquent Behavior due to Employment

> Of course not (not engaging in delinquent behavior anymore). I do this (search for bugs) every day when I'm at work. No kidding! (He works as a programmer who is responsible for finding bugs in online games). (Youth d)
>
> In the past, I didn't earn money by myself, so I didn't know how difficult money-making is … Now I earn $250 a day, which means that I can only get half an ounce of ketamine … so expensive! So I don't take ketamine anymore now. (Youth i)
>
> Now I'm more concerned about other people's feelings. I've learnt to take other people's perspectives before saying and doing anything. So I think that I was wrong (to uncover and bully other people on the Internet) before. (He works as a peer counselor) (Youth l)

On the other hand, participants showed other reasons for not engaging in delinquent behavior. For Youth d, employment offered him a legitimatized way to engage in bug-finding. Since his interests, potentials, and needs had already been fulfilled in his job, his drive to engage in delinquent behavior was weakened. For Youth i and Youth l, they gave up delinquent behavior including drug-taking (Youth i) and cyber bullying (Youth l) as they understood the importance of saving money (Youth i) and perspective-taking (Youth l), respectively. They thought that engaging in delinquent behavior wasted money (Youth i) and brought harm to others (Youth l).

In summary, all of the above verbatim accounts of participants show that young people in hidden situations have jobs, such as graphic design (Youth b), working as an online shop assistant (Youth c), programming (Youth d), webpage designing (Youth f), working as a game manager (Youth g), making cosplay costumes (Youth h), translation (Youth j), working as a sensory operator on the gaming platform (Youth k), and working as a peer counselor (Youth l). Participants have various reasons for ceasing delinquent behavior due to employment. In general, the reasons show coherence to the literature review, including increased sense of satisfaction brought about by the job, being more "at stake" (69, 1,044), and establishment of a new life and identity due to employment. Although the money earned from jobs might create opportunities for engaging in delinquent behavior [e.g., Ref. (60)], it does not apply in the case of the youth participants. It is the nature, quality, and meaningfulness of their jobs, as well as their outweighing of benefits and drawbacks of being delinquent, that effectively prohibit them from engaging in delinquent behavior.

DISCUSSION AND CONCLUSION

Results showed that 15.1% of youths in hidden situations had jobs. They mainly worked in an Internet-based, home-based manner, with some of them being self-employed or working as freelancers, and they were able to make money from their jobs. This suggests that these youths' being jobless is a prejudice; they are not necessarily those who lack social status as described in previous literature [e.g., Refs. (11, 12, 76)] but can engage in work during prolonged seclusion as their preferred lifestyle and use it to support their lives. Also, the relationship between employment and delinquent behavior was significant in the context of youths in hidden situations. Employment serves as a form of informal social control (38) or "meaningful social attachment" (95, 381) to reduce the likelihood of being involved in delinquent behavior by creating opportunities for supervising behavior, increasing the risk for offending, decreasing the idle time for offending, and allowing new opportunities to build new social networks. Also, employment helps youths in hidden situations to transform, develop a new identity, develop a new set of values, and enhance their self-esteem (37, 38, 48). Additionally, it is noted that the quality of jobs plays a part in these youth's desistance in delinquent acts (28, 50). As stated in previous research, the importance of employment in reducing delinquent behavior is the positive experience that employment brings (e.g., perceiving a job as good and fulfilling, and enhancing self-worth), not just the nature of employment (e.g., full-time or part-time) (64, 96). In the case of the youths, it appears that not only the structure and stability of their jobs (e.g., working hours) are significant—when they love their jobs and think that their jobs help them pursue their preferred lifestyle, their employment can serve as a form of informal social control that effectively displaces the delinquent lives they used to have. All these suggest that the relationship between employment and delinquent behavior as stated in the existing literature could be applied in the context of youth in hidden situation. The work engaged by the youths in hidden situations displayed the same impact on reducing delinquent behavior as stated in traditional theories.

The results about the youths' employment situations provoke reflections upon the concept of employment in Hong Kong. According to the Census and Statistics Department (23), "employed population" refers to "persons aged 15 and over who have been at work for pay or profit during the 7 days before enumeration or who have had formal job attachment"; although there are no clear definitions of "formal job attachment," employment is commonly recognized as "working outside" [e.g., Ref. (24, 4)]. Also, despite the fact that the Hong Kong Standard Industrial Classification Version 2.0 (HSIC V2.0) has covered a variety of categories of industries (20 broad categories) including primary (e.g., "Agriculture, forestry and fishing"), secondary (e.g., "Manufacturing" and "Construction"), and tertiary industries (e.g., "Information and communications" and different service industries) (97, 12), the delineation of the categories is mostly based on the structure of the local economy (23). From the above definitions of employment, it is noticed that although various types of industries are recognized, the mode of work appears to be exclusive of home-based work. A probable result of this definition will be that some jobs, such as home-based work and Internet-based work, will not receive social recognition and these people will still be perceived as jobless or having low motivation to work even though they have contributed their labor to earn a living. In fact, alongside technological advancement, it is well known that Internet-and home-based work is increasingly popular among people in contemporary society (98); owing to the lifestyle of youths in hidden situations, these youths even play a part in pioneering this trend. Hence, in response to societal changes, the understanding of employment should change

accordingly and the stereotypical understanding of employment among the general public should be overturned.

To conclude, the results of this study show that young people in hidden situations, though not all of them, have work. This helps de-stigmatize them as a group of jobless youth who are socially isolated and have a fear of entering the labor market. Although, from a clinical perspective, prolonged hidden situation would lead to negative consequences including mental issues (e.g., depression and social anxiety), social isolation, and fear of engaging in interpersonal relationships [e.g., Refs. (99, 100)], it is pointed out that as long as these youths can find out the interests and meaningfulness of work, they will be motivated to get a job again (101), which in turn buffers them from engaging in delinquent behavior. According to previous studies on youths in hidden situations (77, 102), being able to pursue the self-preferred interests during prolonged hidden situation brings about an enhanced sense of well-being and quality of life. Hence, the dominant judgments of these youth might no longer apply. Instead, it is necessary to view the young people in hidden situations and even the concept of employment from a brand-new angle. To address these implications, firstly, during practice, instead of encouraging young people in hidden situations to "re-engage into the mainstream society," practitioners can try to adopt a youth-oriented perspective to appreciate their choice of work life and the subsequent positive effects; meanwhile, practitioners can undergo parental education, to educate the parents of these youth about how they can support their children's growth and development through allowing them to pursue the work they prefer, rather than forcing their children to step out of home and enter the mainstream labor market, which may not suit these young people's needs. Through this kind of intervention, it not only helps advocate a change in the public concept about youths in hidden situations but also helps nurture positive growth and development of the youth as it acknowledges their uniqueness and individuality. Most importantly, owing to the positive values of home-based or Internet-based work engaged by youths in hidden situations, it is advocated that the definition of "employment" must be revised and enriched, with the meaning of formal work being extended to home-based work, Internet-based work, and freelance jobs, so as to respond to the societal changes and embrace the diversity in the concept of employment in society. The modification of the definition of employment will benefit not only youths in hidden situations but also other groups of youths who had jobs of similar nature.

LIMITATIONS AND FUTURE STUDIES

The sampling method used in this study likely constitutes the limitation of this study. Since the participants were mainly recruited through the Internet, the sample might probably not be able to include young people in hidden situations who do not use the Internet. As such, the representability of the sample might be hindered. Hence, in the future, similar studies can be performed on participants who are recruited by other types of sources to see whether similar results can be derived.

Also, it is mentioned that the relationship between employment and delinquent behavior is affected by other factors, such as level of self-control and delinquent propensity [e.g., Refs. (49, 50)]; also, it is even pointed out that prior identity transformation (e.g., perceiving the delinquent career as costly rather than beneficial) must exist before employment serves as an effective social bond to buffer against delinquent behavior (103–105). To see if this also applies in the case of youths in hidden situations, in future studies these factors can be incorporated into the analysis, so as to further enrich the research of youths in hidden situations in terms of the relationship between employment and delinquent behavior (e.g., the intervening effect of identity change and employment in these youths' desistance in delinquent behavior).

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the "Research and Ethics Committee, City University of Hong Kong," with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the "Research and Ethics Committee, City University of Hong Kong."

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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Correlations of Internet Addiction Severity With Reinforcement Sensitivity and Frustration Intolerance in Adolescents With Attention-Deficit/Hyperactivity Disorder: The Moderating Effect of Medications

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Background: Deviations in reinforcement sensitivity and frustration-related reactions have been proposed as components of the biopsychosocial mechanisms, which explained the high vulnerability to internet addiction (IA) among individuals with attention-deficit/hyperactivity disorder (ADHD). There is currently limited knowledge on the relationship of IA symptoms with reinforcement sensitivity and frustration intolerance, as well as factors moderating those correlations in this population.

Objective: The aims of this study were (1) to examine the associations of IA symptoms severity with reinforcement sensitivity and frustration intolerance and (2) identify the moderators of these associations among adolescents diagnosed with ADHD in Taiwan.

Methods: A total of 300 adolescents aged between 11 and 18 years who had been diagnosed with ADHD participated in this study. Their levels of IA severity, reinforcement sensitivity, and frustration intolerance were assessed using the Chen Internet Addiction Scale, behavioral inhibition system (BIS) and behavioral approach system (BAS), and Frustration Discomfort Scale, respectively. The associations of IA severity with reinforcement sensitivity and frustration intolerance were examined using multiple regression analysis. Possible moderators, including medications for ADHD, were tested using the standard criteria.

Results: Higher fun seeking on the BAS (p = .003) and higher frustration intolerance (p = .003) were associated with more severe IA symptoms. Receiving medication for

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treating ADHD moderated the association between fun seeking on the BAS and severity of IA symptoms.

Conclusion: Fun seeking on the BAS and frustration intolerance should be considered as targets in prevention and intervention programs for IA among adolescents with ADHD.

Keywords: adolescent, attention-deficit/hyperactivity disorder, internet addiction, reinforcement sensitivity, behavior approach system, behavioral inhibition system, frustration intolerance

INTRODUCTION

The negative effects of internet addiction (IA) have become a concern in the past decades. IA is characterized by persistent internet use despite negative consequences, loss of control, preoccupation with internet use, increasing amounts of time spent online, and withdrawal symptoms (1). Internet gaming disorders are listed in the "Conditions for Further Study" section in the Fifth Edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (2). Adolescents were raised in an era in which the internet rapidly expanded its influence in daily life.

Attention-deficit/hyperactivity disorder (ADHD) is the most common comorbidity among adolescents referred for treatment of IA (3). Relevant studies have consistently reported associations between IA and ADHD. One study reported that 14% of adults with IA have also been diagnosed with ADHD (4). Individuals with IA have a 2.5 times higher risk of being diagnosed with ADHD according to a meta-analysis (5). Ko et al. (6) discovered that during a 2-year follow-up period, adolescents with significant ADHD symptoms were more likely to develop IA than were those without. Moreover, ADHD symptoms, including inattention and impulsivity/hyperactivity, were more severe in individuals with IA than in healthy controls (5). Evidence suggests that the relationship between ADHD and IA is likely to be bidirectional and mutually interactive. For example, although a 3-year follow-up study reported that children and adolescents with more severe attention problems spent more time playing video games during follow-up (7), a 2-year prospective study discovered that heavy digital media users without ADHD symptoms at baseline had a higher risk of developing ADHD symptoms during the follow-up period (8).

Ko et al. (9) proposed possible biopsychosocial mechanisms to explain the high correlation between ADHD and IA, including avoidance of boredom and delayed reward, striatal dopamine release, compensation for real-life frustrations, impaired inhibition, and deviation in reinforcement sensitivity. Reinforcement sensitivity and frustration may play important roles among these mechanisms. Firstly, patients with ADHD were reported to have deviations in responses to reinforcements, such as rapid habituation to repeated rewards and decreased responses to punishments, which may predispose these individuals to IA because internet activities often provide quick rewards and responses (10). Secondly, adolescents with ADHD often encounter various frustrations in their daily life because of their symptoms. Striatal dopamine release during video gaming (11) may enhance the performance of the game players, thereby helping adolescents with ADHD to compensate for real-life frustrations. In addition, impulsivity, inattention and hyperactivity usually produce frustrations in an interpersonal relationship; therefore, individuals with ADHD may rely more on the internet because it is easier to establish interpersonal relationships online than that in real world. In this view, IA may be a consequence of poor tolerance to frustrations. Recognizing these possible factors which contribute to the strong association between ADHD and IA is crucial to prevention and providing interventions for IA in adolescents with ADHD. However, previous reseaches supporting these proposed mechanisms are still limited. To the best of our knowledge, only one study examined the predictors of IA symptoms in adolescents clinically diagnosed with ADHD (12). Hence, in this study, we focused on the roles of reinforcement sensitivity and frustration intolerance to address these knowledge gaps.

Reinforcement Sensitivity Theory (RST) was developed by Gray and consists of the behavioral inhibition system (BIS) and behavioral approach system (BAS), which are used to identify an individual's sensitivity to punishment and reward, respectively (13). BAS and BIS can provide explanations for impulsivity and anxiety, respectively (14). Although Gray revised his theory in 2000, making some adjustments to account for the complexity of the constitution and interaction of RST systems (15), many prominent studies have utilized the older RST model (14). Most research on the role of RST in IA has also used the older RST model (12, 16–20). To maintain consistent methodology, we also used the original RST model in this study. Cross-sectional and prospective research on adolescents and adults has identified associations between reinforcement sensitivity and IA symptoms. Specifically, high BAS fun seeking and high BIS have been demonstrated to be positively correlated with the severity of IA in cross-sectional studies (17, 21). A 1-year follow-up study revealed that individuals with higher total BAS and BAS fun seeking were more likely to develop IA (18).

Internet activities are usually characterized by immediate responses and rapid rewards; therefore, deviations in sensitivity to reinforcement may contribute to vulnerability to IA in patients with ADHD (9). Abnormal reinforcement sensitivity is considered a fundamental characteristic of ADHD (10, 22, 23). Research has indicated that patients with ADHD have higher reward sensitivity to immediate reinforcements (24), more rapid habituation to repeated reinforcements (25), and lower response to punishment (25, 26). Impulsivity, a prominent symptom of ADHD, is commonly reported in individuals with IA (19, 27), and it has been linked to BAS functioning (28). Studies on subjects with ADHD have also reported that higher BAS fun seeking, BAS drive, and BIS are positively associated with IA symptoms (12, 19). However, few studies have been conducted on patients clinically diagnosed with ADHD, and more information is required to support the role of reinforcement sensitivity in patients with ADHD. Moreover,

evidence suggests that the effects of reinforcement sensitivity vary under different conditions. Research has found that increased age and low parental occupational SES were significantly associated with severe internet addiction symptoms in adolescents with ADHD (12). Family factors have been reported to moderate the association between reinforcement sensitivity and behavioral problems in children and adolescents (29). Adolescents receiving medication for ADHD exhibited problematic online gaming symptoms and concurrent decreases in BAS and BIS scores (20). Moreover, reinforcement sensitivity was reported to be a vulnerable factor of psychiatric disorders, such as depression, anxiety, and substance abuse (30). However, no study has explored the moderating effects of socio-demographic characteristics, medical treatment for adolescents with ADHD, and concurrent psychiatric disorders on the association between IA symptoms and reinforcement sensitivity in adolescents with ADHD.

Frustration intolerance refers to the difficulty accepting that reality does not correspond to personal desires (31). It is a type of irrational belief related to emotional and behavioral problems based on the theory of rational emotive behavior therapy (32). Adolescents with IA have been reported to have higher frustration intolerance that healthy controls (21), indicating that frustration intolerance is associated with difficulty with self-control (33). Aversion to delayed reward, which may be a source of frustration, is a core feature of ADHD (22). Researchers have observed high frustration intolerance in youths with ADHD (34–36). Hypothesizing that frustration intolerance is a predictor of IA symptoms in individuals with ADHD is therefore reasonable. Nevertheless, no study has examined the relationship between frustration intolerance and IA symptoms in adolescents with ADHD. Considering the high risk of IA in adolescents with ADHD, understanding the role of frustration intolerance in predicting IA may facilitate the design of effective cognitive behavioral therapies targeting ADHD adolescents with IA. Furthermore, sex is currently the only factor that has been proven to moderate the correlation between frustration intolerance and IA in adolescents (21). In the present study, we investigated whether socio-demographic characteristics, medical treatment for adolescents with ADHD, and concurrent psychiatric disorders moderate this relationship between frustration intolerance and IA symptoms in adolescents with ADHD.

The aims of the present study were to examine the correlations between IA severity and reinforcement sensitivity and frustration intolerance as well as identify moderators of these correlations in adolescents in Taiwan who have been diagnosed with ADHD. We hypothesized that both reinforcement sensitivity and frustration intolerance exhibit significant correlations with IA severity, and that these correlations may be moderated by sociodemographic characteristics, ADHD symptoms and treatment, psychiatric comorbidities, and parental factors.

MATERIALS AND METHODS

Participants

Participants for this study were recruited from the child and adolescent psychiatric outpatient clinics of two medical centers in Kaohsiung, Taiwan. Adolescents aged between 11 and 18 years, who visited the outpatient clinics and have been diagnosed with ADHD according to the diagnostic criteria specified in the DSM-5 (2), were consecutively invited to participate in this study during the period from August 2013 to July 2015. ADHD was diagnosed on the basis of multiple data sources, including (i) an interview with a child psychiatrist; (ii) clinical observation of the participant's behavior; and (iii) medical history provided by parents and parent-reported severity of ADHD symptoms assessed from the short version of Swanson, Nolan, and Pelham, Version IV Scale (SNAP-IV)-Chinese version (37, 38). Adolescents with intellectual disabilities, schizophrenia, bipolar disorder, autistic disorder, communication difficulties, or cognitive deficits that adversely affect their ability to understand the study purpose or complete the questionnaires were excluded. A total of 333 adolescents who had been diagnosed with ADHD and their parents were selected for this study, 300 of which (90.0%) agreed to participate in this study and were interviewed by research assistants through a questionnaire. Of the 33 adolescents who refused to join this study, 19 refused because of their parents' opinions and 14 refused because of their own opinions. The Institutional Review Boards of Kaohsiung Medical University and Chang Gung Memorial Hospital, Kaohsiung Medical Center, approved the study. Written informed consent was obtained from all participants before assessment.

Measures

Internet addiction. We used the Chen Internet Addiction Scale (CIAS) to assess participant self-reported severity of IA symptoms in the recent 1 month. The CIAS contains 26 items evaluated on a 4-point Likert scale, with scores ranging from 26 to 104 (39); a higher total score indicates more severe IA symptoms. The CIAS has been commonly used to assess internet addiction among children and adolescents in Taiwan (1, 40). The internal reliability (Cronbach's α) of the CIAS was .94 in the present study.

Reinforcement sensitivity. The Chinese version of BIS and BAS scales contain 20 items evaluated on a 4-point Likert scale; these scales assess participants' self-reported sensitivity for the two motivational systems according to RST (13, 28, 41). The BIS measures the degree to which respondents expect to feel anxiety when confronted with cues for punishment. The BAS includes subscales of reward responsiveness, drive, and fun seeking, which measure the degree to which rewards lead to positive emotions, an individual's tendency to actively pursue goals, and the tendency to seek out and impulsively engage in potentially rewarding activities, respectively. A higher total score on the subscale indicates a higher level of reinforcement sensitivity. The Chinese versions of BIS and BAS scales were translated from the original version using the standard forward-, backward-, and pretest-step method and have been reported to have good criterion and construct validity in the previous study on Taiwanese population (41). The BIS and BAS scales have been used to assess reinforcement sensitivity among adolescents in Taiwan (12). The Cronbach's α of the four subscales ranged from .68 to .83 in the present study.

Frustration intolerance. In the present study, the Chinese version of Frustration Discomfort Scale (FDS) was used to

evaluate the self-reported frustration intolerance belief of participants (21, 42). The FDS contains 28 items evaluated on a 5-point Likert scale, with scores ranging from 28 to 140; a higher total score indicates higher frustration intolerance beliefs. The Chinese versions of FDS scales was translated from the original version using the standard forward-, backward-, and pretest-step method and have been used to evaluate frustration intolerance beliefs in Taiwanese adolescents (21). The Cronbach's alpha of the FDS was.90 in the present study.

*ADHD symptoms and treatment. I*n the present study, the short version of SNAP-IV-Chinese version was used to assess the parent-reported severity of ADHD symptoms for adolescents in the recent 1 month. This short version of SNAP-IV-Chinese version is a 26-item rating instrument that includes the core Fourth Edition of DSM (DSM-IV)-derived ADHD subscales of inattention, hyperactivity/impulsivity, and symptoms of oppositional defiant disorder with good criterion and construct validity (37, 38). Each item was rated on a 4-point Likert scale from 0 (not at all) to 3 (very much). In this study, the total scores for the inattention and hyperactivity/impulsivity subscales were used for analysis. The Cronbach's α of these two subscales was .86 and .88, respectively. Whether the participants received medication for ADHD was determined based on parent reports and participant medical records.

Psychiatric comorbidities. The depressive disorders, anxiety disorders, tic disorders, and autism spectrum disorders (ASDs) of participants were assessed based on the clinical interviews and chart reviews by three child psychiatrists. Those who had been diagnosed with any ASD and low intelligence (defined as a score less than 70 on the Chinese version of the Fourth Edition of the Wechsler Intelligence Scale for Children [43]) or those who had communication difficulties were not invited to participate in this study. For the purpose of analysis, psychiatric diagnoses were categorized as depressive or anxiety disorders, tic disorders, and ASDs.

Parental factors. The present study evaluated the marital status of the parents of participants (married and living together vs. divorced or separated) and assessed their occupational socioeconomic status (SES) using Close-Ended Questionnaire of the Occupational Survey (CEQ-OS) (44). Parents choose their occupations from 14 categories in the CEQ-OS, which were further classified into five levels according to their occupational socioeconomic status. A higher level indicates higher occupational socioeconomic status. The CEQ-OS has been proven to possess excellent reliability and validity and has been commonly used in studies on children and adolescents in Taiwan (44). In the present study, levels I, II, and III of the CEQ-OS were classified as low occupational SES, whereas levels IV and V were classified as high occupational SES. This questionnaire was completed by parents.

Procedure

The research assistants conducted interviews using the CIAS, BIS/BAS, and FDS to collect data from adolescents. Their parents completed SNAP-IV under the direction of the research assistants. Data analysis was performed using SPSS 20.0 statistical software (SPSS Inc., Chicago, IL, USA).

Statistical Analysis

Because that there were several factors examined in this study, we used two-step statistical analyses to examine the correlation of IA severity with reinforcement sensitivity and frustration intolerance and reduced the possibility of multiple comparison. In the first step, we used Pearson's correlation and *t* test to select possible factors predicting IA severity for further analysis, including sociodemographic characteristics, ADHD symptoms and treatment, psychiatric comorbidities, parental factors, reinforcement sensitivity, and frustration intolerance. The significant factors in the first step were used in the second step, which consisted of a multiple regression analysis that was used to evaluate the correlations of reinforcement sensitivity and frustration intolerance with IA severity by controlling for the effects of other factors. A two-tailed p value of less than 0.05 was considered statistically significant.

We also used standard criteria (45) to examine whether the associations of reinforcement sensitivity and frustration intolerance with IA severity differed in terms of sociodemographic characteristics, ADHD symptoms and treatment, psychiatric comorbidities, or parental factors. According to the criteria, moderation occurred when the interaction term for the predictor (reinforcement sensitivity and frustration intolerance) and the hypothesized moderator were significantly associated with the dependent variable (IA severity) in multiple regression analysis after controlling for the main effects of both the predictors and hypothesized moderator variables. In this study, if reinforcement sensitivity, frustration intolerance, and hypothesized moderators were significantly associated with IA symptoms, then the interactions (reinforcement sensitivity or frustration intolerance × hypothesized moderators) were further selected for multiple regression analysis to examine the moderating effects.

RESULTS

Sociodemographic Characteristics and Correlates of IA Symptoms

Table 1 presents the sociodemographic and ADHD characteristics, comorbidities, IA severity, and BAS/BIS and FDS scores of participants. **Table 2** lists the correlations of IA severity with age, ADHD symptoms, BIS/BAS and FDS scores, as examined using Pearson's correlation. According to Cohen (46), older age, more severe inattention and oppositional symptoms, higher score for fun seeking on the BAS, and higher frustration intolerance belief on the FDS were weakly but significantly correlated with more severe IA symptoms. **Figure 1** shows the scatter plots of the correlations between IA symptoms and fun seeking on the BAS and between IA symptoms and FDS score.

Table 3 presents the differences in IA severity between participants with various sociodemographic characteristics, medication status, and psychiatric comorbidities. The results indicated that adolescents with low paternal and maternal occupational SES exhibited more severe IA symptoms than did those with high paternal and maternal occupational SES. Adolescents receiving medication for ADHD had less

TABLE 1 | Sociodemographic and ADHD characteristics, comorbidities, internet addiction severity, and levels of BAS/BIS and FDS (N = 300).

	n (%)	Mean (SD)	Range
Age (years)		12.8 (1.8)	10–18
Sex			
Girls	41 (13.7)		
Boys	259 (86.3)		
Education (years)		7.0 (1.8)	4–12
Parental marriage status			
Married and live together	231 (77.0)		
Divorced or separated	69 (23.0)		
Paternal occupational socioeconomic status			
High	125 (41.7)		
Low	175 (58.3)		
Maternal occupational socioeconomic status			
High	94 (31.3)		
Low	206 (68.7)		
ADHD symptoms on the SNAP-IV			
Inattention		12.7 (5.8)	0–27
Hyperactivity/impulsivity		8.8 (6.0)	0–27
Oppositional		9.8 (5.7)	0–24
Receiving medication for ADHD	254 (84.7)		
Comorbidity			
Depressive or anxiety disorders	40 (13.3)		
Tic disorders	34 (11.3)		
Autism spectrum disorders	34 (11.3)		
Severity of Internet addiction on the CIAS		47.7 (14.1)	25–95
BIS/BAS			
BIS		19.3 (3.7)	8–28
Reward responsiveness on the BAS		16.2 (3.3)	5–20
Drive on the BAS		12.2 (2.9)	4–16
Fun seeking on the BAS		10.6 (2.7)	4–16
FDS		71.4 (25.4)	28–135

ADHD, attention-deficit/hyperactivity disorder; BAS, behavior approach system; BIS, behavior inhibition system; CIAS, Chen Internet Addiction Scale; FDS, Frustration Discomfort Scale; SNAP-IV, Swanson, Nolan, and Pelham, Version IV Scale.

TABLE 2 | Correlation of age, ADHD symptoms, BIS/BAS, and FDS with internet addiction severity: Pearson's correlation.

	Internet addiction severity Pearson's *r*	*p*
Age (years)	.142	.014
ADHD symptoms on the SNAP-IV		
Inattention	.145	.012
Hyperactivity/impulsivity	.085	.142
Oppositional	.170	.003
BIS/BAS		
BIS	.106	.066
Reward responsiveness on the BAS	.004	.943
Drive on the BAS	.048	.403
Fun seeking on the BAS	.261	<.001
FDS	.290	<.001

ADHD, Attention-deficit/hyperactivity disorder; BAS, Behavior Approach System; BIS, Behavior Inhibition System; FDS, Frustration Discomfort Scale; SNAP-IV, Swanson, Nolan, and Pelham, Version IV Scale.

severe IA symptoms than did those not receiving medication for ADHD.

Testing of Moderators

As described in the Statistical analysis section, significant factors in the first step were selected for further multiple regression analysis in the second step to detect the independent factors related to IA symptoms (Model I in **Table 4**). The results indicated that low maternal occupational SES, higher fun seeking on the BAS, and higher frustration intolerance belief on the FDS were associated with more severe IA symptoms, whereas receiving medication for ADHD was associated with less severe IA.

Because maternal occupational SES and receiving medication for ADHD were significantly associated with IA symptoms, the interactions among the predictors (reinforcement sensitivity and frustration intolerance) and possible moderators (maternal occupational SES and receiving medication for ADHD) were included in the multiple regression analysis based on the standard criteria proposed by Baron and Kenny (45) described in the Statistical analysis section (Model II in **Table 4**). The results indicated that the interaction between fun seeking on the BAS and receiving medication for ADHD was significantly associated with IA severity, suggesting that receiving medication for ADHD moderated the association between fun seeking on the BAS and IA severity. The results of further analysis revealed a significant association between fun seeking on the BAS and IA severity only in participants receiving medication for ADHD ($\beta = .154$, $t = 2.301$, $p = .022$) and not in those not receiving medication for ADHD ($\beta = .291$, $t = 2.004$, $p = .052$).

DISCUSSION

The results of this study revealed that although both BAS fun seeking and frustration intolerance were positively associated with IA symptoms, medication treatment for ADHD moderated the relationship between fun seeking on the BAS and IA severity. To the best of our knowledge, this is the first study to identify the moderators of correlations of IA symptoms with reinforcement sensitivity and frustration intolerance in adolescents with ADHD.

BAS fun seeking represents the tendency to seek stimuli and response to proximal rewards (47). Internet use provides individuals with activities having various modes of stimulation and rapid rewards; therefore, individuals with high BAS scores may be more likely to develop IA. A bidirectional relationship remains possible, as indicated in a longitudinal study (18). The present study discovered that the association between BAS fun seeking and IA severity is significant only in adolescents receiving medication for ADHD. This finding is different from the results of other studies, which have concluded significant associations of BAS fun seeking and IA severity in adolescents or young adults (16–18) and adolescents with ADHD (12). The results of our study may indicate that the effects of RST subsystems on IA severity are complex and interactive. Gray's revised version of the RST includes the subsystems of the BAS, Fight/Flight/Freeze System (FFFS), and BIS (14, 15). BAS controls approach

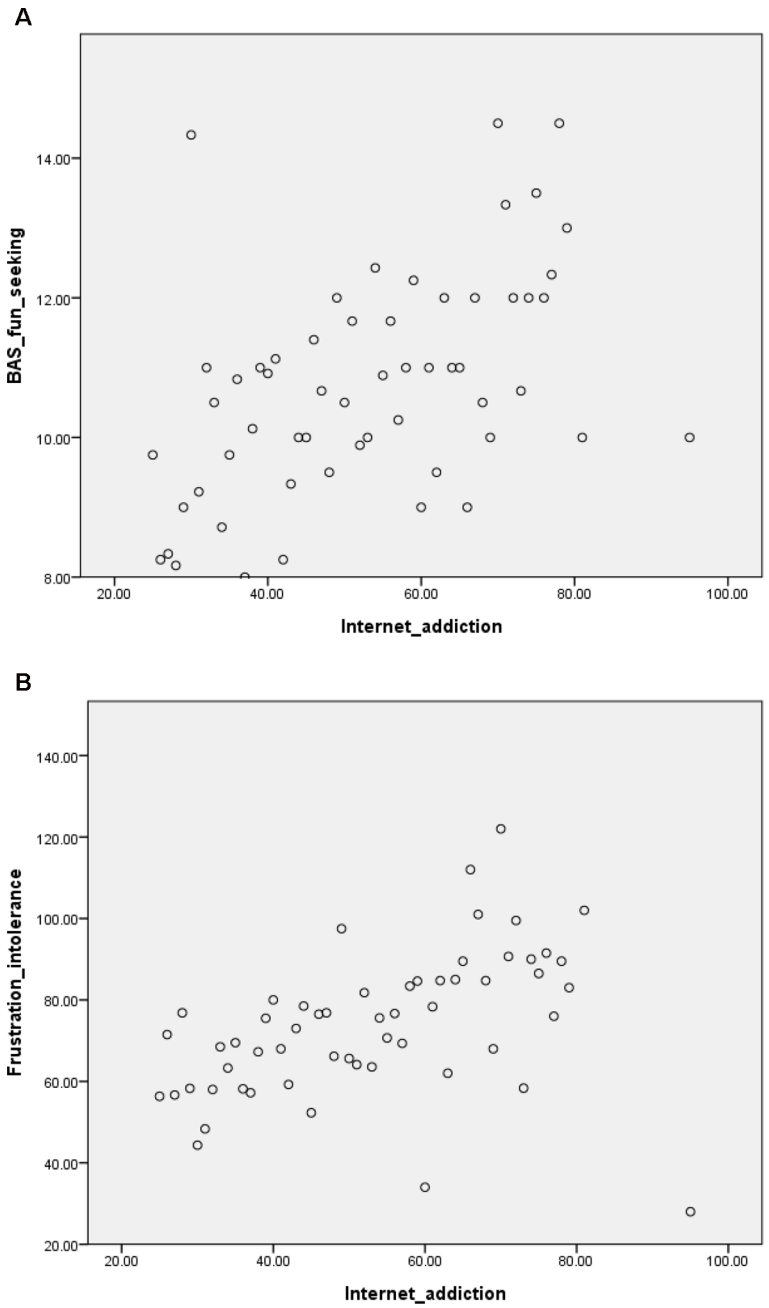

FIGURE 1 | Scatter plots of correlations between internet addiction symptoms and fun seeking on the Behavioral Approach System (BAS) scale **(Figure 1A)** and between internet addiction symptoms and frustration intolerance **(Figure 1B)**.

behavior, and FFFS controls avoidance behavior to aversive stimuli. Both BAS and FFFS are activated during an event that includes both rewarding and aversive stimuli, resulting in a motivational conflict. BIS is then activated by the motivational conflict, and the ongoing behavior is inhibited while directing the individual's attention to the source of conflict (14). Although internet use produces immediate rewards and relief from boredom, it also frequently results in negative consequences that may lead to motivational conflict. Therefore, IA symptoms may be influenced by the result of these mixed interactions of RST subsystems. Moreover, BAS functioning is considered to be based on dopaminergic systems in the CNS (48), which has also been the primary focus of hypotheses on ADHD etiology (49, 50). Deviation in the dopaminergic process may be a mechanism underlying the difference in association between BAS fun seeking and IA in adolescents with ADHD with and without medication. Dopaminergic and noradrenergic neurotransmission are targets of the most commonly used ADHD medications

TABLE 3 | Comparison of internet addiction severity of participants according to sociodemographic characteristics, ADHD characteristics, and comorbidities.

	Internet addiction severity Mean (SD)	*t*	*P*
Sex			
Girls (*n* = 41)	49.2 (16.2)	.715	.475
Boys (*n* = 259)	47.5 (13.8)		
Parental marriage status:			
Intact (*n* = 231)	47.8 (14.5)	.151	.880
Broken (*n* = 69)	47.5 (13.1)		
Paternal occupational SES			
High (*n* = 125)	45.7 (12.7)	–2.108	.036
Low (*n* = 175)	49.1 (14.9)		
Maternal occupational SES			
High (*n* = 94)	44.4 (12.0)	–2.734	.007
Low (*n* = 206)	49.2 (14.8)		
Receiving medication for ADHD			
No (*n* = 46)	53.1 (13.4)	2.830	.005
Yes (*n* = 254)	46.7 (14.1)		
Comorbidity			
Depressive or anxiety disorders			
No (*n* = 260)	47.8 (13.9)	.254	.800
Yes (*n* = 40)	47.2 (15.6)		
Tic disorders			
No (*n* = 266)	47.7 (14.3)	.115	.909
Yes (*n* = 34)	47.4 (12.9)		
Autism spectrum disorders			
No (*n* = 266)	47.7 (14.3)	–.027	.979
Yes (*n* = 34)	47.8 (13.0)		

ADHD, Attention-deficit/hyperactivity disorder; SES, socioeconomic status; SNAP-IV, Swanson, Nolan, and Pelham, Version IV Scale.

TABLE 4 | Associated factors and moderators of internet addiction severity.

	Model I			Model II		
	β	*t*	*p*	β	*t*	*p*
Age	.067	1.199	.232	.071	1.262	.208
Low paternal occupational SES	.110	1.940	.053	.119	2.121	.035
Low maternal occupational SES	.125	2.226	.027	–.358	–1.470	.143
Inattention symptoms on the SANP-IV	.038	.580	.563	.039	.603	.547
Oppositional symptoms on the SANP-IV	.077	1.183	.238	.061	.949	.343
Receiving medication for ADHD	–.113	–2.061	.040	–.077	–.312	.755
Fun seeking on the BAS	.175	2.948	.003	.300	1.582	.115
FDS	.180	3.048	.003	–.206	–1.336	.183
Low maternal occupational SES x Fun seeking on the BAS				.051	.200	.842
Receiving medication for ADHD x Fun seeking on the BAS				.511	2.463	.014
Low maternal occupational SES x FDS				–.298	–1.009	.314
Receiving medication for ADHD x FDS				.244	1.310	.191
F		7.827			6.151	
p		<.001			<.001	
Adjusted R^2		.154			.171	

ADHD, Attention-deficit/hyperactivity disorder; BAS, Behavior Approach System; FDS, Frustration Discomfort Scale; SES, socioeconomic status; SNAP-IV, Swanson, Nolan, and Pelham, Version IV Scale.

(i.e. methylphenidate and atomoxetine) in Taiwan. One study discovered that 3 months of methylphenidate and atomoxetine treatment in adolescents with ADHD was associated with a decreased score on the BAS scale (20). ADHD medications may modulate the dopaminergic and noradrenergic systems in the brain and thus affect the relationship between BAS fun seeking and IA severity. The association between BAS fun seeking and IA in general adolescents from the general population and those treated with medication for ADHD, but not in ADHD adolescents without medication, may reflect the normalizing effect of ADHD medications on reinforcement sensitivity. This renders the association between BAS fun seeking and IA in adolescents with ADHD who take medication as more similar to that in adolescents from the general population. However, other possible explanations include differences between medication-treated and medication-free groups in terms of baseline demographic or symptom characteristics. The causal relationship of the effects of ADHD medication on the association between BAS fun seeking and IA severity requires further clarification by prospective studies.

In the present study, frustration tolerance was demonstrated to be a significant predictor of IA severity after controlling for other correlates in the regression model. The theory underlying rational emotive behavior therapy proposes that irrational beliefs triggered by events lead to subsequent negative consequences (51). Conversely, Ko et al. suggested that early internet exposure may lead adolescents to become accustomed to environments with immediate gratification, and they may have a limited ability to tolerate frustrations, prompting the development of the irrational belief of frustration intolerance (21). Individuals with ADHD may experience a great deal of frustration in daily life because of deficits in attention and executive function. After thoughts characteristic of frustration intolerance have been provoked, internet activities may serve as coping strategies for tension relief. The results of this study suggest that the frustration intolerance belief requires adequate evaluation and intervention when managing or preventing IA in adolescents with ADHD.

The current study discovered that lower maternal SES was associated with higher IA severity in adolescents with ADHD. Family SES has been proven to play a pivotal role in adolescent health conditions, and parental SES has been demonstrated to influence depression, obesity, and self-rated health among adolescents in the US (52). Children and adolescents from families with higher SES tend to exhibit healthier behaviors (53). Moreover, parenting is crucial to managing ADHD symptoms, and parents with higher SES may be more likely to have access to ADHD-related psychoeducational information. Additionally, parents with higher SES may have more knowledge on appropriate internet use, and therefore, may be more likely to monitor their children. In traditional Taiwanese families, mothers more commonly manage home routines and primarily serve as child caretakers. Therefore, the responsibility of monitoring and controlling internet use may be more commonly taken up by mothers in Taiwan. However, because the concept of gender equality has evolved alongside the increasing prevalence of double-income households in Taiwan, parental influence on IA still warrants careful consideration. One study reported that

parental SES predicts IA severity in adolescents with ADHD, but maternal SES does not (12). Overall, evidence supports the phenomenon that parental SES is a critical correlate of IA in adolescents with ADHD.

Established treatment modality for IA is lacking. Medications that have been studied included escitalopram, bupropion, methylphenidate, and atomoxetine (54). Methylphenidate and atomoxetine were reported to be associated with decreased severity of online gaming and BAS/BIS scores in adolescents with ADHD (20). The results of this study support the need for further investigation on the role of ADHD medications in treatment for adolescents with ADHD. Cognitive behavioral therapy is the major non-pharmacological intervention for IA among previous studies (54). Our study indicates that future research may examine the efficacy of incorporating management of frustration intolerance belief and the tendency of fun seeking in cognitive behavioral interventions in treating patients with ADHD and IA. Moreover, the effect of ADHD medications on both fun seeking and IA severity should be monitored during such interventions.

Several limitations of this study require careful consideration. Measurements were all self-reported; therefore, common method bias cannot be completely ruled out. Adding clinical interview in the evaluation process will improve the diagnostic validity in future studies. Psychometrics of the Chinese versions of BIS-BAS scale and FDS used in the adolescent population warrant further examination. The cross-sectional design limited the capability of forming conclusions regarding causality. Participants were recruited from outpatient departments, and individuals with ADHD who were not receiving clinical care were not approached, meaning that the results may not be generalizable to all adolescents with ADHD. Medications for treating ADHD were not specified in our study; therefore, variety in the effects of medications may have introduced bias into the results. However, methylphenidate and atomoxetine are the only two compounds that have been approved for treating ADHD in Taiwan and comprise almost all medications used for treating ADHD (55, 56). Last but not least, the types of internet activities were not reported in this study. There have been debates on whether different problematic online behaviors, such as interent gaming, online social networking and online shopping should be viewed as one single entity or different distinct behaviors driven by various gratifications (57). Whether differences exist among correlations of various internet activities with reinforcement sensitivity and frustration intolerance requires further study. It is also recommended in further research to apply a prospective design, as well as examine the effects of various ADHD medications.

CONCLUSION

The results of the current study indicated that BAS fun seeking and frustration intolerance belief were significantly associated with IA severity in adolescents with ADHD. Differences were observed in the association between BAS fun seeking and IA between participants receiving ADHD medication and those not receiving ADHD medication. Reward sensitivity and frustration intolerance require attention during prevention and management programs for IA in adolescents with ADHD. The effect of ADHD medication should also be considered when evaluating the relationship between reinforcement sensitivity and IA.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of Kaohsiung Medical University with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Kaohsiung Medical University.

AUTHOR CONTRIBUTIONS

W-HL: conception and design of the study, drafting the manuscript. W-JC: conception and design of the study, drafting the manuscript. RH: drafting the manuscript. H-FH: acquisition and analysis of data. C-FY: conception and design of the study, acquisition and analysis of data, drafting the manuscript or figures.

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The Status of Pro-social Tendency of Left-Behind Adolescents in China: How Family Function and Self-Esteem Affect Pro-social Tendencies

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In China, adolescents are frequently left behind. To date, few studies have focused on the pro-social tendencies of left-behind adolescents and the relationship of family function, self-esteem, and pro-social tendency is yet to be examined. This study, therefore, aims to understand the status of pro-social tendency of left-behind adolescents and to explore the mediating and moderating roles of self-esteem in the relationship between family function and pro-social tendency. A large, school-based survey was conducted in three Chinese provinces. An analysis of covariance was first used to identify the differences in pro-social tendency between adolescents who were and were not left behind. We then analyzed the variance within left-behind adolescents using demographics, left-behind type, years of being left-behind, and caregiver related characteristics. A structural equation model was used to analyze the relationship of family function, self-esteem, and pro-social tendency, with bootstrapping used to explore the mediating role of self-esteem. Additionally, an ordinary least squares regression was used to examine the moderating effect of self-esteem. The results showed that the pro-social tendency of left-behind adolescents was lower than in non-left-behind adolescents (F = 15.11, p = 0.0001). Family function was positive related to pro-social tendency (r = 0.259), which had not only a direct effect on pro-social tendency (β = 0.254), but also an indirect effect through self-esteem (β = 0.071, bias-corrected 95% CI: 0.051:0.090; percentile 95% CI: 0.053:0.092). Additionally, 21.85% of the total effect of family function on pro-social tendency was mediated by self-esteem. Furthermore, self-esteem negatively moderated the relationship between family function and pro-social tendency (β = −0.208, $p < 0.0001$), such that the effect of family function on pro-social tendency became weaker as self-esteem increased. The current study verified the negative effect of being left behind on the social development of adolescents

and contributed to the understanding of the importance of self-esteem in the relationship between family function and pro-social tendency. Interventions aimed at enhancing self-esteem should be developed and implemented in left-behind adolescents to promote wellness in the entirety of psychological and social outcomes.

Keywords: left-behind adolescents, pro-social tendencies, self-esteem, family function, mediating effect, moderating effect

INTRODUCTION

In China, the rapid growth of the economy is contributing to an increasing amount of internal migrants moving from rural to urban areas to seek employment opportunities (Hu et al., 2008; Guang et al., 2017). Although some rural migrants have brought their families with to the cities (Nielsen et al., 2005), most parents opt not to take their children with them, due to financial constraints and the transient nature of the work in urban areas (Keung Wong et al., 2007; Gao et al., 2010). Those children are known as "left-behind children," who stay in their rural home towns. It is estimated that over 61 million children in rural regions are currently growing up in the absence of their mother, their father, or both (Fellmeth et al., 2018). There is an urgent need for improved understanding of the impacts of family separation on the health and well-being of left-behind children. Adolescence is a critical stage of socialization in an individual's life (Brand and Klimes-Dougan, 2010). Up to 20% of adolescents worldwide experience psychological or social disorders (World Health Organization., 2005). LBAs are separated from their parents over a long period of time and are cared for by their grandparents or other relatives, with some even taking care of themselves. Physical time with their parents is very limited and contact is generally maintained by telephone. While they may benefit from increased family income (Lu, 2015; Tao et al., 2016), the social and psychological cost as a result of sacrifices related to geographical and emotional closeness can't be ignored (Chang et al., 2017; Fellmeth et al., 2018). Previous research has shown that LBAs are prone to feelings of being abandoned/unloved and felt confusion and worry, all of which may lead to negative consequences in socialization (Chang et al., 2017; Han et al., 2018).

Pro-social tendencies, defined as behaviors that are intended to benefit others, are regarded as social adaptations that play a crucial role in one's social life (Jun, 2018). As a whole, this construct is one of the most important in regards to social functions and crucial aspect of adolescents' positive development (Carlo and Randall, 2002; Liu et al., 2019). It is valued in most cultures, likely due to the relationship with harmonious human relationships (Calderón-Tena et al., 2011; Knight and Carlo, 2012). To date, few studies have focused on the influence of the left-behind experience on pro-social tendency among LBAs, with conflicting results from those that have. For example, some results suggested that LBAs were less likely to be pro-social (Chen et al., 2016) and that the negative effect on children tends to be higher for long-term parental migration than for short-term parental migration (Viet Nguyen, 2016). Contrarily, other research yielded no significant differences between left-behind children and those not left-behind (Xin and Xu, 2010; Ye, 2014). Additionally, the effect of parental migration varies across different areas and between different types of migration (Viet Nguyen, 2016). Therefore, it is imperative to elucidate the question of whether parent-child separation increases the risk of adverse effects on pro-social tendency and, if so, exploring the influential factors of pro-social tendency to address the psychological and social outcomes of LBAs.

Family function, defined as the degree of family cohesion and positive communication, measures the extent to which a family works as a unit and reflects a family member's perception of and satisfaction with the functional state of the family (Shi et al., 2017). In a household with migrant parents, it is particularly difficult for a LBA to define family roles and boundaries (Zhou et al., 2018). As parents migrate to work with periods of separation from children, family function may be disturbed. Previous research has shown that LBAs tend to rate family function significantly lower than non-LBAs (Zhao et al., 2014), particularly those who are separated from their mothers alone or from both parents (Zhou et al., 2018). Families are the cornerstone of society and one of the main social environments for children. Results from previous research suggested that family function is positively associated with the pro-social tendency of the child (Mejia et al., 2006; Renzaho and Karantzas, 2010), pointing to the importance of the family environment in promoting pro-social behavior during the formative years of life. Those with good family function were more likely to have a high level of pro-social tendencies, suggesting that family function is a critical influencing factor in a child's development and has an extensive impact on psychological and social outcomes. To date, however, little is known about the impact of family function on LBAs. Weakness of family function may seriously affect the socialization process of LBAs. Consequently, it has become a primary concern for researchers to find ways to decrease the risk of adverse effects of low family function on pro-social tendencies among LBAs.

Self-esteem is the evaluation the individual makes and maintains with regard to him or herself (Rosenberg, 1965). Self-esteem is an inner attitude at the center of the construction of personality and psychic balance that contributes to the development of adaptive processes over the course of one's life (Doré, 2017). Individuals with low self-esteem may have fewer cognitive resources to cope with daily stressors, making them vulnerable to emotional exhaustion and social maladjustment.

Abbreviations: ADF, asymptotically distribution-free; AGFI, adjusted goodness of fit index; ANCOVA, analysis of covariance; CFA, confirmatory factor analysis; CFI, comparative fit index; GFI, goodness of fit index; LBAs, left-behind adolescents; OLS, ordinary least squares; SEM, structural equation model; SMC, squared multiple correlation; RMSEA, root mean square error of approximation.

Previous studies have demonstrated that low self-esteem was more prevalent among LBAs than non-LABs (Tang et al., 2018) and that self-esteem is positively associated with pro-social tendencies (Yun and Lee, 2007), which indicates that those with high self-esteem are more likely to have pro-social tendencies (Fu et al., 2017; McChesney and Toseeb, 2018). Furthermore, self-esteem is considered to be a mediator between family function and internet addiction (Shi et al., 2017), as well as a mediator between social support/happiness and pro-social tendencies (Guo et al., 2014; McChesney and Toseeb, 2018) in other populations. Self-esteem also act as a moderator between family function and depression (Yoo and Chung, 2018) and between dispositional envy and pro-social tendencies (Yu et al., 2018). Both the relationship between family function and self-esteem and the relationship between self-esteem and pro-social tendency have been examined in other populations. To our knowledge, however, the relationship of family function, self-esteem, and pro-social tendency has yet to been studied in LBAs. Additionally, the mediating and moderating effects of self-esteem between family function and pro-social tendency have not yet been elucidated. While self-esteem is generally considered to be a relatively stable and enduring feature, it may change under certain circumstances (Zangirolami et al., 2018). In this sense, it is not a static phenomenon, rather it is a dynamic process that can be modified at any time. Previous research has demonstrated that interventions can improve self-esteem (Liu et al., 2015; Nosek et al., 2016; Zangirolami et al., 2018). Given the parent-child separation that inevitably arises under China's existing social system, a quick improvement in the family function of LBAs may not be possible. Therefore, evidence demonstrating the mediating and moderating roles of self-esteem between family function and pro-social tendency indicates that pro-social tendency will likely be improved by intervening to increase self-esteem among LBAs.

Given the previous evidence and above mentioned concerns, the aim of this study is to understand the status of pro-social tendencies of LBAs and to analyze the relationship of family function, self-esteem, and pro-social tendency. Based on previous research, the following hypotheses have been put forward:

Hypothesis 1: The pro-social tendency of LBAs is lower than that of non-LBAs.
Hypothesis 2: Family function is positively related to the pro-social tendencies of LBAs.
Hypothesis 3: Self-esteem mediates the effect of family function on the pro-social tendencies among LBAs.
Hypothesis 4: Self-esteem moderates the direct relationship between family function and pro-social tendencies among LBAs.

MATERIALS AND METHODS

Study Design and Sample

A cross-sectional study was conducted in April and May 2016, utilizing a population of adolescents in the Sichuan, Henan, and Shandong provinces of China. These highly populated provinces have been largely characterized by the exportation of labor forces to other major metropolitan regions in China. LBAs in these regions are quite prevalent and can be generalized to all of China.

A two-step random, stratified, cluster-based sampling technique was utilized for the current study. First, one city was randomly selected from each province (Nanchong in Sichuan, Zhoukou in Henan, Heze in Shandong). Next, one high school and two middle schools in rural areas were randomly selected within each sampled city. If the sampled school was small (number of students < 200), one additional school was randomly selected. In total, ten schools (three high schools and seven middle schools) were enrolled. All students in the selected schools were invited to enroll in this study. All study related materials were administered to the classes as a whole in their respective classrooms in a single, 30-min session without the presence of teachers.

A total of 9,675 students were recruited for this study, with 355 students either refusing to answer the survey or returning incomplete questionnaires, yielding a total N of 9,320 (96.33%) of whom we sought to categorize as LBAs or non-LBAs. Students were categorized as an LBA or non-LBAs by their response to the question, "Do one or both of your parents migrate to another place because of work for at least 6 months?" Students were relatively evenly split between the two groups, with 4,716 of the 9,320 students (50.60%) categorized as LBAs and 4,242 students categorized as non-LBAs.

Measures

The pro-social tendency scale was taken from the social adjustment scale for adolescents (Zhou and Zhang, 2008). The scale consists of seven items measured on a 5-point Likert-type scale, rated according to the degree of agreement with which the respondent has experienced (1 = strongly disagree, 5 = strongly agree). Prior to performing any analyses, a CFA of the scale was conducted. The fit indices of the scale were acceptable: $\chi^2 = 120.870$, $p < 0.0001$, the GFI = 0.993, the AGFI = 0.975, the CFI = 0.967, and the RMSEA = 0.034. The composite reliability (0.8278) and the average variance extracted (0.4087) were also acceptable, indicating an acceptable internal quality of the model.

Family function was measured by the family APGAR, which is primarily used to assess one's perception of family function by examining how he or she regards the relationships between family members (Smilkstein et al., 1982). It is comprised of five Likert-type items, each with three possible responses according to the frequency of feeling satisfied with each item, ranging from zero (hardly ever) to two (almost always). The final score is the sum of the scores from all five items, with higher final scores denoting better family function. The Chinese version of the scale has been widely applied in China, with excellent validity and reliability (Hai et al., 2017; Li et al., 2018). Results of a CFA demonstrated that the model of one factor was a good fit ($\chi^2 = 133.027$, $p < 0.0001$, GFI = 0.993, AGFI = 0.979, CFI = 0.931, RMSEA = 0.074), indicating the suitability of the scale in the current sample. The composite reliability (0.7484) and the average variance extracted (0.3744) suggested an acceptable internal quality of the model.

The self-esteem scale was selected from The Rosenberg Self-esteem Scale (Rosenberg, 1965). It is comprised of five items

(e.g., "I think I have many advantages"), each with four possible responses according to the degree of agreement (1 = strongly disagree, 4 = strongly agree) and has been validated in adolescents to evaluate their self-worth and self-acceptance (Delgado et al., 2013; Romera et al., 2016). Overall self-esteem is demonstrated by a total score of all five items, with higher scores reflecting a higher level of self-esteem. The CFA fit indices of the scale in this study showed an acceptable fit (χ^2 = 140.225, $p < 0.0001$, GFI = 0.975, AGFI = 0.926, CFI = 0.901, RMSEA = 0.076). The composite reliability (0.8058) and the average variance extracted (0.4559) were also acceptable, indicating good internal quality of the model.

Statistical Analysis

Data analyses were conducted using SPSS 21.0 (SPSS China Corp., Shanghai, China) and Amos 20.0 software packages (SPSS Inc., Chicago, IL, United States). All statistical tests were two-sided and significance levels were set at $\alpha = 0.05$. A CFA was performed to determine the internal structural validity of the instruments before exploratory analysis. The composite reliability and average variance extracted were calculated to evaluate the reliability and validity of the instruments. A composite reliability value at or above 0.60 suggests good reliability (Bacon et al., 1995). The average variance extracted value at or above 0.50 indicates adequate convergence, while between 0.36 and 0.50 may be acceptable (Fornell and Larcker, 1981). An ANCOVA was used to analyze the differences in pro-social tendency, family function, and self-esteem between LBAs and non-LBAs after adjusting for demographic characteristics and characteristics related to the caregiver. To identify the characteristics of pro-social tendencies among LBAs, an ANCOVA was also performed to explore the specific group variances of the pro-social tendencies after controlling for other demographics, left-behind characteristics, and caregiver characteristics.

Structural equation modeling was used to further verify the direct and indirect effects of family function on pro-social tendencies and self-esteem. Accounting for the categorical nature of the questionnaire variables and the descriptive results of the items, where the absence of normality was evident when some variables reached values well over zero in asymmetry and values of kurtosis were greater than 2 (Bollen and Long, 1994), ADF methods were used to calculate SEM with AMOS 20.0, which is widely recognized as an appropriate estimation procedure to handle non-normal multivariate data (Byrne, 2001; Huang and Bentler, 2015), particularly with a large sample size such as ours (n = 4716). The goodness-of-fit of the model was evaluated by the significance of χ^2 (values above 0.05 indicate a good fit). As χ^2 is highly susceptible to sample size, other indicators were also considered, namely the GFI, the AGFI, the CFI, and the RMSEA. A RMSEA value at or below 0.08 denotes a good fit, while values of 0.90 or above suggest a good fit for all other named indices (Tong and Bentler, 2013; Monroe and Cai, 2015). In addition, a bootstrapped estimate of 5000 samples was applied to evaluate the mediating roles of self-esteem between family function and pro-social tendency and both bias corrected 95% confidence intervals (CI) and percentile 95% CI were calculated (Biesanz et al., 2010).

In order to test the moderating effects of self-esteem on the relationship between family function and pro-social tendency, an OLS regression was used. The dependent variable (pro-social tendency) was regressed on the interaction term family function × self-esteem with the main effects of family function and self-esteem, as well as control variables (Dawson, 2014) entered into the equation. Since adding an interaction term can cause problems with multi-collinearity in a moderated multiple regression model, the interaction term was calculated from the z-standardized family function and self-esteem terms and then tested as a moderating effect of self-esteem. The variables were entered into regression model in four steps. In step 1, the demographic variables (age, gender, school type, study site, father's education level, mother's education level), left-behind characteristics (left-behind type, duration of being left-behind) and characteristics related with the caregiver (type of caregiver, age of caregiver, education level of caregiver, communication frequency between the caregiver and LBAs) were input as control variables. In step 2, the independent variable (family function) was added, and in step 3, the moderator (self-esteem) was added. The interaction term (z-family function × z-self-esteem) was entered into the model in step 4. The moderation effect is considered significant if the coefficient of the interaction term is significant. However, the size and precise nature of this moderation effect is not easy to derive from examination of the coefficients alone, therefore we plotted the effect in order to properly interpret it and used a simple slope test to calculate the predicted values of pro-social tendency under different conditions (a common method is to use values that are one standard deviation above and below the mean to show high and low values of family function and high and low values of self-esteem) and the predicted relationship between family function and pro-social tendency at different levels of self-esteem (Hu et al., 2018). Additionally, f^2 was calculated to measure the size of the moderation effect, which is the ratio of variance explained by the interaction term alone to the unexplained variance in the final model (Aiken and West, 1991). A value of f^2 at or below 0.02 indicates a small effect size (Dawson, 2014).

RESULTS

A total of 9,320 students were enrolled in the current study (30.87% from Sichuan, 47.96% from Henan, and 21.17% from Shandong). Approximately half, at 4,716 (50.60%), of the students were categorized as LBAs with the other 4,242 students categorized as non-LBAs. Most (65.65% of 4,716) of the LBAs were middle school students and 34.35% were high school students. LBAs were aged 10–18 years (Mean = 15.54; SD = 2.24), of which 51.05% were male and 48.95% were female. The majority of LBAs (70.06%) were left-behind by both parents, with 26.00% left by their father and 3.94% left by their mother. Additionally, 41.12% of LBAs were left behind for more than 10 years. Most who were left behind were under the supervision of their single parent (30.52%) or grandparents (62.67%), with 43.28% of caregiver 60 years or older and 34.87% between 40 and 60 years old. The education of LBA caregivers was generally

very low, with 55.73% having completed primary school or less and 29.89% having completed middle school. Over half (56.82%) of the fathers of LBA had a middle school education and 54.18% of the mothers of LBA mothers had a primary school education or below. Most LBAs had regular communication with their caregivers, with 55.31% frequently communicating with their caregivers, 34.08% occasionally communicating with their caregivers, and 10.61% seldom or never communicating with their caregivers.

The mean value of pro-social tendencies among LBAs was 22.52 ± 4.53, compared to an average of 24.83 ± 4.36 for non-LBAs. To verify the hypothesis that LBAs may have lower pro-social tendencies than non-LBAs, we compared the pro-social tendencies between non-LBAs and LBAs using ANCOVA after adjusting for age, gender, study site, school type, and caregiver characteristics. The results showed that LBAs' pro-social tendency was significantly lower than non-LBAs ($F = 15.11$, $p = 0.0001$). Furthermore, the family function and self-esteem of LBAs were also significantly lower than non-LBAs (see **Table 1**).

The Characteristic Analysis of Pro-social Tendencies Among LBAs

To identify the characteristics of pro-social tendencies among LBAs, an ANCOVA was used to explore the specific group variances of the pro-social tendency, after controlling for demographic, left-behind characteristics, and caregiver characteristics. The results showed that female LBAs scored significantly higher on pro-social tendency than males ($F = 183.88$, $p < 0.0001$). The mean pro-social tendency score of high school students was significantly higher than junior middle school ones ($F = 5.20$, $p = 0.0226$). Additionally, LBAs from the Henan province had more pro-social tendencies than those from the Sichuan provinces ($F = 4.27$, $p = 0.0140$). Additionally, the longer adolescents had been left behind, the lower their pro-social tendencies, LBAs who were left-behind for more than 10 years scored significantly lower on pro-social tendency those left behind for less than 10 years ($F = 2.93$, $p = 0.0196$). Furthermore, the higher the frequency of communication between the caregiver and LBAs, the higher the pro-social tendencies of LBAs ($F = 38.32$, $p < 0.0001$). No statistical differences were found in pro-social tendencies among other categorical items ($p > 0.05$, see **Table 2**).

Correlation Analyses of Family Function, Self-Esteem, and Pro-social Tendency

A Pearson correlation analyses revealed that the pro-social tendency of LBAs was positively correlated with family function ($r = 0.259$, $p < 0.0001$) and self-esteem ($r = 0.206$, $p < 0.0001$). In addition, family function and self-esteem were also positively correlated ($r = 0.280$, $p < 0.0001$).

TABLE 1 | Comparison of the main study variables between LBAs and non-LBAs.

Variables	Non-LBAs (n = 4,242)	LBAs (n = 4,716)	F	p
Family function	6.101 ± 2.418	5.511 ± 2.496	4.31	0.0379
Self-esteem	14.670 ± 2.582	14.375 ± 2.545	4.02	0.0451
Pro-social tendency	24.830 ± 4.366	22.522 ± 4.536	15.11	0.0001

Testing for the Mediation Effect of Self-Esteem

Structural equation modeling was used to explore the direct and indirect effects of family function on pro-social tendency and self-esteem among LBAs. We used "family function," "self-esteem," and "pro-social tendency" as latent variables. Family function was measured by five items (FF1–FF5), self-esteem was also measured by five items (SE1–SE5), and pro-social tendency was measured by seven observed variables (PST1–PST7; see **Figure 1**). This model demonstrated that family function was positively related to self-esteem (β = 0.361, $p < 0.001$), explaining 13.1% variance of self-esteem (SMC of self-esteem = 0.131). Self-esteem had a positive direct effect on pro-social tendency (β = 0.197, $p < 0.001$), as did family function (β = 0.254, $p < 0.001$). Additionally, the results of a 5000 bootstrapped mediation analysis indicated that self-esteem significantly mediated the relationship of family function on pro-social tendency, with an indirect effect of 0.071 (bias-corrected 95%CI: 0.051:0.090; percentile 95%CI: 0.053:0.092). The explained variance of pro-social tendency was 13.9% in this model and the model fit was good ($\chi^2 = 844.541$, $p < 0.0001$, GFI = 0.967, AGFI = 0.956, CFI = 0.916, RMSEA = 0.036), determined by values of GFI, AGFI, and CFI greater than 0.90, and a RMSEA value less than 0.08. Based on the above analysis, the effect of family function on pro-social tendency was generated through two paths (See **Table 3**). First, the direct effect of family function on pro-social tendency was 0.254, accounting for 78.15% of the total effect (0.325). Second, there was an indirect effect of family function on pro-social tendency through self-esteem (0.071), which account for 21.85% of the total effect. Therefore, 21.85% of the total effect of family function on pro-social tendency was mediated by self-esteem. These results validate our hypothesis that self-esteem plays a mediating role in the relationship between family function and pro-social tendency.

Testing for the Moderating Effect of Self-Esteem

Table 4 presents the results of OLS regression analysis. The demographics, left-behind characteristics, and caregiver characteristics combined contributed to 6.11% of the variance of pro-social tendency, while family function and self-esteem accounted for 4.54 and 2.47%, respectively. Results from step 4 of the regression analysis suggest that self-esteem significantly negatively moderated the effect of family function on pro-social tendency (β = −0.208, $p < 0.0001$), accounting for an additional 5.22% variance of pro-social tendency. The value of f^2 was 0.064, which is greater than 0.02, suggesting an acceptable size of the moderation effect. Therefore, these results supported the hypothesis that self-esteem negatively moderated the relationship between family

TABLE 2 | Characteristic analyses of pro-social tendency among LBAs.

Variables		*N*	$\bar{x} \pm s$	*F*	*p*
Gender				183.88	<0.0001
	Male	2,382	21.654 ± 4.779		
	Female	2,284	23.409 ± 4.103		
Age (years)				1.73	0.1579
	<12 years	107	23.047 ± 4.085		
	∼12 years	1,312	22.318 ± 4.839		
	∼14 years	1,560	22.359 ± 4.555		
	∼16 years	1,737	22.790 ± 4.291		
Study site				4.27	0.0140
	Sichuan	1,794	22.275 ± 4.899[a]		
	Henan	2,082	22.829 ± 4.098		
	Shandong	840	22.463 ± 4.823		
School type				5.20	0.0226
	Middle school	3,097	22.376 ± 4.647		
	High school	1,619	22.801 ± 4.305		
Left-behind type			0.94 ± 0.3910		
	Both parents	3,304	22.483 ± 4515		
	Father only	1,226	22.597 ± 4.594		
	Mother only	186	22.720 ± 4.549		
Care giver				0.66	0.5183
	Single parent	1,434	22.652 ± 4.634		
	Grandparents	2,945	22.459 ± 4.481		
	Others	320	22.675 ± 4.468		
Education level of father				0.51	0.6787
	Primary school or below	1,371	22.381 ± 4.512		
	Middle school	2,658	22.515 ± 4.484		
	High school	608	22.865 ± 4.689		
	College degree or above	41	22.439 ± 5.353		
Education level of mother				1.16	0.3240
	Primary school or below	2,522	22.347 ± 4.453		
	Middle school	1,738	22.697 ± 4.453		
	High school	353	22.918 ± 4.971		
	College degree or above	42	22.357 ± 4.953		
Education level of care giver				1.37	0.2491
	Primary school or below	2,597	22.408 ± 4.519		
	Middle school	1,393	22.544 ± 4.594		
	High school	537	23.106 ± 4.348		
	College degree or above	133	22.714 ± 4.638		
Age of care giver (years)				0.28	0.8397
	<20 years	223	22.502 ± 4.718		
	∼20 years	798	22.465 ± 4.768		
	∼40 years	1,630	22.615 ± 4.437		
	∼60 years	2,023	22.509 ± 4.500		
Communication frequency between caregiver and LBAs				38.32	<0.0001
	Frequently	2,571	22.923 ± 4.469[b]		
	Occasionally	1,584	22.220 ± 4.503[c]		
	Seldom or never	493	21.448 ± 4.683		
Duration of being left-behind				2.93	0.0196
	∼6 months	1,078	22.792 ± 4.402		

(Continued)

TABLE 2 | Continued

Variables		N	$\bar{x} \pm s$	F	p
	∼1 year	436	22.365 ± 4.446		
	∼3 years	428	22.410 ± 4.648		
	∼5 years	833	22.360 ± 4.563		
	∼10 years	1,938	22.084 ± 4.835[d]		

[a]The mean pro-social tendency of this group was significantly different from the second group; [b]The mean pro-social tendency of this group was significantly different from the second group (t = 6.331, p < 0.0001) and the third group (t = 7.514, p < 0.0001); [c]The mean pro-social tendency of this group was significantly different from the third group (t = 3.309, p = 0.0009); [d]The mean pro-social tendency of this group was significantly different from the first group (t = 2.758, p = 0.0058), the third group (t = 2.269, p = 0.0233) and the fourth group (t = 2.256, p = 0.0241).

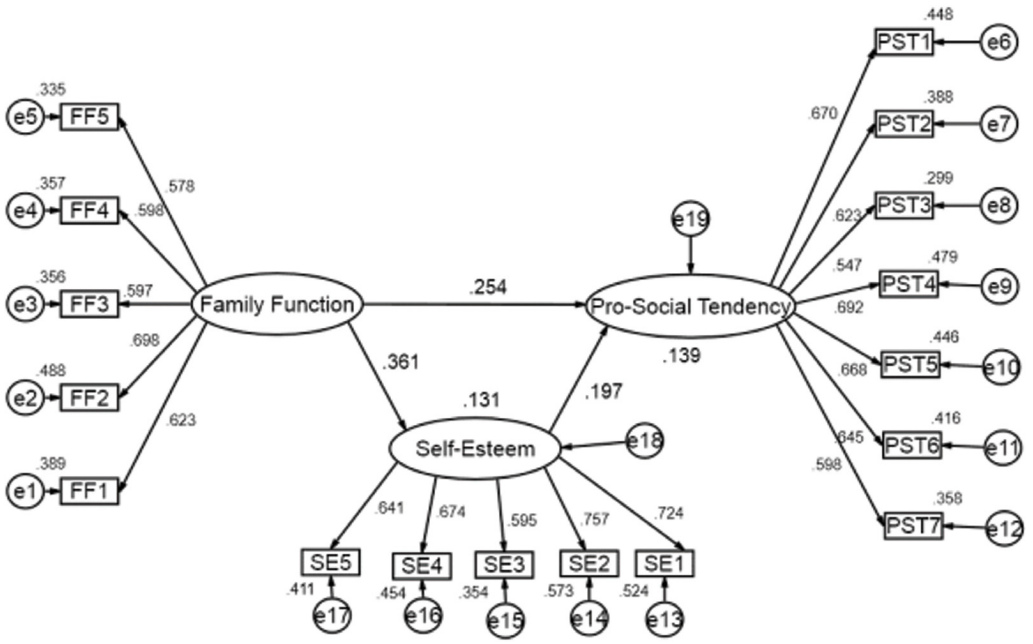

FIGURE 1 | The structural equation model on the relationship of family function, self-esteem, and pro-social tendency among left-behind adolescents (family function, self-esteem, and pro-social tendency were used as latent variables; FF1–FF5, five items of family function; SE1–SE5, five items of self-esteem; PST1–PST7, seven items of pro-social tendency; e1–e17, the measurement error of each observed variable to estimate latent variable; e18–e19, the residuals that may affect the endogenous latent variables but not the exogenous latent variables; the path coefficient between two latent variable is the standardized regression weight, denoted as β; the path coefficient from the latent variables to each item is the standardized factor loading, which is denoted as λ; the coefficients marked next to the observed variables and dependent latent variables were squared multiple correlations).

function and pro-social tendency. The negative coefficient of the interaction term indicated that the effect of family function on pro-social tendency became weaker as self-esteem increased. Additionally, simple slope test results demonstrated that family function had a significant positive effect on pro-social tendency, both when self-esteem was low (β = 0.253, t = 15.43, and $p < 0.0001$) and high (β = 0.178, t = 8.42, and $p < 0.0001$). **Figure 2** illustrates the interaction effect of self-esteem and family function on pro-social tendencies such that when family function moved from low to high, the high self-esteem individuals' pro-social tendency increased significantly, however, the low self-esteem individuals' pro-social tendency increased more steeply than those with high self-esteem. These results suggested that self-esteem could impact the effect of family function on pro-social tendency.

TABLE 3 | The effect size and proportion of paths in the total effect model.

Path	Effect size	Proportion (%)
Family function → pro-social tendency	0.254	78.15
Family function → self-esteem → pro-social tendency	0.071	21.85
Total	0.325	100.00

DISCUSSION

Despite the increased attention on the importance of family function to one's physical and mental development, few studies to date have focused on the influence of parent-child separation on pro-social tendency among LBAs. Questions concerning the underlying mediating and moderating mechanisms of

TABLE 4 | The ordinary least squares (OLS) regression analysis for pro-social tendency.

Variables	Pro-social tendency			
	Step 1 (β)	Step 2 (β)	Step 3 (β)	Step 4 (β)
Age	0.099[b]	0.088[b]	0.078[b]	0.078[b]
Gender	0.195[b]	0.185[b]	0.206[b]	0.206[b]
School type	−0.035	−0.039	−0.044	−0.043
Study site 1 (Henan vs. Sichuan)	0.033[a]	0.003	0.009	0.009
Study site 2 (Shandong vs. Sichuan)	−0.006	−0.020	−0.026	−0.025
Left-behind type 1 (father vs. both parents)	0.001	0.004	0.004	0.003
Left-behind type 2 (mother vs. both parents)	0.019	0.025	0.024	0.023
Duration of being left-behind 1 (∼6 months vs. ∼10 years)	0.043[b]	0.046[b]	0.042[b]	0.042[b]
Duration of being left-behind 2 (∼1 year vs. ∼10 years)	0.036[a]	0.038[a]	0.036[a]	0.036[a]
Duration of being left-behind 3 (∼3 years vs. ∼10 years)	0.022	0.025	0.020	0.020
Duration of being left-behind 4 (∼5 years vs. ∼10 years)	0.035[a]	0.035[a]	0.031	0.030
Caregiver 1 (grandparents vs. single parent)	−0.020	−0.013	−0.013	−0.013
Caregiver 2 (others vs. single parent)	−0.004	−0.005	−0.003	−0.003
[c]Edu-caregiver 1 (middle school vs. primary school or below)	0.002	0.002	0.001	0.001
[c]Edu-caregiver 2 (high school vs. primary school or below)	0.028	0.020	0.020	0.019
[c]Edu-caregiver 3 (college degree or above vs. primary school or below)	0.008	0.007	0.008	0.008
Age of caregiver 1 (<20 years vs. ∼60 years)	−0.005	−0.015	−0.013	−0.014
Age of caregiver 2 (∼20 years vs. ∼60 years)	−0.025	−0.031	−0.028	−0.028
Age of caregiver 3 (∼40 years vs. ∼60 years)	−0.030	−0.027	−0.027	−0.028
[f]Communication frequency 1 (occasionally vs. frequently)	−0.103[b]	−0.053[b]	−0.048[b]	−0.050[b]
[f]Communication frequency 2 (seldom or never vs. frequently)	−0.119[b]	−0.049[b]	−0.041[a]	−0.040[b]
[d]Edu-father 1 (middle school vs. primary school or below)	0.008	0.001	0.001	0.001
[d]Edu-father 2 (high school vs. primary school or below)	0.021	0.011	0.007	0.006
[d]Edu-father 3 (college degree or above vs. primary school or below)	0.002	0.001	0.004	−0.004
[e]Edu-mother 1 (middle school vs. primary school or below)	0.033[a]	0.026	0.019	0.020
[e]Edu-mother 2 (high school vs. primary school or below)	0.018	0.012	0.009	0.010
[e]Edu-mother 3 (college degree or above vs. primary school or below)	−0.006	−0.009	−0.012	−0.011
Family function		0.230[b]	0.186[b]	0.187[b]
Self-esteem			0.168[b]	0.168[b]
Family function × self-esteem				−0.208[b]
F	11.68[b]	19.89[b]	24.10[b]	32.36[b]
Adjusted R^2	0.0611	0.1065	0.1312	0.1834
ΔR^2	0.0611	0.0454	0.0247	0.0522

[a]$p < 0.05$; [b]$p < 0.01$; [c]Dummy variable of education level of caregiver; [d]Dummy variable of education level of father; [e]Dummy variable of education level of mother; [f]Dummy variable of communication frequency between caregiver and LBAs.

self-esteem between family function and pro-social tendency still remain largely unknown. Therefore, the current study aimed to understand the status of pro-social tendency and examined the relationships of family function, self-esteem, and pro-social tendency in a large number of LBAs in rural China. Furthermore, the current study explored the mediating and moderating roles of self-esteem on the relationship between family function and pro-social tendency. The main results of this study verified our hypotheses.

Consistent with previous research in China, the current study showed that approximately half of middle/high school students were left behind by one or both parents (Yuan and Wang, 2016; Fellmeth et al., 2018). The proportion of LBAs in China is higher than that in other countries, with 27% in Philippines and 36% in Ecuador (Yuan and Wang, 2016). The pro-social tendency of LBAs was lower than non-LBAs, with detriments particularly exacerbated in those who had been left behind longer, confirming the negative impact of parent-child separation and attachment interruption on the socialization process of LBAs in the critical period of development (Chen et al., 2016; Wang et al., 2017). Fortunately, our results suggest that frequent communication with caregivers may promote the development of pro-social tendencies among LBAs. Pro-social tendencies have been shown to be associated with a wide range of positive individual characteristics and outcomes, including empathy (Penner et al., 2005), agreeableness (Caprara et al., 2010), and peer acceptance (Layous et al., 2012). Furthermore, parental discipline techniques have been found to be important for building pro-social behavior during childhood (Flynn et al., 2015). Therefore, it is of particular importance to pay close attention to the pro-social tendencies of LBAs whose parents have been absent for a long time.

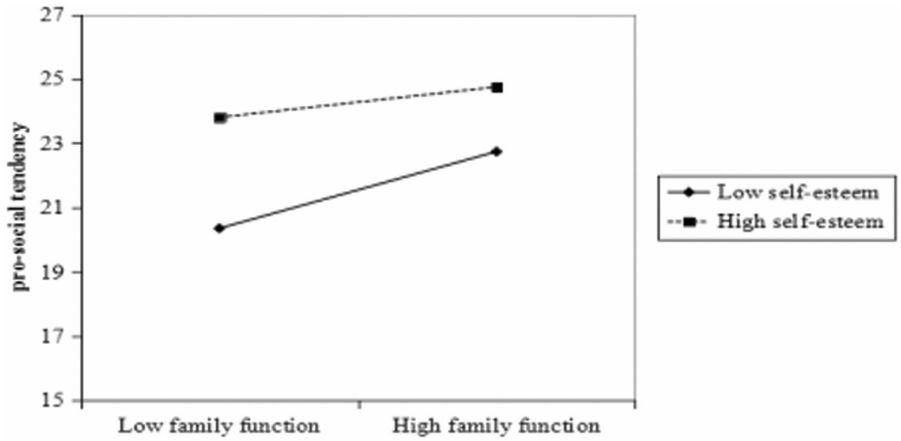

FIGURE 2 | The moderating effect of self-esteem on the relationship between family function and pro-social tendency.

Male LBAs scored significantly lower on pro-social tendency than did females. Accumulating researches have demonstrated that males and females exhibit different methods of mental processing (Haferkamp et al., 2012; Gohier et al., 2013) and have found gender differences in social functioning (Huang et al., 2016). Seemingly, an unacceptable social environment could elicit opposite behaviors from females and males. Our results could, therefore, support the wider hypothesis of gender-based differences in mental processing. The mean pro-social tendency score of high school students was significantly higher than of middle school students and LBAs from the Henan province scored significantly higher on pro-social tendency than those from the Sichuan provinces. Even so, the practical value is not worth considering, as the difference of the mean score between groups was less than 1. These results are consistent with the findings of others (Eisenberg et al., 2015). Given our other results, we suggest that attention should be drawn to the pro-social tendency of LBAs, particularly males who have been left behind for many years.

Also consistent with previous research, results from the current study suggest that family function is positively associated with pro-social tendencies (Mejia et al., 2006; Renzaho and Karantzas, 2010). Those with good family function tended to have high levels of pro-social tendencies, suggesting that family function is an important influencing factor of pro-social tendency among LBAs. In accordance with previous research, the family function of LBAs suffered compared to non-LBAs, plausibly due to the geographical distance with parents and rare parent-child communication (Zhao et al., 2014; Zhou et al., 2018), suggesting potential social adaptation issues of LBAs as those who had lower family function tended to have lower pro-social tendencies. The current study also demonstrated that family function increased LBAs self-esteem, which in turn was positively related to LBAs' pro-social tendency. That is, self-esteem mediated the relationship between family function and pro-social tendencies. Therefore, high level of self-esteem seems to be one of the explanatory mechanisms for why LBAs with good family function are less likely to have problem with pro-social tendencies. To the best of our knowledge, this is the first study to report such results in the literature. These findings are consistent with the social control theory, which posits that an individual's attachment to others is a crucial element in the restriction of problem behaviors among adolescents (Hirschi, 1969). Indeed, LBAs with good family function leads to good family cohesion and positive communication with family members, as well as high family member intimacy. The relationships that LBAs build with key members in their life will increase their positive psychological state, which in turn will reduce the risk of psychological and social problems. These findings extend the prior research by illuminating why good family function can decrease problem in pro-social tendencies among LBAs. Some previous research on LBAs pro-social tendency has suggested the importance of paying attention to the influences of family function, whereas other research emphasized self-esteem. The current study was the first that integrated research from both areas to uncover LBAs pro-social tendency. This integrated model suggests that protective factors in the left-behind environment (e.g., family function) may enhance some protective intrapersonal traits (such as self-esteem), which in turn improve pro-social tendencies. In addition to the overall mediation results, each of the separate associations in the mediation model is noteworthy. For the first stage of the mediation process (family function→self-esteem), our findings support the notion that good family function is related to an increased in self-esteem in LBAs. This finding is consistent with the self-determination theory (Deci and Ryan, 2000) and the attachment theory (Ainsworth, 1989), both of which posit that good family member relationships play a vital role in one's development. Indeed, LBAs with good family function are more likely to be people with good relationship with family members and psychological health, which in turn could prevent them from a series of psychological and social problems. For the second stage of the mediation model (self-esteem→pro-social tendency), self-esteem was positively associated with pro-social tendencies in LBAs. This finding is congruent with previous research (Zuffiano et al., 2016; Fu et al., 2017; McChesney and Toseeb, 2018), indicating that people with high self-esteem are more likely

to have high pro-social tendency. This finding supports the notion that self-esteem is a motivating factor and important psychological resource for achieving positive social outcomes.

The other goal of this study was to examine whether the self-esteem could moderate the direct link between family function and pro-social tendency among LBAs. The results verified our hypotheses that self-esteem negatively moderates the relationship between family function and pro-social tendency. Family function had significant positive effect on pro-social tendency whether self-esteem was low or high, but it had a much greater impact in LBAs with low self-esteem than it did in those with high self-esteem. Self-esteem may, then, affect the effect strength of family function on pro-social tendency. Indeed, the effect of family function on pro-social tendency became weaker as self-esteem increased. Therefore, self-esteem can be regarded as a plausible indicator to distinguish whether people with low family function could be at greater risk for psychological or social problems. In light of above analysis, we can presume that self-esteem mediated and moderated the effect of family function on pro-social tendency among LBAs.

Consistent with previous research, LBAs had significantly less pro-social behaviors than non-LBAs (Chen et al., 2016; Viet Nguyen, 2016). Although the current study demonstrated that family function is positively related to pro-social tendencies, it is of little practical implication to improve LBAs' pro-social tendency by improving family function, as this is a societal construct that would be difficult to improve in a short time under China's existing social system. As long as there exists parent-child separation, it will inevitably affect the family function of LBAs. Both as a motivating factor and as an important psychological resource, self-esteem seems to mediate and moderate the effect of family function on pro-social tendency. Once self-esteem is improved, the adverse effect of low family function may be offset somewhat and pro-social tendencies will then be promoted, due to the positive relationship of self-esteem on pro-social tendency and the weakened impact of the adverse effect of low family function on pro-social tendency. Importantly, self-esteem is not a static phenomenon, but rather a dynamic process that can be developed and managed (Liu et al., 2015; Zangirolami et al., 2018). Interventions such as physical activity and mindfulness-based programs, which have been designed to enhance self-esteem, have been effective with other groups with a set of psychological and social outcomes positively changed (Nosek et al., 2016; Jalali et al., 2018; Zangirolami et al., 2018). It is plausible that if these interventions are also effective with LBAs, it will be of great practical significance to improve their pro-social tendencies. Therefore, it is our contention that strategies of enhancing LBA's self-esteem should be developed and implemented in China as soon as possible, particularly in males who have been left behind for several years.

Based on the above analysis, our findings have important implications to the management of LBAs. First, the current study demonstrates that parent-child separation has negative effects on family function and pro-social tendencies among LBAs that and self-esteem may contribute to the ability to use psychological resources to help combat low family function and promote pro-social tendencies. These results promote the importance of self-esteem in dealing with the consequences of poor family function, allowing individuals to maintain a positive and healthy status. Furthermore, our findings offer a new perspective for LBA's managers (such as teachers, or the government.) to combat the adverse effect of poor family function on pro-social tendency by providing LBAs with self-esteem development training programs (for example: a mindfulness-based program), particularly males that have been left behind for several years. Despite the many contributions made by the current study, there are limitations that could be improved in future research. For example, study utilized a cross-sectional research design that cannot determine causality and data was collected during a fixed period. To combat these limitations, future studies should consider utilizing a longitudinal design to track the pro-social tendency of LBAs through their growth trajectory. Additionally, we relied on self-report, which can be subject to information bias. Future studies should collect additional information from the at-home parents, caregivers, teachers, and peers. Furthermore, the current study only recruited rural students. To be able to generalize results, students in non-rural areas should also be included in future studies. Additionally, the current study only researched family function as it influences pro-social tendencies and only measured certain demographic, left-behind characteristics, and caregiver characteristics as potential confounding variables. Additional risk factors and confounding variables, such as socioeconomic factors, should be included in future studies. In spite of the above limitations, the present study provides a preliminary and novel understanding of the underlying mechanisms of the relationships between family function, self-esteem, and pro-social tendencies among LBAs.

CONCLUSION

In conclusion, the present study adds to the existing literature suggesting that parent-child separation has a negative effect on family function and pro-social tendencies among LBAs. Family function had a positive impact on self-esteem and pro-social tendency, while self-esteem had a significant positive effect on pro-social tendency. Furthermore, family function was found to have a positive direct and indirect effect on pro-social tendency, through self-esteem. Indeed, 21.85% of the effect of family function on pro-social tendency was mediated by self-esteem. Additionally, self-esteem negatively moderated the relationship between family function and pro-social tendency; the effect of family function on pro-social tendencies weakened as self-esteem increased. Seemingly, then, self-esteem appears to affect the impact of family function on pro-social tendencies. The current study provides an initial insight into the potent mechanisms of the relationships between family function, self-esteem, and pro-social tendency among LBAs, which has, to the best of our knowledge, not yet been examined. These results provide insights into the importance of self-esteem in LBAs and provide a theoretical and practical basis to the managers of LBAs to develop targeted interventions to improve LBA's self-esteem, to aid in the successful coping of poor family function so that they may maintain a positive and healthy social status. Because of the

cross-sectional design of the present study, we intend to design a longitudinal study to confirm the dynamic relationship among family function, self-esteem, and pro-social tendencies.

ETHICS STATEMENT

This study was carried out in accordance with the Declaration of Helsinki. The protocol was reviewed and approved by the ethical committee group of Jinzhou Medical University. The study procedures were carried out in accordance with the ethical standards. No bio-markers or tissue were collected. Prior to the administration of any study related questionnaires, approval from the officials of sampled schools was obtained in writing and the written informed consent was obtained from the parents or legal guardians on behalf of the adolescents to participate in the study. Participation was entirely voluntary, confidential, and anonymous. Participants were informed that they were free to withdraw from the study at any time.

AUTHOR CONTRIBUTIONS

FG was involved in the study design, analysis, and interpretation of the data as well as the drafting and revising of the manuscript. YY participated in data acquisition, study design, and interpretation of the results. CY, YX, and HM provided help with the data collection, analysis, and interpretation. HL made substantive intellectual contributions to the interpretation of data and the draft of the manuscript. All authors have read and approved the final manuscript.

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BRIEF RESEARCH REPORT
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Clarifying Deeper Psychological Characteristics of Hikikomori Using the Rorschach Comprehensive System: A Pilot Case–Control Study

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Hikikomori, a form of severe social withdrawal more than 6 months, has increasingly become a crucial issue especially among adolescents. Loneliness, avoidant personality, Japanese culture-related attachment style ("amae"), and difficulty in expressing emotions are suggested to be related to hikikomori. However, deeper psychological aspects have not been well clarified. The Rorschach test is one of the most popular psychological assessment tools to evaluate deeper personality traits. The Rorschach Comprehensive System (CS) has been established as the most reliable scoring method. Until now, no CS research has been conducted focusing on hikikomori. Therefore, we herein conducted a pilot case–control study using CS in clinical cases with and without hikikomori condition. Participants were recruited from the Mood Disorder/Hikikomori Clinic at Kyushu University Hospital. Twenty-two patients with hikikomori (HK patients) and 18 patients without hikikomori (non-HK patients) participated in the present study. All the 40 participants conducted the self-report Structured Clinical Interview for *DSM-IV* Axis II Personality Disorders (SCID-II) personality questionnaire and CS. Regarding the SCID-II personality questionnaire, various personality traits including passive aggressive trait were significantly higher in HK patients. Among CS variables, HK patients showed higher scores on FC (Form Color) and SumT (total number of texture-related responses). In addition, frequency of SumT was higher in HK patients. The present results suggest that persons with hikikomori are more likely to express emotions indirectly and expect others to presume their feelings and thoughts. Persons with hikikomori may also have difficulty in becoming independent emotionally from primitive dependence and attachment on significant others. Further investigations with larger samples are warranted for validation.

Keywords: social withdrawal (hikikomori), the Rorschach Comprehensive System, adolescence, passive aggressive personality, dependence, amae, assertion

INTRODUCTION

Hikikomori, a form of severe and prolonged social withdrawal, began to garner attention in Japan especially after the publication of *Hikikomori: Adolescence Without End* by a psychiatrist/psychopathologist, T. Saito, in 1998 (1). Hikikomori is now regarded as a crucial sociocultural issue especially among adolescents (1–3). Our previous case study has suggested the presence of persons with hikikomori who have adolescent mentalities even after the age of adolescence (4). Therefore, even though persons with hikikomori may be past the age of so-called adolescence, it is important to consider their problems as adolescent issue. We have previously been defined hikikomori as a state of social withdrawal combined with avoidance of major social interactions and responsibilities (e.g., education, employment, and friendship) lasting at least 6 months (5). Previous research has revealed that the majority of cases with hikikomori condition are comorbid with psychiatric disorders. A variety of hikikomori-related case reports and clinical studies have shown the possible relationships between psychological aspects, personality traits, and hikikomori (6). We have revealed that loneliness and avoidant personality are strongly linked to hikikomori (7). In addition, previous studies have suggested psychological and behavioral features of hikikomori such as Japanese culture-related attachment style ("amae") and difficulty in expressing emotions (8); however, deeper psychological and personality aspects have not been well clarified.

The Rorschach test is one of the most well-known psychological assessment tools to evaluate broad and deeper personality traits such as personality organization and functioning including unconscious defense mechanisms. This tool can reveal deeper psychological aspects in various psychiatric disorders (9–11). Currently, the Rorschach Comprehensive System (hereafter referred to as CS) has been established as the most popular scoring method in terms of its standardized administration rules, high inter-rater and test–retest reliability, and high statistical construct validity (12, 13). CS has revealed various deeper psychological aspects in psychosomatic and psychiatric disorders including alexithymia and chronic pain (14, 15). However, to our knowledge, no CS research has been conducted focusing on hikikomori. We believe that CS can evaluate deeper psychological mechanisms that are linked to the roots of hikikomori such as loneliness, avoidant personality, "amae," and difficulty in expressing emotions. Therefore, as a pilot study to grasp deeper hikikomori-related psychological and personality traits, we herein conducted a case–control study using CS in psychiatric patients with and without hikikomori condition.

METHODS

This study was performed in accordance with the Declaration of Helsinki and was approved by the ethics committees of Kyushu University, Fukuoka, Japan.

The Department of Neuropsychiatry at Kyushu University Hospital has recently established a Mood Disorder/Hikikomori Clinic (16, 17), where hikikomori condition is evaluated based on the semi-structured diagnostic interview (5). In the present study, research staff recruited clinical cases from the Mood Disorder/Hikikomori Clinic, from June 2014 to March 2016. Patients were informed of the aims and methods regarding the present study and that their participation was completely voluntary. Patients who agreed to participate in the present study then registered as study participants with written informed consent. The participants received a gift card incentive worth approximately $18.

Self-Report SCID-II Personality Questionnaire

The Structured Clinical Interview for *DSM-IV* Axis II Personality Disorders (SCID-II) is a semi-structured interview for assessment of Axis II 10 personality disorders based on the *Diagnostic and Statistical Manual of Mental Disorders,* 4th edition (*DSM-IV*), such as avoidant personality disorder, depressive personality disorder, and passive aggressive personality disorder (18). All the participants conducted a self-rated screening personality questionnaire, the self-report SCID-II personality questionnaire, which can estimate 10 personality traits with 119 items by a 2-point scale of yes (1) and no (0).

The Rorschach Comprehensive System

As shown the above, the CS has been established as the most reliable scoring method (12, 13). We referred to Takahashi et al. for scoring form quality based on standardized data from the Japanese population (19). CS considers a normal protocol test with less than 14 responses as invalid, and no participant was eliminated from the analysis based on this criterion. A clinical psychologist (AI) administered CS and scored the responses of all the participants. The tentative scores were reviewed by the examiner (AI) and another clinical psychologist (RK), and finalized after discrepancies had been discussed in order to strengthen the reliability of the present CS data.

Statistical Analysis

Student's *t*-test was conducted for comparison of SCID-II subscales between the HK patients and non-HK patients. For comparison on the Rorschach CS variables, medians of major variables were compared between HK patients and non-HK patients using the Mann–Whitney *U* test, and frequency data for CS major variables were examined using the chi-squared test. All analyses were performed using IBM SPSS 24 Advanced Statistics for Mac OS. For all analyses, a probability of value of $p < 0.05$ was considered significant.

RESULTS

We recruited 22 clinical cases (male = 12, female = 10, age *mean* = 33.14, SD = 9.33) who met the definition of hikikomori (a 6-month or longer period of time spent mostly at home; hereafter referred to as "HK patients") and 18 clinical cases (male = 11, female = 7, age *mean* = 37.94, SD = 8.93) without hikikomori condition in their present and previous history (as "non-HK patients"). All the cases agreed to participate in the study, and a total of 40 clinical participants enrolled in the following assessments and comparison analysis.

The average age of onset among 22 HK patients was 21.67 years (SD = 7.64). The average period of withdrawal at present was 5.25 years (SD = 4.10). In addition, 11 cases (50%) of the HK patients had previous experience of hikikomori. Many hikikomori sufferers are known to begin to withdraw from society at their adolescence; thus, we believe that analysis of the data using the present HK patients provides us valuable knowledge in the understanding of the psychopathology of hikikomori with adolescent problems. Regarding home environment, 20 cases (91%) of HK patients and 11 cases (61%) of non-HK patients lived with others (mainly family members).

All the participants received a psychiatric diagnosis based on the *DSM-IV* (20). In HK patients, primary psychiatric diagnoses were, in order, the minor depressive disorder (n = 17), major depressive disorder (n = 3), social anxiety disorder (n = 1), and psychosis (n = 1). Regarding non-HK patients, primary psychiatric diagnoses were, in order, minor depressive disorder (n = 10), major depressive disorder (n = 3), panic disorder (n = 1), social anxiety disorder (n = 1), bipolar affective disorder (n = 1), psychosis (n = 1), and alcohol use disorder (n = 1) (**Table 1**).

TABLE 1 | Primary psychiatric diagnoses on patients with hikikomori (HK patients) and patients without hikikomori (non-HK patients).

Diagnosis	HK patients (*N* = 22)		Non-HK patients (*N* = 18)	
	Number	%	Number	%
Major depressive disorder	3	13.6	3	16.7
Minor depressive disorder	17	77.3	10	55.6
Bipolar affective disorder	0	0	1	5.6
Psychosis	1	4.5	1	5.6
Social anxiety disorder	1	4.5	1	5.6
Panic disorder	0	0	1	5.6
Alcohol use disorder	0	0	1	5.6

Significant differences were found in various personality traits between HK patients and non-HK patients. Total scores of personality traits of avoidant, depressive, narcissistic, paranoid, passive aggressive, schizoid, and schizotypal personality in the SCID-II personality questionnaire were significantly higher in HK patients compared with non-HK patients (**Table 2**).

CS analysis has revealed some interesting outcomes in hikikomori. Mann–Whitney *U* test showed that the score of FC (Form Color) in the cluster of "affect" was significantly higher in HK patients compared with non-HK patients. The score of SumT (sum of the number of texture-related responses) in the cluster of "interpersonal perception and behavior" was also higher in HK patients compared with non-HK patients (**Table 3**). In addition, as our purpose in the present study was an exploratory pilot study with small samples, we newly compared frequency of SumT on two conditions: SumT = 0 and SumT ≥ 1. The frequency of SumT ≥ 1 in HK patients was significantly higher (40.9%) than in non-HK patients (11.1%; $p < 0.05$). Among 22 HK patients, nine cases showed one or two texture-related responses, including two cases that showed two texture-related responses. On the other hand, among 18 non-HK patients, only two cases showed one texture-related response and 16 cases showed no texture-related response (**Table 4**). Food response (Fd) is also one of the variables in "interpersonal perception and behavior." There was no significant difference on the score of Fd between HK patients and non-HK patients (**Table 3**). The results of comparisons on other CS variables are shown in **Supplementary Table 1**.

DISCUSSION

This is the first case–control study to reveal some deeper psychological and personality features for clinical cases with hikikomori condition using the scores of CS.

The SCID-II personality questionnaire showed a positive relationship between hikikomori and various personality traits

TABLE 2 | Comparisons of Structured Clinical Interview for *DSM-IV* Axis II Personality Disorders (SCID-II) personality questionnaire between HK patients and non-HK patients.

Variables	HK patients (*N* = 22)		Non-HK patients (*N* = 18)		Statistics	
	Mean	SD	Mean	SD	t	p-value
SCID-II						
Avoidant personality	4.67	1.56	3.17	1.95	−2.67	0.011*
Independent personality	3.14	1.93	2.44	2.18	−1.064	0.294
Obsessive-compulsive personality	4.43	1.99	3.44	2.04	−1.524	0.136
Passive aggressive personality	2.68	1.76	1.17	1.58	−2.837	0.007*
Depressive personality#	5.05	1.80	3.33	2.57	−2.44	0.02*
Paranoid personality	3.57	1.99	1.41	1.50	−3.699	0.001**
Schizotypal personality	3.62	2.62	1.94	2.15	−2.158	0.037*
Schizoid personality#	3.67	1.28	2.50	1.72	−2.368	0.022*
Histrionic personality	1.00	1.20	1.00	1.28	0	1
Narcissistic personality#	3.68	2.73	1.83	1.89	−2.522	0.02*
Borderline personality	4.82	3.05	3.67	3.50	−1.112	0.273
Antisocial personality#	1.41	1.82	0.61	0.70	−1.757	0.087

*Statistical p-values were derived from Student's t-test. *$p < 0.05$, **$p < 0.01$.*
#There were missing values.

TABLE 3 | Comparisons of Rorschach Comprehensive System (CS) variables between HK patients and non-HK patients.

Cluster	Variable name	HK patients (*N* = 22)			Non-HK patients (*N* = 18)			U	Z	p-value
		Mean	Median	SD	Mean	Median	SD			
Affect	FC	2.50	2.50	1.68	1.39	2.00	1.14	123	−2.1	0.037*
	CF + C	2.50	2.00	2.43	2.17	2.00	1.92	183	−0.4	0.68
	pureC	0.41	0.00	0.96	0.50	0.00	1.04	182	−0.6	0.55
	SumC'	1.55	1.00	1.77	1.67	1.00	1.33	168.5	−0.8	0.41
	WSumC	3.95	3.75	2.89	3.11	3.00	2.33	161	−1.0	0.31
	Afr	0.51	0.46	0.16	0.47	0.40	0.21	162	−1.0	0.33
	S	3.18	3.00	2.44	2.89	3.00	1.71	194	−0.1	0.91
	Blends	3.14	2.50	2.32	2.61	2.50	1.54	183	−0.4	0.68
	R	24.91	23.50	8.48	24.67	22.50	6.21	191.5	−0.2	0.86
	CP	0.00	0.00	0.00	0.00	0.00	0.00	198	0	1
Interpersonal perception and behavior	COP	0.27	0.00	0.55	0.61	0.00	0.92	161.5	−1.2	0.29
	AG	0.45	0.00	1.14	0.44	0.00	0.51	163	−1.2	0.25
	GHR	2.91	3.00	1.97	4.33	3.00	3.24	149	−1.4	0.18
	PHR	2.73	3.00	1.80	1.83	2.00	0.99	138	−1.7	0.09
	a	2.64	2.00	2.82	3.50	2.50	3.38	170	−0.8	0.44
	p	4.32	4.00	2.59	3.78	4.00	2.10	180	−0.5	0.62
	Food	0.82	1.00	0.85	1.11	1.00	0.76	154	−1.3	0.19
	SumT	0.50	0.00	0.67	0.11	0.00	0.32	137	−2.1	0.033*
	Human content	5.73	6.00	2.60	5.94	4.50	3.73	192.5	−0.2	0.88
	pureH	2.09	2.00	1.51	2.50	2.00	2.60	195.5	−0.1	0.95
	PER	1.09	0.00	2.41	1.06	0.50	1.73	182	−0.5	0.63
	Isolation	0.13	0.12	0.10	0.14	0.12	0.10	189.5	−0.3	0.82

*Statistical p-values were derived from Mann–Whitney U test. *p < 0.05, **p < 0.01.*

FC, Form Color Response; CF+C, Color Form Response + Pure Color Response; SumC', Sum of Achromatic Color Determinants; WSumC, Weighted Sum of Chromatic Determinants; Afr, Affective Ratio; S, White Space Details; R, Response; CP, Color Projection; COP, Coorporative Movement; AG, Aggressive Movement; GHR, Good Human Representation; PHR, Poor Human Representation; a, active; p, passive; PER, Personalized answer.

TABLE 4 | Frequency of texture-related responses (SumT = 0, SumT ≥ 1) among HK patients and non-HK patients.

Characteristic	HK patients (*N* = 22)		Non-HK patients (*N* = 18)	
	Number	%	Number	%
SumT = 0	13	59.1	16	88.9
SumT ≥ 1 (SumT = 1 and SumT = 2)	9	40.9	2	11.1

including passive aggressive personality. Passive aggressive personality can be described as critical in social situations with extra-punitive expression (20). Persons with this personality tend to express anger and aggression in more indirect ways. The present result suggests that persons with hikikomori condition are more likely to express their aggressive feelings in more indirect ways.

FC in CS is known to indicate the tendency to adjust emotions to others and the environment, or the likeliness to suppress emotional expressions when a person is moved or shaken up by social situations (12, 21). Based on the standard textbook interpretation, persons with larger FC tend to control their feelings and to express emotions indirectly and/or implicitly (12). Larger FC is related to the above-mentioned high passive aggressiveness. Thus, our finding of larger FC in HK patients may explain the deeper psychological mechanism of high passive aggressiveness in hikikomori. Based on these outcomes, we propose that it is important to acquire the skill to express emotions more directly and effectively in terms of hikikomori treatment and prevention. Future intervention approaches such as assertive training should be developed and applied in the clinical practice and prevention of hikikomori.

Texture-related response in CS represents needs and openness to close emotional relationships. SumT, the total number of texture-related responses, was larger in HK patients compared with non-HK patients in the present study. Interestingly, the frequency of SumT ≥ 1 in HK patients was significantly higher (40.9%) than in non-HK patients (11.1%). According to the standard interpretation of CS, this result can be interpreted that persons with hikikomori condition tend to have affirmative view toward others and expect more close emotional relationships (21). However, this interpretation may be contradictory to the actual behaviors of social withdrawal. We suppose the contradictory may be related to sociocultural background. According to the CS database of Japanese normal adults (n = 400), SumT = 0 appears among 57% of Japanese healthy adults, SumT = 1 appears among 29%, and SumT = 2 appears among 14% (22). Considering Japanese sociocultural background, persons with SumT = 1 may have emotional relationship with others based on need for affection and try to maintain the relationship (22). On the other hand, Takahashi et al. reported that Japanese persons with SumT = 1 can also be interpreted that they are not satisfied with the present social relationship and thus are strongly seeking close emotional relationships (22). In the present study, the frequency of SumT ≥ 1 in HK patients was significantly higher (40.9%) than in non-HK patients (11.1%; $p < 0.05$). What is this result showing?

Based on the above (22), we herein propose that strong feeling of loneliness in persons with hikikomori condition may lead to longing for close emotional relationships.

Another notable point is that texture-related responses in CS are known to be related to attachment, dependence, and psychological reliance especially based on experiences between a child and a caregiver (mainly mother) in childhood (12). Interestingly, [SumT > 1] is one of the criteria in the Coping Deficit Index (referred to as CDI) in CS (12). A person with high CDI is regarded to have difficulties in adjusting to social situations (12). In the present study, 91% of HK patients lived with others (mainly with parents). A survey by the Japan's Cabinet Office showed that many persons with hikikomori condition are under protection of their family both physically and financially (23). Therefore, we propose that some persons, who have high desires for basic affection and emotional support, may tend to withdraw into their home when they cannot satisfy their needs for basic affection and emotional support in social situations such as school and the workplace.

On the other hand, food content (Fd) is another CS variable related to dependence and psychological reliance. If an adult shows Fd ≥ 1, in the standard textbook interpretation, the person tends to show more dependent behaviors than expected (22). In other words, persons with more Fd tend to expect others to be tolerant and to act for their demands. According to the CS database of Japanese normal adults (n = 400), Fd = 0 appears among 65% of Japanese healthy adults, Fd = 1 appears among 26%, and Fd ≥ 2 appears among only 9% (22). Interestingly, in the present study, 13 HK patients (59%) and 15 non-HK patients (83%) showed Fd ≥ 1, but no significant difference was found between HK patients (Fd mean = 0.82, Mdn = 1) and non-HK patients (Fd mean = 1.11, Mdn = 1). According to a previous study by Schefar [as cited in Ref. (12)], Fd is related to desire for oral-phase dependence (12). Therefore, Fd response may indicate an immature and undifferentiated desire for dependence and one-sided dedication. On the other hand, texture-related response represents sense of touch such as a silk-soft feel or wrinkled hand, which needs self-others differentiation (24). Texture-related responses are produced based on experience of touching/being touched (12). Therefore, persons with texture-related response may have an affirmative impression of touching and ask for relationship with others.

Both HK patients and non-HK patients may have immature and undifferentiated desire for dependence and one-sided dedication, to some extent. However, some of HK patients may be simultaneously more open to have emotional relationship with others. Based on the above, our finding suggests Japanese clinical patients, even though with or without hikikomori condition, may tend to have an immature and undifferentiated desire for dependence and one-sided dedication.

These behavioral patterns have previously been discussed in line with "amae" proposed by Japanese psychoanalyst Takeo Doi (4, 8, 25, 26). The concept of "amae" has been studied as an origin of interdependence between mother and child in Japanese culture, and as a desire to obtain integrated feelings through passive communication with each other (25). The point is that persons with hikikomori may protect themselves by staying in primitive interdependent relationships with significant others (especially mother), even when they come to enter adulthood that requires social engagement as an independent self. Our findings also suggest a psychological aspect of hikikomori as they expect others to presume their feelings and thoughts without their own assertion. This aspect may make it difficult to face and deal directly with problems in social life.

A previous study has suggested difficulty in revealing pathological aspects of dependence such as "amae" in Japanese society (27). Interestingly, there are no significant differences of dependent personality traits between HK patients and non-HK patients using the self-rated questionnaire. The present study suggests CS to be an insightful tool clarifying deeper psychological characteristics and society-based unconscious aspects such as "amae," which are difficult to assess solely through self-rated scales.

From the above, our findings suggest that hikikomori phenomenon may have the aspect of coping behaviors to satisfy one's desire for dependence. We assume at least some persons with hikikomori condition have the groundwork of counting on others, when confronting difficulties. Furthermore, tendency to regulate expressing emotions can be understood as one's ability to try to adapt oneself the environment. However, if a person suppresses his/her feelings and controls emotional expression too much, he/she may easily get exhausted. Especially when he/she can only express his/her anger and aggression indirectly or implicitly, his/her social interaction may become filled with frustration. Difficulty in making the shift from primitive dependence and attachment on significant others may lead to avoiding hardship in social interaction and prolonging the period of hikikomori condition. We propose it is important to notice that not all persons with hikikomori avoid emotional relationship with others. The groundwork of counting on others may be a key to support for hikikomori sufferers.

LIMITATION AND FUTURE PERSPECTIVES

The present study has some limitations. The main limitation is small sample size. Next, participants had a variety of psychiatric disorders and socioeconomic backgrounds. In the present study, we found quite different personality tendencies between HK patients and non-HK patients, by regulating the two groups according to *DSM-IV* axis I diagnoses. However, we did not consider personality tendencies, because of the small sample size. Our findings imply that personality traits are strongly related to hikikomori phenomenon. Future research regulating samples according to SCID-II personality traits is warranted to address the unconscious-level characteristics of hikikomori and non-hikikomori beyond artificial personality traits. The third limitation is the validation process of CS scores. In the present study, the CS administrator (AI) evaluated the tentative CS scores and finally validated by obtaining the consensus with another psychologist (RK). More standardized validation methods should be applied for future research. Finally, we did not use multiple test correction to avoid the risk of false negatives, as the purpose of this study was the inclusive analysis of CS variables and hikikomori to serve exploratory pilot outcomes for future validation (25). We successfully grasped valuable CS variables with statistically significant difference. Since candidate variables related to hikikomori phenomenon have been identified, future

validation study, especially focused on CS variables and clusters related to emotional regulation, dependence, and relationships with others, is warranted. Moreover, clinical studies with greater sample size should be conducted to validate our preliminary findings and psychological aspects and hikikomori in more detail.

In conclusion, we propose the psychological characteristics of hikikomori as follows: 1) difficulty in expressing emotions and feelings directly (according to the result of passive aggressive personality trait and large FC), 2) difficulty in becoming independent from relationships based on strong desire for basic affection and emotional support (according to the result of large SumT), and 3) expecting others to presume his/her feelings and thoughts without his/her own assertion (according to the result of FC, SumT, and Fd). Future research should be conducted whether FC, SumT, and Fd in CS could be predictive indicators when evaluating deeper personality aspects of each patient with hikikomori and selecting precision treatments for him/her. Since limited empirical research has been conducted regarding hikikomori, CS has potential for application in clinical research settings with greater sample size, such as comparisons of therapeutic effects among several treatments.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of Ethical Guidelines for Medical and Health Research Involving Human Subjects, published by Japan's Ministry of Health, Labor, and Welfare, and the ethics committee of Kyushu University with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the ethics committee of Kyushu University.

AUTHOR CONTRIBUTIONS

The corresponding author TK contributed to the conception and design. TK, AI, RK, KK, HK, and NK contributed to the investigation. RK, AI, SI, HK, and TK contributed to the data checking, analysis, and interpretation of data. FF and NK checked the process of interpretation of data and data analysis. RK, AI, and TK drafted the article, and HK, NK, FF, SI, and SK revised it critically for important intellectual content. All the authors provided final approval of the version to be published.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2019.00412/full#supplementary-material

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Internet Addiction, Smartphone Addiction, and Hikikomori Trait in Japanese Young Adult: Social Isolation and Social Network

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Background: As the number of internet users increases, problems related to internet overuse are becoming more and more serious. Adolescents and youth may be particularly attracted to and preoccupied with various online activities. In this study, we investigated the relationship of internet addiction, smartphone addiction, and the risk of hikikomori, severe social withdrawal, in Japanese young adult.

Methods: The subjects were 478 college/university students in Japan. They were requested to complete the study questionnaire, which consisted of questions about demographics, internet use, the Internet Addiction Test (IAT), the Smartphone Addiction Scale (SAS)–Short Version (SV), the 25-item Hikikomori Questionnaire (HQ-25), etc. We investigated the difference and correlation of the results between two groups based on the purpose of internet use or the total score of each self-rating scale, such as screened positive or negative for the risk of internet addiction, smartphone addiction, or hikikomori.

Results: There was a trend that males favored gaming in their internet use while females used the internet mainly for social networking *via* smartphone, and the mean SAS-SV score was higher in females. Two-group comparisons between gamers and social media users, according to the main purpose of internet use, showed that gamers used the internet longer and had significantly higher mean IAT and HQ-25 scores. Regarding hikikomori trait, the subjects at high risk for hikikomori on HQ-25 had longer internet usage time and higher scores on both IAT and SAS-SV. Correlation analyses revealed that HQ-25 and IAT scores had a relatively strong relationship, although HQ-25 and SAS-SV had a moderately weak one.

Discussion: Internet technology has changed our daily lives dramatically and altered the way we communicate as well. As social media applications are becoming more popular, users are connected more tightly to the internet and their time spent with others in the real world continues to decrease. Males often isolate themselves from the social community in order to engage in online gaming while females use the internet as to not be excluded from

their communications online. Mental health providers should be aware of the seriousness of internet addictions and hikikomori.

Keywords: internet addiction, smartphone addiction, behavioral addiction, hikikomori, social withdrawal

INTRODUCTION

The number of internet users in Japan has exceeded 100 million and continues to grow. Internet technology has changed our daily lives dramatically. Adolescents and youth may particularly be attracted to and preoccupied with various online activities. A nationwide survey conducted by the Ministry of Internal Affairs and Communications of Japan (MIAC) in 2017 demonstrated that 96.9% of teenagers in Japan use the internet on a daily basis (1).

As the number of internet users increases, problematic internet use, or internet addiction, has been rising as well. The term internet addiction has been used frequently and casually to describe individuals with severe internet overuse or problematic internet use (2–5). Kimberly Young, an American psychologist, initially proposed provisional diagnostic criteria for subjects with problematic internet use with her naming of "internet addiction" in reference to *Diagnostic and Statistical Manual of Mental Disorders* (DSM) IV (6) criteria for substance dependence in 1996 (7). Two years later, Young revised her definition of internet addiction, which made it more similar to an impulse control disorder in DSM-IV (8). It has been controversial whether internet addiction is a clinical entity in psychiatry since Young's proposal about two decades ago (5, 9–11). Internet addiction has not been listed as a psychiatric disorder in the DSM-5 in 2013 (12) nor the International Classification of Diseases (ICD)-11, which was released in June 2018 (13). However, after thorough discussion, some regard it as one type of behavioral addiction and this attitude seems to be the majority (3, 14–16).

In recent years, internet access has been changing. The results of the MIAC survey (n = 38,630) reported that 59.7% of users access the internet through a smartphone, while 52.5% of them use the internet *via* desktop and/or laptop computers (1). Dominance of the smartphone is more prominent in younger age groups compared to senior age groups. A lot of teens have their smartphones with them throughout the day due to smartphones having superb mobility and multifunction capability. They can connect to the internet anytime and anywhere.

This phenomena of a rapid increase of smartphone users can be observed throughout the world. With more people using smartphones, problems regarding smartphone overuse become more serious. On these backgrounds, the concept of smartphone addiction has attracted the attentions of researchers from several countries (17–22), while debate about whether it is one of the behavioral addictions or not has been lasting (23).

Our previous study demonstrated that male internet users favored online gaming while female users were online for social networking services (SNSs) *via* their smartphones (24–26). The results from a national survey conducted by MIAC in 2013 also came to a similar conclusion; in that male users preferred playing games on the internet while female users mostly used it for communications with their friends (27). It is notable that 68.4% of teenagers use SNSs, according to the MIAC survey (1). It appears that adolescents and youth maintain their friendship primarily by communicating on the internet, especially young women.

Hikikomori phenomena, severe social withdrawal, is one of the most serious social concerns in Japan over the last two decades (28, 29). The concept of hikikomori was first introduced to the public when a Japanese psychiatrist, Tamaki Saito, published a book in 1998 with the name in its title (30). In his book *Social Withdrawal (Shakaiteki Hikikomori)*, Saito defined hikikomori provisionally as "those who withdraw entirely from society and stay in their own homes for more than six months, with onset usually during the latter half of their twenties, and for whom other psychiatric disorders do not better explain the primary causes of this condition." Since then, hikikomori has attracted the interest of researchers and a few epidemiological studies have been carried out in Japan. In 2006, the World Mental Health Japan Survey reported that the prevalence of hikikomori was approximately 1.2% of the Japanese population and 232,000 families had ongoing hikikomori subjects (31).

In response to social needs for development of effective interventions to hikikomori, Japan's Ministry of Health, Labor and Welfare (MHLW) published a guideline for hikikomori in 2010 (32). In this guideline, hikikomori is defined as "a situation where a person without psychosis is withdrawn into his/her home for more than six months and does not participate in society such as attending school and/or work." In accordance with this definition, several studies have been conducted, including well-structured multinational studies (33–37), and social interest in hikikomori phenomena has been growing around the world.

Japanese government pays much attention to hikikomori and regards this phenomenon to be of high importance. The Cabinet Office of the Japanese government published results of their study on lifestyle of the youth in 2016 and reported that the number of hikikomori was estimated to be 176,000 in a narrow sense (core hikikomori) and 541,000 in a broad sense (the total of both core hikikomori and on the verge of hikikomori) (38). In the definition of this report, pre-hikikomori condition means people who spend most of the time in their own room or home but go out for shopping at convenience stores near their houses. In contrast with the original concept of hikikomori, the recent concept of hikikomori allows the subjects with hikikomori to avoid going out but still have social contact with others over the internet (39). To prevent development of severe hikikomori, early detection and early intervention to pre-hikikomori is an important issue of the society.

Gradually, hikikomori phenomena gained attention from both Japanese and foreign researchers, as well as several academic papers that were published even outside of Japan (40–50). Recently, most of hikikomori subjects are using internet in common while

they are shutting themselves in their own homes. Some papers are suggesting the close relationship between internet addiction and hikikomori (43, 49).

In this study, we investigated the relationship between internet use and hikikomori trait in Japanese young adults.

METHODS

Data presented in this study were collected as part of a multicenter study for the development of effective interventions to hikikomori, a severe social withdrawal syndrome, which is directed by one of the co-authors of this paper (TK).

Subjects

The subjects of this study were 487 college and university students in Sapporo and its environs, Japan. All colleges and universities are private, and their deviation scores are average or a little below the average. Research collaborators for data collection were recruited through personal connections of the first author of this paper (MT). Nine teachers from three universities and six colleges agreed to participate in this study voluntarily and distributed questionnaire sheets as a printed matter in their classrooms. In this study, the subjects received the questionnaire sheets and filled out the questionnaire completely in the classroom.

Study Questionnaire

The study questionnaire consisted of questions about demographics (age, gender, etc.), internet use (length of internet use on weekdays and weekends, purpose of internet use, favorite SNS, etc.), Young's Internet Addiction Test (IAT) (51), the Smartphone Addiction Scale (SAS)–Short Version (SV) (17, 18), the 25-item Hikikomori Questionnaire (HQ-25) (52), and Tarumi's modern-type depression trait scale; Avoidance of social roles, Complaint and low Self-esteem (TACS) (53). The results of TACS were excluded from statistical analyses for this paper because validity and reliability of this scale were not yet confirmed at the time of writing this paper.

It took about 15 to 20 min for respondents to complete the questionnaire. A research collaborator at each study site was watching and waiting in the classroom to support respondents upon their requests.

Smartphone Addiction Scale–Short Version

The original version of the SAS was developed as a self-report scale in South Korea (18). The standard SAS includes 33 questions that assess six factors relating to smartphone overuse on a six-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). Kwon et al. also developed the short version of SAS (SAS-SV) by extracting 10 questions from standard SAS to use it as a smartphone addiction screener in adolescents (17). Medical professionals, including the developer of SAS, confirmed the validity of the SAS-SV by having an interview with randomly selected subjects in South Korea. In translating the SAS-SV into Japanese, there was a little modification by inserting the term LINE (54) into the sentence of Q8 in the standard SAS: "Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook."

SAS and/or SAS-SV has been translated into Chinese, Malay, Arabic, Brazilian-Portuguese, Spanish, and French (55–59). The reliability and validity of the translated version of SAS have been examined in several countries. An investigation of the reliability and validity of the Japanese version of the SAS and SAS-SV has been in progress (60).

Young's Internet Addiction Test

Young's IAT has 20 items regarding internet overuse. All items begin with the phrase "How often do you…", e.g., "How often do you try to cut down the amount of time you spend online and fail?" Respondents are requested to choose one of the following scores: 5 = always, 4 = often, 3 = frequently, 2 = occasionally, and 1 = rarely. The IAT has been used to measure the severity of internet addiction. The total score of IAT ranges from 20 to 100. In the present study, we classified the level of internet addiction according to the cutoff points previously reported by Young (51) and by referring to previous studies by Japanese researchers (61–63). In this study, the total IAT scores for each group were less than 40 points for the average online user, 40 to 69 for possibly addicted to the internet, and 70 to 100 points for severe internet addiction. The reliability and validity of the Japanese version of the IAT have been investigated (64, 65).

The 25-Item Hikikomori Questionnaire

The HQ-25 was developed as a self-administered instrument for assessing severity of symptoms of hikikomori over the preceding 6 months (52). The HQ-25 consisted of 25 questions regarding psychological features and behavioral patterns of typical hikikomori syndrome, such as lack of social connectedness, active social isolation or withdrawal behavior, avoidance of social contact, and a sense of alienation from society. All items of HQ-25 were rated on a scale ranging from 0 (strongly disagree) to 4 (strongly agree). Among 25 items, 6 items need to be reverse-scored to create a total scale score. The HQ-25 has a score range of 0–100. Developers of HQ-25 proposed a cutoff score of 42 (out of 100), which was associated with a sensitivity of 94% and specificity of 61% in their clinical study.

Statistical Analysis

Questionnaire sheets with blank answer(s) were excluded from statistical analyses. As a result, 24 out of 511 collected sheets were excluded.

Statistical analyses were completed using StatFlex Ver.6. Welch's t-test was used to compare the mean of two groups. Pearson's correlation coefficient was calculated to investigate the association between two factors. In all cases, statistical significance was set at $p < 0.05$.

Ethics

This study was approved by the ethics committee of Specified Medical Corporation Sapporo Yushin-no-sato Tokiwa Hospital. The study's aim was stated on the cover page of the questionnaire

sheets that requested voluntary respondents to answer all questions anonymously. Answering the questions was deemed to constitute consent.

RESULTS

There were 487 respondents (132 male, 355 female) who completed study questionnaires. The mean age was 19.6 ± 1.5 (males 20.2 ± 1.8/females 19.4 ± 1.4) years with an age range between 18 and 28. Summary of the results are shown in **Table 1**.

Internet Use

The mean length of internet use was 4.86 ± 3.1 (males 4.80 ± 3.2/females 4.89 ± 3.1) h on weekdays and 6.82 ± 4.1 (males 6.71 ± 4.2/females 6.86 ± 4.0) h on weekends without statistically significant differences in gender. The most common purpose of internet use was SNS in both genders (40.9% among males, 70.1% among females, 62.2% among all subjects), followed by video-sharing and gaming. The rate of internet use for gaming was higher among males (18.9%) than females (4.8%).

Participants were also asked what SNS they preferred out of LINE, Twitter, Facebook, Instagram, and others. LINE was selected as the most popular SNS application by both male and female groups (66.7% among males, 55.8% among females, 58.7% among all subjects) followed by Twitter among males (17.4%) and Instagram among females (29.4%).

Smartphone Addiction Scale–Short Version

The overall SAS-SV scores were 29.6 ± 8.8 (the total score distributed from 10 to 59) for all subjects, 27.4 ± 8.2 for males, and 30.4 ± 8.9 for females. Female subjects had a significantly higher SAS-SV score than males. This finding was consistent with results from previous studies in South Korea (17, 18). Kwon and his group proposed gender-specific SAS-SV cutoff points for males (a cutoff value of 31) and females (a cutoff value of 33). According to the proposed cutoff points, 48 out of 132 male subjects (36.4%) screened positive and 146 out of 355 female subjects (41.1%) screened positive as well.

Young's Internet Addiction Test

Concerning the IAT, the overall score was 41.0 ± 13.1 (the total score distributed from 0 to 86), with 255 respondents (52.4%) regarded as the average online users (IAT <40), 216 (44.4%) regarded as possible addiction (IAT 40 to 69), and 16 (3.3%) regarded as severe addiction (IAT 70 and higher). Referring to previous studies that classified subjects with 70 or higher on the IAT as severe

TABLE 1 | Summary of the results.

	Whole	Male	Female	p value
	(n = 487)	(n = 132)	(n = 355)	
Age	19.6 ± 1.5	20.2 ± 1.8*	19.4 ± 1.4	*p < 0.0001
Internet use (h)				
Weekdays	4.86 ± 3.1	4.80 ± 3.2	4.89 ± 3.1	p = 0.7947
Weekend	6.82 ± 4.1	6.71 ± 4.2	6.86 ± 4.0	p = 0.7182
Purpose (%)				
Gaming	42 (8.6)	25 (18.9)	17 (4.8)	
SNS	303 (62.2)	54 (40.9)	249 (70.1)	
Video-sharing	101 (20.7)	38 (28.8)	63 (17.8)	
Music	23 (4.7)	9 (6.8)	14 (3.9)	
Web searches	13 (2.7)	4 (3.0)	9 (2.5)	
Others	5 (1.0)	2 (1.5)	3 (0.9)	
Favorite SNS (%)				
LINE	286 (58.7)	88 (66.7)	198 (55.8)	
Twitter	70 (14.4)	23 (17.4)	47 (13.2)	
Facebook	6 (1.2)	2 (1.5)	4 (1.1)	
Instagram	117 (24.0)	13 (9.9)	104 (29.4)	
Others	8 (1.7)	6 (4.5)	2 (0.6)	
SAS-SV	29.6 ± 8.8	27.4 ± 8.2	30.4 ± 8.9*	*p = 0.0005
Above cutoff	194 (39.3)	48 (36.4)	146 (41.1)	
IAT	41.0 ± 13.1	41.8 ± 15.5	40.7 ± 12.2	p = 0.4729
<40	255 (52.4)	66 (50.0)	189 (53.2)	
40≤ IAT <70	216 (44.4)	58 (43.9)	158 (44.5)	
70≤	16 (3.3)	8 (6.0)	8 (2.3)	
HQ-25	28.1 ± 16.3	29.5 ± 16.9	27.5 ± 16.1	p = 0.2552
<42	379 (77.8)	103 (78.0)	276 (77.8)	
42≤	108 (22.2)	29 (22.0)	79 (22.3)	

*$p < 0.05$.

internet addiction (51), 3.3% of our subjects were IA. Mean IAT scores and the number of subjects (%) in respective score ranges on IAT (average online uses, possibly addicted and severely addicted to the internet) in each gender were as follows: 41.8 ± 15.5, 66 (50.0%), 58 (43.9%), and 8 (6.0%), respectively, among males; and 40.7 ± 12.2, 189 (53.2%), 158 (44.5%), and 8 (2.3%), respectively, among females. Statistical analyses revealed non-significant difference in the mean IAT score.

The 25-Item Hikikomori Questionnaire

The overall HQ-25 scores were 28.1 ± 16.3 (the total score distributed from 0 to 82) for all subjects, 29.5 ± 16.9 for males, and 27.5 ± 16.1 for females. There was no difference in the HQ-25 scores between males and females (Welch's t-test, p = 0.2552). Based on the cutoff score proposed by the developer of HQ-25, in the male group, 29 out of 132 subjects (22.0%) had scores indicating being at risk for hikikomori.

Two Group Comparison between Gamers and SNS Users

We analyzed the results of this study by making two groups according to the main purpose of internet use, gaming, and SNS. **Table 2** shows the summary of the results. Regarding the mean length of internet use in both weekdays and weekends, mean IAT score, and mean HQ-25 score, all of them were significantly longer and higher in the subjects who used the internet primarily for gaming. The only result that did not show significance was the mean SAS-SV score.

The two group comparison between male gamers (n = 25) and male SNS users (n = 54) demonstrated that male gamers used the internet significantly longer in the weekend (9.00 ± 5.0 vs 6.30 ± 4.1, p = 0.00256) and scored significantly higher on IAT (48.2 ± 18.1 vs 38.7 ± 12.9, p = 0.0245), SAS-SV (30.6 ± 8.1 vs 26.2 ± 8.1, p = 0.0285), and HQ-25 (32.9 ± 17.8 vs 21.9 ± 11.5, p = 0.0082), compared to male SNS users, although there was not a significant difference in the length of internet use in weekdays (6.32 ± 3.8 vs 4.61 ± 3.2, p = 0.0593).

TABLE 2 | A two-group comparison between gamers and SNS users.

	Gaming (n = 42)	SNS (n = 303)	p value
Age	20.1 ± 1.4*	19.4 ± 1.4	*p = 0.0043
Internet use (h)			
Weekdays	6.40 ± 4.1*	4.85 ± 3.1	*p = 0.0211
Weekend	8.86 ± 5.2*	6.70 ± 3.9	*p = 0.0136
SAS-SV	32.1 ± 7.9	30.1 ± 8.8	p = 0.1317
Above cutoff	23 (54.8)	118 (38.9)	
IAT	49.6 ± 15.8*	39.7 ± 11.9	*p = 0.0003
<40	12 (28.6)	173 (57.1)	
40≤ IAT <70	25 (59.5)	124 (40.9)	
70≤	5 (11.9)	6 (2.0)	
HQ-25	36.3 ± 17.8*	24.7 ± 14.2	*p = 0.0002
<42	27 (64.3)	257 (84.8)	
42≤	15 (35.7)	46 (15.2)	

*p < 0.05.

Hikikomori Trait and Internet Addiction

Two-group comparisons were performed between the subjects who scored 42 and higher on HQ-25 (at high risk for hikikomori) and those with an HQ-25 score of less than 42 (low hikikomori-trait). The results are shown in **Table 3**. Subjects with high risk for hikikomori scored significantly higher on both SAS-SV and IAT, and used the internet longer than subjects with low risk for hikikomori.

Correlation among HQ-25, SAS-SV, and IAT

We investigated the correlation between two of the following three factors in this study: HQ-25, SAS-SV, and IAT. The association between two factors was examined by calculating Pearson's correlation coefficient. Correlations between IAT and SAS-SV (**Figure 1**), HQ-25 and SAS-SV (**Figure 2**), and HQ-25 and IAT (**Figure 3**) were analyzed. The correlation coefficient was 0.6931 (95% confidence interval, 0.6439 - 0.7366) (p < 0.00001) for IAT and SAS-SV, suggesting a relatively strong positive correlation. A weak correlation was observed between HQ-25 and IAT (r = 0.3905, 95% confidence interval, 0.3125 - 0.4633, p < 0.00001). However, between HQ-25 and SAS-SV, we could scarcely find a correlation (r = 0.1636, 95% confidence interval, 0.0758 - 0.2488, p = 0.00029).

DISCUSSION

Internet addiction is characterized by excessive and problematic internet use and clinical features of behavioral addiction: preoccupation, compulsive behavior, lack of control, and functional impairment. Internet addiction has been attracting increasing social interest because the problems related to internet use are becoming more and more serious. Recently, more than half of internet users in Japan access the internet through their smartphones. As the number of smartphone

TABLE 3 | A two-group comparison between subjects at high and low risk for hikikomori.

	At high risk for hikikomori (n = 108)	At low risk for hikikomori (n = 379)	p value
Age	19.8 ± 1.9	19.5 ± 1.4	p = 0.0681
Internet use (h)			
Weekdays	5.48 ± 3.7*	4.66 ± 2.9	*p = 0.0298
Weekend	7.71 ± 4.4*	6.53 ± 3.9	*p = 0.0091
SAS-SV	31.2 ± 9.2*	29.1 ± 8.6	*p = 0.0302
Above cutoff	54 (50.0)	140 (36.9)	
IAT	47.6 ± 14.5*	38.9 ± 11.7	*p < 0.0001
<40	30 (27.8)	225 (59.4)	
40≤ IAT <70	69 (63.9)	147 (38.8)	
70≤	9 (8.3)	7 (1.9)	

*p < 0.05.

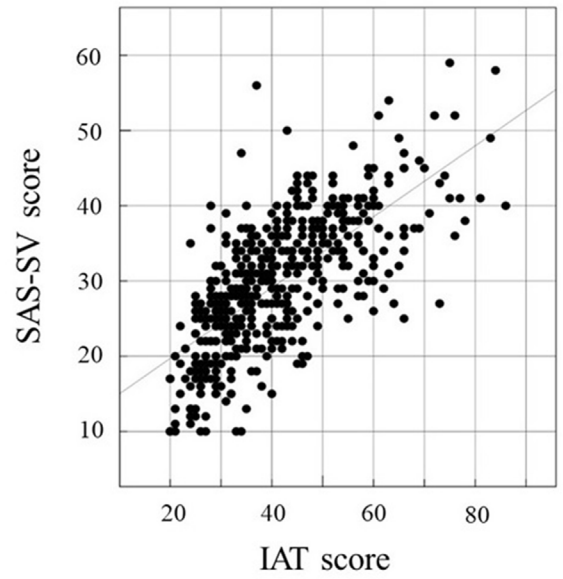

FIGURE 1 | Correlation of Internet Addiction Test (IAT) (51) score and Smartphone Addiction Scale–Short Version (SAS-SV) (17) score. The correlation coefficient was 0.6931 (95% confidence interval, 0.6439 – 0.7366, $p < 0.00001$).

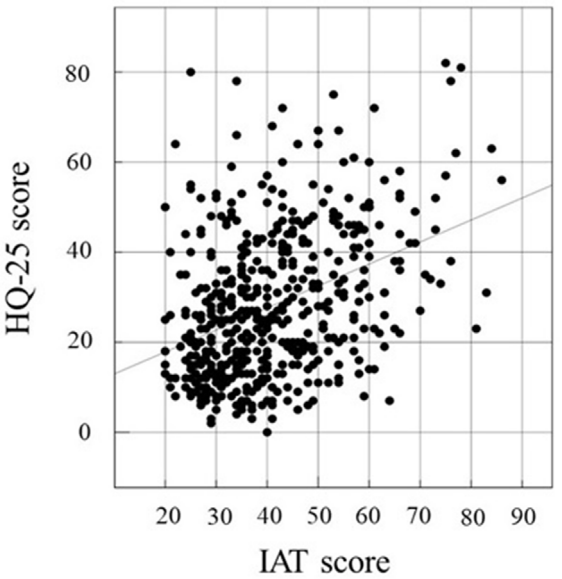

FIGURE 3 | Correlation of IAT (51) score and HQ-25 (52). The correlation coefficient was 0.3905 (95% confidence interval, 0.3125 – 0.4633, $p < 0.00001$).

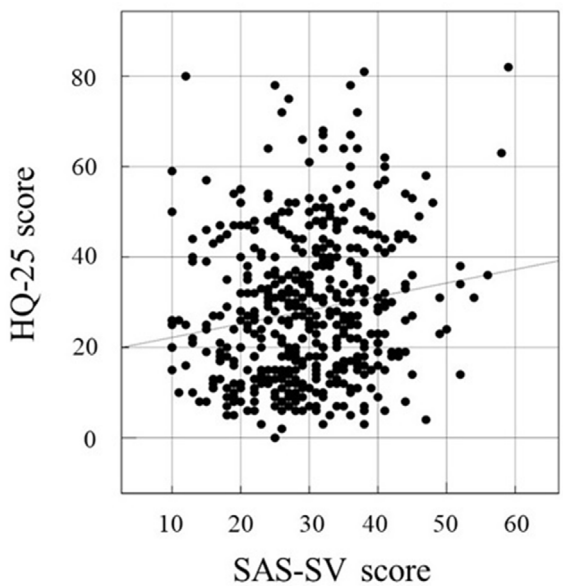

FIGURE 2 | Correlation of SAS-SV (17) score and 25-item Hikikomori Questionnaire (HQ-25) (52). The correlation coefficient was 0.1636 (95% confidence interval, 0.0758 – 0.2488, $p = 0.00029$).

users increases, problems related to smartphone use become more serious too. Neither internet addiction nor smartphone addiction are listed as a psychiatric disorder in the latest version of DSM and ICD. However, since internet addiction is a major public health problem, the Korean government implemented an online gaming shutdown policy in 2011 to prevent internet addiction in adolescents less than 16 years old and established many government-funded centers to support the recovery of the subjects with an internet addiction (66).

Excessive online gaming is the most common cause of internet addiction throughout the world. About one quarter of adolescent males use the internet to enjoy online gaming, according to the report by MIAC (27). Problematic internet use for gaming is a serious concern in many countries and sudden death cases in adolescents during gaming have been reported from several Asian countries. In response to increased awareness of the seriousness of pathological gaming, in the DSM-5, "Internet Gaming Disorder" is included in section III as "Conditions for Further Study," suggesting the possibility of it being recognized as an independent clinical entity in a future revision. Furthermore, the ICD-11 published in June 2018 included "Gaming Disorder" under the heading of "Disorders due to addictive behaviors." In ICD-11, gaming disorder is characterized by a pattern of persistent or recurrent gaming behavior, which may be online or offline, manifested by: 1) impaired control over gaming; 2) increasing priority given to gaming to the extent that gaming takes precedence over other life interests and daily activities; and 3) continuation or escalation of gaming despite the occurrence of negative consequences. The pattern of gaming behavior is of sufficient severity to result in significant functional impairment over a period of at least 12 months. Conceptualization of gaming disorder will facilitate future studies on this issue.

Results from our study revealed that users who mainly use the internet for gaming also use the internet significantly longer on both weekdays and weekends and their mean IAT score was significantly higher than those who use the internet for SNSs.

It is notable that the mean HQ-25 score in gamers was much higher than SNS users, but no statistically significant difference was found between these two groups on the mean SAS-SV score. A cross-country survey among adolescents reported that males favored playing games on a computer. It is presumed that they prefer online gaming on a computer with a larger screen and a connected controller specially designed for gaming, although they would play games on a smartphone outside of their homes. In general, most of the male gamers enjoy online gaming in their own rooms and some of them enjoy it with their friends while chatting online. Considering these findings, internet users for gaming, mainly male adolescents and youth, are relatively isolated and withdrawn and prefer gaming to social activity.

It is notable that the rates of the subjects who screened positive for hikikomori (22.2%) and smartphone addiction (39.8%) were relatively high despite the study subjects being healthy college/university students. The internet has changed our lives dramatically and has become a daily necessity globally. The mean age of the subjects was 19.6 ± 1.5 years old. Because the internet has become an indispensable tool for our daily lives in the last twenty years, all the subjects of this study have been exposed to advanced IT technology since their early childhood. The internet has altered the way we communicate with each other and asocial individuals might only need to make a minimal effort to communicate with their friends. Nowadays, social interactions tend to occur directly on the internet and the necessity of talking with their friends in person might be decreased. Young generations who have grown up with the internet could prefer to interact with others online rather than engage in interpersonal communication in the real world. Of course, our subjects were essentially not hikikomori cases because they were attending their classes. However, about one fifth of our subjects may potentially be psychologically withdrawn from the social network of their classmates despite not being physically withdrawn from the classroom. Regarding the high rate of positive screenings for smartphone addiction, since most of the youth have their smartphones with them anytime and anywhere, they might already be aware of their overuse. It could be common for them to have social interactions with their friends online through their smartphone.

As the number of the internet users increases, the number of SNS users becomes higher as well. The term "Facebook addiction" has been established and several studies on this theme have been published mainly from European countries (67–69). This concept emerged due to the fact that the number of active Facebook users is outstandingly high compared to other SNS sites (70). In Japan, because the number of LINE users is two-fold higher than Facebook among the youth (1), we need to monitor excessive and problematic use of LINE carefully.

LINE is the most popular SNS application among Japanese youth. It is used for sending text messages and making free calls, mainly on smartphones. Nowadays, people share their LINE ID in their basic contact details. Even in the classroom, at the beginning of the first term, students share their LINE IDs to make semi-official contact networks with classmates to share important information. Some of the enjoyable features of LINE may contribute to its popularity, including simplicity of setting up private and "closed" chat groups with other users, and sending LINE stickers or so-called "stamps," amusing graphic illustrations and emoticons. Our results showed that about 60% of our subjects chose LINE as their favorite SNS application. This rate of LINE users is consistent with results from a previous large-scale survey (1).

Several factors may inadvertently cause excessive LINE use among adolescent girls. One of them could be a "(has been) Read" sign. A "Read" sign shows up on sender's smartphone once a message has been read by other group members. LINE users might experience significant distress in this context. Message senders without prompt response from others could perceive they might be ignored or neglected intentionally, and vice versa. Message recipients could be obsessive about checking the screen and replying to the message promptly. Thus, they have their smartphone with them all day long being tied to the internet not to be excluded from the closed chat groups on LINE.

In this study, females scored significantly higher than males on SAS-SV and more than 40% of female subjects scored higher than the proposed cutoff point, suggesting that they might be addicted to their smartphone. Two-group comparisons between Gamers and SNS users showed that the subjects who use the internet for SNS scored significantly lower on HQ-25 and this result might suggest that they were more socially active to maintain the relationship with their friends than those who use the internet for gaming. In general, males favor online gaming while females use the internet primarily for chatting with peers on SNS applications *via* smartphone (25, 26, 71). As we mentioned earlier, young females continue to exchange messages throughout the day on LINE. However, social media applications in the closed online community could be a platform for cyberbullying. Bullying at schools is a serious social problem in Japan (72). In June 2013, a law against bullying, the Ijime Prevention Methods Promotion law, was enacted in Japan, requiring all schools to make efforts to prevent bullying and enable its detection for appropriate intervention at earlier stages. In this law, bullying is defined as "any physical or psychological assault, regardless of location, means or occasion, if the targeted victim suffers psychological distress." According to this definition, this law clearly includes cyberbullying. Cyberbullying can be triggered by subtle actions, such as someone not replying to a message after reading it. Because the pause after the "(has been) Read" sign could imply various meanings, like neglect or disregard, LINE users will check their smartphones obsessively and compulsively, craving a response. Socially sensitive female adolescents and youth are staying connected to the internet, whether they are enjoying it or not.

We also compared the results of two groups: at high and low risk for hikikomori. According to the cutoff score proposed by the developer of HQ-25, subjects who scored 42 and higher were grouped as high risk for hikikomori while those who scored less than 42 were treated as low risk for hikikomori group. Subjects in high risk for hikikomori group used internet much longer and scored significantly higher on both SAS-SV and IAT than those in low risk for hikikomori group. It has been reported that hikikomori phenomena are related to other psychiatric disorders, including developmental disorders (28, 31, 33, 34,

37). Internet addiction often has comorbid psychiatric and developmental disorders (73–77). It is possible that internet addiction and hikikomori have similar psychopathological backgrounds. Autism spectrum disorder (ASD) is characterized by two core features: impairments in social interaction and restricted, repetitive behavior. Attention deficit hyperactivity disorder (ADHD) is defined by three symptoms: inattention, hyperactivity, and impulsivity. Young initially proposed provisional diagnostic criteria for subjects with problematic internet use with her naming of "Internet addiction" in reference to DSM-5-TR criteria for substance dependence (51). After lively debate on conceptualizing problematic internet use as one type of behavioral addictions, Young revised her definition of IA and made it closer to an Impulse Control Disorder (8). Impulsivity has been associated with addictive behaviors in adolescents (78). Both ASD and ADHD often exist as comorbid conditions (79–81). Clinical features of these common developmental disorders, i.e., restricted and repetitive type of behavior and difficulty in controlling impulsivity, could contribute to internet addiction. Impairments in social interaction would be an important factor of hikikomori. Disconnection from relationships with friends as a result of pathological internet use will keep the subjects connected to the internet instead.

The argument that internet addiction could be a cause of hikikomori often ends up in a chicken or egg situation. However, there is no room for discussion about a fact that a large number of hikikomori subjects are online almost all through the day in their own rooms or houses. Not all but some youths with hikikomori traits are socially active only in virtual spaces on the internet as an anonymous internet user or by acting a different personality through an avatar, the graphical representation of the internet user. Many male internet users enjoy playing online games with "internet friends" without disclosing their personal information such as age, gender, place to live and name. They are connected with many "internet friends" while being online, but they could be socially isolated to some extent in their real lives. As for female internet users, they remain being online *via* smartphones so as not to be excluded from their communications on SNS applications such as LINE and seem to be socially active on the internet superficially. However, some of female SNS users are overwhelmed by a large number of messages and might be afraid of opening the social media application. Female internet users enjoy chattering *via* smartphones, but it is not uncommon for them to have an aversion to face-to-face communications with their friends in the real life. Some young females who are active in social interaction on SNS application often decline an invitation to a party or hesitate to go out for shipping with friends. They might be concerned about being humiliated by making a perceived mistake in their face-to-face conversation and tend to regard it as irretrievable. Youths could be traumatized more seriously by an undesirable event in the real life compared to what happened on the internet.

Recently, the concept of Modern-Type Depression (MTD) has been proposed and is getting more attention in Japan (82). Characteristics of MTD include situation-dependent depressive symptoms, a disposition to blame others, and strong avoidant tendencies including social avoidance (83). Youths with MTD could exhibit absenteeism from their work and spend much time on the internet. MTD has something in common with hikikomori in terms of avoiding social situations and could be a gateway condition that leads to hikikomori.

There are several limitations in this study. The sample size was limited, and only college and university students were invited to participate. It is impossible to generalize our results because of a significant sampling bias, including the lopsided male-female ratio of the study subjects. None of our subjects underwent a clinical interview. We did not use multiple measures to assess hikikomori condition. Loneliness and social isolation were not assessed in this study, although both of them are similar to hikikomori. It is difficult to distinguish internet addiction from excessive internet use precisely using self-rating scales. The scales used in this study, such as the SAS-SV, IAT, and HQ-25, have limited validity. We also did not assess for any formal diagnosis of psychiatric disorders in our subjects. The subjects at high risk for hikikomori group in this study were not in the essential hikikomori condition in its original meaning because they attended the classroom. Because this is not a longitudinal study but a cross-sectional study, we cannot confirm the stability of relationship among the variables assessed in this study.

To the best of our knowledge, this is the first study to investigate the relation among internet addiction, smartphone addiction and risk for hikikomori in Japanese young adults. As the number of internet and smartphone users increases, the problem of internet/smartphone addiction will become more prevalent in Japan, and one of possible sequelae of these conditions will be hikikomori. Mental health providers should be aware of the seriousness of behavioral addictions and hikikomori. Risk factors of hikikomori include internet addiction and instructions for appropriate internet use could be a protective factor. We envision that further studies will invite a larger number of subjects with a wider age range, as well as include a clinical interview to confirm the condition of internet/smartphone addiction and hikikomori.

ETHICS STATEMENT

The study protocol was approved by the ethics committee of Tokiwa Hospital prior to data collection. This study was conducted in accordance with the Declaration of Helsinki. The aim of this study was clearly stated on the first page of the anonymous questionnaire sheets. Response to the questionnaire was deemed indicative of consent.

AUTHOR CONTRIBUTIONS

MT contributed to the study design, data collection, data analysis, data interpretation and writing. AT contributed to the study design, data interpretation, and writing. WU and JK contributed to the data collection and data interpretation. RK and HK contributed to the data analysis and data interpretation. TK contributed to the study design, data interpretation, and writing.

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Female Gaming, Gaming Addiction, and the Role of Women Within Gaming Culture: A Narrative Literature Review

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Research investigating female gaming has begun to emerge despite gaming being traditionally more popular with males. Research in the 21st century has drawn attention to the role of women in culture, society, and technology, and female gaming is one of the growing phenomena not to have been researched in depth. The aim of the present paper was to review female gaming (i.e., the role of females within video game culture) and identify any associated psychopathological symptomatology. The review adapted the Sample, Phenomenon of Interest, Design, Evaluation, Research (SPIDER) model in conducting a narrative literature review. A search of three scientific electronic databases yielded 49 papers for further evaluation. From a methodological perspective, studies had to fulfill the following criteria to be included: i) published between the years 2000 and 2018; ii) assessed female gaming or the female position within gaming culture, iii) contained quantitative, qualitative, or mixed methods approaches to produce empirical data or discuss theoretical implications through reviews, iv) be retrievable as a full-text peer-reviewed journal paper, and v) published in English, German, Polish, Spanish, Italian, Portuguese, or French. Four categories emerged from the papers: i) the benefits of female gaming, ii) why women might play video games less than men, iii) perceptions and realities of female characters within video games, and iv) women's position in gaming culture. The main findings showed playing video games has benefits for women in terms of enhancing cognitive, social, and physical abilities. However, they are less encouraged to play video games due to negative expectations based on gender and/or experiences during game play. Video games are associated with stereotypical male characteristics, such as being overly aggressive, and frequently contain sexualized content. Female gamers appear to require coping strategies to handle online harassment. Females look for different things in video games, which are not often included in game designs thereby limiting their abilities. For instance, female avatar representation—which is exaggerated and hypersexualized—can prompt social comparisons and lead to feelings of decreased self-esteem, depression, and other impacts on well-being. Overall, there are still obstacles for women playing video games even though they comprise half of the gaming population.

Keywords: internet addiction, internet gaming disorder, gaming disorder, behavioral addiction, female gaming, gaming culture, narrative review

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INTRODUCTION

Over the past two decades, the number of female video game players has increased, and females today make up half of the gaming population according to both the Entertainment Software Association (ESA) (1) and the Interactive Software Federation of Europe (ISFE) (2). Simultaneously, research on addictive internet use has proliferated, and gaming disorder was recently recognized as a new mental health disorder (and a behavioral addiction) by the World Health Organization (3). Thus, gaming addiction is now officially a new psychopathology that has emerged as a consequence of the development and increasing popularity of video games and online technologies during the 21st century.

Despite the growing female gaming population, almost all research on gaming addiction is focused on male gamers. Currently, there is no agreement on the prevalence of gaming addiction due to its conceptualization and methodological problems within the research that has been conducted to date. This is because most research i) comprises surveys using non-representative samples (i.e., instead of using randomized samples, or other methodological approaches, such as classic experiments or mixed methods research); ii) uses different scales to assess problematic gaming [e.g., Problem Video Game Playing Questionnaire (4) for offline and online video gaming, Internet Gaming Disorder Scale–Short-Form (5)]; iii) uses scales and screens based on different addiction criteria (e.g., substance use disorder criteria, gambling disorder criteria); iv) uses different cutoff scores even when using the same instrument; v) utilizes different conceptualizations of gaming [e.g., problematic gaming, addictive gaming, internet gaming disorder (IGD), online gaming disorder, offline gaming disorder]; vi) assesses gaming without taking into account the various technologies and devices (e.g., computers, consoles, smartphones, and tablets); and vii) does not tend to take into account the different game genres played [e.g., massively multiplayer online role-playing games (MMORPGs), multiplayer online battle arena (MOBA) games, etc.].

For these reasons, the estimated prevalence rates of disordered gaming have been reported to range from 0.2% up to 34% (6), which is highly variable for a disorder. However, among samples using nationally representative data, the range is much smaller (up to 9% at most) (6). Higher prevalence rates are reported in Asian countries, especially in young adult males (7). However, very little attention has been paid to the societal and cultural parameters associated with gaming, even in cross-cultural studies. These tend to have a robust psychometric approach that usually guarantees measurement invariance across languages (8, 9) and focus on individual factors (10, 11). However, these recent studies suggest an integrative biocultural approach (i.e., to distinguish universal as opposed to culturally contingent dimensions of human suffering) as well as addressing socio-cultural factors and how these impact on mental health (in general) and problem gaming as a potential form of behavioral addiction (more specifically).

During the past decade, a few empirical studies have specifically researched female gaming (12–14). Through interviews and online diaries, Lewis and Griffiths (12), as well as McLean and Griffiths (15), highlighted that women usually play casual games typically for shorter periods compared with men. They take on their own female roles as gamers and have their own i) gaming experience and habits, ii) game motivations and choices, iii) technology preferences, and iv) gamer identity. In summary, this research has found that female casual gamers report i) peripheral knowledge from gaming [i.e., technical knowledge, games knowledge in First-Person Shooter (FPS) and MMORPGs]; ii) gaming as a domestic life priority (i.e., gaming as an activity influenced by shared vs. non-shared leisure pursuit, unsympathetic partner, facilitating social behavior; e.g., *Wii Walk It Out*); iii) gaming as a personal preoccupation (e.g., as routine in daily life, to satisfy an emotional need, for competition and/or self-challenge, as an enjoyable waste of time, or as a hobby); and iv) gaming and technology as gendered (i.e., concerns about gendered stereotypes) because female gamers characterize themselves as "tech-savvy" (which goes alongside social perceptions as "geeky guys" because gamer identity appears to be more associated with masculinity). However, it has also been found that women feel comfortable making technology purchases and consider age as a more important factor than gender, which appears to negatively affect older women who do not grow up with technologies and online video games. Finally, female identity is sometimes viewed as vulnerable and may underlie why some female gamers utilize male avatars in-game.

However, from a neuroimaging perspective, Wang and colleagues (14) recently found that females appear to be more vulnerable to online gaming addiction relative to males. The study tried to get a better understanding of sex differences relating to biological mechanisms underlying IGD, a proposed mental health disorder included in the final section of the latest (fifth) *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) by the American Psychiatric Association (16). They used the structural magnetic resonance imaging technique and detected a group-by-sex interaction. More specifically, they found that male and female IGD participants had increased and reduced cortical thickness, respectively, alongside their right posterior cingulate cortex (PCC) compared to same-sex recreational game players. Contrarily, male and female IGD participants reduced and increased cortical thickness, respectively, in their right PCC. Moreover, only females had negative correlations between cortical thickness and their self-reported cravings and IGD scores. These findings suggest that males and females are differently affected by IGD and that women are more vulnerable than men based on the effects created by IGD in the brain regions examined.

More recent quantitative studies analyzing IGD (17, 18) have found that the prevalence of disordered gaming appears to be more balanced than previous studies. For instance, a recent study (17) found differences between genders when comparing specific problematic internet uses, where the potential at-risk problem online gamers comprised 10.8% of the total sample (i.e., 5.3% males and 5.5% females). Moreover, how gaming preference affects IGD scores across genders has been also observed (18), where IGD was predicted by several variables with gender differences. This included time spent online, gaming motives, and depressive symptoms. For female gamers, IGD predictors included higher time spent online, higher scores on specific gaming motives (i.e., escape and competition), together with significant depressive symptoms, compared with male

gamers [e.g., whose IGD predictors were two types of motives to play online video games (i.e., escape and coping), together with higher depressive symptoms than females].

Another gender issue in IGD concerns gaming preference across genders. For example, the respective game genre that individuals play has a different effect on IGD score depending upon the player's gender, although results are contradictory (e.g., men appear to prefer MMORPGs, while women appear to prefer casual video games) (18). For men, coping is a predictor of IGD, while for women, competition is a predictor, whereas escapism is a predictor of IGD in both genders. However, in a recent quantitative study concerning female gaming, women who played video games also reported spending more time on role-playing games, MMORPGs, FPS games, simulation games, action-adventure games, casual games, and MOBA games. Moreover, achievement and social motivations were predictors of IGD and daily time spent online (19). Thus, the preferred game genre may explain differences between genders in terms of time spent gaming (e.g., especially FPS games, MMORPGs, and MOBA games) and IGD scores (e.g., especially MMOPRGs and MOBA games), at least among female gamers (19).

Clinicians treating gaming addiction have reported that this mental disorder may go unnoticed in females (20) and that women being treated for this problem appear to show differences in the experience of other psychopathologies (including IGD and other addictions) compared with men (21). Nevertheless, problematic and potentially pathological gaming in women has rarely been addressed in either theoretical work or empirical research.

With respect to the scarce literature on female gaming and female gaming culture (22), women are arguably situated outside of video game culture (i.e., they are not part of traditional masculine gaming culture) (18, 19), which results in a low gamer identity profile (and is a reason why women may choose a male avatar while gaming or is more competitive than male gamers), and needs to take into account about how and why female gaming can become stigmatized. Women are often discriminated against by male players, which also discourages women from labeling themselves as gamers (13).

A number of comprehensive narrative reviews have been undertaken regarding the phenomenon of female gaming relating to gaming culture. According to male gender stereotypes, women are not considered as "true" or "hard-core" gamers (where video game skill is viewed as the main defining feature of a "gamer," e.g., playing more complex and competitive video games on dedicated consoles, identifying with the gaming community, and sometimes engaging in competitive electronic sports where gamers can earn money in international tournaments), mainly because they appear to play more casually and less skillfully compared to their male counterparts (23). However, this depends on how "gamer" is defined and the fact that most professional gamers are male. Furthermore, female players who achieve a high level of skill and competence are invisible and/or actively marginalized and may be problematic in terms of the conceptualization of "female gamer."

Moreover, the association between representation of women within video games and their well-being has been recently studied (24). Findings showed female gamers report self-objectification and consequently perceive low levels of self-efficacy, which was corroborated by both genders (e.g., female characters are usually subordinate to the male hero, in addition to being objectified and hypersexualized). Nevertheless, solutions to some of the effects of stereotype threat on females' gaming performance have been demonstrated *via* experiments. Kaye and Pennington (25) examined the impact of stereotype threat on female online gamers' performance (i.e., situations in which individuals' performance may be hindered by stereotype-salient cues), and whether manipulating the availability of multiple social identities (i.e., personal self and the self as a product of valued social groups) is established effectively for eliminating these performance decrements. Findings showed that stereotype-threatened females underperformed on the gaming task relative to males in the control condition (e.g., prejudice in online video games), and the intervention of multiple social identities appeared to protect females' gaming performance from stereotype threat (e.g., *via* more supportive gaming communities through inter-group cooperative tasks).

Thus, two types of harms appear to be associated with female gaming at present: i) the personal harm of potential gaming addiction at an individual and psychopathological level, and ii) the societal harm of stigmatizing female gaming at a community and psychosocial level. To date, few studies have focused on the second type of harm studies, and even fewer have examined gaming behaviors based on individual gamers' perceptions and potential risk of psychopathology, such as gaming addiction [e.g., IGD (17–19) or Gaming Disorder (5)]. Moreover, almost all studies reported have focused on negative consequences associated with female gaming without assessing female gaming behavior from both positive and negative perspectives at individual and community levels. Consequently, there is a gap in knowledge regarding female gaming from a gender perspective, including its nature, benefits, and potential risks to individual and community health.

In order to overcome the limitations in female gaming research, the aim of this narrative literature review is to provide a comprehensive overview of studies assessing female gaming or the position of women within gaming culture. The present paper includes studies from both an individual perspective and a cultural perspective in order to obtain a more inclusive and contemporary view of gaming behavior in females.

METHODS

Data Source, Search Strategy, and Research Questions

A narrative review of the literature was undertaken to identify all of the relevant publications concerning female gaming, female gaming addiction, and the position of women within gaming culture. The review adapted the Sample, Phenomenon of Interest, Design, Evaluation, Research (SPIDER) model in conducting a narrative literature review (25). This is an alternative search strategy tool compared to the Population, Intervention, Comparison, Outcome (PICO) model, which is usually used as a systematic search strategy tool intended for quantitative research questions (26). The following research questions where formulated: 1) What is the role of the female gamers in gaming behavior and gaming culture in contemporary society? 2) Which variables have an influence on the role of female gamers at an individual and community level?

Between February and March 2018, a literature search was conducted using the scientific databases *Web of Science* (*WoS*), *PsycInfo*, and *PubMed*. The following search terms were entered with regard to female gaming, specifically, girl* OR woman OR female* OR women AND game* OR gaming AND mobile OR online OR video* OR digital OR MMO* OR MOBA OR virtual OR VR OR AR OR FPS.

Eligibility Criteria

The SPIDER model structured the search terms and eligibility of criteria (see **Table 1**).

Study Selection and Data Extraction

Following title and abstract review, duplicate papers were removed. All other papers that appeared to meet the inclusion criteria were then assessed using the full text. At this point, any variations from the inclusion criteria were noted, and these papers were excluded. For instance, studies where the female subpopulation could not be distinguished from the male subpopulation were excluded. In addition to this, studies which were not published in peer-reviewed journals were excluded as indicated in the inclusion criteria (27–34). The search strategy is presented in **Figure 1**. All included studies were read, and key pieces of information were extracted including: sample size, recruitment process and participants, design of the study, aims, measures or tools used, main results, and the implications of the study. Thematic synthesis was then conducted.

RESULTS

Forty-nine studies were identified that met the inclusion criteria for this review (see **Figure 1**; see **Appendix A in the Supplementary Material**). As this study was the first of this nature concerning female gaming, the included studies represented research using various methodologies, such as clinical trials, experimental studies, and case studies, as well as other methodologies. Four main types of research were identified: i) the benefits of female gaming; ii) why women might play video games less than men; iii) perceptions and realities of female characters within video games; and iv) women's position in gaming culture. The results section briefly outlines each of these. A few studies had material which could be included in more than one category.

The Benefits of Female Gaming [*n* = 11]

Within the included studies, several considered how women engaging with video games might have a beneficial outcome. These comprised research examining clinical or environmental interventions (35–40), investigating cognitive and social learning, as well as strategies developed through game play (36, 37, 41–45). Studies that investigated the utility of video games to enrich an aspect of the participants' life were proportionally more recent than those which considered other features of female gaming (35–40). Clinical interventions considered the physical (36, 37, 39) and mental benefits (35, 37, 38) which could be offered to women who interact with video games. All of these studies saw improvements in their participants' abilities or health. However, they had relatively small sample sizes (ranging from two seniors (37, 40) to 23 women (37). The majority of studies also recruited from only one website (35, 38, 40).

Despite these limitations, video games were shown to have physical benefits, such as encouraging exercise in adults with lower mobility due to age and illnesses (37, 38, 40) and relieving pain symptoms in participants with fibromyalgia syndrome by offering cognitive distraction (38). Female gaming was also shown to improve mental well-being because video games were demonstrated to be acceptable psychotherapeutic tools to assist mental health recovery in adolescents (35). Gaming positively influenced executive functioning ability in women with urinary incontinence (37) and attention in elderly individuals (40). Two studies considered how gaming environments might be utilized as a teaching tool within undergraduate student populations (36). In both studies, it was observed that learners with less gaming experience showed lower levels of presence within the environment than others and that women were just as likely to succeed with this type of educational intervention as men (36, 39).

TABLE 1 | SPIDER Table of Study Inclusion and Exclusion Criteria.

	Inclusion	Exclusion
Sample	Prioritization was given to female gamers, although other samples including male gamers were included if there was a subsample of women analyzed independently as a specific gender	Female gamers not addressing female gamers issues at an individual or community levels; male gamer samples; or female and male gamer samples where both were analyzed together as a unique gender
Phenomenon of Interest	Studies about female gaming or females in gaming culture	Studies examining other related themes (e.g., male gamers, industry professionals, etc). Studies which do not specifically consider gaming or gaming culture
Design	Theoretical (e.g., reviews) or empirical peer-reviewed papers with all methodological approaches (e.g., experiments, survey, qualitative or mixed-methods)	Non-peer reviewed papers (e.g., gray literature, book chapters, conference proceedings, PhD theses, etc).
Evaluation	Synthesis, quantitative analysis, qualitative or mixed methods analyses of benefits of female gaming, why women play video games, and female characters within video games; and women's role in gaming culture.	Any paper not addressing the topic included in the research questions (e.g., women learning electroacoustic composition)
Research Type	Peer-reviewed journal articles published between the years 2000 and 2018, with full text available in English, German, Polish, Spanish, Italian, Portuguese, or French.	Peer-reviewed papers published in the 20th century. Gray literature (e.g., conference papers, reports, thesis, dissertations), protocols, editorials, opinion pieces, etc).

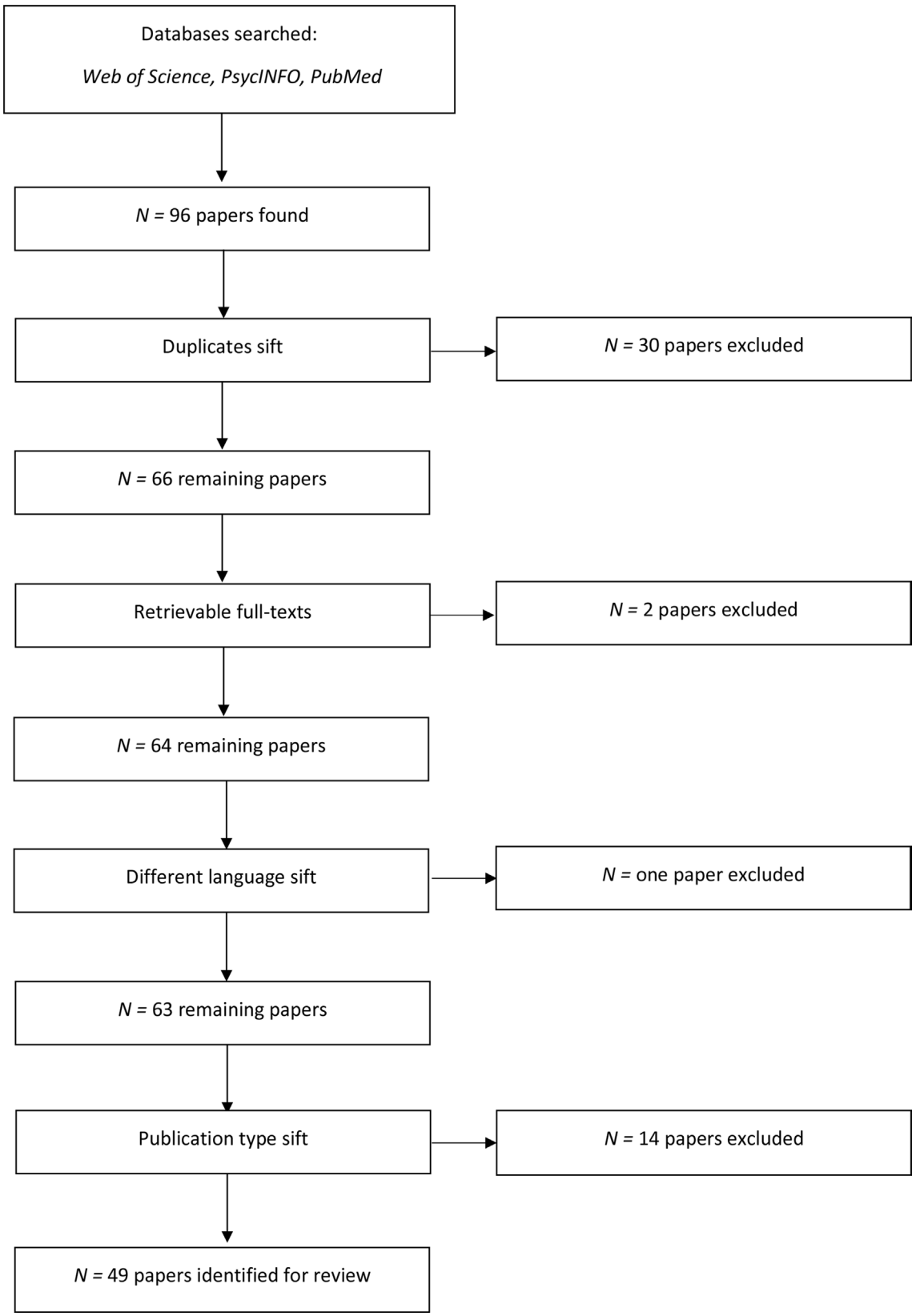

FIGURE 1 | Flow chart displaying the search process.

However, DeNoyelles and colleagues (36) concluded that college-age women were less likely to be gamers. Therefore, they suggested that female non-gamers might struggle slightly more due to less gaming experience and suggested standardized support according to gender.

Even at an early age, it has been demonstrated that girls have similar abilities to gain strategy and performance skills by playing video games compared to boys (41). This was shown in 104 children (second to fifth-grade) where frequency of gaming was viewed as a better predictor of gaming performance and strategy than gender (41). This was reinforced by Olson and colleagues (45) who considered the main differences between video game play of males and females to be the amount of time spent playing and the types of video games. In a sample of 1,254 children taken from two schools' seventh and eighth grade classes, it was shown that gaming was very common with 93.6% of children playing video games over the past 6 months but that boys were much more likely to play over 15 h a week in comparison to girls (45).

In a cross-country study of 145 young girls (M = 11.3 years) who played video games online, it was shown that prosocial gaming exposure to typical online video games (e.g., MMORPGs) had a strong relationship with perspective taking and sympathy, suggesting less severe violence acceptance (43). Within in-person co-playing, a subsample of girls demonstrated heightened prosocial behavior and stronger emotional connection when engaging with their parents (44). Again, this is evidence that video game playing has a positive impact on how girls develop their cognitive abilities, including social interaction. Alternatively, Olson and colleagues (45) demonstrated that more boys played video games than girls and that gaming could be utilized as a male anger management strategy. This could be reflective of how adolescents are primed to cope with emotional responses.

It has also been found that adult female gamers need less input when evoking response reactions than female non-gamers and have a greater neural plasticity which enhances this ability due to the familiarity of movements which are needed in gaming (42). This was verified in two studies by Gorbet and Sergio (42), in which they showed that playing video games has beneficial consequences on visuomotor performance but that these brain patterns are different from previous studies observing male responses, which may indicate different ways in which male and female brains react to problem solving within video games. Nonetheless, video games have a positive impact on muscle movements and response times to stimuli, as well as enhancing brain plasticity (42).

Why Women Might Play Less Video Games than Men [n = 17]

Traditionally, women are thought to play less video games than men (13, 14). Several studies included in this narrative review discussed this consideration and offered reasons why female gaming is less common. Notable was the influence of gender expectations among those that engaged with playing video games. As previously mentioned, Olson and colleagues (45) attributed gender differences in time spent gaming to how social gender identities influence how children play, although male and female children play for the same reasons (e.g., fun, creative engagement, and emotional coping). One study found that if women play as often as men, they tend to reach similar levels of success within the game, discouraging the belief that women are less skilful at gaming (46). However, they also noted that female players tend to play less or stop earlier than their male counterparts, which they argued was due to gender expectations and peer community, e.g., game play was viewed as male dominated (46). These implications originated from two large studies of 9,483 players and 18,000 responses across two online video games. The vast majority of both populations were men, 82% and 74.5%, respectively (46); thus, from the respondents alone these studies indicate a community heavily featuring men.

The lower levels of female gaming may also be due to the nature of video games and the relationship with personal traits. For instance, violence and aggression are the focal point of many video games, such as FPS games. It has been suggested that repeated exposure to violent video games may elicit more aggression from boys than girls (47). A study of 98 adolescents from China indicated that there was no difference in reaction time to aggressive words when girls were primed by violent and non-violent video games, but that boys scored significantly higher when playing violent video games (47). This finding is supported by previous results (48) suggesting that violent-sexist video games are related to masculine beliefs (e.g., aggression and dominance), and therefore reduced empathic feelings when considering violence towards women. This might suggest that girls play video games less frequently than boys due to the level of aggression required by some video games. However, Ferguson and Donnellan (49) found contradictory results when running confirmatory analysis of Gabbiadini and colleagues' (48) three-way interaction between game condition (neutral, violent, or violent-sexist), gender, and avatar identification. This demonstrated that there was no indication of a main effect of game content on empathy towards girls and that masculine beliefs were affected only slightly (p = 0.049). The authors suggested that this inconsistency of results would likely be reduced by a cultural research shift to preregistered studies and a focus on the validity of published results (49).

Generally, it is argued that exposure to violent video games can increase aggressive behavior and that this motivation can be higher when playing as a same-sex character (50). This second point relates less strongly to female gaming due to there being fewer female characters to act as (50) and because violence in video games causes women to disengage earlier (51). Within their study of 444 students across two universities, Hartmann and colleagues (51) suggested that women had limited exposure to violent video games due to trait empathy, which caused more anticipated guilt while playing, and therefore reducing enjoyment. Both men and women often select male avatars, which has been associated with more aggressive game play (52). For women, the selection of a male avatar may negatively influence the level of identification with the avatar. This may lead to women playing less often than men not due to aggression but due to less presence with characters within the video games. This conjecture is supported by studies from Eastin (53), which indicate that same-sex avatars encourage greater levels of presence within players, influencing aggression (54). Therefore, it is possible that female gamers do not succeed as much within violent video games as they often have to play an

opposite-sex character competing against opposite-sex characters, reducing their presence and aggression, thus causing less success when leveling up or mastering the game.

Related to this, Norris (54) explored how individuals with aggressive personalities might interact with computer use and gaming in a population of 430 women recruited online. The population was split by those who were gamers and those who used chat rooms. Gamers were not found to be more aggressive than chatters, but more frequent game play was associated with more aggression within gamers (54). Using computers was thought to be masculine, with women who scored highly for masculine traits (e.g., being active, independent, and competitive) being shown to have higher levels of computer use (54). This provides some evidence for the association between game play and aggression. However, it does not consider the type of video games that the gamers in this sample played or the violent content of these. Again, encouraging computer use and viewing gaming as a cross-cultural activity (rather than masculine activity) was suggested (54).

Alternatively, Ferguson and Donnellan (49) suggest that female gamers tend to get stressed within gaming not because of the hostility or aggression of video games, but instead the annoyance of the game not being suited to them or what they would naturally select to play. This would suggest that women play less than men simply due to annoyance that the video games are not developed with female audiences in mind, as much as their male counterparts. A major reason why women tend to play less video games than men is the coping strategies that are required to handle harassment online (55–57). One benefit of anonymous online game play is that individuals may change their gender (e.g., changing their avatar from male to female or vice versa), allowing them to explore their gender identities (55). However, this can also have negative consequences. For example, Crow and Watts (55) found that some male teenagers changed their gender online to gain help from other players in the game or to help get rare items. This reinforced the stereotype that female players were less skilled and seeking preferential treatment, thus generally having to deal with more harassment. Women acting as male characters online was viewed as a valid strategy for handling harassment (55–58). Indeed, Martey and colleagues (58) found that while men were more likely to switch their avatar´s gender, they often did not seek to hide their offline gender, unlike women. Gender switching was considered to be more of a strategic selection within this sample (58), which might be related to the older age of the participants, averaging 29 years in comparison to the adolescents in Crowe and Watts' sample (55).

In their qualitative study of strategies for online harassment, Cote (56) noted that strategies for managing gaming environments were often used such as playing offline, blocking players, and needing to prove oneself within the game. In informal conversations with nine online gamers, four of whom were women, coping strategies again favored anonymity of gender, non-verbal play, and banding with other women when dealing with sexual harassment or expectations from other players (59). Female gamers were considered inherently different, in that their legitimacy was put into question and they were asked to "prove" their gender (59). This hinders women from having the same gaming experience as men, and it impacts on their progression within video games (57, 59). Fox and Tang (57) found that across multiple countries, a common technique to avoid harassment was to reduce communication either completely or by masking their voices. By doing this, coordination abilities with teammates were reduced, causing women to level up more slowly than their male counterparts.

Motivations for game play may also be indicated as a reason why women tend to play less than men. One study found that women playing *Diablo III* tended to be motivated by their partners acting as a proxy player for the partner's character when the male partner was too busy to play (60). This often ended with women deciding to buy and play the game themselves, often playing longer and spending more money than men (60). While this might not be a usual way to introduce others to gaming, the study provided evidence that encouraging female gaming had a positive effect on women wanting to play video games more often. This could relate to women feeling that playing video games influences their value as a significant other, which was demonstrated by Kasumovic and colleagues (61) within their studies. Sexual interest and mate value were positively related to violent video game exposure among women, and this was discussed as being due to women feeling like more attractive partners by having this shared interest (61). Therefore, a motivation to engage with gaming might be related to self-perceived sexual attractiveness.

Not only do video games have some utility to elicit motivation through self-perceived attraction, but Song and Fox (62) suggest that romantic video games can relate to these beliefs and thereby motivate romantically inclined individuals to participate in this activity. This study found that women with higher identification with their avatars had stronger parasocial beliefs (the perception of the figure to be known socially, rather than seen as a fictional character) about the romantic target within the game. These individuals also tended to have stronger beliefs about idealized romance (62). In this sense, the motivation to play is related to their desire of maintaining the relationship with the character within game, similar to studies which indicate shared gaming is a positive aspect of the partner relationship (60, 61).

Perceptions and Realities of Female Characters within Video Games [*n* = 12]

Nearly one quarter of the included studies observed female characters within video games. These are broadly separated into studies considering the appearance of characters (63–67), how these characters were used in the video games (68–70), and how the characters themselves influence gamers' beliefs (71–74). A number of these studies considered the physical characteristics of female characters through video game covers or game representation within gaming culture (63–65). It was often noted that women were less featured than men on game covers and that when they were featured, this was in a highly sexualized manner with exaggerated bodies, particularly regarding size of breasts and buttocks and slimness of waist (63, 65–69). Fisher (65), who considered characters from video game magazines, suggested that women were represented as sex objects rather than actual characters or avatars for gamers. These studies noted that positive portrayals were rare and weak within presentation, which may further discourage video game use among women (65). Indeed, this may detract from how women interact with gaming culture.

Across 368 characters, it was shown that female video game characters were smaller than a typical American and had unrealistic body proportions (67). Worryingly, Martins and colleagues (67) suggested that the highest degree of photorealism within characters were those taken from children's video games. Unsurprisingly, video games intended for older audiences tend to feature the most sexualized characters, with fighting video games having the highest sexualization overall (66). Sexualization of women within video games was not shown to be associated with the success of video game sales across a 31-year period (66). Alternatively, within Spanish versions of console game covers, longitudinal comparative analysis suggested that there has been a decrease in the presence of violence and sexual objectification in female characters in more recent years (64). It is key to note here that across countries, depending on laws and policies in different countries, the covers of video games may vary and that the results of Burgess et al. (63), Fisher (65), and Martins and colleagues (67) are related specifically to US game releases. Near (70) stated that in their study of 399 video games purposively sampled from US sales, having a woman in the center or alone on the game cover negatively impacted sales.

As noted by Burgess and colleagues (63), male characters were almost 4 times more likely to be portrayed than female characters on console video game covers and were given significantly more game-relevant action. Of the utility given to women within video games, female characters are more likely to be secondary to the story of the game than males, and their role is typically sexualized. This was shown across 571 video games with playable female characters (66). This relationship is not demonstrated in the sample of 12 contemporary video games of 22 characters conducted by Jansz and Martis (69), who found that while male characters dominated video games, there was equal gender distribution between leading protagonists. Alternatively, female support characters were considered to hold more dominant positions compared to their male counterparts who were considered to be submissive (69). On the other hand, when looking at how children interpret physical features of characters, it was suggested that strength or masculine characteristics, such as athletic arms, are a translation of the character's abilities rather than just for appearance (68). While this study was only conducted with 19 children, seven of whom were girls, it suggests that the appearance of a character is acceptable if it is representative of the abilities the characters hold.

However, while this is an interesting consideration of how children might interpret characters' bodies, there have been several studies showing that a game character's appearance may negatively impact how people perceive their own bodies (67, 71, 74). Martins and colleagues (67) considered that the high level of photorealism within children's video games could influence body dissatisfaction at an early age and negatively impact how children perceive healthy bodies. For university students, the effect of characters' bodies on self-perception has been demonstrated in both males and females, with both studies demonstrating reduced self-esteem (71). Interestingly, the female study evidenced that although self-esteem was impacted, body satisfaction was not, and this was attributed to female gamers considering the unrealistic comparisons being made (71). This might be a reflection of a smaller sample being used in the female study (32 participants compared to 51 within the first study) (71), or it could be a representation of video game priming at earlier ages.

Another study, which was more recently published, also examined male and female university students across two studies (74). They found that video games featuring hyper-idealized character bodies had a positive impact on body image satisfaction and attitudes among women but worsened these beliefs among men (74). These studies were conducted with a larger pool of students (149 female students and 197 males) (74). However, with regard to abilities, it was considered women might make downward comparisons based on the empowerment of physical capabilities by the avatar (74). In children, the physical traits representing particular abilities were viewed as positive, whereas in adulthood comparisons related to body may be more apparently negative.

One concern that is apparent from studies examining avatar bodies is the impact that they can have on the acceptability of violence towards and rape of women. Among 141 undergraduate students, it was found that following violence against women within video games, sexualized objectification and condoning rape myths increased in male participants (72). It was considered that the level of exposure and increased realism of the game influenced these attitudes so as to appear more acceptable (72). Again, for adolescents, playing as sexualized female characters indicated greater acceptance of rape myths and tolerance of sexual harassment (73). These studies indicate the influence of sexualized characters within video games and highlight how characters' appearances can have negative influences on beliefs which may translate to real women and which could appear as sexual harassment to women offline. Alternatively, when designing female characters in video games, a sample of 14 females aged between 14 and 75 years demonstrated that they thought professionalism and interpersonal relationships were more important to a character than appearance, emphasizing behavior over physical characteristics (75). From this type of understanding, game designers might be able to develop avatars which encourage more women to play video games and convey less stereotypical roles.

Women's Position in Gaming Culture [*n* = 14]

Women are considered to be less engaged with gaming than men (12, 13, 76). It is possible that this extends to the culture as well as game play. However, despite this gender bias towards men, women are a part of gaming culture (23). This is emphasized by their positions as designers, gamers, and as users of gaming technology. Nevertheless, gaming culture is still considered to be a male-dominated environment (76), and the competence of women in these positions is often questioned (59, 77–79).

In a commentary paper, Harvey and Fisher (76) discussed the context of how women in gaming culture are perceived. Their study emphasized the challenges of being in this environment, particularly in the position of a video game designer (76). Within their commentary, they claimed that female designers received attention for physical appearance and as a "token female" rather than being considered for their abilities of game design. Arguably, this mimics the harassment seen within the online gaming environment itself,

and because of these issues, it was noted that there was a constant problem of visibility as a female designer (76), again relating to the coping strategies observed to deal with online harassment (56, 57). However, it was also acknowledged that some of the hostility came from other women within gaming culture, promoting exclusivity, invalidating other players, and being unsupportive of other women within gaming (76). This was likely associated with women consistently having their position within the culture challenged.

A clear example of this discrimination is described by a study (77) which included the argument between Ryan Perez (a game journalist for the *Destructoid* video game blog) and Wil Wheaton (an American actor) regarding Felicia Day, a prominent female gamer. This incident included Perez slandering Day, reducing her to a sexual image, instead of an actual gamer. Perez suggested that she had poor gaming skills, and Wheaton defended Day (77). From this interaction, the bias against women in gaming culture is evident, considering that the attack from Perez was unprovoked by Day, her behaviors, or her fans. It is important to note that other men within gaming culture do not share these beliefs (including Wheaton), and this might encourage resistance against such comments in the future.

In the incident against Day, her competence as a gamer was questioned (77). This is a common pattern seen within gaming culture (79). Across two studies, Kaye et al. (79) demonstrated that avatar gender has an impact on how competent a player is considered to be. In their initial study, women with male avatars were considered to be more highly skilled than women playing as female characters, an effect that was not seen within male gamers. The second study attributes this to gender-role beliefs predicting sexist beliefs across MMO games and FPS games (79). Again, this relates to the gender swapping seen in previous studies as well as the responses which are attributed to this behavior (55). Within their small study, Linderoth and Ohrn (59) found that players were typically assumed to be male and therefore more competent, reinforcing the idea that women need more help or favors within video games.

Despite this study's small sample size and low number of female gamers (four participants), it is evident that there is a bias in favor of men as gamers seen across research (59, 79, 80). However, this bias is not just among men. In their study of 39 female university students, Vermeulen and colleagues (80) demonstrated that women take gender as an indicator of skill when gaming, and they experienced more stress when playing against men. Considering this issue, the authors (80) suggested that this reaction was based on competitiveness as a perceived skill, where this competitive response was greater against women. The belief that female gamers are less competent when using technology is also seen in computerized assessments and by their own self-perceptions (78). This study demonstrated among a sample of 407 adolescents that boys had higher levels of computer game self-efficacy (78), most likely related to earlier priming of computerized technology when young (e.g., gaming at a younger age). Furthermore, the avatar's appearance can impact self-efficacy in gaming. In a study of 328 university students, playing as sexualized female characters negatively impacted women's self-efficacy when considered against non-sexualized characters (81). Students stated that this was based on considering the women's capabilities, both cognitively and physically (81). This indicates that there are gendered beliefs towards women within video games when they are represented in a hyper-sexualized way, which may influence external considerations regarding women's abilities.

Although gaming culture is mostly viewed as comprising men, a literature review evaluating 10 video games suggested that gamers were more evenly distributed in gender (23). As gender visibility is often limited as a coping mechanism within game play (57, 59), this study suggested that men are more visible, allowing them to more easily identify with the "gamer" label (23). However, it does appear that there are fewer women who play these video games more heavily due various game play elements such as violence, aggression, and/or representation, and this may explain why women stop gaming at earlier stages than men (46, 49, 53, 56, 57, 59). Paaßen and colleagues (23) go one step further and suggest that the stereotype of gamers is accepted into the identity of male gamers, whereas women are required to be either a woman or a gamer, marginalizing women within gaming culture.

DISCUSSION

The aim of this narrative literature review was to provide a comprehensive overview of empirical and theoretical studies concerning female gaming and the position of women within gaming culture from an individual and cultural perspective. The 49 studies in the review of female gaming were classified into four types of research studies, namely, i) benefits of female gaming, ii) why women play video games less than men, iii) perceptions and realities of female characters within video games, and iv) women's position within contemporary gaming culture. Each of these will be discussed below.

The studies reviewed indicate that playing video games has a wide variety of benefits for women, in terms of both physical and mental health benefits. Empirical research suggests women have much to gain from interacting with video games at a variety of ages and by playing different types of video games (17–19). Gaming by females in childhood and adolescence may enhance cognitive, social, and/or movement abilities and enhance engagement with educational tools (18, 19). Indeed, the benefits of enhanced brain plasticity and reaction times may be advantages for offline interactions, such as sporting activities or problem solving. Integrating gaming more fluidly into female's lives may improve mental and physical health long term, as well as reduce isolation through online communication (19).

This is in line with previous research (82) showing that video games have many beneficial effects on gamers (both genders, young and old) and are used in various contexts, including video games as physiotherapy and occupational therapy, distractors in the role of pain management, cognitive rehabilitation, improvement of social and communication skills among the learning disabled, alleviating symptoms of impulsivity/attention deficit disorders, therapeutic benefits in the elderly, psychotherapeutic settings, health care, treatment of anxiety disorders, and psychological well-being. Moreover, experimental research (83) indicates that playing video games can result in improved task-switching, better top-down attentional control (rather than bottom-up) and processing speed, and increased and quicker time perception.

It is concluded that there has been considerable success when video games are specifically designed to address a specific problem or to teach a specific skill. However, generalizability outside the game-playing situation remains an important consideration.

A number of studies included in this narrative literature review were concerned with the question of why women appear to play less video games in comparison to men. Across the included studies which included both men and women, female participants were typically in the minority (46, 51, 55, 58), with the exception of the studies conducted by Yang et al. (52) and Lopez-Fernandez (17). It is possible that this is representative of the overall gamer population, as men appear to comprise a larger proportion of gaming culture, or inversely that gaming culture is catered for male gamers (22–25). Overall, the studies included here indicate that women are less encouraged to participate in playing video games due to negative expectations based on gender or experiences during game play, as well as video games being designed and developed in a way which is less enticing to women, including overly aggressive and sexualized content (84).

In addition to this, an important reason for why women tend to play less video games than men is the coping strategies that are required to handle harassment online, with women often playing male characters in order to avoid in-game harassment and bullying (15, 56, 57, 85). Kuss (85) also showed that males benefit from this strategy because they often play female characters in order to receive additional support from other gamers, suggesting that gender-swapping is a strategy that is applied by both male and female players and results in various benefits in terms of their game play and well-being, which was supported by another study (86), indicating that playing a female character in MMORPGs results in positive social attributes. However, Lopez-Fernandez et al. (19) have shown that female gamers do not swap their avatar gender to cope with the potential violence when gaming online. Moreover, females appear to look for different things in video games in comparison to men (e.g., relationship maintenance) (19, 18), and game designers should take this into consideration when developing video games for this growing audience. This, in itself, would impact how women are perceived within video games and that their abilities to gain high experience levels, rare items, and special capabilities are just as good as that of men.

The next major theme incorporated in the present review was the perceptions and realities of female gaming characters within video games. The results indicate that not only are female characters featured less frequently in video games, their representation often appears to be exaggerated and hyper-sexualized in terms of emphasizing their female attributes (i.e., size of breasts and buttocks, and slim waists), which may negatively impact on female gamers' own body image given the representations of female bodies in video games do not correspond with the reality of female bodies (63). This is consistent with the scarce empirical research performed on female gamers at present (19). Upward social comparisons of oneself with others, as they frequently occur on social media sites, may in fact lead to feelings of decreased self-esteem and depression (18, 84), suggesting that this mechanism may apply similarly in comparisons between one's female avatar and oneself, leading to decreases in well-being and symptoms of mental disorders, such as mood disorders.

Research has showed that having female characters prominently represented on video game box art decreases sales rates (70). Overly sexualized female characters in game can have a negative impact on self-perceptions and beliefs which may impact interactions and perceptions outside of the game. For instance, some video games propagate acceptability of violence towards and rape of women, increasing acceptance of the rape myth (72). Young and Whitty (87) explored why taboos, including rape, are violated in video games, and point out that the freedoms afforded by video games may negatively impact on gamers and their real-life interactions. Gamers can develop strong attachments to their online representations in the form of their avatars, and violence against them is distressing (88). Hypersexualized female bodies and condoning violence against female characters in-game may have negative impacts on gamers' perceptions of themselves, others, and their interactions with females, suggesting game designers should carefully consider the inclusion of females with exaggerated female attributes and violence when developing video games (89).

Within younger audiences, it might be appropriate to have bodies which are representative of the special abilities held by the character, but ultimately from the sample of studies included in this review, it appears that hyper-exaggerated bodies can have negative influences on body satisfaction with women and to some degree with men. By considering this, game developers should be encouraged to indicate abilities through the character's body, but in a less hyper-idealized manner because this may improve the gamer's perceived body image. Indeed, this would allow young audiences to consider the behavior of the character to be integrated with their appearance and suit older audiences who are more concerned about the behavior and skills of an avatar. Furthermore, reducing the sexualization of females would have liberating effects in terms of how women are considered both within and outside of video games. Similarly, other socio-demographic features (e.g., ethnic, cultural, religious, or sexual) in the avatars shown could offer a bigger range of identities and tastes which could facilitate avatar identification without body image dissatisfaction and other problems which are currently causing the heteronormative video game content in gamers (89–91).

The final main theme covered in the reviewed studies was women's position in gaming culture. Statistics suggest female gamers are increasing in number (1, 2), with female gamers significantly outnumbering males when it comes to mobile gaming (92), typically comprising "casual" gaming. Despite this, gaming culture still appears to be male-dominated (67, 76), while female gamers' abilities as competent game players are put in question and not considered yet as "true" or "hard-core" gamers (24, 77). The experiences of women in gaming culture are mirrored within other fields with technology discrimination [e.g., electroacoustic composition (93)], otherwise known as "Programmed Inequality" (94) (i.e., despite the growing number of females, there are still barriers to entering and working in male-dominated environments; e.g., there appears to be a systematic neglect of technical training due to gender). This highlights that the problem of women having a valued presence in technological culture and industry is not new. Furthermore, it appears that there are no regional or time variations regarding this issue.

This review expanded on previous research and targeted specific outcome studies covering the topic of female gamers, but it is not without its limitations. One major limitation is that while the authors followed rigorous search methods to identify relevant papers, the review was limited to those published

reports that the authors were able to locate. It is possible there are additional studies that cover this topic but were not included in this review (i.e., because of publication bias). The large number of outcome studies is in itself a strength in formulating conclusions that can be extracted about female gamers and their position in gaming behavior and gaming culture. Even for a scarcely researched topic such as this, the research team found a considerable number of peer-reviewed papers. However, there are also limitations, such as excluding papers in Asian languages given the large gaming culture in Asian countries, including China and Japan, many of which have developed sophisticated targeted approaches in preventing gaming addiction (95), mainly because it is considered much more of a public health concern in these countries than elsewhere.

Additionally, the specific scientific databases selected and the inclusion criteria used to conduct this review may have excluded some sources, especially from other disciplines outside of psychology and medicine, although *WoS* is an interdisciplinary database. Furthermore, expanding the review to female gaming from female and male perspectives could in some way have limited the views of this specific gender, although alarming findings have also emerged (e.g., technology discrimination). Finally, the present study is probably affected by generalizability bias. For instance, in terms of geographic location, out of the 49 studies that provided information, 45 were essentially located in the Western culture [i.e., 33 in America (27 in the United States, 4 in Canada, and 2 in Chile) and 12 in Europe (the Netherlands, Spain, United Kingdom, Italy, Sweden, Denmark, Germany, and Belgium); see Appendix A for details about the authors, location, and other methodological elements of the samples in each paper]. Thus, it is not possible to draw conclusions about the extent to which sample demographics across the studies in this review reflect female participants only, the population within a particular geographic region, or across the nation. The findings only reflect those based on gaming research in Western culture.

Overall, the included studies reflect the difficulties that women experience within video games among the general community of gaming. Women are still harassed, belittled, and considered less able than men when it comes to gaming, by both men and women. To hold an identity within gaming culture, women must follow strict rules about how they conduct themselves and hold views which emphasize that they are part of gaming culture and that other women are not part of gaming culture. Building on from this, women need to support each other openly and visibly in the community, with reinforcement from men. The solidarity campaign HeForShe (https://www.heforshe.org/en) started by the United Nations is an excellent case in point addressing gender equality, whereby both women and men are encouraged to commit to standing in "solidarity with women to create a bold, visible and united force for a gender equal world." In the context of women's position in gaming culture, this contemporary feminist movement helps support the view of women as being just as capable and skilful gamers as men and require just as much respect and recognition from gaming culture, which they are part of. It may influence beliefs that women are inferior within gaming and encourage more females to play video games. It may also open up communication in such a way that harassment is reduced, and designers consider video games with women as their audience more so than they have done previously. According to the ESA (96), 45% of United States gamers are women and are therefore a very large market that can be targeted by the gaming industry.

Taken together, the research cited in the present narrative literature review suggests female gamers are a growing population. Gaming appears to offer a variety of benefits for them, from cognitive and psychological benefits to physical and social benefits. However, women still face an over-sexualized representation of female in-game characters, online harassment, and an expectation that they are less skilful players in comparison to male gamers. Furthermore, contemporary video games do not sufficiently target female gaming motivations and gaming-related interests, despite the number of female gamers increasing. Based on the outcomes of this narrative literature review, it can be suggested that the gaming industry should pay more attention to the needs and interests of female gamers given they are an audience to be taken seriously and now large in number. Moreover, research should be encouraged to specifically investigate female gamers' motivations, as well as the psychosocial impact that in-game violence and hypersexualization of female characters has on their mental health and well-being, as well as their overall gaming experience. Longitudinal, qualitative, and psychometric approaches should be combined to offer a more comprehensive and holistic picture of the female gamer, including their socio-demographics, interests, and psychosocial environment of gaming, including the gaming culture they are part of.

AUTHOR CONTRIBUTIONS

OL-F, DK, and MG contributed to the conceptualization. OL-F and AW contributed to the data curation. AW conducted the formal analysis. OL-F, DK, and MG contributed to the funding acquisition. OL-F, DK, and AW conducted the investigation. OL-F, DK, and AW contributed to the methodology. OL-F conducted the project administration. OL-F, DK, and MG contributed to the resources. OL-F conducted the supervision. Writing of the original draft was done by OL-F (Abstract and Introduction), AW (Method and Results), and DK (Discussion). Review and editing were done by OL-F, DK, AW, and MG.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyt.2019.00454/full#supplementary-material

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Heavy Study Investment in Italian College Students. An Analysis of Loscalzo and Giannini's (2017) Studyholism Comprehensive Model

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Loscalzo and Giannini (2017) recently proposed the construct of studyholism (or obsession toward study) and a theoretical model highlighting its potential antecedents and outcomes. This study aims to analyze some of these antecedents and outcomes by means of a path analysis including both studyholism and study engagement. The participants are 1,958 Italian college students aged between 18 and 60 years (*M* age = 23.53 ± 4.43) and heterogeneous as far as their year and major of study are concerned, as well as concerning the city in which they attended their courses. They filled some instruments that allow evaluating studyholism and study engagement, along with individual and situational antecedents (e.g., worry and overstudy climate) and outcomes (e.g., sleep quality, study–relationships conflict, dropout intention). In addition to the path model we performed aiming to test the direct effects we hypothesized, we performed two MANOVAs for analyzing if there were differences on the antecedents and outcomes among the four kinds of student suggested by Loscalzo and Giannini (2017; i.e., engaged studyholics, disengaged studyholics, engaged students, and detached students). The results of this study support Loscalzo and Giannini's (2017) conceptualization of studyholism as an internalizing disorder, since worry is the strongest predictor of studyholism ($\beta = .67$, $p < .001$). In addition, in line with Loscalzo and Giannini's (2017) theorization, we found some differences among the four kinds of student on both the antecedents and outcomes we analyzed. This study has critical theoretical, preventive, and clinical implications. It supports the definition of studyholism as an OCD-related disorder. Also, about preventive implications, it shows that interventions aiming to favor students' wellbeing should target also engaged students, since study engagement predicts social impairment as well as studyholism. Finally, it suggests that in a clinical setting, it is important to distinguish between disengaged studyholics and engaged studyholics as they have different relationships with some antecedents and outcomes; also, they both have functional impairment, even if in different areas.

Keywords: grade point average, heavy work investment, obsession, perfectionism, study addiction, study engagement, work addiction, workaholism

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INTRODUCTION

Workaholism, or work addiction, is a clinical condition that has been extensively studied since its first definition at the beginning of the 1970s (1). Probably, workaholism has not yet been formally recognized in the *Diagnostic and Statistical Manual of Mental Disorders, 5th edition (*DSM-5) (2), despite the many peer-review papers, because it still lacks a shared definition and operationalization of criteria, which has prevented the gathering of sufficient evidence for inclusion in the manual (3–5). Moreover, almost all the papers are focused on organizational psychology and do not take into account a clinical perspective. In line with this, the first proposal of DSM-like criteria was done in 2017 by Loscalzo and Giannini (5). Loscalzo and Giannini (5) thoroughly analyzed the literature and previous workaholism models in order to propose a comprehensive theoretical model that encompasses all the main components of workaholism and is easy to test, as well as an instrument for evaluating workaholism referring to their conceptualization (i.e., Work-related Inventory, WI-10; 6). It is interesting to note that the study of Spagnoli et al. (7) supported the importance of distinguishing between engaged and disengaged workaholics, as suggested by Loscalzo and Giannini (5).

Despite workaholism being studied for almost 50 years, the analysis of a similar problem behavior in students is recent. Some studies used workaholism instruments on student samples [e.g., Refs. (8, 9)]. However, the first study that analyzed problematic overstudying with an instrument specifically developed for its assessment is the one by Andreassen et al. (10), which conceptualized problematic overstudying in the behavioral addiction framework. In contrast, Atroszko et al. (11) are the first to propose study addiction as a new area in the behavioral addiction field and to present the psychometric properties of the instrument previously used by Andreassen et al. (10) for its evaluation. Atroszko et al. (11) stated that study addiction could be analyzed from a work addiction perspective, given the many similarities between work and study.

Loscalzo and Giannini (12) recently proposed a different conceptualization of problematic overstudying that goes beyond the addiction model and that differs from that of Atroszko et al. (11) concerning some critical theoretical points (12–15). In sum, they introduced their definition of studyholism as an obsessive-compulsive-related disorder (OCD-related disorder) made up of two components (i.e., obsessive-compulsive symptoms and high or low study engagement), which led to the proposal of two subtypes of studyholics: engaged studyholics (students with high levels of both study-related obsessive-compulsive symptoms and study engagement) and disengaged studyholics (students with high levels of study-related obsessive-compulsive symptoms and low levels of study engagement).

More specifically, Loscalzo and Giannini (12, p. 31) defined (disengaged) studyholism as "a possible new clinical condition which is characterized by internalizing symptoms (i.e., obsessive-compulsive symptoms such constant thinking to study or inner drive to study) and by low levels of study engagement (something that also includes the inner motivation for studying)." Hence, they included the positive dimension of study engagement in their definition of studyholism. Study engagement, indeed, is positively associated with academic performance and success [e.g., Refs. (16–18)] and with wellbeing (17, 19–21). When introducing study engagement in their definition, Loscalzo and Giannini (12) made reference to Schaufeli et al. (22) definition, which has been derived from that of work engagement. Salanova et al. (23) assumed that students' activities could be considered as work: students and workers are involved in structured and mandatory activities that are directed toward a goal. Consequently, the same three components of work engagement may be applied to study engagement: vigor, dedication, and absorption. Hence, Loscalzo and Giannini (12) included these three dimensions in their study engagement definition, but they also specified that intrinsic motivation should be considered as an additional component for the analysis of study engagement when analyzing studyholism.

The introduction of study engagement in the definition of studyholism, which is based on the workaholism literature (5, 24, 25), allows to specify that not all the students with high time and energy investment in study (or heavy study investors, HSIs) are studyholics. Studyholism and study engagement are indeed two different forms of heavy study investment.

In line with this, crossing the high/low levels of studyholism (or study-related obsessive-compulsive symptoms) and study engagement, it is possible to define four kinds of student, three of which are HSIs: disengaged studyholics, engaged studyholics, engaged students, and detached students (12). **Table 1** shows the four types of student.

The detached student, being characterized by low levels of both studyholism/study-related obsessive-compulsive symptoms and study engagement, is not an HSI. This is a negative type of student, as he/she is not studyholic, but he/she is also detached from one of the most important activities in his/her life, namely, studying, which in turn could lead to negative consequences, such as low academic performance, high intention to drop out from school, and psychological impairment.

Regarding the HSIs, the engaged student is the most desirable one, characterized by low levels of studyholism/study-related

TABLE 1 | Loscalzo and Giannini's (2017) four types of student.

Type of student	Studyholism (obsessive-compulsive symptoms) level	Study engagement level	Heavy study investor	Negative type of student
Detached Student	Low	Low	No	Yes
Engaged Student	Low	High	Yes	No
Engaged Studyholic	High	High	Yes	Yes
Disengaged Studyholic	High	Low	Yes	Yes

obsessive-compulsive symptoms and high levels of study engagement.

Finally, the two types of studyholics are both characterized by high levels of studyholism/study-related obsessive-compulsive symptoms, but they differ in their high (engaged studyholics) or low (disengaged studyholics) levels of study engagement. Loscalzo and Giannini (12) specified that when referring to disengaged studyholics, they could simply be called studyholics, as to maintain continuity with the workaholism literature that has generally adopted a negative conceptualization. However, by introducing the engaged studyholic type, they pointed out that there could be a less impaired kind of studyholic. Engaged studyholics, even though less impaired, should receive a preventive intervention aiming to avoid their development into the disengaged type and foster instead their evolution into engaged students. In conclusion, the distinction between engaged and disengaged studyholics, as well as among the three kinds of HSI, is a core point of Loscalzo and Giannini's (12) theorization as it allows preventing overpathologization of a common and often desirable behavior such as study (26). The authors pointed out that overstudying (or studyholism) should be considered as a pathological behavior only when it is associated with low study engagement and high impairment.

Finally, Loscalzo and Giannini (12) presented a model including both possible antecedents and outcomes of studyholism, which also distinguishes between individual and situational antecedents/outcomes. In order to develop this model, they referred mainly to Loscalzo and Giannini's (5) workaholism model. The literature about problematic overstudying is scant (10–15, 27–29), while the workaholism literature is extensive. Hence, *keeping in mind the possible differences that could exist between workaholism and studyholism*, the knowledge about workaholism could be useful for the proposal of a studyholism model that needs to be tested in order to be adjusted based on the specific findings gathered with regard to studyholism.

More specifically, among individual antecedents, Loscalzo and Giannini (12) listed personality traits, perfectionism, motivation, cognitive factors, inability to down-regulate negative emotions, and psychiatry disorders. As far as situational antecedents are concerned, they proposed the overstudy climate, which might be spread both at school and in the family. They included the area of study as an example of situational antecedent related to the overstudy climate, as they speculate that some kind of majors (e.g., medical studies) may foster studyholism more than other courses (e.g., humanities studies). Finally, concerning studyholism outcomes, they suggested low wellbeing at school (especially in non-university students), low academic performance, physical and health impairment (including psychological disorders), and family functioning problems among the individual ones, while they listed aggressive behaviors and low positive relationships in class (especially in non-university students) among the situational outcomes.

The present study aims to shed light on the internalizing (i.e., OCD-related) and/or externalizing (i.e., behavioral addiction) nature of problematic overstudying and on the antecedents and outcomes suggested by Loscalzo and Giannini (12) as being associated with studyholism. By adopting the OCD model (12, 14, 15), it follows that two antecedents deserving attention are perfectionism and worry.

Although in the literature there are many different multidimensional conceptualizations of *perfectionism*, there seems to be consensus that it can generally be represented by very high strivings and concerns (30). These two components have different associations with positive and negative outcomes. More specifically, perfectionistic concerns (PC) is associated with higher psychopathology and lower health and wellbeing (31–35). Perfectionistic strivings (PS), instead, has a positive association with positive affect, life satisfaction, and physical health (32, 36–38), even though it seems also to be a risk factor for eating disorders and low physical health (34, 39, 40). As concerns these mixed findings about PS, Stoeber (30) suggested that the presence of both high strivings and concerns leads to negative outcomes, while the presence of elevated strivings without high concerns is generally associated with healthier adjustment.

Perfectionism has been widely studied in workers, perhaps because most people have at least one life domain in which they are perfectionistic (41), and this life domain often seems to be work, also including academic work (41, 42). Some studies showed that perfectionism is associated with lower productivity and efficiency (43, 44). Moreover, for the specific relationships between PS, PC, and work-related constructs, Stoeber and Damian (45) highlighted that the studies conducted until now showed that PS is associated with higher work engagement. PC, instead, is unrelated in some studies, while in others, it has a negative relationship with work engagement. The same relationships between PS, PC, and work engagement have been found in students too (46, 47). With regard to the relationship between perfectionism and workaholism, Clark et al. (48) recently conducted a meta-analysis on 10 studies, finding a close relationship between the two constructs. Moreover, referring to five studies published about the relationship between workaholism and perfectionism including a distinction between PS and PC, they reported that both PS and PC are positively related to workaholism (in some studies in both correlation and regression analyses, while in others only in one of the two analyses). Finally, Mazzetti et al. (49), analyzing PS only, found that it has a positive correlation with workaholism only in the context of an overwork climate. In conclusion, while both PS and PC are positively related to workaholism, PS is generally related to higher work engagement, while PC is generally associated with less work engagement (50).

Besides professional work, academic work is also a life domain often characterized by perfectionism (41, 42). However, the literature about perfectionism in academic settings is not so extensive, as could be expected (51). Rice et al. (52) summed up the literature about the relationship between academic outcomes and perfectionism by stating that generally studies have found that PS is positively associated with grade point average (GPA), while the relationship between PC and GPA is instead less consistent, and when statistically significant, PC is found to be negatively associated with GPA, and the effect size is usually small. This finding seems to be consistent across different school levels, namely, middle school, high school, and college (52).

Perfectionism is an antecedent of many psychological problems, such as depression, anxiety, eating disorders, and OCD (35, 39, 53). Regarding OCD specifically, perfectionism has been suggested as a risk factor for developing OCD (54), even though for some scholars it is better conceptualized as a predisposing trait for OCD; hence, it is necessary but not sufficient for the development of OCD (55). Perfectionism is present at high levels in people with an OCD diagnosis (53, 56–59), and it is negatively related to treatment response (59, 60). It is correlated with obsessive-compulsive symptoms also in non-clinical population (55, 61). Moreover, Pinto et al. (62), in their review of the literature about perfectionism in OCD, reported that perfectionism is also present in many OCD-related disorders, such as body dysmorphic disorder, trichotillomania, skin picking, and hoarding problems. Finally, they conclude their review by stating that OCD and perfectionism are related, especially in the dimensions of doubt about actions and concern over mistake.

Another antecedent deserving attention is worry. It is a form of repetitive negative thinking (RNT) that is usually described as the core component of general anxiety disorder (GAD; 2) and recently has been proposed as a transdiagnostic process, as it is present in most psychopathologies (63–66). As an example, it has been showed that worry is a factor contributing to OCD, panic disorder, social phobia, and depression (67–71). Worry, besides being a common process across several internalizing disorders, is associated with many negative outcomes, such as higher stress, lower physical health, and sleep problems (72–77). Moreover, trait worry is related to perfectionism (78, 79) and to higher concern over mistakes (80), which may be associated with several negative outcomes. The instrument usually used to evaluate trait pathological worry is the Penn State Worry Questionnaire (PSWQ) (81), whose items are not related to specific domains but are instead content free. Given this characteristic, the PSWQ is appropriate for evaluating trait worry (82, 83), especially when the researcher aims to evaluate its role as an antecedent of other disorders than GAD.

By means of preliminary analyses on a sample of 300 Italian college students (84), we selected six antecedents (i.e., PS, PC, study-related perfectionism, trait worry, overstudy climate, and major of study) and 12 outcomes (GPA, hours spent studying daily generally and before exams, university dropout intention, positive and negative affect, general stress, sleep quality impairment, daytime sleepiness, relationship impairment due to study, family and friends' complaints, and aggressive behaviors at university) to study in a sample of college students. On the basis of the literature, we hypothesized that while studyholism has a negative effect on academic performance, and psychological and health wellbeing, study engagement instead has a positive effect on these variables. **Table 2** shows our hypotheses concerning both the antecedents and the outcomes.

Finally, we analyzed whether there are differences as far as studyholism (and study engagement) antecedents and outcomes are concerned among the four kinds of student proposed by Loscalzo and Giannini (12): disengaged studyholics, engaged studyholics, engaged students, detached students. Loscalzo and Giannini (12), in their theoretical model, suggested that disengaged studyholics might have higher functional impairment than have engaged studyholics and that detached students may experience negative consequence anyway. Engaged students, instead, are defined as the more desirable kind of student.

It is essential to highlight that, in order to support the OCD model (12) against the addiction model (11), the result about the predictive value of worry on studyholism seems to be the most critical. We expect to find a high predictive value of worry (i.e., a β value higher than .50). The predictive value of perfectionism seems to be less critical, as previous studies about its relationship with OCD showed that this personality trait is necessary but not sufficient for the development of OCD (55).

Also, in order to confirm Loscalzo and Giannini's (12) model more generally, we expect to find some differences in the antecedents and outcomes between disengaged studyholics and engaged studyholics. These findings would also question the Atroszko et al. (11) model, which does not foresee the distinction between two subtypes of study addicted: with a high or low level of study engagement.

In sum, even if this is the first research to adopt Loscalzo and Giannini's (12) model for analyzing problematic overstudying, it may have important implications for both preventive and clinical purposes (i.e., developing interventions aiming to foster academic success and students' wellbeing). Also, it may help to shed light on the internalizing and/or externalizing nature of problematic overstudying, which until now has been analyzed from the addiction model perspective only. In this context, we want to highlight that, especially in light of comorbidity issues, we cannot define this new potential clinical condition as a pure OCD-related disorder (or as a pure behavioral addiction). We believe instead that it may be better defined as a condition more similar to an OCD-related disorder than to an addiction (12–15, 86).

METHOD

Participants

We recruited a sample of 1,958 Italian college students (75.4% females, 24.6% males) aged between 18 and 60 years (*M* age = 23.53 ± 4.43).

They attended their courses in many different Italian cities, although Florence is the most represented (39.2%). Regarding major area of study, we created the following macro groups: technology (engineering, architecture, and informatics), 11.2%; social sciences (psychology, sociology, economy, law, educational studies, etc.), 31%; humanities (literature, language, art, philosophy, history, etc.), 25.9%; medical studies, 13%; science (math, physics, biology, statistics, and chemistry), 12.8%; helping professions (nursing, obstetrics, etc.), 1.1%; and para-medical studies (biotechnology, veterinary medicine, pharmacy, etc.), 5%. The proportions of students in years 1 to 5 were 16%, 20.9%, 26.7%, 14.2%, and 15.2%, respectively. Moreover, 7% of the students reported being in their sixth year. Nearly half of these participants are medical students (it is the only course that requires 6 years for getting the master degree), while the others are students in other courses. Moreover, 65% of these students

TABLE 2 | Hypotheses about the antecedents and the outcomes analyzed in the study.

Variable	Hypotheses	Literature
Perfectionistic Strivings (PS) or the perfectionism component usually associated with positive outcomes	(i) any specific hypothesis for SH	Some studies found a positive association between PS and workaholism (45), while Loscalzo (84) preliminary study found that it does not predict SH on Italian students.
	(ii) Positively predicts SE	e.g., 45, 46
	(iii) Positively predicts positive emotions	e.g., 36, 38
	(iv) Positively predicts GPA	52
	(v) Positively predicts study-related perfectionism	It is based on the consideration that study-related perfectionism is a domain-specific type of perfectionism.
Perfectionistic Concerns (PC) or the perfectionism component usually associated with negative outcomes	(i) Positively predicts SH	45
	(ii) Negatively predicts SE	However, it should be noted that while some studies support this hypothesis, other studies found the absence of a relationship between PC and work engagement (45).
	(iii) Positively predicts dropout intention	It is based on the literature supporting that PC is usually associated with negative outcomes (e.g., 31, 33).
	(iv) Negatively predicts positive emotions and positively predicts negative emotions, general stress, and sleep problems	e.g., 32, 34
	(v) Positively predicts study-related perfectionism	It is based on the consideration that study-related perfectionism is a domain-specific type of perfectionism.
	(vi) Any specific hypothesis concerning the effect on GPA	The literature shows inconsistent findings about the relationship between the two variables (52)
Study-related Perfectionism	(i) Positively predicts some study-related variables: SH, SE, GPA, time spent studying, aggressive behaviors at university, family and friends' complaints, and the conflict between study and personal relationships	It is based on the consideration that it is a perfectionism form specifically related to study.
Trait worry	(i) Positively predicts SH	Worry is a factor contributing to OCD (68), and it is a transdiagnostic process across internalizing disorders (e.g., 64, 66)
	(ii) Negatively predicts SE	SE is a positive factor, while trait worry is a feature of internalizing disorders (e.g., 64, 66)
	(iii) Positively predicts study-related perfectionism	It is based on the literature showing that worry is related to perfectionism (79, 80)
	(iv) Positively predicts negative emotions, general stress and sleep problems, and negatively predicts positive emotions	e.g., 75–77
School and Family Overstudy Climate or the students' perception that their family and teachers expect that they overstudy	(i) Positively predicts SH	5, 12, 49
	(ii) Negatively predicts SE	It is based on the consideration that SE is a positive factor, while overstudy climate is a variable that foster SH and workaholism (5, 12, 49)
	(iii) Overstudy climate, as communicated by means of teacher overt comments about performance, positively predicts two study-related variables, namely, study-related perfectionism and aggressive behaviors at the University	It is based on the speculation that comments about the performance may influence study-related behaviors
Area of Study—Technology, Social Sciences, Humanities, Medical, Sciences	(i) Medical studies positively predict SH and Humanities studies negatively predict SH. Any other hypothesis about the effect of the area of study on SH.	12
	(ii) Any specific hypothesis about the direction of the prediction for school-related variables: SE, GPA, time spent studying (i.e., hours per day of study generally and before exams), and social relationship impairment due to study	There are no previous studies comparing the same area of study groups on these variables.
Studyholism	(i) Does not predict GPA or negatively predicts it but with a low value (i.e., less than .20)	11, 85
	(ii) Does not predict positive emotions	preliminary study conducted by Loscalzo (84)
	(iii) Positively predicts time spent studying	12, 85
	(iv) Positively predicts the intention to drop out from university	12
	(v) Positively predicts negative emotions, general stress, sleep problems, relationship impairment due to study	e.g., 5, 11, 12, 48

TABLE 2 | Continued

Variable	Hypotheses	Literature
	(vi) Positively predicts family and friends' complaints about study and aggressive behaviors at the university	5, 12
Study Engagement	(i) Positively predicts GPA	e.g., 16, 18, 21
	(ii) Positively predicts time spent studying	85
	(iii) Positively predicts positive emotions	e.g., 17, 19
	(iv) Negatively predicts the intention to drop out from university	e.g., 16, 17, 21
	(v) Negatively predicts negative emotions, general stress, sleep problems, aggressive behaviors at the university, family and friends' complaints about study and relationship impairment due to study	e.g., 19–21

SH, Studyholism; SE, Study Engagement; GPA, Grade Point Average.

declared having been rejected during school or being currently behind in their studies. Thus, we suggest that probably non-medical students and some medical students are behind in their studies and not actually in their sixth year. Unfortunately, we did not differentiate the question about being currently late with studies or having been rejected before university; hence, further distinctions cannot be made.

Materials

Study-Related Perfectionism Scale (87)

The Study-Related Perfectionism Scale (SPS) is an 11-item self-report instrument that allows an evaluation of maladaptive perfectionism in the academic context by means of four scales: excessive strivings and concerns, error intolerance, inability to delegate, and group work avoidance. The participants answer by indicating how much they agree with each item by means of a five-point Likert scale ranging between 1 (*strongly disagree*) and 5 (*strongly agree*). The SPS has good fit indices for a four-factor model (GFI = .96; CFI = .97; RMSEA = .06) and good internal reliability for its total score (α = .82), which may be calculated due to the good correlation between the factors. The SPS also has good convergent validity (87).

Penn State Worry Questionnaire (81)

This is a 16-item self-report instrument that measures trait worry. Since it is content free, it does not evaluate worries related to specific time frames or situations. Five items need to be reversed in order to get the total score for the test. The response format is a five-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The Italian version (88) shows good psychometric properties and good internal reliability (α = .85), although four reversed items are not fully satisfactory. In the present study, the α value is even higher: .89.

Overstudy Climate Scale (89)

The Overstudy Climate Scale (OCS) is an 18-item self-report instrument that allows evaluating parent overstudy climate (P-OSC) and teacher overstudy climate (T-OSC). As far as T-OSC is concerned, this is evaluated by means of two scales: pressure toward hard study (T-OSC-HS) and overt comments related to the students' academic performance (T-OSC-OC). The response format is a five-point Likert scale ranging between 1 (*strongly disagree*) and 5 (*strongly agree*). The OCS has good psychometric properties. The three-factor structure showed a good fit (GFI = .93; CFI = .97; RMSEA = .04). Moreover, the three scales have good internal consistency: P-OCS, α = .90; T-OCS-HS, α = .85; and T-OCS-OC, α = .80 (89).

Short Almost Perfect Scale (90)

The Short Almost Perfect Scale (SAPS) is an eight-item self-report instrument that allows evaluating both PS (standards scale) and PC (discrepancy scale). It is the short form of the Almost Perfect Scale—Revised (APS-R) (91). The participants answer on a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). We administered the Italian version of the SAPS (92), which has a better fit for the six-item and two-factor model (CFI = .95; RMSEA = .10) than has the original eight-item version (CFI = .88; RMSEA = .13). More specifically, the Italian version of the SAPS does not include items 2 (discrepancy) and 5 (standards) in the scoring. The internal reliability of the scale is .83 for standards and .68 for discrepancy. Even though the psychometric properties of the SAPS are not fully satisfactory, we decided to retain this instrument, as other perfectionism instruments are much longer than the SAPS, and we believe it was better to have a short test, given the many instruments administered to the participants in this research. Also, the Italian and US SAPS showed partial scalar invariance, indicating functional equivalence (93).

Studyholism Inventory (86)

It is a 10-item self-report and brief screening instrument that allows evaluating studyholism and study engagement. It was created by an initial pool of 68 item, and its final 10-item version (with two filler items, one for each scale) has good psychometric properties (85, 86). Moreover, using the cutoffs proposed by Loscalzo and Giannini (85), it is possible to distinguish between high and low studyholism and study engagement. Moreover, by crossing high/low levels of studyholism/study engagement, it is possible to identify four kinds of student: disengaged studyholics, engaged studyholics, engaged students, and detached students. Finally, the first sheet of the instrument includes some open-format questions about study habits (e.g., studying on the

weekend, and hours of study per day). The participants answer by indicating how much they agree with each item by means of a five-point Likert scale ranging between 1 (*strongly disagree*) to 5 (*strongly agree*).

Mini Sleep Questionnaire (94)

This is a 10-item self-report instrument evaluating sleep quality and daytime sleepiness. The participants answer by means of a seven-point Likert scale ranging between 1 (*never*) and 7 (*Always*). The Italian version (95) maintained the original two-factor structure, and it has good psychometric properties. Cronbach's *alpha* is .75 for both sleep quality and daytime sleepiness. However, one item (snoring) is not included in the scoring for the Italian version.

Study–Relationship Conflict Scale (96)

The Study–Relationship Conflict Scale (SRCS) is a nine-item self-report instrument that allows evaluating the following scales: quarrels at school (QS); relationship impairment (RI), and family and friends' complaints (FFC). The response format is a five-point Likert scale ranging between 1 (*strongly disagree*) and 5 (*strongly agree*). The three-factor structure fits the data well (GFI = .98; CFI = .98; RMSEA = .04), and the three scales have good internal reliability, especially taking into account the fact that each scale is made up of three items only: QS, α = .67; RI, α = .63; and FFC, α = .64 (96).

Depression Anxiety Stress Scales-21 (97)

The Depression Anxiety Stress Scales-21 (DASS-21) is a 21-item self-report scale that has been derived from a longer 42-item version (DASS) (98) by selecting seven representative items for each of the three scales (i.e., depression, anxiety, and stress). The participants answer by means of a four-point Likert scale ranging between 0 (*did not apply to me at all - never*) and 3 (*applied to me very much, or most of the time - almost always*). The Italian version (99) retained both the three-factor structure and the one-factor structure, hence allowing us to refer to a total score of general stress. Moreover, the Italian version has good psychometric properties, and, as far as the internal reliability in the community sample goes, the α values are .82 (depression), .74 (anxiety), .85 (stress), and .90 (general stress).

Positive and Negative Affect Schedule (100)

This is a 20-item self-report instrument that assesses two emotional dimensions: positive and negative affect. Each scale is composed of 10 items. The participants respond to each item by means of a five-point Likert scale ranging from 1 (*very slightly* or *not at all*) to 5 (*extremely*). There are two versions of the Positive and Negative Affect Schedule (PANAS), which differ in the instruction only, as they can refer to positive and negative affect as a trait, or as a state. For this study, as we were interested in affectivity as a studyholism outcome, we used the state version. The Italian version (101) has good psychometric properties, and the internal consistency is .85 for state negative affect and .83 for state positive affect.

Intention to Drop Out of University (102)

We used the Italian translation (103) of the three items used by Hardre and Reeve (102) for evaluating the intention to drop out of school. Two items have been shown to predict dropping out one year later (104). The response format of the three items is on a five-point Likert scale ranging from 1 (*never*) to 5 (*very often*). For the present study, we changed the word "school" to "university" in two items.

Procedure

Once we obtained ethical approval from the University of Florence in order to gather the data and to conduct the present research, we created an online questionnaire including all the instruments, in the same order that we described them in the previous section. In addition, we added a first page with demographic data (e.g., gender and age). Study-related variables such as GPA and time spent studying are included in the open-question sheet of the Studyholism Inventory (SI-10).

Students attending courses in Florence were contacted by means of an invite that they received through their institutional email addresses, thanks to the University Office's collaboration. In the email that they received, the main objective of the research was explained, and the email address of one of the authors was provided. They could respond through this e-mail address to ask for the link to the questionnaire in order to fill it out anonymously. Since we thought that this kind of active participation (the students contacted us personally in order to get the questionnaire) could limit the participations of students, we tried to reach more Florence students by sharing the link to the questionnaire on several Facebook University groups. Moreover, in order to get the participation of students from other Italian cities and regions, we also shared the questionnaire's link in Facebook University groups of other Italian cities. The use of social media as a valid recruiting tool is supported by previous studies that have shown that samples collected through this recruitment strategy are no different from those gathered through other data collection methods (105–107).

Given that the questionnaire was administered online, we could not ask the participants to sign the informed consent before filling out the questionnaire. However, we wrote the usual informed consent information in the first page of the questionnaire. Then, we asked the participants to check a box saying that they agreed to take part in the research by going on and filling out the questionnaire on the following pages.

Data Analysis

We performed the analyses by means of SPPS.22 (Chicago, IL, USA) and AMOS.20 (Chicago, IL, USA).

First, we calculated descriptive statistics for the variables analyzed in this research and their zero-order correlations. Then, in order to test the hypotheses that are related to studyholism and study engagement antecedents and outcomes, we tested a structural equation model (SEM). More specifically, as the model does not involve any latent factor, we tested, by means of path analysis (maximum likelihood estimate method), the direct effects of the antecedents on studyholism and study engagement and on other studyholism antecedents (e.g., worry on study-related perfectionism), as well as the direct effects of studyholism and study engagement on academic,

psychological, and physical outcomes and the direct effects of some antecedents on these outcomes. In order to evaluate the fit of the model, we used the following indices and cutoff values: χ^2/df ratio, which indicates a good fit if its value is less than 3 (108), although it is influenced by sample size (109); goodness-of-fit index (GFI), comparative fit index (CFI), Tucker–Lewis index (TLI), and normed fix index (NFI), whose cutoffs are <.90 lack of fit, .90–.95 good fit, and >.95 excellent fit (110); and root mean square error of approximation (RMSEA), where a value below .05 indicates excellent fit, while values between .05 and .08 indicate an acceptable fit (111). For all analyses, $p < .05$ is considered statistically significant and $\beta = \pm .10$ as the cutoff value for supporting our hypotheses.

Finally, we analyzed if there are antecedents and outcomes differences among the four kinds of student by means of two MANOVAs (which were followed by the Bonferroni *post hoc* test) for a total of 19 follow-up ANOVAs. Due to the high number of multiple comparisons performed to evaluate differences among the four kinds of student on the same sample, we adjusted the alpha level by means of the Bonferroni correction for multiple comparisons. More specifically, we set an adjusted alpha level of .003 (112). The four groups of students have been created referring to the SI-10 (86) cutoff values for Italian College students (85).

RESULTS

Structural Equation Model

Table 3 shows descriptive statistics of all the variables analyzed in the SEM model: studyholism, study engagement, antecedents, and outcomes. **Table 4** shows the zero-order correlations of the study variables. From **Table 3**, it is evident that one variable does not have a normal distribution (quarrels at university); however, we decided to retain it in the model as it is not a predictor and because deleting this scale from the model does not improve the fit markedly.

Figure 1 depicts the theoretical model we are going to test, namely, Loscalzo and Giannini's (12) comprehensive model, while **Figure 2** shows the operationalized graphical model as suggested by Nicol and Pexman (113). However, as our hypothesized model involves many antecedents and outcomes, as well as several direct relationships between antecedents and outcomes, we depicted the major links only. Hence, **Figure 2** shows the relationships between both studyholism and study engagement and their antecedents and outcomes.

As far as the other hypothesized relationships are concerned, we presented them in **Table 5**. This table shows all the relationships we are going to analyze with the SEM in order to test our hypotheses about studyholism and study engagement antecedents and outcomes.

The hypothesized model showed an excellent fit to the data: $\chi^2 = 742.194$, $df = 188$, $p < .001$, $\chi^2/df = 3.95$; CFI = .97; NFI = .96; TLI = .95; RMSEA = .039. The structural model, with standardized path estimates and the variance explained by the predictors of each dependent variable, is presented in **Table 5**. Moreover, **Figure 3** depicts the major links with their standardized path estimates.

In sum, the model explains the 56% of the variance in studyholism, with the strongest predictor being worry ($\beta = .67$, $p < .001$). The other hypothesized studyholism antecedents are instead not statistically significant or they have very low β values (e.g., PC: $\beta = .06$, $p = .001$). Moreover, the model explains 32% of the variance in study engagement, and PS is its strongest predictor ($\beta = .41$, $p < .001$).

TABLE 3 | Descriptive statistics of all the variables in the model (n = 1,958).

Variable	Range	*M* (SD)	Skewness	Kurtosis
Studyholism	4–20	14.83 (3.78)	−.50	−.47
Study Engagement	4–20	14.77 (3.59)	−.54	−.23
Perfectionistic Concerns (Discrepancy)	3–21	13.27 (4.83)	−.16	.48
Perfectionistic Strivings (Standards)	3–21	16.99 (3.42)	−.85	−.89
Study–related Perfectionism	11–54	28.75 (8.51)	.32	−.42
Worry	16–80	55.21 (14.03)	−.25	−.74
Parent Overstudy Climate	9–45	24.08 (8.98)	.34	−.73
Teacher Overstudy Climate—Hard Study	4–20	8.21 (3.81)	.90	.23
Teacher Overstudy Climate—Overt Comments	5–25	17.43 (4.59)	−.41	−.16
Grade Point Average	18–31*	26.62 (2.22)	−.64	.15
Hours per day of study—generally	0–16	4.47 (2.14)	.60	.50
Hours per day of study—before exams	0–16.5	7.23 (2.35)	.44	.83
Dropout Intention	3–15	6.43 (3.58)	.93	−.19
Positive Affect	10–50	26.99 (8.80)	.21	−.69
Negative Affect	10–50	23.02 (10.22)	.51	−.76
General Stress	0–63	27.78 (16.07)	.28	−.85
Sleep Quality Impairment	5–35	18.63 (7.02)	.09	−.67
Daytime Sleepiness	4–28	18.02 (5.68)	−.30	−.65
Quarrels at University	3–15	4.04 (1.88)	2.46	7.39
Family and Friends' Complaints	3–15	6.14 (3.05)	.90	.06
Social Relationship Impairment	3–15	7.08 (3.18)	.54	−.51

**Italian GPAs range between 18 and 30; 31 stands for 30 cum laude.*

TABLE 4 | Zero-order correlations for study variables (n = 1,958).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. PC	–																				
2. PS	.16***	–																			
3. SPS	.38***	.38***	–																		
4. PSWQ	.48***	.10***	.40***	–																	
5. P-OCS	.20***	–.03	.16***	.16***	–																
6. T-OSC-OC	.22***	.06**	.24***	.19***	.27***	–															
7. T-OSC-HS	.16***	.08***	.20***	.20***	.35***	.52***	–														
8. SH	.42***	.11***	.34***	.73***	.17***	.22***	.25***	–													
9. SE	–.15***	.46***	.29***	.04	–.10***	–.01	–.01	.09***	–												
10. GPA	–.24***	.24***	.21***	–.04	–.15***	–.05*	–.09***	–.08***	.39***	–											
11-H-Gen	.06*	.20***	.12***	.11***	–.03	.06**	.06**	.19***	.30***	.10***	–										
12. H-Exams	.08***	.19***	.18***	.17***	.02	.04	.09***	.20***	.27***	.16***	.56***	–									
13. Drop Int.	.36***	–.13***	.10***	.35***	.19***	.22***	.17***	.36***	–.31***	–21***	-06**	–.04	–								
14. PANAS+	–.20***	.24***	–.02	–.25***	–.09***	–.01	–07**	–.19***	.31***	.09***	.09***	–.01	–23***	–							
15. PANAS–	.44***	.05****	.30***	.57***	.20***	.21***	.17***	.51***	–.08***	–13***	.07**	.10***	.38***	–08***	–						
16. DASS-21	.50***	.07**	.34***	.69***	.23***	.24***	.23***	.62***	–.10***	–13***	.09***	.13***	.47***	–20***	.72***	–					
17. MSQ-SQ	.36***	.07**	.23***	.50***	.19***	.19***	.15***	.46***	-07**	–13***	.05*	.05*	.33***	–10***	.50***	.62***	–				
18. MSQ-DS	.37***	.04	.21***	.46***	.21***	.18***	.19***	.45***	–.09***	–14***	.02	.08***	.31***	–17***	.48***	.60***	.64***	–			
19. SRCS-Q	.18***	.01	.20***	.16***	.18***	.34***	.18***	.15***	–.04	–06**	.04	.05*	.18***	.02	.25***	.25***	.22***	.20***	–		
20. SRCS-C	.08***	.29***	.38***	.26***	.01	.17***	.12***	.26***	.40***	.29***	.30***	.28***	–.02	.15***	.18***	.19***	.12***	.09***	.25***	–	
21. SRCS-SI	.23***	.19***	.35***	.36***	.15***	.20***	.21***	.42***	.22***	.06**	.32***	.32***	.14***	–.03	.30***	.35***	.24***	.23***	.28***	.58***	–

****p ≤.001; **p ≤.01; *p < .05; PC, Perfectionistic Concerns, SAPS Discrepancy scale; PS, Perfectionistic Strivings, SAPS Standard scale; SPS, Study-related Perfectionism Scale; PSWQ, Penn State Worry Questionnaire; P-OCS, Parent Overstudy Climate Scale; T-OSC-OC, Teacher Overstudy Climate Scale, Over Comments scale; T-OSC-HS, Teacher Overstudy Climate, Hard Study scale; SH, Studyholism; SE, Study Engagement; GPA, Grade Point Average; H-Gen, Hours of study per day generally; H-Exams, Hours of study per day before exams; Drop Int., Dropout Intention; PANAS +, Positive Affect; PANAS–, Negative Affect; DASS-21, Depression Anxiety Stress Scale-21, General Stress; MSQ-SQ, Mini Sleep Questionnaire, Sleep Quality; MSQ-DS, Mini Sleep Questionnaire, Daytime Sleepiness; SRCS-Q, Study–Relationships Conflict Scale, Quarrels at School scale; SRCS-C, Study–Relationships Conflict Scale, Family and Friends' Complaints scale; SRCS-SI, Study–Relationships Conflict Scale, Social Impairment scale.*

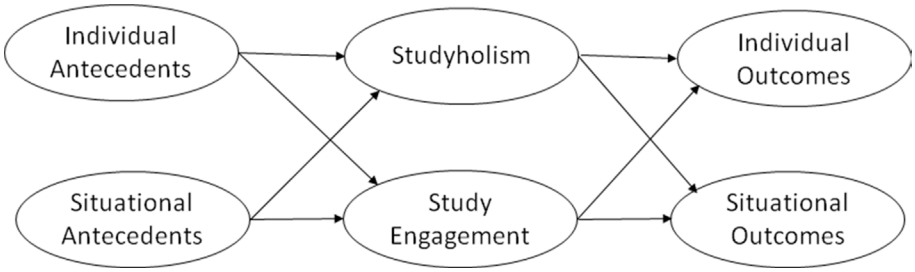

FIGURE 1 | Loscalzo and Giannini's (2017b) theoretical model.

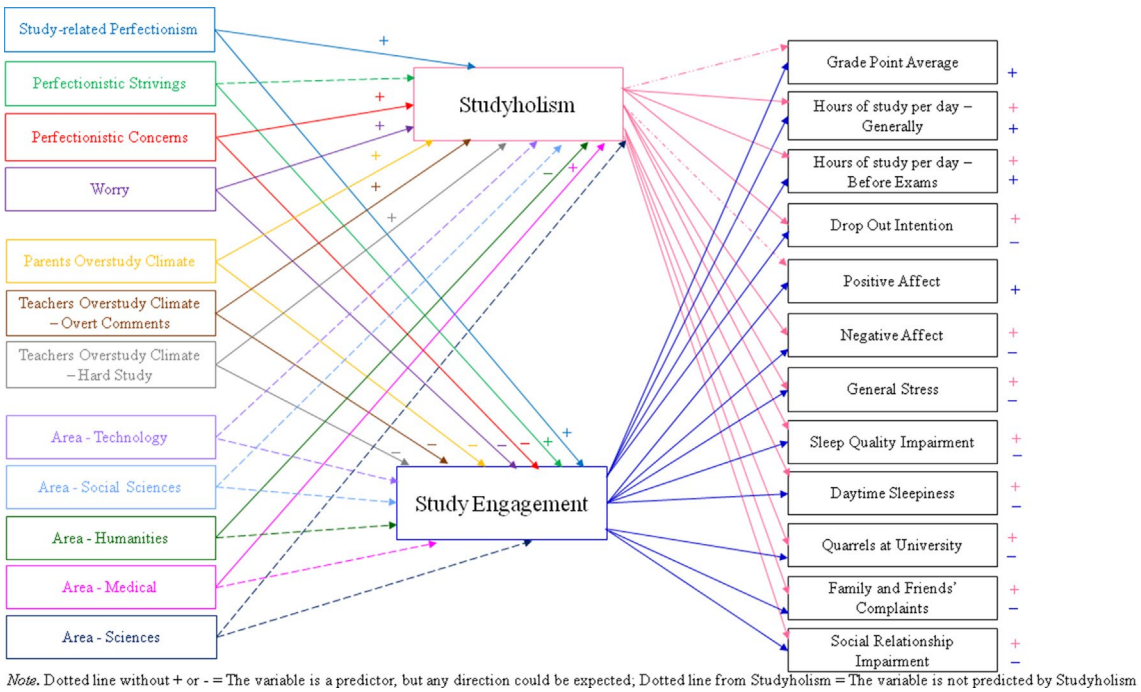

FIGURE 2 | Hypothesized model for Studyholism and Study Engagement antecedents and outcomes.

For outcomes, general stress is the dependent variable whose variance is explained the most by its predictors (they explain the 54% of the variance). The strongest predictor of general stress is worry (β = .43, $p < .001$), followed by studyholism (β = .25, $p < .001$). Finally, the model explains 27% of variance in dropout intention, with studyholism positively predicting it (β = .30, $p < .001$) and study engagement negatively predicting it (β = −.30, $p < .001$).

Differences in Studyholism Antecedents Among the Four Kinds of Student

In order to analyze if there are differences among the four kinds of student (i.e., disengaged studyholics, engaged studyholics, engaged students, and detached students) in PS, PC, study-related perfectionism, worry, and overstudy climate (P-OSC, T-OSC—overt comments, and T-OSC—hard study), we performed a MANOVA with the type of student as independent variable and the individual and situational antecedents as dependent variables.

The multivariate test showed a statistically significant effect for type of student: $F(21, 531) = 26.11$, $p < .001$, partial $\eta^2 = .49$. Next, follow-up ANOVAs showed that regardless that a Bonferroni adjusted alpha level of .003 is used, there is a statistically significant group difference on all the antecedents analyzed, except for T-OSC—overt comments ($p = .005$). **Table 6** shows the descriptive statistics and the follow-up ANOVA results of MANOVA for all the antecedent variables analyzed. **Figure 4** shows the graphical representation of the contrasts in the means for the four groups analyzed.

More specifically, the Bonferroni *post hoc* test revealed that disengaged studyholics have statistically significantly lower levels of *PS* than have both engaged studyholics ($p < .001$) and engaged students ($p < .001$). Moreover, engaged studyholics and engaged students have higher PS than have detached students

TABLE 5 | Hypothesized model for studyholism and study engagement antecedents and outcomes (see Hypothesized Direction column) and standardized path weights and R^2 for each dependent variable of the structural equation model (n = 1,958).

Dependent variable	R^2	Predictor	Hypothesized direction	β	*p*-value	Hypothesis confirmed
Study—Perfectionism	.32					
		Perf. Strivings	+	.32	<.001	Yes
		Perf. Concerns	+	.17	<.001	Yes
		Worry	+	.26	<.001	Yes
		T-OSC-Overt Com.	+	.14	<.001	Yes
Studyholism	.56					
		Perf. Strivings	?	.02	ns	N/A
		Perf. Concerns	+	.06	.001	No
		Study—Perfectionism	+	.02	ns	No
		Worry	+	.67	<.001	Yes
		P-OSC	+	.01	ns	No
		T-OSC-Overt Com.	+	.02	ns	No
		T-OSC-Hard Study	+	.08	<.001	No
		Area—Technology	?	.02	ns	N/A
		Area—Social Sciences	?	−.05	ns	N/A
		Area—Humanities	−	−.08	.01	No
		Area—Medical	+	.01	ns	No
		Area—Sciences	?	−.02	ns	N/A
Study Engagement	.32					
		Perf. Strivings	+	.41	<.001	Yes
		Perf. Concerns	−	−.33	<.001	Yes
		Study—Perfectionism	+	.24	<.001	Yes
		Worry	−	.07	<.001	No
		P-OSC	−	−.07	.002	No
		T-OSC-Overt Com.	−	−.01	ns	No
		T-OSC-Hard Study	−	−.03	ns	No
		Area—Technology	?	−.02	ns	N/A
		Area—Social Sciences	?	−.03	ns	N/A
		Area—Humanities	?	−.02	ns	N/A
		Area—Medical	?	−.02	ns	N/A
		Area—Sciences	?	−.03	ns	N/A
Grade Point Average	.30					
		Perf. Strivings	+	.08	<.001	No
		Perf. Concerns	?	−.25	<.001	N/A
		Study—Perfectionism	+	.21	<.001	Yes
		Studyholism	No	−.08	<.001	Yes*
		Study Engagement	+	.25	<.001	Yes
		Area—Technology	?	.02	ns	N/A
		Area—Social Sciences	?	.09	.02	N/A
		Area—Humanities	?	.34	<.001	N/A
		Area—Medical	?	.13	<.001	N/A
		Area—Sciences	?	.05	ns	N/A
Hours of study per day—Generally	.17					
		Studyholism	+	.15	<.001	Yes
		Study Engagement	+	.30	<.001	Yes
		Study—Perfectionism	+	−.01	ns	No
		Area—Technology	?	.05	ns	N/A
		Area—Social Sciences	?	−.13	.002	N/A
		Area—Humanities	?	−.14	<.001	N/A
		Area—Medical	?	.10	.002	N/A
		Area—Sciences	?	−.02	ns	N/A
Hours of study per day—Before Exams	.15					
		Studyholism	+	.14	<.001	Yes
		Study Engagement	+	.24	<.001	Yes
		Study—Perfectionism	+	.05	.02	No
		Area—Technology	?	.08	.02	N/A
		Area—Social Sciences	?	−.09	.04	N/A
		Area—Humanities	?	−.01	ns	N/A
		Area—Medical	?	.16	<.001	N/A
		Area—Sciences	?	.04	ns	N/A

TABLE 5 | Continued

Dependent variable	R^2	Predictor	Hypothesized direction	β	*p*-value	Hypothesis confirmed
Dropout Intention	.27					
		Studyholism	+	.30	<.001	Yes
		Study Engagement	–	–.30	<.001	Yes
		Perf. Concerns	+	.18	<.001	Yes
Positive Affect	.19					
		Studyholism	No	–.05	ns	Yes*
		Study Engagement	+	.23	<.001	Yes
		Perf. Strivings	+	.17	<.001	Yes
		Perf. Concerns	–	–.07	.007	No
		Worry	–	–.21	<.001	Yes
Negative Affect	.38					
		Studyholism	+	.20	<.001	Yes
		Study Engagement	–	–.08	<.001	No
		Perf. Concerns	+	.19	<.001	Yes
		Worry	+	.34	<.001	Yes
General Stress	.54					
		Studyholism	+	.25	<.001	Yes
		Study Engagement	–	–.11	<.001	Yes
		Perf. Concerns	+	.18	<.001	Yes
		Worry	+	.43	<.001	Yes
Sleep Quality Impairment	.29					
		Studyholism	+	.21	<.001	Yes
		Study Engagement	–	–.08	<.001	No
		Perf. Concerns	+	.13	<.001	Yes
		Worry	+	.28	<.001	Yes
Daytime Sleepiness	.27					
		Studyholism	+	.24	<.001	Yes
		Study Engagement	–	–.10	<.001	Yes
		Perf. Concerns	+	.15	<.001	Yes
		Worry	+	.22	<.001	Yes
Quarrels at University	.12					
		Studyholism	+	.06	.01	No
		Study Engagement	–	–.08	<.001	No
		Study—Perfectionism	+	.13	<.001	Yes
		T-OSC-Overt Com.	+	.27	<.001	Yes
Family and Friends' Complaints	.26					
		Studyholism	+	.16	<.001	Yes
		Study Engagement	–	.31	<.001	No
		Study—Perfectionism	+	.24	<.001	Yes
Social Relationship Impairment	.27					
		Studyholism	+	.33	<.001	Yes
		Study Engagement	–	.14	<.001	No
		Study—Perfectionism	+	.20	<.001	Yes
		Area—Technology	?	.08	.004	N/A
		Area—Social Sciences	?	–.04	ns	N/A
		Area—Humanities	?	–.05	ns	N/A
		Area—Medical	?	.08	.004	N/A
		Area—Sciences	?	.06	.03	N/A

*+, Positive predictor; –, Negative predictor; No, No predictor;?, No direction specified; β values lower than.10 are judged too low for saying that they support the hypothesis; Perf., Perfectionistic; Study—Perfectionism, Study-related Perfectionism; P-OSC, Parent Overstudy Climate; T-OSC-Overt Com., Teacher Overstudy Climate, Overt Comments; T-OSC-HS, Teacher Overstudy Climate, Hard Study; *, The hypothesis is confirmed, since it stated that the independent variable does not predict the dependent variable; N/A, Not Applicable, there was no specific hypothesis about the positive or negative direction.*

($p < .001$). There is no statistically significant difference between disengaged studyholics and detached students and between engaged studyholics and engaged students.

With regard to *PC*, disengaged studyholics have statistically significantly higher levels than have engaged studyholics ($p = .004$), detached students ($p < .001$), and engaged students ($p < .001$). Moreover, engaged studyholics have statistically significantly ($p < .001$) higher PC than have detached and engaged students. There is no difference between detached students and engaged students.

In addition, engaged studyholics have statistically significantly ($p < .001$) higher levels of *study-related perfectionism* than have

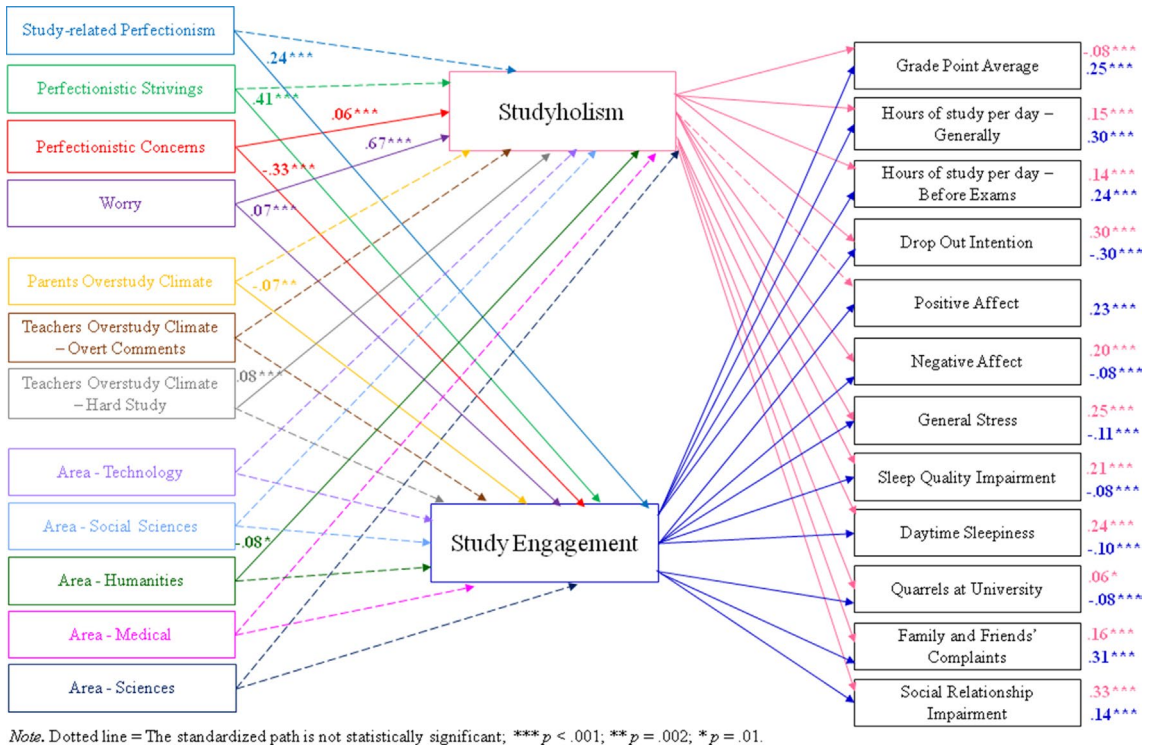

FIGURE 3 | Structural model with standardized path estimates for Studyholism and Study Engagement antecedents and outcomes (n = 1,958).

disengaged studyholics, and engaged and detached students. Moreover, disengaged studyholics have statistically significantly ($p < .001$) higher levels of study-related perfectionism than have detached students. Finally, detached students have marginally significantly ($p = .054$) lower levels of this antecedent than have engaged students. There is no difference between disengaged studyholics and engaged students.

Next, disengaged studyholics and engaged studyholics scored higher on *worry* than did both detached and engaged students ($p < .001$). There is no difference between disengaged and engaged studyholics, and between detached and engaged students.

Finally, concerning the overstudy climate, Bonferroni *post hoc* analyses showed, for *P-OSC*, that disengaged studyholics have statistically significantly higher levels than have detached ($p = .003$) and engaged ($p = .001$) students; however, there is no difference between disengaged and engaged studyholics, and there are no other statistically significant group difference on this variable. Moreover, the only statistically significant ($p = .011$) group difference on *T-OSC—hard study* is between engaged studyholics and engaged students, with the former scoring higher.

Differences in Studyholism Outcomes Among the Four Kinds of Student

In order to investigate if there are differences among the four kinds of student in sleep quality impairment, daytime sleepiness, positive and negative affect, general stress, quarrels at university, family and friends' complaints, social relationship impairment due to study, time investment in study, GPA, and intention to drop out from university, we performed a MANOVA with type of student as the independent variable and the outcomes as dependent variables.

The multivariate test showed a statistically significant effect for type of student: $F(36, 532) = 16.97$, $p < .001$, partial $\eta^2 = .53$. Next, follow-up ANOVAs showed that, regardless that a Bonferroni adjusted alpha level of .003 is used, there is a statistically significant group difference on all the outcomes analyzed, except for quarrels at university ($p = .035$). **Table 7** shows the descriptive statistics and the subsequent ANOVAs conducted after the multivariate test. **Figure 5** shows the graphical representation of the contrasts in the means for the four groups analyzed.

More specifically, concerning *sleep quality impairment* and *daytime sleepiness*, the Bonferroni *post hoc* test revealed that disengaged and engaged studyholics have statistically significantly ($p < .001$) higher levels of sleep quality impairment and daytime sleepiness than have detached and engaged students; however, there is no difference between engaged and disengaged studyholics and between engaged and detached students. Hence, disengaged studyholics do not significantly differ from engaged studyholics; however, they both have greater sleep impairment than have engaged and detached students.

Next, with regard to *positive and negative affect*, disengaged studyholics have statistically significantly lower levels of positive affect than have engaged studyholics ($p < .001$), engaged students ($p < .001$), and detached students ($p = .04$). Moreover, engaged

TABLE 6 | Means (SDs) and follow-up ANOVAs conducted after the MANOVA of antecedents by type of student.

Dependent variable	F°	η^2	p	Type of student	M (SD)	n
Perfectionistic Strivings	42.34	.40	<.001	Disengaged Studyholic	14.06 (4.55)	47
				Engaged Studyholic	19.60 (2.22)	82
				Detached Student	13.69 (4.09)	39
				Engaged Student	18.85 (3.02)	27
				Total	16.98 (4.37)	195
Perfectionistic Concerns	26.02	.29	<.001	Disengaged Studyholic	16.96 (4.22)	47
				Engaged Studyholic	14.11 (4.87)	82
				Detached Student	10.41 (4.11)	39
				Engaged Student	8.63 (4.49)	27
				Total	13.30 (5.33)	195
Study-related Perfectionism	30.68	.33	<.001	Disengaged Studyholic	28.51 (9.82)	47
				Engaged Studyholic	35.93 (8.57)	82
				Detached Student	20.64 (7.05)	39
				Engaged Student	26.30 (8.19)	27
				Total	29.75 (10.35)	195
Worry	173.07	.73	<.001	Disengaged Studyholic	70.32 (8.35)	47
				Engaged Studyholic	68.46 (9.48)	82
				Detached Student	35.82 (12.11)	39
				Engaged Student	35.41 (8.75)	27
				Total	57.81 (18.60)	195
Parent Overstudy Climate	6.75	.10	<.001	Disengaged Studyholic	28.87 (10.10)	47
				Engaged Studyholic	24.40 (10.19)	82
				Detached Student	21.59 (8.43)	39
				Engaged Student	19.85 (6.85)	27
				Total	24.29 (9.85)	195
Teacher Overstudy Climate—Overt Comments	4.38	.06	.005[#]	Disengaged Studyholic	8.49 (4.02)	47
				Engaged Studyholic	9.48 (4.29)	82
				Detached Student	7.49 (4.76)	39
				Engaged Student	6.44 (3.15)	27
				Total	8.42 (4.30)	195
Teacher Overstudy Climate—Hard Study	4.78	.07	.003	Disengaged Studyholic	18.55 (4.92)	47
				Engaged Studyholic	18.89 (4.77)	82
				Detached Student	16.51 (4.95)	39
				Engaged Student	15.56 (4.01)	27
				Total	17.87 (4.89)	195

°, df = 3,191; #, using Bonferroni correction, it is not statistically significant.

studyholics (p = .026) and detached students (p < .001) have lower positive affect than have engaged students. There is no difference between engaged studyholics and detached students. For negative affect, disengaged and engaged studyholics have statistically significantly (p < .001) higher level than have detached and engaged students. In addition, disengaged studyholics have higher negative affect than have engaged studyholics (p = .032). There is no difference between engaged and detached students. In sum, disengaged studyholics have the lowest levels of positive affect and the highest levels of negative affect.

About *general stress*, the results showed that disengaged and engaged studyholics have statistically significantly (p < .001) higher general stress than have engaged and detached students. There is no difference between disengaged and engaged studyholics, nor between engaged and detached students. Thus, there is no difference on general stress between disengaged and engaged studyholics.

Then, the Bonferroni *post hoc* test showed that engaged studyholics have significantly (p < .001) higher levels of *family and friends' complaints* than have disengaged studyholics, and engaged and detached students. Also, detached students have lower levels of family and friends' complaints than have engaged students (p < .001). There is no difference between disengaged studyholics and both detached and engaged students. For *social relationship impairment*, engaged studyholics have higher relationship impairment (p < .001) than have disengaged studyholics and detached and engaged students. Moreover, disengaged studyholics have higher social relationships impairment than have detached students (p < .001). There is no difference between disengaged studyholics and engaged students, and between detached and engaged students. In sum, there is no statistically significant difference between the four kinds of student concerning quarrels at university. However, engaged studyholics have higher levels of family and friends' complaints and of social relationship impairment than have disengaged studyholics.

Next, concerning academic-related outcomes, we found that engaged studyholics generally study more *hours per day* than do disengaged studyholics and detached students (p < .001), and that engaged students study more hours a day than do detached students (p = .004). There is no difference between disengaged studyholics and both detached students

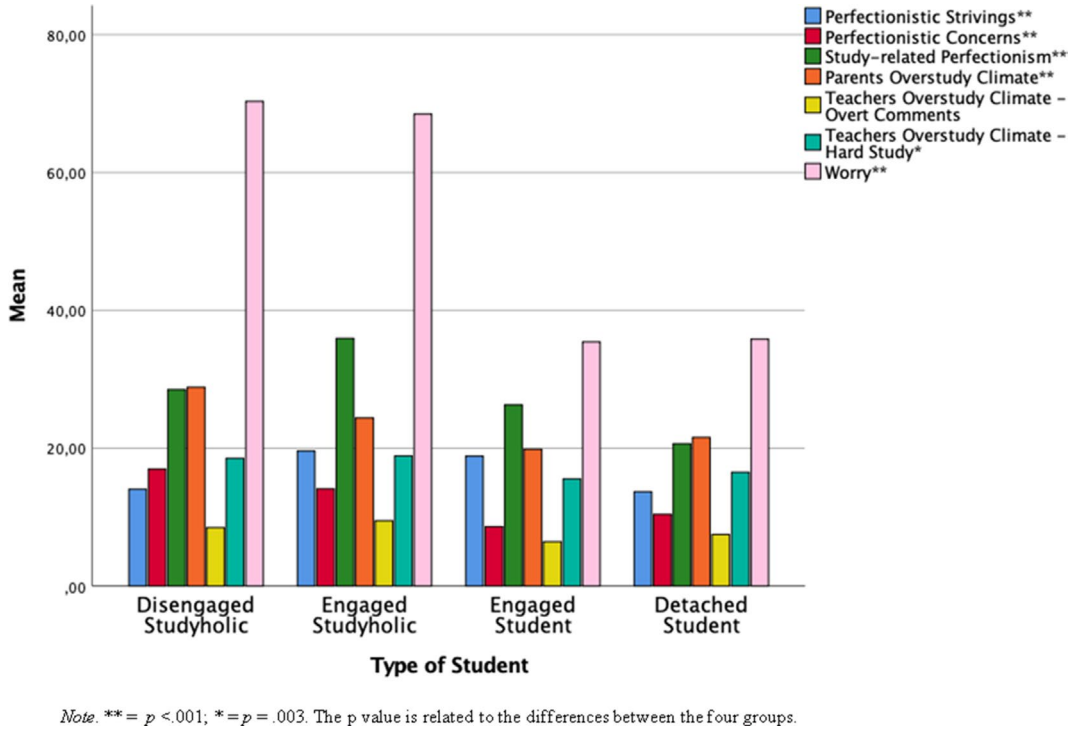

FIGURE 4 | Bar graphs representing the mean of the antecedents by the four groups of student.

and engaged students, nor between engaged studyholics and engaged students. Moreover, as far as *hours of study per day before exams* are concerned, engaged studyholics study more hours than do disengaged studyholics ($p = .001$) and detached students ($p < .001$). There are no differences between disengaged studyholics and both detached and engaged students, nor between engaged studyholics and engaged students, nor finally between detached students and engaged students. Hence, engaged studyholics spend more time studying than do disengaged studyholics.

Moreover, for *GPA*, disengaged studyholics have statistically significantly ($p < .001$) lower GPA than have engaged studyholics and engaged students. Moreover, engaged studyholics have higher GPAs than have detached students ($p < .001$). Finally, engaged students have higher GPAs than have detached students ($p < .001$). There is no difference between disengaged studyholics and detached students, and between engaged studyholics and engaged students. Hence, disengaged studyholics have statistically significantly lower GPAs than have engaged studyholics.

Finally, for *dropout intention*, disengaged studyholics have statistically significantly ($p < .001$) higher dropout intention than have engaged studyholics, engaged students, and detached students. Moreover, engaged studyholics ($p = .001$) and detached students ($p < .001$) have higher dropout intention than have engaged students. In addition, detached students have higher dropout intention than have engaged students ($p < .001$). There is no difference between engaged studyholics and detached students. In sum, disengaged studyholics have higher dropout intention than have engaged studyholics.

DISCUSSION

Individual Antecedents

The first hypothesis concerns *PS*, and the SEM results supported almost all of the relationships suggested about this antecedent.

As hypothesized, PS, as general perfectionism, positively predicts study-related perfectionism, which is rather a domain-specific type of perfectionism. Moreover, in line with the literature (45–47), it also positively predicts study engagement (SE). However, it does not predict studyholism (SH), in line with Loscalzo (84) preliminary study, but in contrast with the workaholism literature (45). This finding may suggest that this positive component of perfectionism should not be addressed by interventions aimed to prevent or to reduce studyholism, as it does not seem to foster it. Moreover, as workaholism is instead usually associated with high PS, we speculate that workaholism and studyholism, even though they both are related to the main work activity of workers and students, respectively, could differ in some aspects, for example, in their antecedents. However, it should be noted that even though workaholism studies have generally found a positive association between PS and workaholism, Mazzetti et al. (49) recently highlighted that this relationship emerges only when workers perceive an overwork climate in their organization. Hence, as our study is the first one dealing with studyholism and PS, we suggest that future studies should be conducted on this topic and that no solid conclusion can be made yet.

Finally, PS positively predicts positive emotions, in line with previous studies related to positive health outcomes associated

TABLE 7 | Means (SDs) and follow-up ANOVAs conducted after the MANOVA of outcomes by type of student.

Variable	F°	η^2	p	Type of student	M (SD)	n
Sleep Quality[§]	45.88	.42	<.001	Disengaged Studyholic	24.47 (6.80)	47
				Engaged Studyholic	22.74 (6.77)	82
				Detached Student	13.38 (4.79)	39
				Engaged Student	11.15 (5.26)	27
				Total	19.68 (8.12)	195
Daytime Sleepiness	29.43	.32	<.001	Disengaged Studyholic	21.94 (5.25)	47
				Engaged Studyholic	20.52 (6.11)	82
				Detached Student	14.41 (5.55)	39
				Engaged Student	11.26 (5.98)	27
				Total	18.36 (6.94)	195
Positive Affect	17.85	.22	<.001	Disengaged Studyholic	19.89 (7.94)	47
				Engaged Studyholic	28.59 (9.33)	82
				Detached Student	25.05 (7.81)	39
				Engaged Student	34.19 (9.41)	27
				Total	26.56 (9.81)	195
Negative Affect	39.92	.39	<.001	Disengaged Studyholic	32.85 (10.72)	47
				Engaged Studyholic	28.21 (9.75)	82
				Detached Student	16.44 (6.99)	39
				Engaged Student	14.26 (4.98)	27
				Total	25.04 (11.40)	195
General Stress	100.88	.61	<.001	Disengaged Studyholic	16.83 (3.90)	47
				Engaged Studyholic	16.49 (4.66)	82
				Detached Student	5.62 (3.57)	39
				Engaged Student	5.41 (4.13)	27
				Total	12.86 (6.72)	195
Quarrels at University	2.92	.04	.035[#]	Disengaged Studyholic	4.85 (3.22)	47
				Engaged Studyholic	3.99 (1.60)	82
				Detached Student	3.69 (1.58)	39
				Engaged Student	3.67 (1.71)	27
				Total	4.09 (2.14)	195
Family Friends' Compl.	42.34	.40	<.001	Disengaged Studyholic	5.32 (3.51)	47
				Engaged Studyholic	9.41 (3.08)	82
				Detached Student	3.74 (1.37)	39
				Engaged Student	6.41 (2.34)	27
				Total	6.88 (3.65)	195
Social Rel. Impairment	33.20	.34	<.001	Disengaged Studyholic	7.19 (3.72)	47
				Engaged Studyholic	9.80 (3.28)	82
				Detached Student	4.18 (2.15)	39
				Engaged Student	5.48 (2.76)	27
				Total	7.45 (3.84)	195
Hours—Generally	20.52	.24	<.001	Disengaged Studyholic	3.69 (2.34)	47
				Engaged Studyholic	5.73 (2.34)	82
				Detached Student	2.61 (1.52)	39
				Engaged Student	4.48 (2.18)	27
				Total	4.44 (2.49)	195
Hours—Before Exams	12.66	.17	<.001	Disengaged Studyholic	6.65 (2.62)	47
				Engaged Studyholic	8.45 (2.48)	82
				Detached Student	5.49 (2.82)	39
				Engaged Student	7.13 (2.60)	27
				Total	7.24 (2.83)	195
Grade Point Average	32.49	.34	<.001	Disengaged Studyholic	25.24 (2.41)	47
				Engaged Studyholic	27.62 (1.89)	82
				Detached Student	24.75 (2.32)	39
				Engaged Student	28.59 (1.40)	27
				Total	26.61 (2.51)	195
Dropout Intention	31.95	.33	<.001	Disengaged Studyholic	11.11 (3.36)	47
				Engaged Studyholic	6.56 (3.80)	82
				Detached Student	7.15 (3.38)	39
				Engaged Student	3.67 (1.14)	27
				Total	7.37 (4.09)	195

°, df = 3,191; #, using Bonferroni correction, it is not statistically significant. §, A higher score indicates greater sleep quality impairment; Family Friends Compl., Family and Friends' Complaints; Social Rel. Impairment, Social Relationship Impairment; Hours—Generally, Hours of study per day, Generally; Hours—Before Exams, Hours of study per day, Before exams.

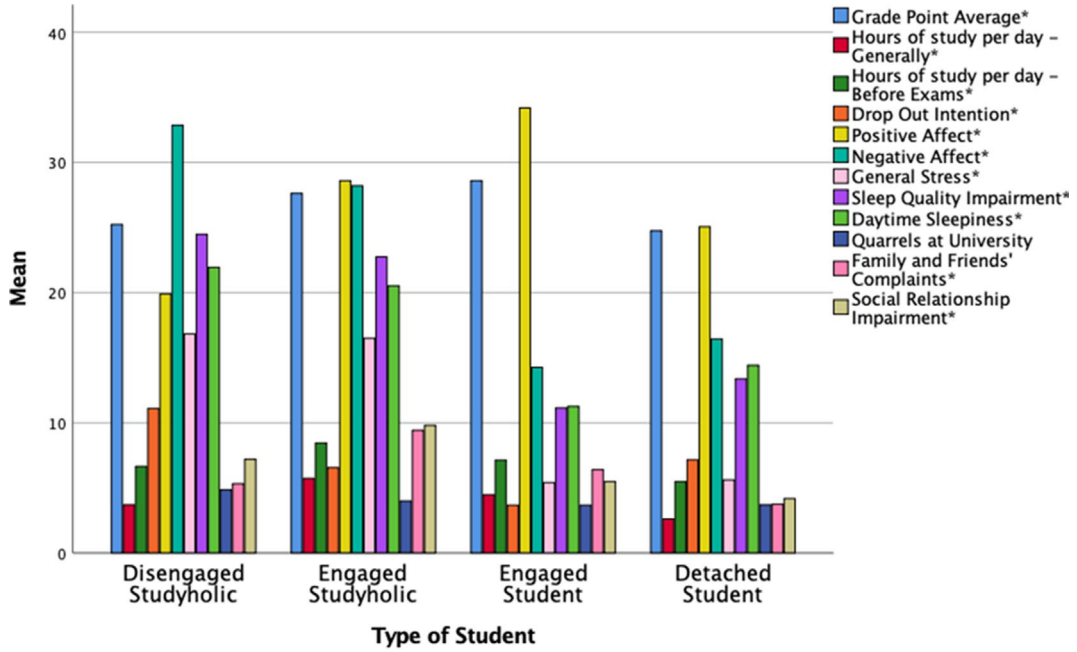

FIGURE 5 | Bar graphs representing the mean of the outcomes by the four groups of students.

with PS [e.g., Refs. (32, 36, 38)]. However, we did not find support for a relationship between PS and GPA. While previous studies found a positive association between these two variables (52), we found that PS is a statistically significant positive predictor of GPA, but with very low magnitude, which is near zero. Since in the model we tested many other variables besides PS, a possible explanation for this low (although positive) value is that the other variables included in the model explain GPA better than PS; for example, SE positively predicts it with a β value of .25.

For *PC*, this general form of perfectionism positively predicts study-related perfectionism, as hypothesized. However, it predicts this domain-specific type of perfectionism with a lower value than does PS. Moreover, as with PS, it does not predict SH. The β value is positive and statistically significant, but since it is near to zero, it does not allow us to conclude that the hypothesis is supported. Hence, this result contrasts with the workaholism literature, which has generally found a positive association between PC and workaholism (45), and with Loscalzo and Giannini (12), who suggested in their theoretical paper that perfectionism is a studyholism antecedent. Again in this case, we suggest that future studies should analyze the relationship between PC and studyholism, as this could inform whether our result is due to the instrument we used for evaluating perfectionism, or to an actual difference between studyholism and workaholism concerning their antecedents. Indeed, it should be noted that the Italian version of the instrument that we used to measure perfectionism, namely, the SAPS (90), does not have a fully satisfactory fit in the Italian version. Hence, even if this study has the merit of shedding some light on the relationships among PS, PC, studyholism, and study engagement, we suggest that future studies should focus more on these relationships and use other perfectionism instruments, in order to deepen the analysis of this topic.

In addition, we did not find support for the hypothesis regarding positive affect. PC negatively predicts positive affect, although its β value is too low for concluding that the hypothesis has been supported. However, the other hypotheses have been confirmed. PC negatively predicts SE, as hypothesized based on the negative association generally found between work engagement and PC (45). It also positively predicts dropout intention, even though studyholism and study engagement have, respectively, a positive and negative higher predictive power than PC on dropout intentions.

In addition, PC positively predicts negative affect, general stress, sleep quality impairment, and daytime sleepiness, as hypothesized based on the literature about PC and wellbeing [e.g., Refs. 31, 33)] (114).

Finally, regarding GPA, we did not posit any specific hypothesis, as the literature showed mixed findings about the relationship between PC and GPA. This study found that PC significantly and negatively predicts GPA, and it is one of the strongest predictors of GPA.

In sum, it seems that this perfectionism component also should not be addressed by preventive and clinical interventions targeting studyholism, as it does not appear to foster it. However, as already stated for PS, further studies should be conducted on these relationships before any conclusion should be made. Moreover, PC is an individual antecedent that deserves to be addressed by preventive interventions aiming to enhance students' wellbeing and academic success, as it is

the strongest predictor of low academic performance (GPA); moreover, even though it does not negatively predict positive emotions, it negatively predicts study engagement (which is usually associated with positive academic performance and wellbeing), and it positively predicts dropout intention and all of the physical and psychological negative outcomes that are included in the model. Hence, even if it does not seem to foster studyholism, it is an individual component that should potentially be targeted in order to reduce dropout intention and increase study engagement.

Next, in the perfectionism domain, the results about *study-related perfectionism* showed that, contrary to the hypothesis, it does not predict studyholism and time spent studying (hours of study per day generally and before exams), but it does positively predict study engagement, GPA, quarrels at university, family and friends' complaints, and social relationship impairment due to study. Hence, study-related perfectionism seems to be an antecedent of positive attitudes toward studying (i.e., study engagement) and good academic performance. However, we suggest not attempting to foster it by means of interventions that aim to favor academic success, as one of its predictor is PC, which is usually associated with negative outcomes; moreover, study-related perfectionism is also associated with more quarrels with teachers and peers at university, with more complaints from family and friends and relationship impairment due to study. Hence, besides its positive association with study engagement and GPA, it is associated with negative outcomes as well, especially as far as social functioning is concerned. For this reason, we suggest that preventive interventions aimed at enhancing academic success and students' wellbeing should address study-related perfectionism with the aim of reducing it, and also foster instead other variables that are associated with positive outcomes only, such as study engagement. Since study-related perfectionism is associated with higher GPA, students might see it as a positive characteristic that they should not dismiss; for this reason, they should be made aware of the negative downsides associated with such perfectionism and that they may be able to gain the same academic success by increasing other personal characteristics that are associated with positive outcomes, such as study engagement.

In addition to perfectionism, there is another individual antecedent that we analyzed by means of the SEM, namely, *trait worry*. First, as hypothesized on the basis of the literature showing that worry is related to perfectionism [e.g., Refs. (79, 80)], we found that it positively predicts study-related perfectionism. Contrary to the hypothesis, it is not a negative predictor of study engagement, but *it is the strongest predictor of studyholism* ($\beta = .67$, $p < .001$), consistent with the literature showing that worry is a factor contributing to OCD (68) and a transdiagnostic process across internalizing disorders [e.g., Refs. (64, 66)]. Finally, in line with previous studies showing an association between worry and health impairment [e.g., Refs. (75, 76)], it negatively predicts positive affect, while it positively predicts negative affect, general stress, sleep quality impairment, and daytime sleepiness. Hence, these results confirm that trait worry predicts many negative physical and psychological outcomes. Moreover, it demonstrated that it is a strong predictor of studyholism, suggesting that it should be the primary focus of interventions aiming to prevent and to reduce studyholism. In addition, from a theoretical point of view, this suggests that studyholism is an internalizing disorder, or an OCD-related disorder, as suggested by Loscalzo and Giannini (12, 14, 15), and not a behavioral addiction (11). Future studies should deepen our understanding of the role of trait worry, and of other internalizing features, in the onset of studyholism.

Situational Antecedents

Besides individual antecedents, we also analyzed two situational antecedents.

For *school and family overstudy climate*, contrary to our hypothesis, none of the three overstudy climate factors (i.e., P-OSC, T-OSC—overt comments, and T-OSC—hard study) predicts studyholism and study engagement, even though the direction is positive for SH and negative for SE, as expected. Hence, we conclude that overstudy climate does not foster studyholism and reduce study engagement in university students. However, we suggest that this situational antecedent should be analyzed in secondary school of first and second grades (i.e., pre-adolescence and adolescence), namely, when studyholism could have its onset (12), when students are younger and hence could be more dependent on what elder significant people expect from them. Finally, as far as overstudy climate is concerned, the results showed that, as hypothesized, teachers' overt comments about students' performance positively predict two study-related variables, namely, study-related perfectionism and aggressive behaviors at the university in the specific form of quarrels. Thus, this suggests that teachers, even if they do not foster studyholism or impair study engagement by means of their overt comments about students' performance (e.g., asking for explanations when they get a grade lower than usual), they can increase quarrels between students and between student and teacher, hence affecting the class climate. For this reason, preventive interventions aimed at supporting positive relationships at the university should address this overstudy climate component by means of educational interventions for teachers, who should be made aware of the potential counterproductive effects of their overt comments in class. These negative effects could be even greater in the lower school levels, where there are fewer students in class and group dynamics are more evident (12).

Another situational antecedents is *area of study*, which in this research has been grouped into the following macro-groups comprising many different courses: technology (engineering, architecture, and informatics); social sciences (psychology, sociology, economy, law, educational studies, etc.); humanities (literature, language, art, philosophy, history, etc.); medical studies; sciences (math, physics, biology, statistics, and chemistry); helping professions (nursing, obstetrics, etc.); and para-medical studies (biotechnology, veterinary medicine, pharmacy, etc.).

Our hypotheses were not confirmed. More specifically, humanities students have statistically significantly lower levels of studyholism than have the other groups; however, the β value is near to zero; thus, while in the expected direction, this does

not allow concluding that the hypothesis has been confirmed or supported. As far as the other areas of study are concerned, the results showed that technology, social sciences, and sciences do not predict studyholism, as well as medical and humanities studies. Moreover, the five areas of study do not predict study engagement as well.

Moreover, the results showed that both humanities and medical students have a higher GPA than have their peers. However, humanities and social sciences students generally spend less hours per day in studying than do their peers in other courses, while medical students study more hours per day both generally and, even more, before exams. No other statistically significant relationship emerged (considering .10 as the β cutoff value). For social relationship impairment due to study, medical, technology, and sciences students have statistically significantly higher impairment than have their peers, but the β values are below .10. In conclusion, it seems that medical students spend more time studying than their peers do, and they receive higher GPAs. However, the students with higher GPAs are humanities students, who also spend less time studying (as well as social sciences students).

On the basis of these findings, we suggest that studyholism preventive interventions should not address a specific area of study, as there is no specific area that positively predicts higher levels of studyholism, but they should rather be distributed across all the courses.

Academic, Health, and Social Outcomes

As concerns the *academic outcomes*, the results showed that, as hypothesized, studyholism does not predict GPA. In line with previous studies on study addiction and studyholism (11, 85), studyholism has only a low negative predictive value on GPA. Study engagement, instead, positively predicts this variable, in line with previous studies [e.g., Refs. (16, 17, 85)]. Also, in line with Loscalzo and Giannini (12, 85), both studyholism and study engagement positively predict time investment in study, both generally and before exams, respectively. Finally, as hypothesized and in line with Loscalzo and Giannini's (12) model and with van Beek et al.'s (25) workaholism study, SH positively predicts dropout intention, while SE negatively predicts it, in line with the previous literature [e.g., Refs. (16, 21)].

The practical implication of these findings is that s*tudyholism is an important risk factor for the drop out of University, while study engagement is a protective factor*. Moreover, as SH and SE are both associated with higher time investment in study but only SE is positively related to higher GPA too, it follows that preventive interventions should focus on training students to learn how to organize their time investment in study fruitfully, and how to reduce their study-related obsessions that could actually lead them to overstudy but without actual learning, or to study a few pages well in many hours. In addition, preventive and clinical interventions should increase study engagement, as it increases the probability of finishing one's own studies.

Next, as far as *psychological individual outcomes* are concerned, the SEM analyses showed that studyholism does not predict positive affect, in line with the hypothesis. However, as hypothesized, it positively predicts negative emotion and general stress, in line with the previous studyholism and workaholism literature [e.g., Refs. (5, 11, 12)]. Study engagement, instead, positively predicts positive affect and negatively predicts general stress, in line with previous studies [e.g., Ref. (19)]. However, it negatively predicts negative affect with a low β value; since it does not reach the selected .10 cutoff, we suggest that this hypothesis has not been confirmed or that study engagement is not an important variable for the explanation of lower levels of negative emotions.

Then, concerning *individual physical outcomes*, studyholism positively predicts sleep quality impairment and daytime sleepiness, in line with the hypothesis and previous studies (5, 11). Study engagement, in contrast, negatively predicts both the two variables, but the β value reaches the .10 cutoff for daytime sleepiness only. Hence, these results suggest that studyholism is associated with negative health outcomes; therefore, preventive and clinical interventions specifically developed for reducing studyholism should be conducted, as it is associated with significant health impairment.

Regarding *social relationships*, and more specifically aggressive behaviors at university, which represent a situational outcome, the results showed that neither studyholism nor study engagement predicts it, in contrast to the hypothesis. The direction is, as expected, positive for SH and negative for SE, although the β values do not reach the .10 cutoff. As already mentioned for overstudy climate, we suggest, in line with Loscalzo and Giannini (12), that aggressive behaviors in class could be more prevalent in non-university schools, as there are closer relationships between peers and between students and teachers. Hence, future studies should analyze the impact of studyholism on aggressive behaviors in pre-adolescents and adolescents.

Next, concerning individual outcomes related to social relationships, the results showed that studyholism positively predicts both family and friends' complaints and social relationship impairment because of study, in line with previous studies on workaholism (5), and with Loscalzo and Giannini's (12) model. However, in contrast with the hypothesis, study engagement, too, positively predicts both family and friends' complaints and social relationship impairment because of study. Hence, these results could suggest that heavy study investment (regardless of whether it is studyholism or study engagement) is not a generally social acceptable behavior, as previously hypothesized similarly to workaholism (12), especially considering that the β value for family and friends' complaints is higher for study engagement. Moreover, heavy study investment leads to relationship impairment also in the case of study engagement, even if to a lesser extent than does studyholism. This means that preventive interventions aiming to foster students' wellbeing, and not only their academic success, might well be addressed to engaged students as well as studyholics, as they are both characterized by social impairment. They should receive some training with the aim of improving their management of time and hence being able to keep on studying and also being able to free some of their time for friends, family, and leisure activities.

Differences Between Disengaged and Engaged Studyholics

For perfectionism, the results showed that *PS* is statistically significantly lower in disengaged studyholics as compared with both engaged studyholics and engaged students. Moreover, engaged studyholics and engaged students have statistically significantly higher PS than have detached students. In sum, the positive component of perfectionism is present at the lowest levels in detached students, while the highest (mean) level is in engaged studyholics. This could be due to the fact that standards are very high both in studyholics and in engaged students, and that as a consequence PS reaches its highest levels in students characterized by both high SH and SE. Looking at the descriptive statistics, the following is the order as concerns PS levels: detached students < disengaged studyholics < engaged students < engaged studyholics.

Then, regarding the negative perfectionism component, disengaged studyholics have statistically significantly higher levels of *PC* than have all the other kinds of student. In addition, engaged studyholics have higher levels of PC than have detached and engaged students. Referring to the descriptive statistics, the following is the order of PC levels: engaged students < detached students < engaged studyholics < disengaged studyholics. Hence, the negative perfectionism component is present at its highest levels in disengaged studyholics, while at the lowest level, it is in engaged students. However, both disengaged and engaged studyholics have higher PC than have the other two kinds of student.

Finally, for *study-related perfectionism*, engaged studyholics have statistically significantly higher levels of this than have the other three kinds of student. Moreover, disengaged studyholics have statistically significantly higher study-related perfectionism than have detached students. Referring to the descriptive statistics, the order is the following: detached students < engaged students < disengaged studyholics < engaged studyholics.

Taken together, these results support Loscalzo and Giannini's (12) proposition about the need for distinguishing among the three kinds of heavy study investor, and that the engaged student is the most positive type, since it has the lowest levels of PC. The disengaged studyholics, instead, are the most negative type, being characterized by the highest levels of PC.

Next, regarding *overstudy climate*, disengaged studyholics have higher P-OSC than have detached and engaged students, but there is no statistically significant difference from engaged studyholics. For T-OSC, there is no statistically significant difference for overt comments about students' performance; however, engaged studyholics scored higher on pressure toward hard study than had engaged students, but there is no statistically significant difference between engaged and disengaged studyholics. Looking at the descriptive statistics, the order for P-OSC is engaged students < detached students < engaged studyholics < disengaged studyholics, while for T-OSC (for both its two components), the order is engaged students < detached students < disengaged studyholics < engaged studyholics. However, as already mentioned before, the analysis related to overstudy climate should be further conducted on pre-adolescents and adolescents, where the influence of this climate could be greater than on youths.

Finally, concerning *worry*, disengaged studyholics and engaged studyholics have statistically significantly higher worry levels than have detached and engaged students, but there is no difference between disengaged and engaged studyholics. However, looking at their means, disengaged studyholics score a little higher than do engaged studyholics. Hence, these results suggest that engaged and disengaged studyholics do not differ in worry, but they do score higher than the other two types of students.

About studyholism *outcomes*, the results showed that engaged and disengaged studyholics have more sleep quality impairment, daytime sleepiness, and general stress than have detached and engaged students, but (besides a slight difference in their means) there is no statistically significant difference between disengaged and engaged studyholics.

However, disengaged studyholics have lower positive affect than have all the other three kinds of student, and engaged studyholics have lower positive emotions than have engaged and detached students. Moreover, engaged and disengaged studyholics have higher negative affect than have detached and engaged students; however, also in this case, disengaged studyholics are more impaired, as they have higher negative affect than have engaged studyholics. Hence, as far as positive and negative affect is concerned, disengaged studyholics have the highest levels of negative affect and the lowest levels of positive affect.

However, the engaged studyholics have higher family and friends' complaints and social relationship impairment than have all the other three types of student. Moreover, there are no group differences related to quarrels at university.

Hence, based on these results, it seems that disengaged studyholic are not more impaired than engaged studyholics [as suggested by Loscalzo and Giannini (12)]. The two types of studyholics do not differ in sleep quality and stress experienced. Moreover, while disengaged studyholics are more emotionally impaired than are engaged studyholics, engaged studyholics are the ones more socially impaired.

Finally, for *study-related variables*, disengaged studyholics have higher dropout intention than have the other three types of student, while engaged studyholics have higher dropout intention than have engaged students. Moreover, disengaged studyholics have a lower GPA than have engaged studyholics and engaged students, while engaged studyholics have a higher GPA than have detached students. Hence, as concerns academic outcomes, both disengaged and engaged studyholics show a functional impairment; however, disengaged studyholics are the most impaired [in line with Loscalzo and Giannini (12)].

Concerning time spent studying, engaged studyholics study more hours a day (generally and before exams) than do disengaged studyholics and detached students. Moreover, engaged students generally study more than detached students do (but not before exams). Hence, in line with the workaholism study of Van Beek et al. (25), engaged studyholics are the ones who spend the most time studying. This could be due to the presence of both high studyholism and study engagement, and this could also explain why, contrary to the hypothesis, these are also the most socially impaired students in this study. It is possible to suggest that they are not able to manage their time; hence, the time they spend

studying is useful for having a higher GPA as compared with that of disengaged studyholics, but they are not able to leave some time free for meeting friends and spending time with their families.

In conclusion, it is useful to differentiate between disengaged and engaged studyholism, and more generally between the four kinds of student, as this allows us to unpack different relationships with the same antecedents and outcomes. In sum, PC seems to be higher in disengaged studyholics than in engaged studyholic, while PS and study-related perfectionism are higher in engaged than in disengaged studyholics. Instead, as far as overstudy climate and worry are concerned, the two kinds of studyholic do not differ. Moreover, for outcomes, disengaged and engaged studyholics do not differ in sleep quality, daytime sleepiness, general stress, and quarrels at university. However, engaged studyholics are more socially impaired (higher family and friends' complaints and social relationship impairment), which could be linked to their higher time investment in study, while disengaged studyholics are more impaired as concerns their affect and their academic success (lower GPA and higher dropout intention).

Limitations

One of the limits of this research is related to the sample, which is large, but most of the participants are females. Moreover, another methodological issue concerns the instrument we used for evaluating PS and PC, namely, the Short Almost-Perfect Scale (SAPS) (90). The Italian version (92) does not have fully satisfactory psychometric properties. Hence, the results for perfectionism should be evaluated while taking into account this methodological problem, and we suggest that future studies should analyze the role of PS and PC on studyholism by means of another instrument in order to compare the results with those that we found using the SAPS. Moreover, academic performance is evaluated by means of self-reported GPA; however, this score does not allow differentiating between students that have a high GPA based on many exams and students that have a high GPA that is based only on a few exams. Hence, future research should analyze the effects of studyholism both on GPA and on the total number of exams, as it is possible that studyholics have a high GPA but they are not able to pass all the exams of a year.

Theoretical and Practical Implications

From a *theoretical* point of view, our results support Loscalzo and Giannini's (12) conceptualization of studyholism as an internalizing disorder, and more specifically as an obsessive-compulsive-related disorder. Worry, which is a typical internalizing symptom, is the strongest predictor of studyholism. Hence, even though perfectionism (which is another internalizing symptom) does not predict studyholism, the results allow concluding that studyholism seems to be more similar to an obsession than to an addiction toward study.

In addition, the results regarding differences between engaged and disengaged studyholics on outcomes seem to suggest that disengaged studyholics are not the most impaired type [as suggested by Loscalzo and Giannini (12)], as they do not differ in sleep quality impairment, daytime sleepiness, general stress, and quarrels at university. Moreover, disengaged studyholics are more emotionally and academically impaired, as they have more negative affect, lower positive affect and GPAs, and higher dropout intentions. However, engaged studyholics are more socially impaired, as they have higher levels of family and friends' complaints and social relationship impairment due to study. Hence, these results seem to suggest that both engaged and disengaged studyholics should be considered as clinical forms of overstudying (and not only the disengaged type), while it should be useful to add two specifiers: 1) engagement: high, average, or low; and 2) impairment: academic, social, or academic and social. Also, as suggested by Loscalzo and Giannini (12), it is useful to distinguish between different forms of heavy study investor when analyzing potential studyholism antecedents and outcomes, as the different types of student could have different relationships for the same variables, as shown by this study.

Finally, on the basis of the results that both studyholism and study engagement positively predict higher family and friends' complaints, we suggest that heavy study investment is not generally a socially acceptable behavior, especially as family and friends' complaints are even higher for study engagement than for studyholism.

Regarding *preventive and clinical implications*, the results suggest that worry should be the primary focus of interventions aimed at preventing or reducing studyholism; hence, it could be helpful to look for programs that have already been tested for reducing worry, and to apply them in the university context.

Perfectionism and study-related perfectionism do not predict studyholism. However, perfectionism concerns should be addressed as well by interventions aiming at improving students' wellbeing and academic success, as this variable predicts lower GPA and study engagement, and greater dropout intention and psychological and physical negative outcomes. Hence, reducing perfectionism concerns could help in increasing study engagement and reducing dropout intention. Instead, as far as study-related perfectionism is concerned, we suggest that, even though it is not a predictor of studyholism, it should be addressed by preventive interventions intended to favor students' wellbeing, as it is a predictor of quarrels with peers and teachers and of family and friends' complaints and social relationship impairment. However, it is also associated with higher study engagement and GPA; for this reason, students might well believe that it is a positive characteristic that allows them to be successful students. Consequently, interventions should make them aware of the potential social negative outcomes associated with study-related perfectionism and that they may accrue the same positive academic results by means of other behaviors that are not associated with negative outcomes, such as study engagement. In conclusion, preventive interventions that aim to improve students' wellbeing and academic success (and that do not focus specifically on studyholism) should possibly target worry, as well as PC and study-related perfectionism. In addition, as area of study does not predict studyholism, we suggest that preventive interventions should be spread across all the courses, as each student could potentially be a studyholic, regardless of his/her specific major, and by the first year of college.

Finally, since study engagement predicts social impairment as well as studyholism, we strongly suggest that preventive interventions aiming to favor students' wellbeing (and not only

academic success) should be addressed to engaged students too. The trainings should focus on teaching them how to manage their time in order to have academic success but also leave some time free for friends, family, and leisure time.

In a clinical setting, it is particularly important to distinguish between engaged and disengaged studyholics as they have different relationships with some antecedents and outcomes. More specifically, PC is higher in disengaged studyholics, while PS and study-related perfectionism are higher in engaged studyholics. However, they do not differ in worry and overstudy climate. In addition, while disengaged studyholics are more impaired as far as their affect and their academic success are concerned, engaged studyholics are more socially impaired. Being aware of these differences could help in tailoring the intervention for the specific student.

CONCLUSIONS

This research supports Loscalzo and Giannini's (12) conceptualization of problematic overstudying as an internalizing disorder, and more specifically as an obsessive-compulsive-related disorder, in contrast with the behavioral addiction model (11). Worry, which is a typical internalizing and OCD symptom, is indeed a strong predictor of studyholism. Hence, the results allow concluding that studyholism seems to be more similar to an obsession than to an addiction toward study.

In addition, the results regarding differences between engaged and disengaged studyholics support Loscalzo and Giannini's (12) model, which foresee the distinction between these two types of studyholism. However, disengaged studyholics are not the most impaired type [as hypothesized by Loscalzo and Giannini (12)]. Disengaged and engaged studyholics do not differ in sleep quality and general stress; moreover, disengaged studyholics are more emotionally and academically impaired, while engaged studyholics are more socially impaired.

About preventive interventions that aim to improve students' wellbeing and academic success (and that do not focus specifically on studyholism), they should possibly target worry, as well as PC and study-related perfectionism. In addition, as area of study does not predict studyholism, preventive interventions should be spread across all the courses, as each student could potentially be a studyholic, regardless of his/her specific major, and by the first year of college. Finally, since study engagement predicts social impairment as well as studyholism, we strongly suggest that preventive interventions should be addressed to engaged students too.

Future studies might test if preventive interventions based on these suggestions are effective in reducing studyholism and improving students' wellbeing and their academic success.

Finally, in a clinical setting, it is particularly important to distinguish between engaged and disengaged studyholics as they have different relationships with some antecedents and outcomes. Being aware of these differences could help in tailoring the intervention for the specific student.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the Ethic Committee of the University of Florence and in accordance with the Declaration of Helsinki. The protocol was approved by the Ethic Committee of the University of Florence.

Our study was exempted from written informed consent, which has been obtained instead, as agreed with the Ethical Committee, in the following way: We wrote the usual informed consent information in the first page of the questionnaire. Then, we asked the participants to check a box saying that they agreed to take part in the research by going on and filling out the questionnaire on the following pages.

AUTHOR CONTRIBUTIONS

YL developed the study design, conducted the literature review, gathered the data, performed statistical analyses, and wrote the draft of the paper. MG critically revised the statistical analyses and the content of the manuscript.

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Hikikomori Phenomenon in East Asia: Regional Perspectives, Challenges, and Opportunities for Social Health Agencies

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Hikikomori, which originated in Japan, refers to the condition where youths withdraw into the home and do not participate in society for an extended period of time. Recent updates on hikikomori presentation within the region were exchanged at a Hikikomori Round Table and Regional Symposium (HRTRS) discussion late 2017, leading to this perspective paper. Hikikomori presents as an overall homogeneous construct, while diversity in clinical presentation exists across East Asian countries. We examined the various presentations, risk factors, theoretical frameworks, and classification issues about hikikomori. In particular, specific risk factors have emerged to some degree across the region, while some are more locale specific. We propose that hikikomori youths have differential onset and developmental patterns, potentially resulting in heterogeneous presentation. We briefly summarized existing interventions in the East Asian region. Intervention strategies need to be tailored to different subtypes. A multicomponent approach would address complexity, multifactorial onset, and development of the condition. The HRTRS presented to participating countries the opportunity to collectively work toward a more universal definition of the hikikomori condition and explored innovative ways to shape existing service structures. Opportunities for participating countries described pertain to early detection of cases, adoption of assessment tools, and improved intervention services.

Keywords: hikikomori, social withdrawal, youth, Asia, challenges, opportunities

INTRODUCTION

Youths who experience prolonged social withdrawal and retreat into homebound states have been referred to as hikikomori (Japan), hidden youth (China, Hong Kong, and Singapore), or socially withdrawn youth (South Korea and Hong Kong). They cause significant social and health concerns, with associated intervention complexities and poorly understood psychopathology, inviting controversy among social work agencies and policy makers (1).

At the Hikikomori Round Table and Regional Symposium (HRTRS) hosted by the National University of Singapore in November 2017, researchers and clinicians from Japan, Hong Kong, South Korea, China, and Singapore convened to share findings toward progressive understanding of the phenomenon.

The HRTRS aimed to describe varying cultural and regional presentations of hikikomori, highlight evidence-based interventions to map out a consensus toward clinical definition, and discuss appropriate sociopolitical responses for the East Asian countries represented. Although the condition has been ubiquitously reported globally, including several European countries, India, and the US (2–6), this article focuses on East Asia where the phenomenon is better differentiated and described. The present article aims to overview similarities and differences in identification, intervention, and support strategies to summarize opportunities in the region.

PREVALENCE

Prevalence estimates are only available for Japan and Hong Kong (7, 8). For Japan, the lifetime prevalence rate of social withdrawal of 6 months or more was 1.2% (based on face-to-face survey), while for Hong Kong, it was 1.9% (based on telephone survey). Some argue that the hikikomori condition is becoming more prevalent. If so, it is not known whether this surge is due to increased awareness, improved identification of cases, or causes such as financial circumstance or increased internet usage. In particular, increased internet usage, online gaming, and consequently, the rise of internet-associated addictions may play an important part in the rising rates of social withdrawal (9). Online food delivery and shopping platforms that provide resources and services to the doorstep may further facilitate social withdrawal and disengagement.

CLINICAL PRESENTATION

During the HRTRS, a broad definition was used to accommodate regional differences. Hikikomori is a condition where socially withdrawn youths aged 12–30 years isolated at home for 3–6 months or more, may experience distress, impaired daily functioning, or psychiatric comorbidity. This definition implies that not all those with hikikomori are dysfunctional, and not all those with hikikomori perceive themselves as being dysfunctional. Existing assessment tools include screening questionnaires, such as a self-report Hikikomori screening questionnaire (HQ-25) validated in a Japanese sample (10), and a proposed diagnostic interview tool (6). In addition, research has included social interaction models and biomarkers (11, 12), tools not yet applicable to clinical assessments in distinguishing subtypes of hikikomori.

Hikikomori presents with different stage, duration, and degree of social withdrawal that may be due to differential developmental course of the condition. A Hong Kong study showed that self-reports of self-efficacy, self-esteem, subcultural identity, and empowerment were initially low in youths with 3 to 24 months of social withdrawal but improved beyond 24 months. This positive trend may be due to formation of a subcultural identity within the online community that allowed youths to realize their full potential. Moreover, prolonged social withdrawal was associated with improved physical, social, and psychological quality of life over time (13). Retrospective viewpoints of formerly withdrawn youth suggest that initial phases of social withdrawal may confer a private status that blinds them to the dangers of social skill deterioration and increased apathy, submersed in this state over time (14). These findings await replication in other regions. A cross-national study of 36 socially withdrawn males with an average duration of 2.1 years showed high levels of loneliness and moderate functional impairment (6), but the sample size did not allow for analyses by duration of social withdrawal. In addition, youths often show fluctuations in the degree of withdrawal in all regions (15). This varies from exclusive seclusion in one's bedroom, to youths with no contact with others outside the nuclear family, to youths who infrequently leave home for sustenance.

Variance in duration and form of social withdrawal moderate the corresponding impact on the individual, family, and society. While some hikikomori may not experience a decrease in quality of life, negative behavioral and social consequences may arise from complications associated with a sedentary lifestyle. In Asian societies that emphasize individual industrialism and regular routines, disrupted dietary routines and sleep diurnal reversal patterns are frowned upon, compounded by negative impacts on physical health (12). Adverse social impacts on families include social distancing between family members, escalating to marital and parent–child conflict, sibling rivalry, loss of youth's potential earnings, and depleting parents' savings. Socioeconomic costs include reduced available human capital and possibly negative impacts on population growth.

TYPOLOGIES

Hikikomori carries high psychiatric comorbidity across Asian populations. A Japanese study showed 80% of help-seeking hikikomori met the criteria for a *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* diagnosis (16), including avoidant personality, social anxiety disorder, and major depression. In addition, autistic spectrum disorders and prodromal states of schizophrenia may also demonstrate overlapping symptomatology (3, 6).

In order to further our understanding of the hikikomori phenomenon, a typology distinguishing primary versus secondary hikikomori has been proposed. Suwa and Suzuki (17) and Li and Wong (4) propose a distinction between primary versus secondary hikikomori. Primary hikikomori has no evident psychiatric disorder, while secondary hikikomori has social withdrawal attributable to the presence of psychiatric disorders. This classification of hikikomori is theoretical, while there is little empirical evidence for such a distinction (18). Existing literature indicates substantial numbers of secondary hikikomori in the respective studied populations. However, this may be ascribed to the fact that mental health and social services remain their main receptor platforms and treatment centers. In contrast, primary hikikomori may chiefly be identified through novel research studies designed to capture this elusive group. Furthermore, the primary hikikomori concept remains poorly defined and unstandardized

across studies and countries. For instance, all socially withdrawn youths in South Korea are considered primary hikikomori, while Japan includes those with or without psychiatric comorbidities. This alludes to directional uncertainty on whether prolonged social withdrawal is caused by, correlated with, or causes psychiatric disorders.

Another theoretical framework describes socially withdrawn youths as a function of different interactions between individual, family, school, and social factors (4) *via* different types of social withdrawal processes. Some youths may lack autonomy due to overprotective parenting and financial overdependence. Others may experience existential uncertainty due to discrepancy between parental expectations for achievement and their prospective outcomes. However, no studies to date have examined these underlying mechanisms.

RISK FACTORS

The best-known risk factors for hikikomori are the presence of a psychiatric disorder, developmental disorder, substance-related or behavioral addictive disorders (including Internet and gaming misuse), and poor psychosocial contexts (5, 16, 19). Various risk factors that emerge from the literature are universal among the East Asian regions, including male gender, insecure attachment (20), and psychiatric conditions. Conversely, other risk factors achieve less consensus. Studies on clinically detected hikikomori in Japan, for example, demonstrate that high educational status of families, especially fathers, is reported to increase the risk of hikikomori (21). However, it has been suggested that these studies of clinically detected hikikomori may not represent hikikomori receiving assistance from nonprofit organizations or no assistance at all (22). Hikikomori in Hong Kong detected through social service platforms, for instance, emerges in diversified contexts including low socioeconomic status (SES) families with single parents. However, 80% of cases from Hong Kong emerge from middle to high SES families, mirroring trends observed in Japan.

In countries with high costs of living such as Hong Kong and Singapore, a family with high SES may accommodate financial burden of the hikikomori individual. For anomalies with low SES, several clinicians at the HRTRS anecdotally hypothesized that they may possess specific attributes, such as high cognitive function or remote earning capabilities. Furthermore, low familial support and maternal mental disorder were also positively associated with hikikomori (21).

Dependent behavior described as "amae" in Japanese parent–child relationships has been hypothesized to play a role in developing social withdrawal (23) by normalizing and encouraging the acceptance of their socially withdrawn child (HRTRS) (24) staying at home. These mechanisms await further investigation in the various regions. East Asian parenting styles tend to embody the mother–child relationship as interdependent cooperation, in contrast to the focus on evolving independence and autonomy in Western regions (25). In Korea, the youth culture incorporates a strong sense of cohesion and engagement through social gatherings. When individuals are isolated for more than 6 months, it is perceived as a sign of mental illness. Lastly, preliminary studies in Japan and Hong Kong have begun investigating physiological biomarkers and physical health parameters, respectively, that may eventually contribute to early identification (11, 12).

Furthermore, studies point to the overlap between social withdrawal and Internet and gaming addiction [e.g. Refs. (18, 26)]. Benarous and colleagues, for instance, describe how avoidance and social withdrawal as a persistent maladaptive reaction in a patient with an anxious–avoidant insecure attachment plays a key role in the emergence and persistence of Internet gaming disorder. Lastly, the stigma surrounding mental illness diagnoses may result in preference for hikikomori labeling to mask psychiatric conditions.

Table 1 shows inter-regional presentations of the hikikomori phenomenon, elucidating heterogeneity across regions. The infrastructure to address social or mental health issues determines main modes of identification for the autonomous regions and, in turn, the locale-specific hallmarks of the hikikomori condition. However, regardless of the identification method, hikikomori youths are a heterogeneous population due to differing causes unique to the specific youth.

THERAPEUTIC AND PREVENTIVE INTERVENTIONS

Various healthcare interventions including family, individual, and group counseling or therapy, clinical psychological assessment, and medication or hospitalization exist for hikikomori in various countries. In addition, support and management services including group and interest activities, socialization and skills training, parenting advice, and community education may also be offered (27). Different interventions exist in disparate East Asian regions (refer to **Table 1**). These include home visits, befriending, psychodynamic therapy, parent support groups, Internet addiction programs, art therapy, cyber counseling, e-mentoring, family therapy, pharmacotherapy, animal-assisted therapy (AAT), and halfway homes. Specialized services catered to the hikikomori population exist in Japan and Hong Kong. Interventions are offered through specialized centers (Japan), general (psychiatric) hospitals (China and Singapore), schools (Singapore), government agencies (South Korea) or voluntary welfare organizations, and social agencies (Hong Kong, Singapore, and Japan). Interventions are often administered by social workers and mental health professionals. In China, apart from social work intervention (28, 29), ideological and moral education have also been advocated (30). Currently, referrals are based on condition presentation and location of identification. For instance, a socially withdrawn youth replying to a question in an online game receives cyber counseling, school nonattenders receive intervention through governmental agencies, and parents of socially withdrawn children mostly turn to psychiatric hospitals.

To date, published evidence on treatments for this group is scarce. In their review, Li and Wong (4) identified one empirical evaluation of an intervention specifically targeted at the hikikomori condition, involving a home visitation program conducted in Korea (19). More recently, Wong and colleagues (31) examined the effectiveness of a multicomponent program with animal-assisted therapy (AAT) for socially withdrawn youth in Hong Kong. Program evaluation indicated enhanced self-esteem and perceived employability, and reduced social anxiety. The AAT component did

TABLE 1 | Cross-regional presentation of hikikomori phenomenon.

Country	Japan	Hong Kong	Singapore	Korea	China
Construct	• Hikikomori as a possible psychiatric condition	• Hikikomori as hidden youth with Internet/ gaming addiction	• Hikikomori as socially withdrawn youth with school nonattendance, poor academic performance, and adjustment issues with peers	• Hikikomori as youth with Internet/gaming addiction	• Hikikomori as unemployed, unproductive youth members of society
Leading social health service providers	• Fukuoka Hikikomori Support Center • Mental Health clinics • Academic Research Centre for Hikikomori (Kyushu University Hospital - Hikikomori Support/Research to collect data, clarify biopsychosocial cause/ Intervention/ Networking)	• Social service centers (CRYOUT)	• Mental health services (REACH West, NAMS) • Social services (TOUCH Cyber Wellness, MeToYou)	• Mental health hospitals • Social service centers • Internet addiction prevention centers	• Social service centers • Mental health system/ centers
Available interventions	• Family Supports • Telephone and Direct Counselling • Use of HQ-25 as an evaluation and diagnostic assessment tool • Group Approach	• CRYOUT online gaming platform to identify hikikomori youths • Animal-assisted therapy • Social service conducts home visits. • Socialization, job training,and skills training	• Primary mental health system and school counseling services identify cases • Referred to mental health clinics or social services for intervention.	• School provides surveillance for social withdrawal among nonattendees • Use of social withdrawn youth questionnaire • Therapeutic programs include: Internet addiction prevention, cyber counseling, home visitation, art therapy, case study	• Social work intervention: interviews, family involvement, reintegration with peers and society, skill building • Youth unemployment strategies over outreach to hikikomori.
Key research findings and associated risk factors	• Personality Types (Avoidant and Schizophrenic Personality) • Biomarkers (Low Uric Acid (males), Low High-Density Lipoprotein cholesterol (HDL-C) (females))	• Internet subcultural engagement, online network • Spiritual over material satisfaction • Sociodemographic differences in gender, age, education level, employment status, monthly income	• Gaming addiction • Cyber addiction • School nonattendance • Conscript military service avoidance • Psychological disorders (social anxiety disorder, autism spectrum disorder) • Subculture engagement (Otaku-like, counterculture)	• Cyber addiction • Social violence and bullying in schools • Alcohol abuse Internalizing, ruminative thoughts	• Social anxiety • Cyber addiction • Youth unemployment (oversaturation of university graduates) • Youth lacking financial independence
Next step(s) planned	• Develop assessment systems based on case presentation and biomarkers • Study "Modern-type depression" as a potential gateway disorder hence intervention target for Hikikomori.	• Secure funding to build services for hikikomori population • Adopt snowball sampling method to identify hikikomori related to Internet addiction youths.	• Increase awareness in early detection and treatment among professionals • Conduct focus group with hikikomori youth and their parents, to scope services • Develop novel outreach and composite intervention program • Provide specialized training for house visitation experts to handle comorbid presentations.	• Solicit inter-ministry support in funding, care policy, and program implementation. • Provide training for social workers to recognize hikikomori characteristics • Establish specialized hikikomori service centers.	• Conduct questionnaire survey with psychiatrists, psychologists, social workers • Conduct qualitative interviews with hidden youths • Establish an integrated intervention model • Research into mental health de-stigmatization • Uncover hidden societal impact and costs.

not significantly add to program outcomes but appeared effective in promoting enrolment. During the HRTRS, various strategies to attract and incentivize youth into accepting social and therapeutic interventions were discussed. These include online treatments, potentially incorporated into online gaming, and messaging platforms in Hong Kong's programs. However, the efficacy of these pilot interventions has yet to be assessed. In a cross-national study of 36 socially withdrawn males, a consistent preference for treatment delivered in person over tele-psychiatry was expressed (6). Although social media advertising has demonstrated nominal capacity to detect hikikomori (32), the potential for effective online interventions to bridge the therapeutic gap remains unclear.

In line with other mental health conditions and drawing from the various presentations, intervention strategies evidently need to be tailored to heterogeneous hikikomori subtypes. A multicomponent approach would address complexity, multifactorial onset, and development of the condition. This multicomponent approach should always include youth empowerment and family interventions, whereas AAT should be second-line treatment. For instance, the most severe cases of exclusive seclusion at home may require intensive home visits, coupled with AAT. Alternatively, youths experiencing withdrawal as a transitory state may respond to interventions targeting school resumption and reemployment. In addition, interventions may differ depending on withdrawal duration. Earlier intervention is advantageous to directly address youths with impaired daily functioning. The optimal time frame for intervention appears to be after 3 months of withdrawal, before youths are officially characterized as hikikomori (withdrawal >6 months). At this interval, the joys of regained autonomy have faded, and youths begin to realize the downside but have yet to regain renewed "self-efficacy" and a new sense of hikikomori identity cultivated by a prolonged state of social withdrawal—typically after 2 years.

FUTURE DIRECTIONS: CHALLENGES AND OPPORTUNITIES

Challenges across countries concern the difficulty of case detection due to its hidden nature (32) and that youths may not pathologize this state. Another closely related challenge relates to motivating hikikomori youth to access services or treatment and to return to society. The fragmented knowledge of the condition also hampers optimal intervention. The heterogeneity in presentation, developmental pathways, risk and protective factors, and underlying mechanisms, within regions and across regions, have led to a wide range of services currently being offered, often of unknown efficacy.

The components of challenges at the societal or country level include recognizing burden of care on family and society and the role of authorities or policy makers. As the individual is nested in an ecological social system, the involvement of peers and family is essential to scaffold intervention. Authorities and policy makers may prioritize service planning and implementation by reinforcing case detection by effective gatekeepers. State policy and funding should also focus on awareness, advocacy, and fostering interorganizational collaboration.

The HRTRS presented an opportunity to collectively work toward a more universal definition of the hikikomori condition and explore innovative ways to shape existing service structures. These opportunities pertain to early detection of cases, adoption of assessment tools, and improved intervention services.

Development of opportunities is critical for early detection in the respective regions, through evolving the existing service structures to fit the needs of their youths. For example, primary and secondary school attendance is compulsory and tracked in Singapore. Prolonged absence from school without medical reason could trigger a home visit by a trained social worker. In Hong Kong, it may be helpful to raise awareness to recognize hikikomori symptoms among general practitioners, teachers, and parents, since hikikomori is currently mainly detected through online gaming platforms.

Next, standardization of screening and assessment tools would align primary evaluation within a validated diagnostic framework. We recommend to adopt the HQ-25 screening instrument, as it is theoretically grounded, easy to administer, and shows encouraging psychometric properties (10). We propose that a common method of identification would allow construction of a pathway to justify combinations of recommended interventions. These interventions would directly target affirmed symptomology and causes specific to the hikikomori individual.

As hikikomori is a multifaceted condition, an intervention model that integrates various possible factors affecting the individual could structure and direct intervention. Each country has differing approaches to case identification but may additionally adopt aspects of intervention from other regions to construct a complete biopsychosocial intervention. For example, Singapore may consider adapting AAT into their programs for hikikomori with low motivation and severe withdrawal. For Japan, which has strengths in biological identification and psychiatric and social services, they may consider working toward a more integrated and unified approach. Through a shared information network on research protocol and standardized outcome measurements, different countries may create their own integrated intervention model specific to local needs.

Furthermore, it may be beneficial for regions to examine innovative treatment approaches. The use of augmented reality games to draw socially withdrawn youths out of their rooms and into the real world (33, 34) has recently been suggested. One potential development may include introducing gaming stations at therapy centers and devising activities that encourage offline cooperation and interaction. Another potential avenue pertains to integrating therapeutic gaming with exposure therapy strategies by introducing hikikomori to virtual reality experiences, then shared virtual reality environments, before resocialization into society (9).

The lack of large-scale standardized research has previously been highlighted by multiple authors (4, 35). Future studies should include structured psychiatric assessments to investigate primary hikikomori and associated psychosocial comorbidities to better delineate the cause–effect relationship and intervention touch points for improved outcomes. Furthermore, the debate underlying hikikomori classification is between one camp that contends that it deserves a stand-alone diagnosis in the *Diagnostic and Statistical Manual of Mental Disorders* versus another that argues hikikomori is simply a secondary effect of other psychiatric

conditions. Select studies currently differentiate between onset of other psychiatric conditions before, during, and after hikikomori onset (7). This operational method could be used to differentiate primary and secondary hikikomori and align existing and future literature in streamlining manifestation of psychiatric comorbidity. This would better define case selection for cluster analysis of treatment outcomes and comparison across countries.

In addition, the examination and detection of precursors in large-scale longitudinal epidemiological studies will further enhance early intervention opportunities to prevent withdrawal or limit withdrawal duration. Future studies should also examine Internet and gaming addictions in relation to the hikikomori condition. These collective efforts will further our understanding of this complex phenomenon and consequently improve services provided to prevent or mitigate youth from prolonged social withdrawal.

AUTHOR CONTRIBUTIONS

JW and MW organized the HRTRS and collated all discussions. MW and LK wrote the manuscript. TK, PW, WL, and GC contributed their insights to the HRTRS and the manuscript. All authors contributed to manuscript revision and read and approved the submitted version.

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Intermittent Explosive Disorder in Male Juvenile Delinquents in China

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Objective: Although several previous studies have focused on the mental health problems in detained juvenile offenders in China and found high levels of major psychiatric morbidity, the prevalence of intermittent explosive disorder (IED) in this group remains unknown. The purpose of this study is to discover the prevalence of IED among juvenile offenders in China as well as the difference in demographic characteristics and personality traits between IED offenders and the general population.

Method: A total of 280 delinquent boys (Mean age 16.10 years) were interviewed by trained psychiatrists. The interview procedure included the recording of sociodemographic characteristics, criminal records, Composite International Diagnostic Interviews (CIDI), State-Trait Anger and Expression of Anger Inventory-2 (STAXI-2) and Modified Overt Aggression Scales (MOAS).

Results: Of the 280 delinquent boys, 32 (11.4%) were diagnosed with IED, 129 (46.1%) were non-IED psychopathology controls (PC), and 119 (42.5%) were healthy controls (HC). Except for substance use disorder (SUD), no differences in psychiatric comorbidity were found between youths with IED and those with another psychiatric disorder. Compared with the PC and HC groups, those in the IED group were more likely to commit a violent crime such as rape, assault, or an affray but it is less likely that their motive can be explained by money or property. The IED group also had a higher rate of recidivism history than the HC group. The IED group displayed higher levels of state and trait anger and anger expression than the HC group and lower levels of anger control than both the PC and HC groups. MOAS also showed that those in the IED group were more aggressive than those in the PC and HC groups.

Conclusion: The relationships between IED, anger and aggression reflect the need to develop and implement specific and individually tailored intervention approaches to correct IED juvenile offenders' behavior in order to prevent new crime.

Keywords: intermittent explosive disorder, juvenile delinquent, aggression, anger, China

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INTRODUCTION

Intermittent explosive disorder (IED) is a psychiatric condition characterized by recurrent aggressive behavior, explosive outbursts towards people and property, impaired emotion regulation and behavioral control, and it is often comorbid with other psychiatric disorders (1). IED was once considered a relatively rare disorder, but recent studies have reported diverging

prevalence estimates. In the United States, while the data provided in the Collaborative Psychiatric Epidemiology Surveys showed that the prevalence of IED was in only 1.62% of the population (2), the National Comorbidity Survey in 2001 to 2003 found that the lifetime prevalence of IED was 7.3% and 5.4% when broad and narrow criteria of IED were used, respectively (3). Further, in the National Comorbidity Survey Replication Adolescent Supplement (NCS-A), researchers found that 7.8% of adolescents between the ages of 13 and 17 met the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV) criteria for lifetime IED (4). Meanwhile, for studies in other countries, the mean lifetime prevalence of IED was 3% for the broad definition and 1.6% based on the narrow criteria (1).

Due to the high aggression, anger, hostility, and poor temper control characteristics of IED, a series of studies were carried out which focused on the legal consequences of IED. They found a clear linkage between IED and criminal behavior. For example, in one federal probation jurisdiction in Midwestern United States, DeLisi studied 863 federal correction clients' data and found that those with IED were more likely to be arrested for murder, attempted murder, interference with police, and assault (5). In Chile, Mundt found that the IED prevalence rate was 5.7% among a nationwide random sample of 1,008 prisoners in seven penal institutions (6). Similar associations also existed in the youth population. According to the data from NCS-A (4, 7), when compared to youth without IED, youth with lifetime IED diagnoses had a significantly greater probability of being arrested for burglary or theft (OR = 6.2), violent crime (OR = 11.0), or any other crime (OR = 8.8).

Over the past several decades, juvenile delinquency has emerged as a serious social problem in China (8). As China began its transformation into a market economy in the late 1970s, the problem of juvenile crimes became increasingly troublesome. In 1990, the number of juvenile offenders under the age of 18 adjudicated by the courts was 42,033, with that number rising steadily to 55,817 in 2013, thereby representing an increase of over 33% (9).

Recently, studies focused on the mental health problems of detained juvenile offenders in China have found high levels of major psychiatric morbidity, including attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD) and conduct disorder (CD) (10). These findings demonstrate that juvenile delinquents in the justice system constitute a population with an elevated risk of psychiatric problems (11), showing that it is critically important to address the psychiatric needs of juvenile offenders (12, 13). One drawback of Zhou's study was that it did not mention whether or not IED existed in this population. Since research had confirmed that IED had a comparatively high prevalence (1.7%) in metropolitan China (14), we believe that the incidence of IED in juvenile offenders cannot be ignored.

To date, few studies have investigated IED within a criminal justice context in China. In order to account for the gaps in previous literature, the present study sought to identify IED in male juvenile offenders in China. We investigated the anger-related traits and aggressive behavior in individuals with IED, psychiatric controls, and healthy volunteers in a population of juvenile offenders. The differences between the three groups were compared. We hypothesized that youths with IED would have escalated tendencies of anger and aggressive behaviors compared to those in the other two groups. We also predicted that higher anger and aggression in IED would result in different crime profiles than those in the comparison groups.

MATERIAL AND METHODS

Participants and Procedure

This cross-sectional study was conducted in the only juvenile reformatory in Shanghai, China. All literate male juvenile delinquents incarcerated in this facility from March to August 2012, were included in the study after obtaining informed consent from both themselves and their parents or guardians.

Participants who agreed to participate were instructed to complete all the questionnaires within 30 days after being sent to the reformatory. All questionnaires that were answered completely and sufficiently were included in the study.

During the 6 months of our study, 347 delinquent boys were incarcerated at this reformatory after being disposed by juvenile courts. Finally, 280 (80.69%) of the boys who responded and completed the questionnaires properly were included in the study.

Sociodemographic Characteristics and Crime-Related Variables

Through official police records, we collected information regarding age, household registration, most recent offenses (crime type), and criminal history. A self-report questionnaire designed by the authors was used to collect information about the participants' and their parents' education levels, as well as other family and living situations. In addition, we also asked participants to report the motives of their crimes in the questionnaire (e.g., money-oriented or otherwise).

Psychiatric Interview Measures

The Composite International Diagnostic Interview (CIDI), a fully structured interview administered by trained interviewers (15), was conducted to assess the current psychiatric diagnoses of all participants. CIDI has been used in cross-cultural settings with great success (16). DSM-IV criteria (17) were used to assess the participants' Axis I Disorders, and IED was diagnosed using research criteria (17, 18). The IED participants also met the new DSM-5 criteria for IED (19).

Self-Ratings of Anger

Anger was assessed by the Spielberger State-Trait Anger Expression Inventory-2 (STAXI-2) (20). STAXI-2 is a 57 item self-report scale that is used widely to measure state and trait anger, and it contains several subscales. State anger measures the amount of anger that is experienced at a particular time. Trait anger measures one's disposition to experience angry

feelings. Anger Expression-Out measures the level of verbal and physical anger expressed outwardly at other individuals or objects, while Anger Expression-In measures inward expression of angry feelings (i.e., suppression). Anger Control-Out measures the control of angry feelings by preventing their outward expression, while Anger Control-In measures the level of controlling suppressed anger by calming oneself down. Cronbach alphas for the Chinese version of STAXI-2 were 0.91 for Trait Anger, 0.81 for State Anger, 0.68 for Anger Expression-In, 0.71 for Anger Expression-Out, 0.82 for Anger Control-In, and 0.87 for Anger Control-Out (21).

Aggression Behavior Measures

Aggressive behaviors of these participants within 30 days (their first month in juvenile reformatory) were measured with the Modified Overt Aggression Scale (MOAS) by one researcher. They were based on the participants' self-reporting as well as records provided by prison staff. MOAS is a four-part behavior rating scale designed to measure four types of aggressive behavior as witnessed in the past weeks. Each section consists of five questions, with the first section related to verbal aggression, the second focused on aggression against property, the third measuring auto aggression, and the fourth concerning physical aggression (22). After being translated into Chinese, the MOAS has been found to have modest reliability and validity in psychiatric inpatient samples in China (23).

Ethics

All relevant authorities, including those at the correctional institution and the head of the Shanghai Justice Bureau, were approached. They all granted permission to conduct the assessments and approved our inspection of related files. The Research Ethical Committee at Shanghai Mental Health Center (IORG Number: IORG0002202; FWA Number: FWA00003065) approved the study.

Participants received verbal and written information about the purpose and design of the study. They were informed that their participation was voluntary and that any participant could withdraw without penalty at any time. They were also informed that their responses would remain anonymous, and that only the researchers would see their individual questionnaires.

Statistical Analysis

The data were analyzed using the software package SPSS 19.0 (SPSS Inc., Chicago, IL). The frequencies and means of the demographic variables of the study were first calculated by descriptive statistics. Data were presented as means ± standard deviations.

The differences between demographic variables, crime profiles, and anger prevalence among the three diagnostic groups were analyzed by ANOVAs and chi-squared tests. Kruskal–Wallis tests were used to compare the differences in severity of the aggressive behaviors between the three groups, as the MOAS scores were ordinal variables. The results of multiple comparisons were presented when there was significant statistical difference within the three groups.

RESULTS

Socio-Demographic Characteristics and Crime Profile

Among the 280 participants, 32 (11.4%) participants fulfilled the research criteria for IED (IED group), 129 (46.1%) participants had other DSM-IV psychiatric disorders (psychopathology control group, PC), and 119 (42.5%) participants had no history of psychiatric disorders (healthy control group, HC).

Table 1 shows the analyses of the demographic variables (age, education, and parental education levels) and the crime profiles. Results showed no group differences with regard to age (all aged 15 to 17 years), educational level (from 4 to 11 completed years), proportion of those who were the family's only child, household registration (natives of Shanghai vs. migrants from other regions), family income status, parental marital status, and parental education level. Compared with the other two groups, the IED group had a higher rate of violent crimes (mainly rape, assault, and affray) and a lower rate of attributing their motivation to stealing money or property ($P < 0.001$). The rate of recidivism in the IED group was much higher than that of the HC group ($P < 0.05$) and similar to the PC group.

Psychopathology

Among the juvenile delinquents, the most frequent mental disorder was CD ($n = 111$). In addition, ADHD ($n = 54$), ODD ($n = 31$), SUD ($n = 30$), and AD ($n = 7$) were also found. No respondents were found to have affective disorder, mental retardation, or any other psychotic disorders at the time of assessment. The differences in psychopathology between the IED and PC groups are displayed in **Table 2**. Participants in the IED group had significantly less substance use disorders than participants in the PC group. No differences with other diagnoses were found between the two groups.

Anger and Anger Expression/Control

Compared with the HC group, the IED group displayed a higher level of state anger, trait anger, and anger expression-out ($P < 0.05$). The IED group also had a lower level of anger control-out than the PC and HC groups ($P < 0.01$). No difference on state anger, trait anger, anger control-in, and anger expression were found between the IED and PC groups (**Table 3**).

Aggressive Behaviors

During the first month in juvenile reformatory, the IED group showed not only a higher MOAS weighted total score ($P < 0.001$) but also higher verbal and property aggression scores compared to the PC and HC groups ($P < 0.001$). In physical aggression, the IED group's level was higher than the HC group, but there was no difference with the PC group. No statistically significant difference in auto aggression was found between the three groups (**Table 3**).

TABLE 1 | Socio-demographic characteristics and crime profile of different groups.

	Total *N* = 280	IED *n* = 32	PC *n* = 129	HC *n* = 119	F/χ2	*P*	IED vs. PC	IED vs. HC	PC vs. HC
Continuous variables									
Age (year)	16.10 ± 0.61	16.06 ± 0.62	16.11 ± 0.62	16.10 ± 0.62	0.072	0.931	–	–	–
Education (year)	8.20 ± 1.64	8.72 ± 1.49	7.98 ± 1.64	8.29 ± 1.64	2.966	0.053	–	–	–
Father's education (years)	9.25 ± 3.45	9.88 ± 3.64	9.15 ± 3.38	9.19 ± 3.45	0.607	0.546	–	–	–
Mother's education (years)	8.34 ± 3.44	9.69 ± 4.10	8.06 ± 3.15	8.29 ± 3.49	2.934	0.055	–	–	–
Categorical variables									
The only child in family	192, 68.6%	20, 62.5%	97, 75.2%	75, 63.0%	4.871	0.088	–	–	–
Parental marital status (divorced)	61, 21.8%	5, 15.6%	33, 25.6%	23, 19.3%	2.225	0.329	–	–	–
Family income (monthly)[a]					8.344	0.214	–	–	–
<1,000	29, 10.4%	2, 6.3%	16, 12.4%	11, 9.2%					
1,000–1,999	75, 26.8%	6, 18.8%	39, 30.2%	30, 25.2%					
2,000–3,499	96, 34.3%	17, 53.1%	41, 31.8%	38, 31.9%					
>3,500	80, 28.6%	7, 21.9%	33, 25.6%	40, 33.6%					
Migrant population (*n*, %)	172, 61.5%	16, 50.0%	86, 66.7%	70, 58.8%	3.599	0.165	–	–	–
Types of crime					90.824	<0.001			
Homicide	7, 2.5%	2, 6.3%	2, 1.6%	3, 2.5%			–	–	–
Rape	13, 4.6%	6, 18.8%	6, 4.7%	1, 0.8%			<0.05	<0.05	>0.05
Assault	31, 11.1%	11, 34.4%	15, 11.6%	5, 4.2%			<0.05	<0.05	<0.05
Robbery	50, 17.9%	2, 6.3%	32, 24.8%	16, 13.4%			<0.05	>0.05	<0.05
Affray	32, 11.4%	10, 31.3%	15, 11.6%	7, 5.9%			<0.05	<0.05	>0.05
Theft	113, 40.4%	1, 3.1%	41, 31.8%	71, 59.7%			<0.05	<0.05	<0.05
Fraud	14, 5.0%	0, 0.0%	8, 6.2%	6, 5.0%			–	–	–
Drug-pusher	20, 7.1%	0, 0.0%	10, 7.8%	10, 8.4%			–	–	–
Violence crime (*n*, %)[b]	133, 47.5%	31, 96.9%	70, 54.3%	32, 26.9%	59.024	<0.001	<0.05	<0.05	<0.05
Money or property as the aim (*n*, %)	147, 52.5%	1, 3.1%	59, 45.7%	87, 73.1%	53.918	<0.001	<0.05	<0.05	<0.05
Recidivism (*n*, %)	112, 40.0%	21, 65.6%	76, 58.9%	15, 12.6%	65.197	<0.001	>0.05	<0.05	<0.05

IED, intermittent explosive disorder; PC, psychopathology controls, HC; healthy controls.

[a]*Chinese RMB (yuan) minimum monthly salary (per person).*

[b]*Violence crime refers to homicide, rape, assault, robbery, and affray. Nonviolence crime refers to theft, fraud, and drug-pusher.*

TABLE 2 | Number of participants endorsing DSM-IV disorders.

	IED *n* = 32	PC *n* = 129	χ2	*P*
Anxiety disorder	1, 3.1%	6, 4.7%	0.144	1.000
Attention Deficit Hyperactivity Disorder	8, 25.0%	46, 37.4%	1.307	0.300
Conduct Disorder	17, 53.1%	84, 65.1%	1.577	0.226
Oppositional Defiance Disorder	7, 21.9%	24, 18.6%	0.176	0.627
Substance use disorder	1, 3.1%	29, 22.5%	6.336	0.010

DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; IED, intermittent explosive disorder; PC, psychopathology controls.

DISCUSSION

We presented the first study to investigate the phenomenon of IED in male juvenile offenders in Shanghai, the most populous city in China. Some findings in our research may contribute to the understanding of the linkage between IED and juvenile delinquency in China's urban areas.

Using the DSM-IV criterion, previous studies had found a comparatively high prevalence of IED in metropolitan China, namely, Shen's 1.7% in Beijing and Shanghai (14) and Duan's 3.39% in Shenzhen (24). Our finding of 11.4% participants meeting the criteria of IED cannot be directly compared with these studies as this was not an epidemiological study. Also, we used the IED research criteria that was broader than the DSM-IV IED criteria and closer to the definition of the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (19). That said, it clearly demonstrates that the prevalence of IED in juvenile offenders cannot be ignored.

Further, research has showed that a considerable number of juvenile crime and delinquency cases in urban China were committed by adolescents who had migrated from rural areas (25). We found this phenomenon exists not only in male juvenile offenders with no DSM-IV diagnosis (58.8%), but also in the IED group (50%) and other DSM-IV diagnosis groups (66.7%). This confirms the seriousness of juvenile delinquency among the migrant population in China. Meanwhile, it also showed that IED is a problem that cannot be ignored in both juvenile offender subgroups, urban and migrants.

Individuals with IED, including adolescents, usually had significantly more major lifetime non-personality disorders, including mood disorder, anxiety, and substance dependence

TABLE 3 | Anger and aggressive behavior in different group.

	IED *n* = 32	PC *n* = 129	HC *n* = 119	*F*/χ2	*P*	IED vs. PC	IED vs. HC	PC vs. HC
STAXI-2								
State Anger	28.78 ± 7.68	30.06 ± 9.69	25.37 ± 7.49	9.408	<0.001	0.451	0.047	<0.001
Trait Anger	22.16 ± 4.86	22.32 ± 7.19	19.57 ± 5.92	6.082	0.003	0.899	0.045	0.001
Anger Control-In	18.88 ± 5.99	19.52 ± 5.67	19.61 ± 5.62	0.217	0.805	–	–	–
Anger Control-Out	15.31 ± 5.02	18.68 ± 6.03	18.89 ± 6.07	4.873	0.008	0.004	0.003	0.783
Anger Expression-In	15.63 ± 4.47	17.63 ± 5.33	16.52 ± 4.97	2.653	0.072	–	–	–
Anger Expression-Out	18.06 ± 4.05	17.81 ± 6.20	15.87 ± 5.13	4.485	0.012	0.821	0.048	0.006
MOAS								
Verbal Aggression	1.94 ± 1.13	1.28 ± 1.27	0.74 ± 1.25	31.335	<0.001	0.021	<0.001	<0.001
Against Property	1.30 ± 1.16	0.55 ± 0.93	0.24 ± 0.56	37.242	<0.001	<0.001	<0.001	0.019
Auto aggression	0.41 ± 0.95	0.18 ± 0.58	0.17 ± 0.63	4.433	0.109	–	–	–
Physical Aggression	1.70 ± 1.05	1.43 ± 1.41	0.48 ± 0.96	44.503	<0.001	0.433	<0.001	<0.001
Total score (weighted)	15.56 ± 5.14	8.26 ± 7.15	3.43 ± 5.41	69.669	<0.001	<0.001	<0.001	<0.001

STAXI-2, State-Trait Anger Expression Inventory; IED, intermittent explosive disorder; PC, psychopathology controls; HC, healthy controls.

(7, 26–30). We also found that a considerable proportion of IED juvenile offenders were comorbid with other DSM-IV disorders, such as conduct disorder, attention deficit hyperactivity disorder, and oppositional defiance disorder; however, the proportion was not statistically different when compared to the PC group.

We did not find any mood disorders in IED participants. In fact, we did not find any participants who met the diagnostic criteria of affective disorder, mental retardation, or any other psychotic disorders during the study period. This is because offenders suffering from these disorders are usually judged as "excused," having "extenuated criminal responsibility," or having "no ability to serve a sentence" and thus placed in other institutions. Although depressive disorders could be secondary to their incarceration, our interviews were conducted with offenders who had been in the reformatory no more than thirty days, thus making it difficult to identify depressive episodes within the group. Without doubt, these interviewees may have had affective disorders or other psychotic disorders in the past. However, this study focused primarily on their mental status during their imprisonment. Meanwhile, the IED participants had no significant differences with the other two groups in terms of age and education levels. Thus, age, education level, and psychopathology were not included as covariates in the final analyses.

We examined levels of anger and aggression in three groups of male juvenile offenders. Although the limited sample size (32 IED participants) might lead to certain negative results, we found some difference on STAXI-2 and MOAS scores between the IED and two control groups. Compared with the HC group, the IED group showed a significantly higher anger trait as well as deficiencies in anger control-out ability. This made them more susceptible to experiencing bouts of spontaneous anger; therefore, they also reported higher state anger and anger expression-out. These findings are consistent with previous research findings where IED groups showed increased anger (31).

Studies have shown increased anger in individuals with IED relative to psychopathology control groups (26, 32) and non-aggressive personality disorder groups (33). In this research, the IED and PC groups reported similar levels of anger experience and expression except in the case of anger control ability. The lack of significant difference between offenders with IED and psychopathology control groups may be attributed to the existence of comorbidity in the IED group. The high rate of comorbidity diagnoses might explain the features found in both the IED and psychopathology control groups (26). Further, the similarities between the two groups may have resulted from the diagnostic composition of the PC group in our research. Compared to previous studies that had significant percentages of mood disorder in their PC groups (7, 26–30), our PC group was mainly comprised of those with various externalized disorders, such as ADHD, ODD, and CD, all of which were also characterized by high levels of anger experience and expression (34, 35).

Despite the similarities in anger experience between the IED and PC groups, the IED group showed higher verbal and property aggression compared to the PC and HC groups. Although physical aggression levels in the IED group were similar to the PC group, after weighting all items, the total aggression level of the IED group was the highest of all three groups. The high aggression of IED offenders in the juvenile reformatory poses a considerable risk to staff as well as to non- or less-violent prisoners. Therefore, they should be supervised with additional caution.

We hypothesized that the criminal profiles of juvenile offenders with IED would differ from those of other juvenile offenders. As predicted, participants in the IED group were more likely to be repeat offenders and perpetrators of violent crimes. These results are consistent with DeLisi's previous findings that federal correctional clients with IED had a dramatically higher correlation with recidivism, total arrest charges, and assault-related charges (5). For individuals diagnosed with IED, their aggressive behavior was not usually intended to achieve some tangible objective like money, power, or intimidation (1). We also found that they were less prone to state money as their primary motive for crime. This might be explained by the high rate of reactive aggression and the low rate of premeditated aggression among IED subjects (36). Thus, they were more likely to be involved in violent crimes, such as rape, assault, and affray rather than planned antisocial behavior related to money, such

as robbery and theft. This tendency is confirmed by the lower rate of IED participants attributing money as their motives for crime in their self-reports. This implies a discomforting situation regarding juvenile delinquents in the IED group, that is, the differences suggest the need to develop individualized crime prevention strategies for at-risk IED groups.

When interpreting our results, certain limitations should be considered. First, as a cross-sectional study, the ability to address the causality of the factors was limited. Therefore, further longitudinal studies are needed. Second, when answering questions, respondents may have tended to adhere to social norms rather than actual situations. That said, as the three groups of juvenile offenders were from the same correctional institution, there was no reason to suspect that one of the groups had more obvious misreporting issues when answering these questions, and the comparisons are probably valid. Third, the study only examined the situation of IED among male juvenile offenders in one reformatory in Shanghai. We may not be able to generalize these results to serve as indicators for female IED juvenile offenders or IED adolescents without criminal records in other cities of China. Finally, given the prevalence of depression in prisons in other countries (3, 5, 6), this may also impact the generalizability of the findings. Therefore, further research related to IED must be conducted across a broader population.

Despite these limitations, the study contributes to our understanding of IED in juvenile offenders in China. This is a problem that cannot be ignored by policymakers or mental health and criminal justice professionals. The relationship between IED with excessive anger and aggression implies that specific and individually tailored intervention approaches should be developed to correct IED juvenile offenders' behavior in order to help prevent further crimes. Research in the near future should focus on the risk and protective factors of the disease, the creation of feasible screening and early detection strategies, and the development of effective treatment methods Manuscript Formatting.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of Research Ethical Committees at Shanghai Mental Health Center with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Research Ethical Committees at Shanghai Mental Health Center (IORG Number: IORG0002202; FWA Number: FWA00003065).

AUTHOR CONTRIBUTIONS

YS and BX contributed to the conception of the study. YS, YQ, and MZ performed the investigation. YS and YQ contributed equally to analysis and manuscript preparation. BX reviewed and approved the final version of manuscript.

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Healing Childhood Psychological Trauma and Improving Body Image Through Cosmetic Surgery

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Cosmetic surgery is an interdisciplinary field involving cosmetics and medicine that stems from the early modern obsession with disfigurement. The "correcting" of facial features and body parts was very likely because beauty was at the heart of most reconstructive desires. Cosmetic surgery patients typically experience improvements in body image, and some are very satisfied with the impact of cosmetic surgery in changing their behaviors and improving self-esteem. The doctrine of mind–body connection supports the concept of healing the heart through the body. However, some people feel disgraced after revealing their experiences of cosmetic surgery. It is known that people who experience childhood psychological trauma, such as abuse and school bullying, may opt for cosmetic surgery later in life. The present study aimed to explore the relationship between childhood psychological trauma, cosmetic surgery, and body image. Three female adults who had undergone different types of cosmetic surgery completed the Acceptance of Cosmetic Surgery Scale (ACSS), the Fear of Negative Appearance Evaluation Scale (FNAES), and the Multidimensional Body-Self Relations Questionnaire (MBSRQ), followed by semistructured face-to-face interviews. According to the results, 1) undergoing cosmetic surgery can enhance self-confidence, reduce body dissatisfaction, resolve inner conflicts, and somewhat relieve psychological distress; 2) self-esteem and body image obtained from cosmetic surgery can resolve the distressing aftereffects of childhood trauma that occur later in life; and 3) the perceived sense of beauty achieved from cosmetic surgery contributes to a certain degree of self-confidence in the short term and promotes appearance-enhancing behaviors while increasing the distress of others discovering their cosmetic surgery experiences. The implications of this study are that undergoing cosmetic surgery can have healing effects on childhood trauma; however, there are certain drawbacks that can occur, such as distress and an insatiable desire for or an "addiction" to surgery.

Keywords: childhood psychological trauma, body image, cosmetic surgery, body satisfaction, addiction

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INTRODUCTION

Although it is difficult to define plastic surgery, it can be described as a procedure for the reparation of injury, surgical refinement of deformity, restoration of function, or reconstruction or alteration of the human body (1). Plastic surgery has played a significant role in the healing of wounds and processes of regeneration (2). A study conducted after World War II (3) showed that former soldiers

whose faces had been disfigured during war found it harder to find employment, compared to those with intact faces. Thus, plastic surgery is generally chosen by people with burns or injuries (4) in order to reconstruct or camouflage scars, or by those afflicted with congenital disease (5).

Cosmetic surgery can be described as one of the various fields of plastic surgery that mainly focuses on enhancing a patient's appearance. A previous study (6) reported that the first cosmetic surgery was performed in 16th-century Britain. Later, the innovation of cosmetic facial surgery first arrived between 1970 and 1979 (7). Since then, cosmetic surgery has become a common as well as popular phenomenon, as more people are choosing to undergo a quick transformation in order to fulfill their standards of beauty.

In 2017, a total of 4.31 million cosmetic and nonsurgical procedures were performed in the United States, which was the highest in the world and represented 18.4% of the world's total. Brazil took second place, with 2.42 million procedures performed in 2017, representing 10.4% of the world's total. Meanwhile, Japan has also faced criticism for the prevalence of cosmetic practices, with a total of 1.67 million procedures performed, representing 7.2% of the world's total and ranking third (8). In 2010, the number of cosmetic surgeries performed globally was 14 million (9); however, in 2015, the number has exceeded 21 million, with an increase of over 30% (10). Thus, it is clear that the number of cosmetic surgeries has continued to rise worldwide in recent years.

Influenced by trends in South Korea and Japan, a cosmetic surgery craze has swept across East and Southeast Asia (e.g., China, Hong Kong, Thailand) in recent years, promoted by both mass media (e.g., TV shows, international beauty pageants) and social media (e.g., Facebook, Instagram, and blogs). People choose to undergo cosmetic surgery with the intention of improving certain parts of their body that they feel unsatisfied with. The pursuit of perfection and expectation of resolving intra- and interpersonal conflicts can be the factors leading to cosmetic "addiction." In 2017, there were 20 million cosmetic procedures performed on women, and 3 million such surgeries performed on men (8). Currently, the majority of patients who undergo cosmetic surgery are women. With the increase in social networking and cosmetic techniques, some specialists [e.g., Ref. (11)] have predicted that the popularity of cosmetic surgery will also gradually increase among the male population.

Plastic surgery helps to heal not only physical imperfections but also psychological wounds. Gaspare Tagliacozzi (12), the father of modern plastic surgery, stated that his practice aimed to "bring back, refashion and restore to wholeness the features which nature gave but chance destroyed, not that they may charm the eye but that they may be an advantage to the living soul" (p. 341) (13). Pert (14), a neuroscientist and pharmacologist, stated that "the body and mind are not separate, and we cannot treat one without the other" (p. 274). By undergoing plastic surgery, people aim to simultaneously heal their bodies and minds. One study found that people who underwent cosmetic surgery reported an increase in their self-confidence levels (15) and improvements in their interpersonal relationships (1).

Body image refers to "a phenomenon of a lifetime of ongoing subjective experiences, including memories and emotions that combine with tangible sensory data that are unique to the individual within a broader social and cultural context" (p. 83) (16). The collective cognitive and emotional experiences of individuals formulate their body image, which constructs the awareness of the relation of the body with the physical environment, and enables changes in response to new sensory inputs (16), and even constructs new schemas. Body image is influenced by the beliefs, expectations, and prejudices of the individual, as along with the societal and cultural standards of desirable features (17). Individuals combine and internalize the information received from family, peers, and social media to create an ideal body standard for themselves. This standard of measurement evokes self-judgment on his or her image and is manifestly linked to an individual's emotional state regarding body image.

Prior research has revealed that family (18) and peers (19) are the key figures that affect individuals' body image, as well as possible contributors to the development of body dissatisfaction (20). Direct parental comments about their child's body size or appearance formulate their concepts of body image. Peer influence on body image begins in childhood and continues into adolescence and young adulthood. Peer evaluations and teasing may subsequently influence one's own judgment of beauty and an ideal self-image. Body dissatisfaction during childhood and adolescence can present risks in the development of body image (21), as negative judgment leads to poor body image and body dissatisfaction. Certain studies [e.g., Refs. (22, 23)] have indicated a significant positive correlation between the overall body image, appearance evaluation, and appearance orientation.

Maltreatment by parents (24) and peers (25) has a negative impact on the psychological development of children. Childhood abuse and neglect tend to increase the risk of body dysmorphic disorder in young adulthood (26). People who were abused (27) or emotionally neglected during childhood are more likely to undergo cosmetic surgery later in young adulthood.

Apart from child abuse, school bullying is also one of the most common causes of childhood psychological trauma. Bullying is defined as intentional, repetitive harming or injury by one's peers (28). The types of bullying include physical (e.g., hitting, pushing, and kicking), verbal (e.g., name-calling and teasing), relational (e.g., social exclusion and spreading rumors), and cyber (e.g., e-mail, instant messaging on personal computers, or text messaging on cell phones) (29). One prior study reported that bullying may lead to victims opting for cosmetic surgery later in life (30).

People who seek cosmetic surgery may be experiencing psychosocial distress (31). Some patients with serious psychiatric disorders, such as body dysmorphic disorder (BDD) and eating disorders, may complain about their smallest appearance flaws or undergo excessive emotional distress due to body image dissatisfaction (31). Some patients seek and become addicted to cosmetic surgery and demonstrate a pattern of repeatedly seeking surgery in order to relieve distress. Cosmetic surgery addiction is a kind of polysurgical addiction (32), in which people demonstrate a compulsive need for surgical interventions.

People with such disorders tend to opt for surgical rather than psychiatric treatment (31). Research indicates that, in most cases, cosmetic surgery does not improve the symptoms of BDD (33). Cosmetic surgery has been disparaged as an irrational choice for people who are excessively preoccupied with their appearance.

Nevertheless, previous studies [e.g., Ref. (34)] have reported that cosmetic surgery can enhance the level of self-confidence by improving a person's physical appearance and attractiveness. Cosmetic surgery appears to provide several benefits to people who suffer from body dissatisfaction. Although there are numerous studies [e.g., Ref. (35)] on body image dissatisfaction and BDD, researchers have seldom focused on healing childhood psychological trauma by undergoing cosmetic procedures. A previous study revealed that childhood bullying victims are at an increased risk of undergoing cosmetic surgery in adulthood (30). The findings reported victims experiencing an extreme desire to undergo cosmetic surgery and, consequently, demonstrated significant improvements in depression and anxiety. Another study (36) also stated that cosmetic surgery could have a positive influence on mental health. With the aim to shed light on the controversies surrounding cosmetic surgery, the present study explores the impact of cosmetic surgery on remedying childhood psychological trauma. The conceptual framework shown in **Figure 1** illustrates the various relationships.

METHODS

A mixed-methods case study was designed to assess body image as well as the acceptance of cosmetic surgery while exploring the experience of childhood psychological trauma and cosmetic surgery.

Participants

Participants were chosen purposively; all had undergone cosmetic surgery. Three female adults, ranging from 25 to 30 years of age (M = 27.67, SD = 2.52), were recruited using the snowball sampling technique.

Materials

First, interviewees were asked to provide informed consent. Thereafter, they completed the Multidimensional Body-Self Relations Questionnaire Appearance Scales (MBSRQ-AS) (37), Fear of Negative Appearance Evaluation Scale (FNAES) (38), and Acceptance of Cosmetic Surgery Scale (ACSS) (39), in order to measure their attitudinal dispositions toward the physical self, the fear of negative feedback on their appearance, and the acceptance of cosmetic surgery, respectively.

The MBSRQ-AS is a self-report inventory for the assessment of body image. It is a 34-item self-report inventory that consists of five subscales: appearance evaluation (AE) (7 items), appearance orientation (AO) (12 items), overweight preoccupation (OWP) (4 items), body areas satisfaction scale (BASS) (9 items), and self-classified weight (SCW) (2 items); these are measured on 5-point scales (complete satisfaction to complete dissatisfaction). The MBSRQ-AS is used to measure one's attitudinal dispositions toward the physical self. The three dispositions are evaluative, cognitive, and behavioral components. Moreover, the physical self-encompasses not only measure on one's physical appearance but also the body's competence and its biological integrity (40). The internal consistency of the five subscales ranged from 0.73 to 0.89 and test–retest reliability ranged from 0.74 to 0.91 (37).

The FNAES (41) was adopted to measure the fear of negative feedback regarding an individual's appearance. It consists of a six-item self-report measure that assesses apprehension about appearance evaluation, measured on a 5-point Likert scale (1 = not at all, 5 = extremely). The novel item is index apprehension, which relates to a negative experience with appearance evaluative. It is reliable, with high internal consistency (0.94).

The ACSS (39) involves the multidimensional measure of various aspects of attitudes toward cosmetic surgery. It consists of three subscales. The intrapersonal subscale measures the attitudes related to self-oriented benefits of cosmetic surgery. The social subscale evaluates the social motivations for cosmetic surgery. The consider subscale measures the probability of a participant to consider undergoing cosmetic surgery. All three identified elements are associated with cosmetic surgery attitudes, the

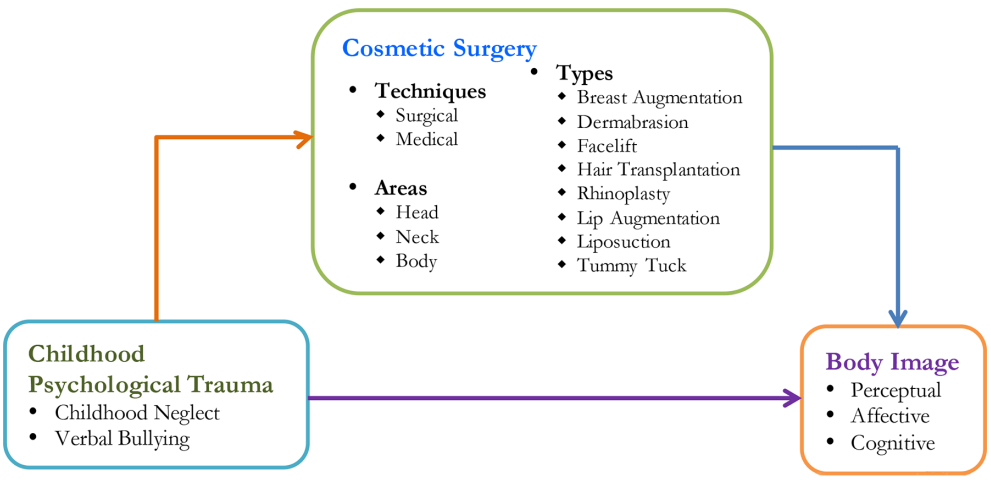

FIGURE 1 | The conceptual framework.

degree to which an individual would consider having cosmetic surgery, and the acceptance of cosmetic surgery based on social and intrapersonal motivation. The ACSS is comprised of 15 items for indicating the participants' level of agreement on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). A high score indicates high acceptance of cosmetic surgery; scoring is reversed in the questionnaire. Previous research has shown that the ACSS has high internal consistency, good test–retest reliability after 3 weeks, and good convergent and discriminant validity (39). Cronbach's alphas for the three subscales were relatively high (intrapersonal 0.92, social 0.90, and consider 0.90).

Second, face-to-face semistructured interviews were conducted individually to understand the experiences and psychological effects of childhood trauma, attitudes toward cosmetic surgery, and cosmetic surgery's influence on the self and interpersonal relationships.

Procedure

The study was divided into two parts. First, the interviewees were told about the aims of the study, its benefits, voluntary participation, anonymity and confidentiality, and the right to withdraw. Second, to protect and maximize the benefits for participants, the interviewees were asked to complete a consent form and the questionnaire through email, before participating in the research. To avoid discomfort, the interviewees were given an interview guideline with structured questions regarding early childhood trauma and the experience of undergoing cosmetic surgery before conducting this study. Third, the three interviewees were then invited for two 45-min semistructured interviews. The details of the study were fully explained without deception. The first session of the interview focused on their childhood trauma, such as child abuse and school bullying, whereas in the second session, interviewees were asked to share their experiences, processes, and consequences of cosmetic surgery. The second interview mainly focused on their purposes for choosing to undergo cosmetic surgery, as well as the connection between trauma experience and cosmetic surgery.

All primary qualitative data, such as interview recordings and questionnaires, were kept strictly confidential. The interviewees' names, photographs, and audio recordings were not disclosed, and the data were only used for research and publication purposes. In addition, to protect and respect the participants' feelings, referral to a counsellor was provided in case the participants needed help or support after participating in the study.

Data Analysis

A mixed design was adopted comprising quantitative and qualitative methods for both data collection and analysis. The resulting data were primarily qualitative but included a small quantitative component for tracking the demographic items as well as the three questionnaires. The quantitative data were analyzed using means and standard deviations, while interpretive thematic analysis was used to analyze the qualitative data.

After all interviews were conducted, the audio recordings were transcribed. To establish meaningful patterns, the data were analyzed using a six-phase coding process as follows: familiarization with data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report (42). The researchers read and reread the transcriptions and noted initial ideas related to trauma experience and cosmetic surgery. Then, the transcripts were coded, and the data were categorized with regard to experiences of early childhood trauma, cosmetic surgery, and body image. The transcripts were read, reviewed, and checked by a rater with a background in academic writing; the rater evaluated the coding and classification scheme and checked the transcriptions for accuracy to avoid bias and misinterpretation (43).

In consideration of interrater reliability, the rater and the researchers first coded the transcripts independently and then discussed the coding to find commonalities and divergences in the themes, thereby uncovering the relationships. Such a triangulation process produces convergence and thus supports validity. The themes in the dataset were used to describe and categorize experiences of early childhood trauma, cosmetic surgery, and body image in preparation for analysis.

Ethical Considerations

This study was approved by the School of Social Sciences Research Ethics Committee (Psychology), Caritas Institute of Higher Education. The research mainly adopted the Ethical Principles of Psychologists and Code of Conduct of the American Psychological Association (44), especially considering principles such as "beneficence and nonmaleficence," "fidelity and responsibility," "integrity," "justice," and "respect for people's rights and dignity," as along with standards such as "resolving ethical issues," "competence," "maintaining confidentiality," "record keeping," "research and publication," "assessment," and "therapy."

To ensure privacy and confidentiality, the anonymity of each participant's identity was guaranteed. A consent statement and a declaration were provided, explaining that the interviewees participated voluntarily and had the right to withdraw at any time and did not have to provide a reason.

Background Information of Interviewees

Interviewee A, a 30-year-old woman, experienced verbal bullying by her male classmates during primary and secondary schools. She currently lives with her boyfriend and has a harmonious relationship with her family. Her family and boyfriend know that she has undergone cosmetic surgery. Beginning in 2010, she underwent a series of cosmetic surgeries, including double eyelid surgery, dark circles treatments, rhinoplasty (nose job), Botulinum toxin injection for face reshaping, plumping cheeks, and V lifting. She feels that she has improved her physical appearance and become a beautiful lady. Now, she visits beauty salons with her friends and reports feeling much better after each cosmetic procedure. Although she has some fear of cosmetic failure, she chooses to not give up the beauty treatments.

Interviewee B, a 28-year-old woman, said she was neglected by her parents during her childhood. She is the eldest sister of the family. Before the birth of her sisters, she felt that her parents loved her very much. However, her parents neglected her and seldom played with her after the birth of her sisters. She complained that she has been assumed to be taking care of her sisters, and sometimes, she feels it is very difficult to be a sister. Her reason for seeking cosmetic surgery is to make herself more

beautiful and to look "better." She has a stable relationship with her boyfriend. Her family and boyfriend are unaware that she has undergone cosmetic surgery. She has already undergone cosmetic surgery twice. The first surgery involved the excision of lesions in sweat glands in order to reduce body odor. The second time was a Botulinum toxin injection for nasal contouring. She worries about the complications and side effects of cosmetic surgery and, therefore, chooses to undergo microplastic surgery.

Interviewee C, a 25-year-old woman, underwent verbal bullying, such as name-calling, by her classmates during primary school. She wishes to please other people in order to gain their approval, for which she kept trying to lose weight and wore makeup daily until it led to a skin allergy. She has undergone cosmetic surgery twice, including medial canthoplasty and rhinoplasty. She has consumed diet pills, used makeup, and enrolled for a slimming treatment. She lives with her family since birth, and her parents and boyfriend are unaware that she has undergone cosmetic surgery. She tends to blame herself while believing that what she does is worthless and that she will always be unhappy, triggering flashbacks of her traumatic experiences. Her skin allergy magnifies her emotional distress.

Table 1 reports the interviewees' detailed demographic information, including age, gender, educational attainment, relationship status, and experiences with cosmetic surgery.

RESULTS

Two interviewees, A and C, reported that verbal bullying was the main factor that led them to undergo cosmetic surgery. Meanwhile, another interviewee, B, reported experiencing childhood neglect. **Table 2** summarizes the results of the MBSRQ-AS, FNAES, and ACSS.

Summarizing the results of MBSRQ-AS, it is seen that there were individual personal factors behind choosing to undergo cosmetic surgery. The findings indicated positive perceptions and feelings of individuals regarding their bodies.

While reviewing the results of the FNAES, we found that all three interviewees chose "Very much" in response to the statement, "It bothers me if I know someone is judging my physical shape." Furthermore, three respondents chose the answer "moderately" in response to the statements, "I worry that people will find fault with the way I look," and "I think that other people's opinions regarding my appearance are too important for me." The results indicated that all three interviewees were dissatisfied with their body image (physical appearance), and paid considerable attention to their physical appearances and others' opinions regarding it.

All interviewees' scores on the ACSS indicated a positive attitude toward the acceptance of cosmetic surgery. The interviewees chose the option "agree" in response to the statement, "Cosmetic surgery is a good thing because it can help people feel better about themselves," which demonstrates that the acceptance of cosmetic surgery is high. All three of them chose the response "unsure" for the following statement, "I would seriously consider undergoing cosmetic surgery if I thought it would make my partner find me more attractive." It showed that they took into consideration their partners' feelings, as their partners may not be able to accept them having undergone cosmetic surgery. Similarly, regarding considerations such as financial issues or side effects, all three respondents chose the answer "unsure" for the statement, "If I can undergo cosmetic surgery for free, I will consider it," which demonstrates that they may consider undergoing cosmetic surgery if they have enough financial support.

Childhood Psychological Trauma and Cosmetic Surgery

In the past, cosmetic surgery was performed with the purpose of restoring a disfigurement caused by an accident, illness, or

TABLE 1 | Detailed sample characteristics of interviewees.

Coding ID No.	Age	Gender	Educational attainment	Relationship status	Underwent cosmetic surgery
Interviewee A	30	F	Secondary school	In a relationship	Yes
Interviewee B	28	F	Bachelor's	In a relationship	Yes
Interviewee C	25	F	Bachelor's	Single	Yes

TABLE 2 | Summary of the scores, means, and standard deviations of the Multidimensional Body-Self Relations Questionnaire Appearance Scales (MBSRQ-AS), Acceptance of Cosmetic Surgery Scale (ACSS), and Fear of Negative Appearance Evaluation Scale (FNAES).

	Subscale	Interviewee A	Interviewee B	Interviewee C	M	SD
MBSRQ-AS	Appearance evaluation (AE)	14	16	14	14.67	1.15
	Appearance orientation (AO)	51	45	50	48.67	3.21
	Overweight preoccupation (OWP)	9	16	15	13.33	3.79
	Self-classified weight (SCW)	3	6	8	5.67	2.52
	Body areas satisfaction scale (BASS)	24	20	23	22.33	2.08
	Total	101	103	110	104.67	4.73
FNAES	Apprehension about appearance evaluation	18	19	21	19.33	1.53
ACSS	Self-oriented benefits	19	18	17	18	1
	Social motivations	17	17	17	17	0
	Consideration of having cosmetic surgery	17	16	18	17	1
	Total	53	51	52	52	1

birth defect, which has led to a serious wound, scar, or deformity. Today, the majority of cosmetic surgeries are performed for aesthetic purposes. Research has highlighted numerous factors that may affect the likelihood of undergoing cosmetic surgery, such as religiousness, low self-esteem (45), age, gender, and vicarious experience of cosmetic surgery through family or friends (46). As mentioned above, previous studies have shown that bullying (30) and child neglect (27) may increase the predisposition toward undergoing cosmetic surgery later in life. In this study, interviewees A and C reported their experiences of verbal bullying during primary and secondary school.

> The most common name-calling I often heard from classmates was "pork chop" (meaning fat girl). If a girl wore a dress that didn't fit properly, or even if a girl had a bad haircut, my classmates would discuss it and make fun of him or her for a long time. The difference between males and females is that girls are more concerned about their physical appearance than boys. (Interviewee A)

> I had been a fat girl since primary school. I was the only child in my family, so my parents spoiled me a lot. When I was in primary 3, my classmates began calling me "pork chop." They would always tease me and ask me "do you feel full?" I didn't really care about them. (Interviewee C)

"Name-calling" is very common in school settings. However, derogatory nicknames may imply a prejudiced view toward others. Interviewee A shared her feelings about her experience of being name-called:

> I felt very upset every time a classmate called me "pork chop." This was because when they called me by this nickname, I would perceive the meaning of "pork chop" to be fat and ugly because they never teased the girls that they liked or called them "pork chop." (Interviewee A)

A pejorative nickname can destroy self-image and lead to negative feelings. It is a kind of prejudice-based bullying. Bias bullying or prejudice-based bullying is a motivated bullying behavior involving prejudice toward a person's actual or perceived identity, such as his/her characteristics or circumstance (47). This unfavorable treatment may possibly be a factor leading to undergoing cosmetic surgery during early adulthood.

Interviewee B was affected by the experience of childhood neglect.

> I always believed that I had a good relationship with my parents before the births of my two little sisters. My parents began devoting all their attention to them. Sometimes, I feel that my parents are overprotective of my sisters. As the eldest sister, I was taught to assume responsibility for taking care of my sisters. (Interviewee B)

Interviewee B mentioned that she plays an important role in her family. She always reminds herself that she should never disappoint her parents.

> I can't remember how many times while facing difficulties, I haven't even wanted to share my concerns with my parents. Maybe I know that I am the eldest sister, and thus, I don't want to put any pressure on my parents. That's why I never share myself with my family.… They never ask how I feel either. (Interviewee B)

Interviewee B stated that although she has good relationships with both her parents, she does not feel loved by her family.

> I think my parents pay too much attention to my sisters. I remember when my two younger sisters would be in trouble, my parents would scold me most of the time. They consider it to be my responsibility to take care of them. I feel so helpless and frustrated because I need parental love and care as well. (Interviewee B)

Appropriate parental care and effective communication are the bridges that connect family members to each other. Interviewee B insisted, "Although I don't feel loved by them, I really do love them." Her feelings appear to be complicated and involve a sense of envy. According to Smith (48), envy involves a person who feels inferior noticing others' superiority or advantage, leading to some form of negative self-evaluation and self-appraisal.

An early adverse experience (e.g., lack of secure attachment, childhood abuse, emotional neglect) may consequently provoke negative emotions, leading to fear of loss, search for secure relationships, as well as emotional scars. Childhood psychological trauma can have a significant effect on children and young adults, with childhood bullying or neglect having the potential to negatively impact their wellbeing. Indeed, the interviewees' childhood experiences may have had a direct or indirect influence on their appearance enhancing behaviors.

Undergoing Cosmetic Surgery Enhances Self-Confidence and Body Image

One of the most obvious benefits of cosmetic surgery is perceived improvement in appearance. People with a pleasing appearance tend to have high self-confidence and a more positive body image. The interviewees in the present study shared their first experiences of cosmetic surgery, their internal struggles, and their reflections on the cosmetic procedures.

Interviewee A decided to undergo cosmetic surgery in order to achieve a physical transformation.

> I had the desire of undergoing cosmetic surgery since primary school. I couldn't tolerate the name "pork chop" any more, even though I didn't care how people saw me.… The first cosmetic surgery I underwent was around 7 or 8 years ago. I can't quite remember how many times I have undergone cosmetic surgery. Every time, I have expected and looked forward to my new look after cosmetic surgery.… I am not a perfect person, but if I can have the opportunity to become a pretty girl, why not try it. (Interviewee A)

Interviewee A believed that cosmetic surgery could give her a beautiful appearance.

> I remember the summer vacation between primary six and secondary one, which was a turning point in my life. I started taking slimming pills and underwent slimming treatment. I would make myself aim to become more perfect. (Interviewee C)

Interviewee C reported finding the experience of changing her physical appearance to be pleasurable. While some people may decide to undergo cosmetic surgery to fulfill their desires to look pretty, others may have different reasons.

> I think the main reason to undergo cosmetic procedures is to look more beautiful and have a better appearance. I believe this is a common answer for most girls. Of course, I have another reason—I would like to draw the attention of my family.… My parents probably think that I am mature and they don't have to worry about me. They never seem to care about my feelings, so I try my best to draw their attention. (Interviewee B)

Interviewee B insisted that family reputation was the core factor that motivated her to undergo cosmetic surgery.

The desire, positive feelings, and successful experiences gained from changing one's physical appearance can be an incentive for reinforcing their appearance enhancing behaviors.

> I think that my self-confidence did improve after undergoing cosmetic surgery because I really feel that I am prettier than before. I didn't feel confident in the past, but now I don't care how people view me or discuss me. I believe that I will continue to undergo cosmetic procedures in the future. (Interviewee A)

The interviewees believed that cosmetic surgery has a positive impact on enhancing their self-confidence. Same as interviewee A, interviewees B and C also had high self-confidence after undergoing cosmetic surgery. Such pleasurable and successful experiences of cosmetic surgery reduce body dissatisfaction and enhance self-esteem and body image.

Healing From the Aftereffects of Childhood Psychological Trauma

Cosmetic surgery and other ways changing one's appearance through the use of cosmetics can enhance self-confidence and body image and may result in healing from some of the aftereffects of trauma that occurred during childhood or young adulthood.

> I am not a "pork chop." No one calls me "pork chop" anymore. I know I look different, but other people don't know I underwent cosmetic surgery. They admire me and my physical appearance. I am happy to receive their praise. (Interviewee A)

> My parents pay more attention to me. They always take me out and introduce me to other relatives. I can see that they are proud of me. They admire how pretty I look. My parents and sisters never ask me about the change in my physical appearance. (Interviewee B)

Interviewees A and B experienced therapeutic effects from cosmetic surgery and improved some of the aftereffects of their childhood trauma. These include no more name-calling or teasing for interviewee A, who is admired by her lover, family, and friends. Likewise, interviewee B gained more attention from her parents. Both of them were able to solve inner conflicts caused by body dissatisfaction.

Interviewee C developed an intimate relationship with a boy from another class after taking diet pills and undergoing slimming treatment.

> I was happy to become friends with him and he was the only friend that I knew from secondary school.… Although we were not from the same class, and I knew that he was the only person that I knew from the whole school.… I started thinking about him every day, and I couldn't believe that I was falling in love with him as I met him again and again! … Unfortunately, he was already in a relationship with another girl. I couldn't control myself and felt that I was such a bad person. I felt so guilty and sorry for my hidden love! (Interviewee C)

However, when the other classmates started discussing their relationship at school,

> He left me alone. I understood that he didn't want to be involved in this complicated relationship. Although I feel upset, I never blame him. (Interviewee C)

Interviewee C cared about the boy's feelings to such an extent that she would undergo cosmetic surgery in order to heal the emotional scar and the regret.

> I understand that I had made a wrong decision at that moment, I really loved him so much and I really wanted to be with him.… During the graduation dinner, I had full makeup on and was dressed up in a fancy dress. I was looking so gorgeous. By that time, I had undergone cosmetic surgery at least three times.… Cosmetic surgery seems to give me power, a chance, and a new self, which is the most perfect thing in my life. (Interviewee C)

To a certain extent, physical appearance is an important underlying component of self-esteem (49). Cosmetic surgery improves the physical appearance of the body and promotes a positive body image.

Benefits and Risks of Cosmetic Surgery

People are motivated to undergo more cosmetic procedures because of their internal feelings and desires for beauty (39) and to benefit from secondary gains such as receiving more attention from loved ones or new romantic relationships (50). Although innovative technology can reduce its risks, cosmetic surgery may incur complications, failures, or dissatisfaction. In other words, not all people benefit from cosmetic surgical treatments.

Interviewee C reported more self-confidence after undergoing cosmetic procedures. She believed that she could draw the attention of others, especially her boyfriend. However, she also discovered the dark side of this romantic story.

> I remember that the boy asked me out to have sex with him after the graduation dinner, and I understood it was very common to have sex with your partner. However, while we were having sex, he only cared about himself and not my feelings. I realized that he never respected me. He treated me like just a sex partner or only a sex object. (Interviewee C)

People are unaware of how events will unfold until they actually happen. Although interviewee C was relieved of her feelings of regret, she soon came to realize that she had made a mistake. After having experienced the intimate relationship, interviewee C reported that she felt like she had suddenly woken up from a dream. Her love story lasted only a moment, but her sorrow may last a lifetime.

Interviewee C reviewed her decision after this traumatic incident as follows:

> In fact, I know it was the consequence and cost of cosmetic surgery. When I reflect back on the years I have spent—the truth, the primary reason for keeping myself fit, for makeup or cosmetic surgery, all these things pop up in my mind immediately. I try to make myself become a perfect girl, I finally realize that nobody seems to notice or appreciate my new body. I was sort of living in a dream until I was hurt by the boy; it was a nightmare and a painful loss. The only thing that came into my mind was.… I never feel happy as I am unlovable and worthless. (Interviewee C)

All interviewees agreed that it is difficult to tell people that they have undergone cosmetic surgery. Therefore, most people choose to not disclose their experiences of cosmetic surgery.

> I never tell my parents and my boyfriend that I have undergone cosmetic surgery. If I tell them, I can't imagine how they would view me … and I don't know how I would face them as well! (Interviewee B)

> I won't tell anyone that I have the experience of undergoing cosmetic surgery. I prefer to tell people that I am inspired by fashion magazines and makeup skills from Japan. (Interviewee A)

To summarize, childhood neglect and school bullying can harm children and lead to psychological trauma that extends into their future lives. Interviewees A and C stated that they will continue to undergo cosmetic surgery in the future. After undergoing such procedures, both interviewees gained the positive effect of enhanced self-esteem and were able to recover from their childhood psychological trauma.

However, interviewee B experienced complications after cosmetic procedures. She stated that failed cosmetic surgery created a secondary victimization:

> I won't undergo cosmetic surgery again, as it left me with a "shadow" and "scar." I can use concealer and cover the scar on my face using makeup products, but I will never recover from my psychological trauma. I will not try any other kind of cosmetic surgery again…. I will remember that cosmetic surgery gave me a noticeable scar that can never be repaired. (Interviewee B)

She further stated that she took this experience seriously and would not recommend other girls to undergo cosmetic surgery. Despite her painful experiences, interviewee B agreed that cosmetic surgery does have the positive effects of enhancing self-esteem and body image.

DISCUSSION

The current study produced three noteworthy findings: 1) undergoing cosmetic surgery had certain positive effects of enhancing self-confidence, reducing body dissatisfaction, resolving inner conflicts, and somewhat relieving psychological distress; 2) self-esteem and body image obtained from cosmetic surgery could help in healing some of the aftereffects of trauma occurring in childhood or young adulthood; and 3) the perceived sense of beauty contributed to improving self-confidence and promoted appearance enhancing behaviors, but increased the distress of others finding out about them having undergone cosmetic procedures.

Cosmetic surgery has been criticized since the end of the 19th century. The earliest cosmetic surgery was performed to reconstruct features of physical appearance, and more recently, it has emerged as a major grooming industry. Its significant role in this age has drawn much attention and concerns regarding the determining of the parameters of physical appearance, especially the appearance of women (51). This study is based on only three case studies, and as such, the limitation of information may be unable to reflect the entire picture.

"The body can and must be healed through the mind, and the mind can and must be healed through the body" (p. 306) (14). People may want to dismiss the significance of appearance dissatisfaction and its subsequent effects on the self, body, and body image. Therefore, this study's importance lies in making populations more aware of concerns regarding cosmetic surgery.

To conclude, cosmetic surgery has some remedying effects on childhood psychological trauma. Undergoing cosmetic procedures may help restore body image and even heal a broken heart. Although there are several possible psychiatric pitfalls that may arise, cosmetic surgery in some cases is effective in reducing psychological distress resulting from childhood psychological trauma, such as school bullying and childhood neglect. Body image, body satisfaction, and acceptance of cosmetic surgery can be considered potential factors for having a positive impact on people's minds. The pursuit of beauty is a common trend in society, and the concept of beauty revolves around physical appearance. Thus, cosmetic surgery is no longer considered to be an option only for young women but for men and women of all ages.

The interviewees gained some benefits from cosmetic surgery that promoted their appearance enhancing behaviors. This may pose a risk of cosmetic surgery addiction. In the past, people relied only on cosmetic products to make themselves appear better. However, with the innovation in and continuous development of cosmetic surgery in recent years, people may increasingly decide to seek cosmetic surgery treatments. Thus, people who intend

to undergo cosmetic surgery must evaluate their risks, possible aftermaths, and psychological concerns.

Today, cosmetic surgeries can be performed in hospitals, beauty salons, and private clinics. However, to perform such procedures, clinicians do not require a minimum surgical qualification or accreditation. Without regulation or control, not only doctors but also beauty consultants can perform surgery without the necessary knowledge, expertise, and experience. This primarily leaves patients with the responsibility of the quality and consequences of cosmetic surgery. Therefore, rules and regulations for performing cosmetic procedures must be considered.

To some extent, cosmetic surgery does indeed enhance body image and somewhat relieve psychological distress. The data collected here can potentially support further research related to other adverse childhood experiences, such as short stature, amputation, or enucleation. Few prior studies have investigated these topics (52). Future studies could more deeply investigate the influence of cosmetic surgery on adverse childhood experiences as well as its effects in adulthood in terms of body image and psychological adjustment.

AUTHOR'S NOTE

This study was accepted by the 5th International Academic Conference on Social Sciences (IACSS 2018) and the abstract was presented as a poster format.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of APA Ethical guidelines, Ethical committee of Psychology, Caritas Institute of Higher Education. The protocol was also approved by the committee.

AUTHOR CONTRIBUTIONS

KI and WH designed the study. KI conducted the interviews, transcribed and translated the data, and wrote the original manuscript. WH contributed to manuscript revision. All authors read, revised, and approved the submitted version.

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BRIEF RESEARCH REPORT
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Similar but Different: Psychological and Psychopathological Features of Primary and Secondary Hikikomori

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Recently, there has been an increase in reports of hikikomori around the globe, and Ukraine is not an exception. The development of hikikomori is often spurred by a history of aversive or traumatic childhood experience, for example, dysfunctions between parents or between a parent and a child (ambivalent attachment) and difficulties at school (peer rejection). Previously described models of hikikomori development mostly were based on research of mixed cohorts of patients (with and without psychiatric comorbidity). To test whether there was a difference in psychological and psychopathological features between primary hikikomori (HG1, n = 13) and secondary hikikomori (HG2, n = 22) cases comorbid with neurotic, somatoform, and stress-related disorders (F40–48, ICD-10), they were compared with each other and with a healthy control group (CG, n = 28). Sociodemographic data, alexithymia [Toronto Alexithymia Scale (TAS-26)], traumatic life events [life experience questionnaire (LEQ)], hostility [Buss–Durkee Hostility Inventory (BDHI)], quality of life [Chaban Quality of Life Scale (CQLS)], and personality traits (Leonhard–Schmieschek Questionnaire) were evaluated. No relevant or statistically significant differences have been found between primary and secondary hikikomori cases, except for greater hostility in the latter. When compared with the healthy control group, the primary hikikomori cases were found to have higher frequency of alexithymia, life span traumatic events (7 ± 3.6), as well as higher levels of resentment and verbal hostility, and a bigger aggression index. In secondary hikikomori cases, higher irritability and resentment have been observed, with more dysthymia, excitability, and anxiety; and although the frequency of psychological traumas was lower (5.5 ± 4), it was still significant. Primary and secondary hikikomori had largely similar characteristics in the Ukrainian sample studied, but more studies with larger samples are needed to validate generalizability of the findings.

Keywords: prolonged social withdrawal, hikikomori, primary hikikomori, secondary hikikomori, psychopathology

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INTRODUCTION

Nowadays, people are increasingly connected digitally, but the prevalence of loneliness (perceived social isolation) also appears to be rising (1). One of the antecedents of social isolation is negative (traumatic) life experience, which may increase feeling of emotional loneliness, leading to loss of bonds in relationships with the close ones and self-destructive behavior (2). Recently, there have been increasingly more reports of particular form of severe and prolonged social withdrawal

(i.e., hikikomori) around the globe, including Ukraine (3, 4). Since the first reference of this phenomenon in the scientific literature, there were numerous attempts to accurately translate and define the meaning of that Japanese word; therefore, various terms describe the same behavior (acute, severe, prolonged, or youth social isolation or withdrawal). Typically, hikikomori is defined as a state of social withdrawal combined with avoidance of major social interactions or responsibilities (e.g., education, employment, and friendships) lasting at least 6 months (5). Individuals with hikikomori commonly have a history of psychiatric comorbidity, but idiopathic (primary) hikikomori also exists (6).

Previous studies mostly examined the psychiatric background of individuals with hikikomori, and comorbidity with psychiatric diagnosis varies depending on study methodology and sampling. The most commonly comorbid diagnoses include schizophrenia and other psychotic disorders, as well as neurotic, mood, and anxiety disorders, such as major depression and social phobia, obsessive-compulsive disorder, eating disorders, and pervasive developmental disorders. Some researchers have mentioned autism spectrum disorder, personality disorders (such as schizoid or avoidant disorders), cannabis abuse with amotivational syndrome, or even Internet addiction (7–9). Recent international survey has shown that the most common comorbidity of hikikomori is avoidant personality disorder. Thus, it was later postulated that avoidant personality is the personality underpinning hikikomori (6, 10).

The existence of a link between hikikomori and psychiatric disorders is still under debate (11). The results of a recent 12-month study of the hikikomori (with only one case from 190 cases having no associated pathology) support the hypothesis that the phenomenon of prolonged social isolation is a severe syndrome common to different mental disorders (secondary hikikomori) and not a new diagnostic category (12).

On the other hand, a large epidemiological study aimed to clarify the correlations between hikikomori lifetime prevalence and demographics and its psychiatric background (mood, anxiety, impulse control, and substance use disorder comorbidity) has shown that of 1,660 aged from 20 to 49 years, 19 people (1.2%) had experienced hikikomori (13). With respect to diagnosis, Koyama stated that 45.5% of hikikomori cases had no lifetime experience of a psychiatric disorder, which is known as primary hikikomori.

Primary hikikomori cases often become treatment resistant: pharmacological treatment has no or partial effect on social withdrawal (14). Although a consensus diagnostic and treatment approach has not been established yet, in order to develop an optimal strategy of prolonged social withdrawal management, more research in psychopathology of primary hikikomori is needed. In contrast, previously described models of prolonged social withdrawal development were based predominantly on research of mixed cohorts of patients (15, 16). Psychological and psychopathological features of hikikomori described based on mixed cohorts are shyness; ambivalent attachment styles and life experiences including rejection by peers and parents; high loneliness and impaired social networks (deficient in social support); apparent inability to maintain meaningful social ties; social withdrawal and avoidance of real-world human interactions; and tendency toward indirect interpersonal exchanges *via* the Internet (15, 17).

Clinical characteristics of secondary hikikomori derived from a comparison of social anxiety disorder (SAD) patients with or without hikikomori were as follows: i) SAD onset preceded or coincided with hikikomori, ii) hikikomori SAD patients subset appeared to have a more severe form of SAD, and iii) hikikomori SAD patients had significantly earlier onset and had worse symptoms based on Liebowitz Social Anxiety Scale (18).

The concept of primary hikikomori is important, as one cannot understand the basis of this pathology by considering hikikomori only in relation to other disorders. Previously, the following five pathological features of primary hikikomori cases based on a comparison with patients with apathy syndrome, "taijin kyofu sho," and personality disorders, were identified: a) episodes of defeat without a struggle, b) an ideal self-image originating in the desires of others rather than in one's own desire, c) preserving the ideal image of the "expected" self, d) parents' investment in the ideal self of the child, and e) avoidant behavior to maintain the positive opinion of others. Researchers highlighted the importance of family relationship problems in the onset of primary social withdrawal (9).

Overall, the development of hikikomori is often spurred by a history of aversive or traumatic childhood experience, for example, dysfunctions between parents or between a parent and a child and difficulties at school. Maladaptive attempts to deal with previous trauma might lead to neurotic, stress-related, and somatoform disorders, which are a large overall group of conditions in ICD-10 that manifest with a range of psychological and somatic symptoms (19).

If a traumatic event is a risk factor for secondary hikikomori comorbid with neurotic, stress-related, and somatoform disorders, as well as for primary hikikomori, the objective is to test whether there are any differences in psychological and psychopathological features characteristic for them.

MATERIALS AND METHODS

Participants

The target population was inpatients or outpatients who had a history of current prolonged social withdrawal (more than 6 months). Participants (aged between 18 and 40) were recruited in 2014–2017 at the psychosomatic medicine and psychotherapy department of the Kyiv Railway Clinical Hospital No. 1 Branch of "Health Center" of JSC "Ukrainian Railway," where patients from all other railway hospitals of Ukraine (eight branches) are referred to on a regular basis. Furthermore, to increase the range of participants, an online advertisement about checking the symptoms of hikikomori was placed in social media. The age- and sex-matched control group participants were recruited among healthy volunteers (28 persons).

Abbreviations: TAS-26, Toronto Alexithymia Scale; LEQ, Life experience questionnaire; BDHI, Buss–Durkee Hostility Inventory; CQLS, Chaban Quality of Life Scale; HG1, primary hikikomori group; HG2, secondary hikikomori group; CG, control group.

Procedure

A total of 56 patients met all the research criteria for hikikomori (17). Twenty-one patients did not complete psychological assessment or did not give consent to take part in further research, which demanded additional visit to the research center. Based on inpatient medical history and outpatient medical charts (clinical diagnosis and ICD-10 code data), the hikikomori group was divided into two subgroups: primary hikikomori, without comorbidity (HG1, n = 13), and secondary (HG2, n = 22) hikikomori, exclusively comorbid with neurotic, somatoform, and stress-related disorders (F40–F48). Primary clinical psychiatric assessment and diagnosis of mental disorders were determined in accordance with the *ICD-10 Classification of Mental and Behavioural Disorders: Clinical Descriptions and Diagnostic Guidelines* (20).

Measures

A semi-structured interview was administered by a researcher to assess the presence of suspected hikikomori according to research hikikomori criteria (17). The sociodemographic data obtained included gender, age, education level, family status, employment (**Table 1**). Self-report questionnaires evaluated alexithymia [Toronto Alexithymia Scale (TAS-26)] (21), hostility and self-destructive behavior [Buss–Durkee Hostility Inventory (BDHI)] (22), and quality of life [Chaban Quality of Life Scale (CQLS)] (23). Other questionnaires used included Leonhard–Schmieschek Questionnaire (24), which aimed to identify accentuated personality traits, and traumatic life experience questionnaire (LEQ) (25). The latter is divided into a series of questions that relate to criminal or civil violence (robbery and torture), traffic accidents, occupational trauma, natural disasters (e.g., technical catastrophes), sexual assault or physical violence (both victim or witness), serious injury, major medical illness or threat of death (own experience or learning that trauma occurred to a close person), or adverse childhood events [separation or loss, time spent in foster care, parental divorce, significant poverty, severe mental illness, or drug addiction of a parent(s)]. LEQ is a favorable instrument as it assesses multiple types of trauma and includes a large number of potential trauma areas (38 situations in total). The parameters used to quantify the traumas include the type of trauma, the age of trauma onset, the frequency of traumatic events (the total number), the effect that the trauma had on the victim's life during the previous year (with a range of scores from 1 to 5: no impact, mild, moderate, severe, and extreme impact) and trauma index—a sum total of the impact scores divided by the number of traumatic events.

Analytic Strategy

To determine the specificity of the research subgroups, they were compared with each other and with the control group. Data analysis was performed using the Mann–Whitney test, which gives the most accurate estimates of the significance for small sample sizes and when the data do not approximate a normal distribution. Three levels of statistical significance (p-value) were used ($p \leq 0.001$, $p \leq 0.01$, and $p \leq 0.05$). The statistical analysis was also performed to identify differences in psychological or psychopathological features of hikikomori depending on sociodemographic data. To test whether there were gender differences, the Mann–Whitney test was used. To analyze

TABLE 1 | Sociodemographic characteristics of research contingent.

	CG (n = 28)		HG1 (n = 13)		HG2 (n = 22)	
	N	**(%)**	***N***	**(%)**	***N***	**(%)**
Gender						
Female	**16**	(57.2)	**7**	(53.8)	**14**	(63.6)
Age						
Under 21 years	**10**	(35.8)	**5**	(38.5)	**6**	(27.2)
21–26 years	**6**	(21.4)	**2**	(15.4)	**8**	(36.4)
Over 26 years	**12**	(42.8)	**6**	(46.1)	**8**	(36.4)
Education						
Secondary drop out	**0**	(0)	**0**	(0)	**1**	(4.5)
Secondary completed	**12**	(42.8)	**2**	(15.5)	**3**	(13.6)
Vocational training	**4**	(14.3)	**1**	(7.7)	**1**	(4.5)
University drop out	**3**	(10.7)	**5**	(38.4)	**9**	(41)
University completed	**9**	(32.2)	**5**	(38.4)	**8**	(36.4)
Family status						
Single	**11**	(39.3)	**11**	(84.6)	**13**	(59.2)
In relationship	**11**	(39.3)	**1**	(7.7)	**6**	(27.2)
Married	**5**	(17.7)	**1**	(7.7)	**3**	(13.6)
Divorced	**1**	(3.7)	**0**	(0)	**0**	(0)
Employment						
Unemployed	**10**	(35.8)	**7**	(53.8)	**11**	(50)
Part-time	**8**	(28.4)	**4**	(30.8)	**4**	(18.2)
Full-time	**10**	(35.8)	**0**	(0)	**4**	(18.2)
Freelance	**0**	(0)	**2**	(15.4)	**3**	(13.6)

differences in age groups, age groups of social withdrawal onset, and among occupational statuses, the Kruskal–Wallis test was used, which is a preferable alternative to one-way ANOVA when the sample size is small, the variable is not normally distributed, or a standard deviation differs.

RESULTS

As seen in **Table 1**, 21 hikikomori cases were female, with a difference in distribution among primary and secondary subgroups. Among the participants, whose mean age was 25.6 ± 6 years, hikikomori manifested before 18 years old in 38.4% of primary and 41% of secondary hikikomori cases, and in 42.4% of all cases between 18 and 26 years old. Prolonged social withdrawal obstructed from completing academic studies (40% had not finished university); the loneliness rate (absence of relationships) constituted 80.1%; half of the hikikomori cases were unemployed; and some (14.4%) chose to work as freelancers. There were statistically significant differences depending on sociodemographic data. The level of suspicion [$\chi^2(2) = 5.98$, $p = 0.05$] and dysthymia [$\chi^2(2) = 5.9$, $p = 0.05$] was significantly higher in those hikikomori cases who were younger than 26 years old. The level of anxiety was significantly lower in those who worked freelance [$\chi^2(2) = 9.93$, $p = 0.02$]. Depending on the age of hikikomori onset, the earlier social withdrawal occurred the higher the level of trauma impact was [$\chi^2(2) = 5.4$, $p = 0.06$]. Women had higher levels of emotional lability ($p \leq 0.01$), anxiety and experienced a larger impact of the life span traumatic events ($p \leq 0.05$).

The secondary hikikomori subgroup (HG2) had the following comorbid psychiatric disorders: adjustment disorder (22.7%), generalized anxiety disorder (18.2%), post-traumatic stress disorder (13.7%), social phobia (13.7%), obsessive-compulsive disorder (13.7%), panic disorder (9%), somatoform disorder (9%), and dissociative identity disorder (4.5%).

When comparing HG1 with HG2, only one statistically significant difference was found in physical hostility (BDHI) 5.9 ± 2 vs 4.3 ± 2.3, but the comparison of HG1 and HG2 with CG showed different statistically significant findings (**Table 2**). Compared with CG, HG1 had higher levels of alexithymia (61.5% vs 42.9% HG2, 17.2% CG), and according to LEQ, they reported higher numbers of life span traumatic events and their greater impact.

The trauma indices in both research groups, as well as the distribution of post-traumatic stress (61.2% vs 61.9%), were almost equal. The most prevalent resembling traumatic situations for hikikomori included emotional insults or neglect (54.3%), learning about a serious life-threatening injury or an unexpected death of a close person (45.7%), emotional disturbances of significant others (42.9%), or parental divorce (34.3%). HG1 faced psychological traumas 25% and 60% more frequently than do HG2 and CG, respectively; in contrast, secondary hikikomori cases witnessed serious injury or death 4.5 times more frequently (**Figure 1**).

The majority of primary (70%) and nearly half of secondary hikikomori cases had higher than normal index of hostility (M = 12.08 ± 6.6 vs M = 10.27 ± 3.1), and the comparison of HG1 and CG has shown that primary hikikomori cases had higher levels of resentment and verbal hostility, and a bigger aggression index. At the same time, secondary hikikomori cases had higher irritability and resentment than had healthy controls. There was no statistically significant difference between HG1 and CG in accentuated personality traits, but HG2 had significantly higher levels of dysthymia, excitability, and anxiety. According to CQLS, nearly half of HG1 (48.6%) and HG2 (46.2%) evaluated their quality of life as low.

DISCUSSION

To our knowledge, this study is the first to analyze a sample of hikikomori cases in Eastern Europe, thereby providing the justification for the hypothesis that this condition arises from specific socioeconomic and cultural changes in the modern society, not just a Japanese culture-bound social withdrawal

TABLE 2 | Statistically significant differences between HG1, HG2, and CG (Mann–Whitney *U* test).

Scale	Characteristics	HG1	HG2	CG	CG–HG1		CG–HG2		HG1–HG2	
		M ± *SD*	*M* ± *SD*	*M* ± *SD*	*U*	*p**-value	*U*	*p**-value	*U*	*p**-value
TAS-26	Alexithymia	73.4 ± 9	70.8 ± 11	61.2 ± 13	78.5	0.002	194.5	0.02	112	0.2
BDHI	Irritability	6.9 ± 2.5	7.1 ± 2.1	6 ± 1.8	133.5	0.1	188	0.01	137	0.8
	Resentment	5.5 ± 1.5	5.1 ± 1.8	3.8 ± 2	98.5	0.01	206	0.04	127.5	0.6
	Verbal hostility	7.8 ± 2.9	6.6 ± 2.7	5.8 ± 2.7	107.5	0.03	242.5	0.1	109.5	0.2
	Physical hostility	5.9 ± 2	4.3 ± 2.3	4.8 ± 2.6	137	0.2	296	0.4	82	0.03
Leonhard–Schmieschek Questionnaire	Negativism	2.9 ± 1.2	2.1 ± 1.5	3.1 ± 2.5	178	0.9	224.5	0.09	98	0.1
	Excitability	14.2 ± 5.4	15.4 ± 5.7	12.1 ± 4.6	146	0.3	182	0.02	112.5	0.3
	Dysthymia	12.7 ± 5.3	14.8 ± 3.9	9.6 ± 4.6	130	0.1	135	0.001	109	0.2
	Anxiety	14.3 ± 5	14.7 ± 6.3	10.6 ± 5.9	116	0.06	192	0.02	130.5	0.6
LEQ	Number of traumatic events	7 ± 3.6	5.48 ± 4	4.4 ± 3.5	87.5	0.006	227	0.1	103	0.1
	Impact of traumatic events	22 ± 14	16 ± 13.6	11 ± 10.6	84	0.005	198	0.03	104.5	0.1
	Trauma index	2.98 ± 0.8	2.97 ± 1	2.23 ± 1	96	0.01	174	0.009	139	0.8
CQLS	Quality of life	13.7 ± 3.3	11.7 ± 2.7	19.3 ± 3.5	45.5	0.001	22.5	0.001	114	0.3

**Exact Sig. [2 * (1-tailed Sig).]—the exact significance level p-value but not corrected for ties.*

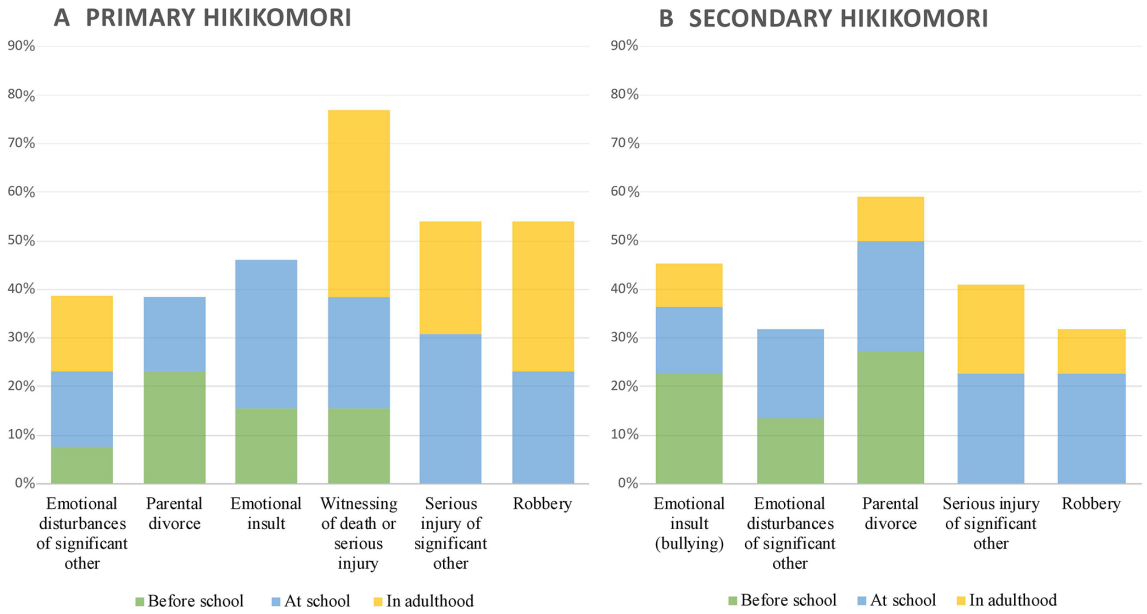

FIGURE 1 | Prevalence (%) and impact of traumatic and life adverse events in primary and secondary hikikomori. Most influential past experiences are illustrated on **A** and **B** and are arranged so as to reflect their actual impact, with the most influential experiences on the left.

syndrome (26). Irrespective of the etiology of withdrawal, whether it stems from other primary mental health problems or is an idiopathic case, modern Internet-connected world allows patients to commit "social suicide," as the Internet can satisfy all the needs of those who want to remain alone in their rooms isolated in their "virtual tombs." Research has shown that the level of anxiety might depend on occupational status, and it was lowest in those who work as freelancers, which seems to be a specific coping strategy for people trying to avoid social interactions and responsibilities.

Although a consensus diagnostic approach has not been agreed upon yet, some diagnostic criteria for hikikomori have already been revised. The age specifier (individuals aged less than 18 years) was eliminated, as research has shown that the onset of social withdrawal can occur at any age (27, 28). In the analyzed sample, in 37% of participants, the onset of social isolation occurred during adolescence, and in 40% of cases, it started between 18 and 26 years old.

Another important finding was that the levels of suspicion and dysthymia were higher in those hikikomori cases who were younger than 26 years. This period in life is characterized by movement, changes, and transitions from one state into another in several domains at the same time. Young people have to make decisions about important concrete directions in life, for example, school, living situation, and peer group. They must also address new challenges with regard to building their own identity, developing self-esteem, acquiring increasing independence and responsibility, and building new intimate relationships. Besides, that they are often confronted with high expectations from significant relatives and peers. Such situations inevitably provoke a certain degree of helplessness, insecurity, stress, and a sense of losing control (29). To address these challenges and successfully cope with these emotions, young people must have access to significant supporting resources such as a stable living situation, intimate friendships, and sufficient economic resources (30).

In reality, however, in both primary and secondary hikikomori cases, there was a high frequency of past traumatic and life adverse events, which prevented them from overcoming the challenges described above. The majority had symptoms of post-traumatic stress (i.e., vulnerable to stress), with their experience of traumatic events being very intense and having a strong impact on their current life. However, the most prevalent situations in terms of frequency were not the most influential. As shown in **Figure 1**, experiences that affected both primary and secondary hikikomori cases the most were as follows: emotional disturbances that occurred to significant others (e.g., severe depression and chronic alcohol or drugs addiction), parental divorce, and emotional insult or neglect (humiliation, embarrassing experiences, or feeling worthless). These traumas occurred predominantly in early childhood or at school. Typically, because of a shift from perceived safety to a new environment (from school to university, moving from one city or country to another), the youth were becoming "a stranger," "a black sheep," or "a scapegoat" in a peer group and were experiencing bullying. These findings correspond with the psychosocial developmental theory of hikikomori (15, 31). In a situation of loss of their secure environment combined with a history of early-life adverse events (loss or separation), an individual's social interactions are blocked due to the reactivation of the insecure attachment system and its emotional and behavioral patterns and coping strategies.

Both primary and secondary hikikomori cases might be characterized as having insufficient ability to identify and verbalize their emotions and a tendency to self-aggressive behavior especially due to high levels of resentment, inner

tension, high anxiety, self-doubt, and a low quality of life. Primary hikikomori cases also resort to direct (verbal and physical) hostility, most probably as a protective behavioral reaction to their immediate environment previously described as "defeat without a struggle" (9). Hostility toward parents is commonly mentioned in literature (32); one study reported 43% of the subjects wanting to kill their parents, with 23% having physically attacked them while attempting to initiate a conversation (33).

When focusing on the differences between primary and secondary hikikomori cases, it was found that in the latter, aggression manifests itself as a personality trait (excitability and impulsivity) rather than behavior. Because of dysthymia and high anxiety, secondary hikikomori cases have a pessimistic self-perception, often become victims of bullying, prefer staying at home, assume a dependent passive position, and have fear of social communication.

It is worth mentioning that in this study the number of female subjects with secondary hikikomori was higher than the numbers found in previous reports, which suggested that social isolation was more frequent in men (13, 28, 31), whereas comorbid psychopathology in the study were neurotic, somatoform, and stress-related disorders, such as panic disorder, specific phobia, social anxiety disorder, generalized anxiety disorder, and post-traumatic stress disorder, which are known to be more prevalent among women than men (34, 35).

Limitations

The present study has several limitations. First, the sample size was relatively small, and cases are not statistically representative of the broader Ukrainian hikikomori population. However, despite the small sample size, statistical methods were chosen accordingly. Second, in this study, secondary hikikomori group included only neurotic, somatoform, and stress-related disorders as comorbidity. Future research should try to explore differences of primary cases with another psychopathology.

CONCLUSION

The findings of this research seem to validate the hypothesis that primary and secondary hikikomori had largely similar characteristics in the Ukrainian hospital sample studied. Future studies encompassing larger samples are needed to validate the generalizability of the findings.

ETHICS STATEMENT

All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the Ethics Committee of "Health Center" Branch of JSC "Ukrainian Railway" Kyiv Railway Clinical Hospital No. 1, and this study was carried out in accordance with its recommendations. The study procedures were carried out in accordance with the ethical standards. No bio-markers or tissue were collected. Participation was entirely voluntary, confidential, and anonymous. Participants were informed that they were free to withdraw from the study at any time.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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Family Behavioral Repertoires and Family Interaction Influence the Adaptive Behaviors of Individuals With *Hikikomori*

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Background: Family support is key in the initial stages of psychological support for individuals with *hikikomori*. However, it remains necessary to confirm the relationship between families' cognitive behavioral factors and the severity of hikikomori to understand ways of improving hikikomori. We examined the influences of family behavioral repertoires for coping with hikikomori and family interaction on the adaptive behaviors of individuals with hikikomori. We employed a control group to examine whether the influence of these adaptive behaviors was unique to families of individuals with hikikomori.

Methods: We asked 185 parents of individuals with hikikomori (hikikomori group) and 460 parents of individuals with no experience of hikikomori (control group) to complete the Family Behavioral Repertoire Scale for coping with hikikomori (FBS-H), the Family Interaction Scale for Hikikomori (FIS-H), and the Adaptive Behaviors Scale for Hikikomori (ABS-H). Using the subscales of the ABS-H as the dependent variables, we conducted hierarchical multiple regression analyses wherein family behavioral repertoire was added in Step 1, experience frequency and cognition of contingency were added in Step 2 as control values, family interaction was added in Step 3, and the interaction terms were added in Step 4.

Results: The ABS-H total and subscale scores were significantly lower in the hikikomori group than in the control group. The social participation subscale showed the largest difference, while the family subscale showed the smallest. In the hikikomori group, we observed a significant adjusted R^2 for the family and value subscales (Step 1). The ΔR^2 in Step 3 was significant for the interaction and family subscales of the ABS-H. In the control group, significant adjusted R^2 values were found for all ABS-H subscales in Step 1, but the ΔR^2 in Step 3 was not significant for any subscales.

Conclusion: Family-related cognitive behavioral factors, such as family behavioral repertoire and family interaction, appear to relate to improvement in hikikomori. Of course, these findings warrant further investigation because we did not examine the longitudinal, causal relations between these variables. In the future, we might also test the

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effect of family support interventions that target families' behavioral repertoire and family interaction.

Keywords: adaptive behaviors, behavioral repertoires, Hikikomori, family, family interaction, parents, social withdrawal

INTRODUCTION

Hikikomori (prolonged social withdrawal) was defined by the Ministry of Health, Labour and Welfare's research group as a phenomenon with the characteristic features of avoidance of social interactions—such as avoidance of school attendance, working, and socializing outside one's home, and staying at home almost every day (save for solitary outings)—for more than half a year (1). A study on the epidemiology of hikikomori in a community-based population aged 20–49 years (n = 1,660) in Japan revealed that 1.2% had experienced the phenomenon in their lifetime (2). Although hikikomori was initially regarded as a distinctively Japanese phenomenon, several studies have reported on the prevalence of individuals with hikikomori in other countries, such as Australia, France, India, Korea, and the USA [e.g., (3–6)].

Many individuals with hikikomori have genuine physical and psychosocial difficulties (2, 6–12). Kondo et al. (7) reported that 80.3% of individuals with hikikomori who utilized the services of mental health welfare centers had a diagnosed psychiatric disorder, such as a mood, anxiety, personality, or developmental disorder. Additionally, Nonaka and Sakai (8) indicated that individuals with hikikomori have significantly lower quality of life than do those who have never experienced hikikomori. Nakagaito et al. (9) reported that many long-term individuals with hikikomori (i.e., those who have had hikikomori for more than 15 years) displayed not only psychological problems but also severe physical problems, such as nutritional disorders and voice disturbances. Accordingly, we believe that hikikomori, in many cases, is not merely laziness, and we speculate that the number of people who show this phenomenon globally will increase in the future (13, 14).

Due to the characteristics of this condition, the best avenue for assessing and supporting individuals with hikikomori is indirectly *via* the family, particularly in the initial stage. Family members themselves also often face considerable difficulty in caring for these individuals (15) and tend to be the people who first begin seeking help for the condition; in only 7% of cases are the initial help seekers individuals with hikikomori themselves (16). Therefore, the most important characteristic of psychosocial support for hikikomori is that therapists cannot access people with hikikomori directly (1).

There are various family support approaches for hikikomori cases, such as family therapy, psychoanalysis, self-help groups, and cognitive behavior therapy (CBT) (1, 17, 18). Some studies have reported the effects of CBT (17, 19); however, there are very few researches on the family support of hikikomori cases. The improvement process has not always been clarified, and studies on CBT have been limited to examining the overall effect of CBT on family; there has been surprisingly little research on the extent to which the specific cognitive behavioral factors of the family targeted by CBT can influence hikikomori. Clarifying this influence will be useful for improving the effect of family support. Family behavioral repertoire (13) and family interaction (14) are the family's cognitive behavioral factors that influence the improvement of hikikomori. In theory, when the family acquires a behavioral repertoire, it is possible to have a basis for using the behavioral repertoire according to the situation of communicating with individuals with hikikomori. As a result, it is speculated that the family interaction will function more positively.

Two particularly important cognitive behavioral factors related to family support are the family behavioral repertoire for coping with hikikomori (20) and family interaction (21). Several studies note that family relationships and parenting styles do not necessarily affect the "expression" of hikikomori. For example, when comparing individuals with hikikomori and those without experience of hikikomori, we found that the influence of the family behavioral repertoire and family interaction are not strongly related to the expression of hikikomori (20, 21). Additionally, Umeda et al. (22), who examined the influence of childhood family environments on the hikikomori experience, reported that childrearing styles do not significantly differ between hikikomori and non-hikikomori groups. Taken together, these findings suggest that the influence of the family might play little role in the "expression" of hikikomori.

However, it would be important to clarify the influence of family-related cognitive behavioral factors on the "improvement" process of hikikomori, given the importance of family support in the initial stage of the condition. So far, no studies have examined this influence. Hikikomori means a decrease in social interaction behavior, which is considered an adaptive behavior (23, 24); accordingly, the less adaptive behavior is performed, the more severe the hikikomori is expected to be. Therefore, the primary purpose of this study was to determine the influence of the "family behavioral repertoire" for coping with hikikomori and "family interaction" on the adaptive behaviors of individuals with hikikomori, according to a hypothesis model. To this end, we used hierarchical regression models to explore the associations of these two family-related cognitive behavioral factors with adaptive behaviors. We assumed a hypothesis model that family interaction is unlikely to be functional unless the family has acquired a sufficient behavioral repertoire. Thus, we could make a hypothesis that the family's behavioral repertoire influences adaptive behaviors of hikikomori, and family interaction strengthens the influence. Therefore, in step 1, we

added the family's behavioral repertoire. Also, as factors influencing family interaction, there are the "frequency of experience of family interaction scenes (the frequency of experiencing specific parent–child interaction scenes in daily life)" and cognition of contingency [which refers to the ability of the family to recognize the results of their own communication (21)]. Therefore, in step 2, scene experience frequency and cognition of contingency were added as the control variables, and family interaction was added in step 3. Furthermore, family cognitive behavioral factors such as behavioral repertoire, frequency of experience of family interaction scenes, cognition of contingency, and family interaction might interactively influence the adaptive behaviors of individuals with hikikomori. For example, it is expected that the behavioral repertoire would have a stronger influence on adaptive behaviors when the cognition of contingency is high. Therefore, the interaction terms of these cognitive behavioral factors were also examined in hierarchical multiple regression analysis.

Additionally, in a secondary purpose of this study, we assumed that individuals with hikikomori are less influenced by environments outside the family than non-hikikomori cases. Therefore, people with hikikomori would be more influenced by their families than people without hikikomori, even when both groups have similar influences from outside the family. Thus, we predicted that the family interaction would have a relatively stronger influence on the adaptive behaviors of individuals with hikikomori than on the adaptive behaviors of people with no experience of hikikomori. Although we could not compare this prediction directly, to investigate it indirectly, we recruited a control group of people without hikikomori.

METHODS

Data Collection

There is plenty of research on Japanese hikikomori cases [e.g., (25)], which largely shows that the Japanese cultural background influences the expression and maintenance of hikikomori (26). Thus, we collected all data from Japanese families in this study. We recruited two samples for this study: family associations of individuals with hikikomori and a web-based normative sample. The family members of individuals with hikikomori all belonged to family associations and support centers in Japan, and were recruited through these associations/centers. The family associations and support centers were initially asked to participate in the investigation, after which we sent questionnaires by mail. Staff at these institutions subsequently asked family members to complete the questionnaires anonymously and return them by mail or in person. The web-based sample consisted of parents of individuals aged 16–49 years from a large-scale web-based research panel in Japan. All these individuals voluntarily agreed to participate. Individuals were free to withdraw from participation at any time. During the analysis, the groups were matched in terms of relationship with the child (father or mother) and the child's gender and age, to facilitate descriptive comparison and clarify whether the influence of family cognitive behavioral factors on children's adaptive behavior was peculiar to hikikomori cases or not. Between the two samples, we matched the proportion of participants according to relationship with the child, and child's gender and age group (by 5 years). We classified participants into two groups: parents of individuals with no experience of hikikomori (control group) and parents of individuals who have experienced hikikomori (hikikomori group). To be eligible to participate in this study, participants had to respond to all items regarding their own age and gender as well as the age, gender, and duration of hikikomori of the individuals with hikikomori.

Measures

Demographics

Participants reported their age and relationship with the child (father or mother), the child's general characteristics (gender, age), and the child's experience of hikikomori (1), both currently and in the past.

Adaptive Behaviors Scale for Hikikomori (ABS-H)

Because hikikomori shows a state in which social interaction behavior is restricted, the adaptive behavior of the individuals with hikikomori is social interaction behavior in many cases. The social interaction behavior of the individuals with hikikomori includes communicating with family or non-family members, social behavior toward their goals, and working or attending school (23). The ABS-H is a parent-rated measure of the social interaction behaviors of individuals with hikikomori. It consists of four subscales: interaction, family, value (behaviors that match the values of individuals with hikikomori), and social participation inside and outside the home (23). The ABS-H comprises 26 items in total, which require participants to assess the frequency of children's adaptive behaviors on a 4-point scale ranging from 0 (almost never) to 3 (almost always). Higher scores on the ABS-H indicate more adaptive behaviors. The ABS-H has adequate reliability, criterion-related validity, discriminant validity, and construct validity (23). Cronbach's alpha showed similar values to a previous study (23), with the hikikomori group $\alpha = 0.94$, control group $\alpha = 0.95$.

Family Behavioral Repertoire Scale for Coping With Hikikomori (FBS-H)

This scale comprises 25 items assessing the behavioral repertoire of the family members of individuals with hikikomori. It comprises four subscales: cooperative (i.e., "Talk to the child with a kind expression"), assertive (i.e., "Try inviting the child gently if there is anything that the child is interested in"), self-control [i.e., "Unaware of what kind of emotion I am feeling when I contact a child" (Reversed items)], and cheerful (i.e., "Talk with a bright expression matching the mood when talking about fun"). Participants rated the items on a 4-point scale ranging from 1 (not applicable) to 4 (applicable). Higher scores indicate a greater family behavioral repertoire for coping with hikikomori. The FBS-H has satisfactory reliability,

convergent validity, and discriminant validity (20). The greater the family behavior repertoire, the more the parents have acquired different ways of coping with hikikomori (e.g., sometimes cooperative, assertive, or cheerful). Cronbach's alpha showed similar values to a previous study (20), with the hikikomori group $\alpha = 0.89$, control group $\alpha = 0.90$.

Family Interaction Scale for Hikikomori (FIS-H)

The FIS-H measures the experience frequency (i.e., "Are told 'Good morning' by your son/daughter"), cognition of contingency (i.e., the ability of families to recognize the results of their own communication), and degree of family interaction in 12 family interaction scenes (**Appendix**). The items describe behaviors of parents in these situations and require parents to indicate whether an increase or decrease occurred in the responses of individuals with hikikomori after parents' behavior. For example, to measure family interaction, we asked "In association with your son/daughter, how likely is this behavior to change?" (after presenting each family interaction scene). More specifically, based on operant conditioning theory, the FIS-H measures whether certain parental approaches to individuals with hikikomori are functional or nonfunctional in specific scenes (21). According to operant conditioning theory, if one's own reaction reinforces the other's behavior, the behavior increases and, if the reaction punishes the other's behavior, the behavior decreases. The "cognition of contingency" indicates the ability to adequately recognize the relationship between another's behavior and one's own reaction. Thus, a high cognition of contingency indicates that it is easy for parents to predict the results of their communication. Participants rate the frequency of their child's behaviors on a 5-point scale ranging from 1 (decreased) to 5 (increased). Higher scores indicate more functional family interaction. The FIS-H has sufficient reliability, convergent validity, and discriminant validity (21). Cronbach's alpha showed similar values to previous study (21) with the hikikomori group $\alpha = 0.83$, control group $\alpha = 0.86$ in cognition of contingency, and the hikikomori group $\alpha = 0.80$, control group $\alpha = 0.87$ in family interaction.

Data Analysis

All data were analyzed using R version 3.4.1 (27) with the "psych" (28) and "mice" (29) packages. Recently, researchers have recommended multiple imputation or maximum likelihood estimation as the best methods of handling missing values (30). We used multiple imputation to handle missing data at the item level of each scale. The results across 50 imputed data sets were combined. We used hierarchical multiple regression analysis to examine the influence of the family's cognitive behavioral factors on the adaptive behaviors of individuals with hikikomori. Specifically, with the subscales of ABS-H as the dependent variables, we conducted separate regression analyses wherein the FBS-H was added in Step 1, the experience frequency and cognition of contingency subscales of the FIS-H were added in Step 2 as control values, the family interaction subscale was added in Step 3, and the interaction terms between FBS-H and FIS-H were added in Step 4. We centered the variables in the interaction terms to minimize the impact of multicollinearity.

Ethical Consideration

The study was approved by the local research ethics committee of the institute to which the author(s) belong. We obtained informed consent before conducting the study. In consideration of individuals' privacy, the study was carried out anonymously.

RESULTS

Missing Data

The item-level missing data rates for the main variables were all less than 4% (0.00–3.41%). Overall, 851 records (1.40%) were missing out of a total of 60,630 records.

Participants

We obtained 148 individuals from the family associations of individuals with hikikomori and 500 from the web-based panel (**Figure 1**). Participants who were not the parents of the child in question were excluded (**Table 1**).

Descriptive Statistics of Main Variables

Table 2 shows the means and standard deviations, as well as group comparisons (including effect sizes), of the total and subscale scores of the ABS-H, FBS-H, and FIS-H. The ABS-H total and subscale scores were all significantly lower in the hikikomori group than in the control group. The social participation subscale showed the greatest difference and the family factor showed the smallest. There was no significant difference between the groups for the FBS-H total score. For the experience frequency subscale of the FIS-H, the control group had higher scores than the hikikomori group. However, the cognition of contingency and family interaction scores were higher in the hikikomori group than in the control group.

Influence of Family's Behavioral Repertoires and Family Interaction on Hikikomori

We calculated variance inflation factor (VIF) to check for multicollinearity problems. Both the hikikomori (VIFs < 2.95) and control groups did not show large values (VIFs < 3.00),

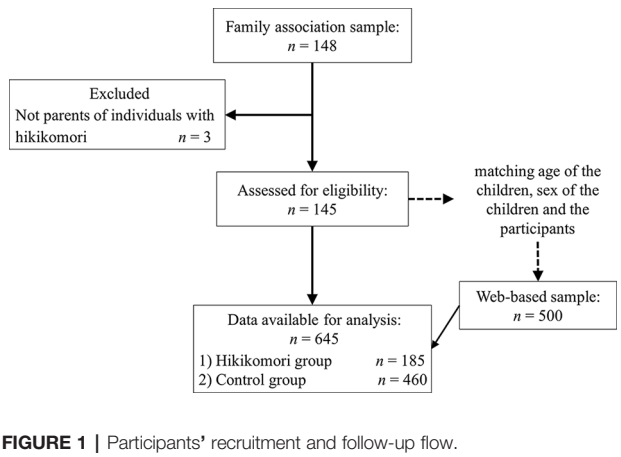

FIGURE 1 | Participants' recruitment and follow-up flow.

TABLE 1 | Demographic characteristics of participants.

	Hikikomori group		Control group	
Participants				
Father, n [%])	46	[24.87]	125	[27.13]
Age, M [*SD*]	63.10	[7.82]	60.49	[8.22]
Living with the child, *n* [%]	157	[84.87]	212	[46.09]
Children				
Male, *n* [%]	116	[84.06]	383	[83.26]
Age, *M* [*SD*]	32.55	[8.36]	32.13	[8.37]
Duration of hikikomori (month), *M* [*SD*]	109.79	[89.46]	-	
n	185		460	

Hikikomori group, parents of individuals with hikikomori; Control group, parents of individuals with no experience of hikikomori.

indicating no problem of multicollinearity. The results of the hierarchical multiple regression analyses in the hikikomori group (**Table 3**) revealed significant adjusted coefficients of determination for the family and value subscales in Step 1 (family: R^2 adj = 0.18, $\beta = 0.42$, $p < 0.001$; value: R^2 adj = 0.03, $\beta = 0.18$, $p < 0.05$). Furthermore, the ΔR^2 in Step 3 was significant for the interaction ($\Delta R^2 = 0.04$, $\beta = 0.21$, $p < 0.05$) and family subscales ($\Delta R^2 = 0.05$, $\beta = 0.17$, $p < 0.05$) of the ABS-H. However, the ΔR^2 in Step 4 was not significant for any of the ABS-H subscales.

The results of the hierarchical multiple regression analyses of the control group (**Table 4**) showed significant adjusted coefficients of determination for all ABS-H subscales in Step 1 (interaction: R^2 adj = 0.24, $\beta = 0.50$, $p < 0.001$; family: R^2 adj = 0.30, $\beta = 0.55$, $p < 0.001$; value: R^2 adj = 0.19, $\beta = 0.44$, $p < 0.001$; social participation: R^2 adj = 0.16, $\beta = 0.40$, $p < 0.001$). Although the ΔR^2 in Step 3 was not significant for any of the ABS-H subscales, in Step 4, it was significant for all subscales (interaction: $\Delta R^2 = 0.03$, $p = 0.001$; family: $\Delta R^2 = 0.02$, $p = 0.03$; value: $\Delta R^2 = 0.02$, $p = 0.04$; social participation: $\Delta R^2 = 0.02$, $p = 0.04$). We also observed significant interaction effects between family behavioral repertoire and cognition of contingency (**Figure 2**), and between experience frequency and cognition of contingency (**Figure 3**), on the interaction subscale of the ABS-H. Furthermore, there was a significant interaction effect of family behavioral repertoire and cognition of contingency on the family subscale (**Figure 4**). Simple slope analysis showed that the influence of family behavioral repertoire was greater when cognition of contingency was lower for the interaction subscale (high: $\beta = 0.30$, $p < 0.001$; low: $\beta = 0.55$, $p < 0.001$) and family subscale of the ABS-H (high: $\beta = 0.18$, $p = 0.009$; low: $\beta = 0.36$, $p < 0.001$). In addition, for the interaction subscale of the ABS-H, the influence of experience frequency was greater when the cognition of contingency was lower than when it was higher (high: $\beta = 0.39$, $p = 0.009$; low: $\beta = 0.62$, $p < 0.001$).

TABLE 2 | Means, standard deviations, and effect sizes in each group.

	Hikikomori group		Control group		*ES*	*ES* 95% CI		*n*
	M	*SD*	*M*	*SD*		lower	upper	
ABS-H								
Interaction	14.11	(9.19)	30.23	(7.96)	1.94	1.73	2.14	633
Family	6.35	(3.46)	8.95	(2.50)	0.93	0.75	1.11	637
Value	4.95	(3.15)	8.64	(2.75)	1.29	1.10	1.48	635
Social	2.95	(3.57)	10.09	(2.01)	2.82	2.58	3.05	634
Total	28.18	(16.32)	57.91	(13.26)	2.11	1.89	2.32	622
FBS-H	76.94	(9.86)	75.94	(9.95)	0.10	–0.08	0.28	622
FIS-H								
Scene experience frequency	10.31	(5.67)	13.50	(4.25)	0.68	0.50	0.86	627
Cognition of contingency	45.34	(6.33)	43.27	(6.24)	0.33	0.15	0.51	618
Family interaction	42.90	(5.92)	41.76	(6.25)	0.18	0.00	0.37	615

Hikikomori group: parents of individuals with hikikomori; control group: parents of individuals with no experience of hikikomori; ABS-H, Adaptive Behaviors Scale for Hikikomori; FBS-H, Family Behavioral Repertoire Scale for Hikikomori; FIS-H, Family Interaction Scale for Hikikomori; ES, effect size (Hedge's g).

TABLE 3 | Results of hierarchical multiple regression analysis of hikikomori group.

	Interaction β		Family β		Value β		Social participation β	
Step 1								
FBS-H	0.14	†	0.42	***	0.18	*	0.02	
R^2 adj	0.02	†	0.18	***	0.03	*	0.00	
Step 2								
FBS-H	0.07		0.29	***	0.10		0.01	
FIS-H/S	0.32	***	0.48	***	0.31	***	0.16	†
FIS-H/C	–0.05		–0.01		–0.03		–0.12	
R^2 adj	0.12	***	0.43	***	0.13	***	0.03	*
ΔR^2	0.11	***	0.25	***	0.11	***	0.04	*
Step 3								
FBS-H	0.05		0.24	***	0.09		0.01	
FIS-H/S	0.36	***	0.56	***	0.38	***	0.18	*
FIS-H/C	–0.19	†	–0.11		–0.12		–0.21	†
FIS-H/I	0.21	*	0.17	*	0.11		0.04	
R^2 adj	0.14	***	0.48	***	0.16	***	0.03	
ΔR^2	0.04	*	0.05	*	0.04		0.01	
Step 4								
FBS-H	0.03		0.24	***	0.10		0.00	
FIS-H/S	0.39	***	0.55	***	0.39	***	0.14	
FIS-H/C	–0.20	†	–0.12		–0.12		–0.18	
FIS-H/I	0.20	†	0.19	*	0.11		0.04	
FBS-H×FIS-H/S	–0.05		–0.02		0.05		–0.01	
FBS-H×FIS-H/C	–0.02		–0.04		0.04		–0.10	
FBS-H×FIS-H/I	0.00		–0.03		–0.06		0.11	
FIS-H/S×FIS-H/C	–0.09		–0.01		0.00		0.08	
FIS-H/S×FIS-H/I	0.09		0.05		–0.01		0.04	
FIS-H/C×FIS-H/I	0.05		0.00		–0.01		0.03	
R^2 adj	0.12	**	0.47	***	0.13	***	0.02	
ΔR^2	0.01		0.01		0.01		0.03	

*FBS-H, Family Behavioral Repertoire Scale for Coping with Hikikomori; FIS-H, Family Interaction Scale for Hikikomori; FIS-H/S, scene experience frequency; FIS-H/C, cognition of contingency; FIS-H/I, family interaction, †p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001.*

DISCUSSION

The hikikomori group had lower scores for adaptive behaviors than the control group. Interestingly, the social participation subscale showed the largest difference, while the family subscale showed the smallest difference. These results support the findings of previous studies (23). Furthermore, family behavioral repertoire did not significantly differ between the groups. This result supports the findings of previous research (20). Although

TABLE 4 | The results of the hierarchical multiple regression analysis in the control group.

	Interaction		Family		Value		Social participation	
	β		β		β		β	
Step 1								
FBS-H	0.50	***	0.55	***	0.44	***	0.40	***
R^2 adj	0.24	***	0.30	***	0.19	***	0.16	***
Step 2								
FBS-H	0.39	***	0.47	***	0.35	***	0.31	***
FIS-H/S	0.22	***	0.25	***	0.19	***	–0.03	
FIS-H/C	0.14	**	0.08	†	0.12	**	0.21	***
R^2 adj	0.30	***	0.36	***	0.23	***	0.19	***
ΔR^2	0.06	***	0.06	***	0.04	***	0.04	***
Step 3								
FBS-H	0.39	***	0.46	***	0.34	***	0.30	***
FIS-H/S	0.22	***	0.25	***	0.19	***	–0.03	
FIS-H/C	0.11	*	0.03		0.08		0.16	**
FIS-H/I	0.05		0.07		0.08		0.08	
R^2 adj	0.30	***	0.36	***	0.23	***	0.20	***
ΔR^2	0.00		0.00		0.00		0.00	
Step 4								
FBS-H	0.37	***	0.43	***	0.31	***	0.29	***
FIS-H/S	0.21	***	0.26	***	0.20	***	0.02	
FIS-H/C	0.19	**	0.09		0.13	†	0.20	**
FIS-H/I	–0.02		0.06		0.07		0.08	
FBS-H×FIS-H/S	–0.01		–0.04		–0.07	†	0.07	†
FBS-H×FIS-H/C	–0.13	**	–0.11	*	–0.09	†	–0.10	†
FBS-H×FIS-H/I	–0.02		–0.02		0.00		–0.01	
FIS-H/S×FIS-H/C	–0.16	*	0.03		–0.01		–0.01	
FIS-H/S×FIS-H/I	0.12	†	0.03		0.10		0.07	
FIS-H/C×FIS-H/I	0.04		0.00		–0.02		–0.02	
R^2 adj	0.32	***	0.37	***	0.25	***	0.21	***
ΔR^2	0.03	**	0.02	*	0.02	*	0.02	*

*FBS, Family Behavioral Repertoire Scale about coping with Hikikomori, FIS, Family Interaction Scale for Hikikomori; FIS/S Scenes experience frequency, FIS/C, Cognition of contingency, FIS/I, Family interaction, †p < 0.10, *p < 0.05, **p < 0.01, ***p < 0.001.*

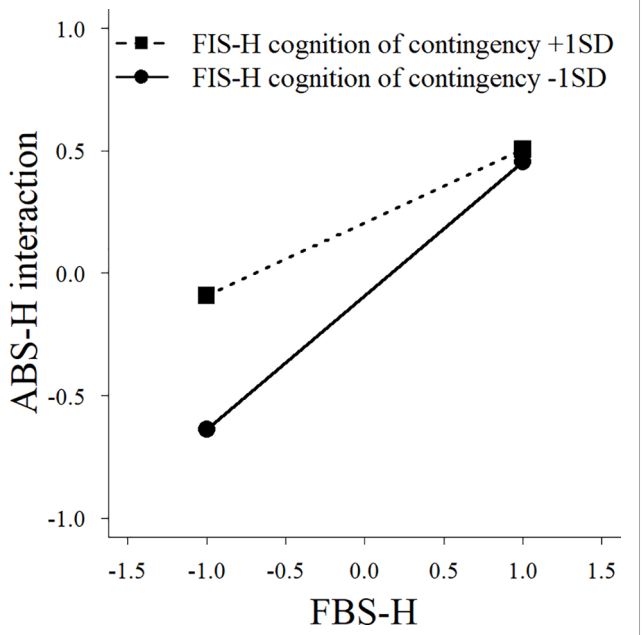

FIGURE 2 | A simple slope analysis between family behavioral repertoire and cognition of contingency for the interaction factor of the Adaptive Behaviors Scale for Hikikomori among parents of individuals with no experience of hikikomori. FBS-H, Family Behavioral Repertoire Scale for Coping with Hikikomori; ABS-H, Adaptive Behaviors Scale for Hikikomori.

the experience frequency score of the family interaction scenes was higher in the control group than in the hikikomori group, the cognition of contingency and family interaction scores were higher in the hikikomori group. These findings also support previous studies (21).

The findings indicated that family behavioral repertoire is significantly associated with the adaptive behaviors of individuals with hikikomori, and that family interaction enhances this association. A similar tendency was observed for the interaction subscale of the ABS-H. We also found that family behavioral repertoire was associated with the value subscale in the hikikomori group. Taken together, the results indicate that family behavioral repertoire and family interactions, despite having no effect on social participation such as school attendance or work, may help promote the adaptive behaviors relating to social interaction with family or others, and the value of individuals with hikikomori. The fact that there was no association with social participation suggests that individual differences in social participation were large, and therefore inconsistent among people with hikikomori. Therefore, it may be necessary to account for such individual differences by providing not only indirect support such as family support (31–33) but also direct support.

In the control group, family behavioral repertoire was found to influence various adaptive behaviors in children, whereas family interaction did not appear to be associated with adaptive behaviors. This latter finding is potentially because those without experience of hikikomori have greater social interaction outside the family, and social interaction outside the family has a relatively strong effect on individuals. By contrast, the living environment of individuals with hikikomori is restricted to the home, meaning that individuals with hikikomori are likely to be more influenced by family interaction patterns. Accordingly, although this study did not compare the hikikomori and control groups directly, it seems necessary not only to extend the family behavioral repertoire of individuals with hikikomori, but to also help improve the functionality of their family interactions to increase the adaptive behaviors of individuals with hikikomori.

The interaction effects found in the control group indicate that family behavioral repertoire has a stronger association with the children's adaptive behaviors (particularly social interaction with family or others) when cognition of contingency is low than when it is high. Even though the lower cognition of contingency suggests that it is more difficult for families to show adaptive responses, having a sufficiently great family behavioral repertoire seems to ensure that children with no experience of hikikomori will exhibit adaptive behaviors. In other words, even if the cognitive of contingency or experience frequency is generally low, the family's functional coping is likely to cause an improvement for individuals with hikikomori if the family acquires a sufficient behavioral repertoire. This result was not found for parents of

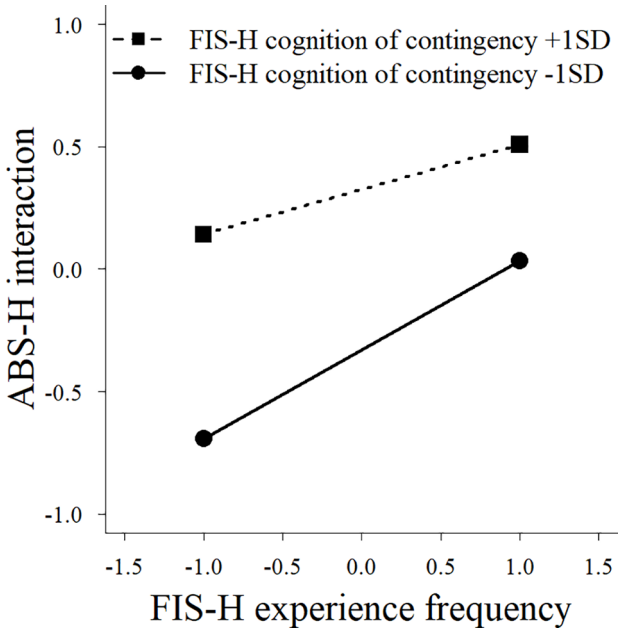

FIGURE 3 | A simple slope analysis between family experience frequency and cognition of contingency for the interaction factor of the Adaptive Behaviors Scale for Hikikomori among parents of individuals with no experience of hikikomori. FIS-H, Family Interaction Scale for Hikikomori; ABS-H, Adaptive Behaviors Scale for Hikikomori.

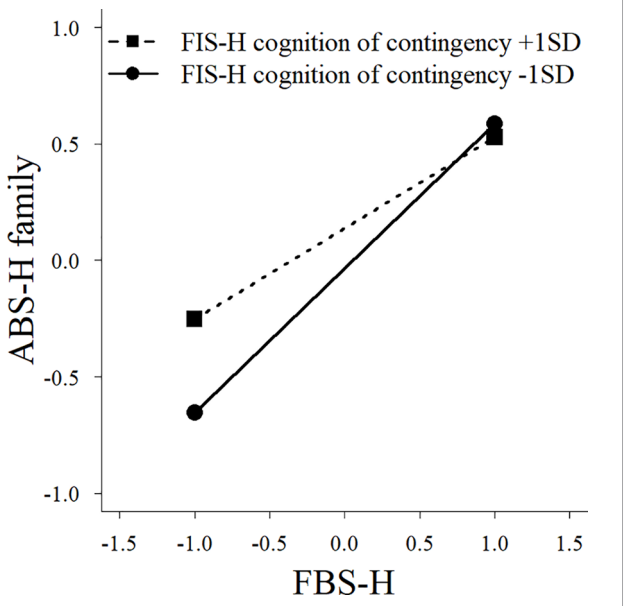

FIGURE 4 | A simple slope analysis between family behavioral repertoire and cognition of contingency for the family factor of Adaptive Behaviors Scale for Hikikomori among parents of individuals with no experience of hikikomori. FBS-H, Family Behavioral Repertoire Scale for Coping with Hikikomori; ABS-H, Adaptive Behaviors Scale for Hikikomori.

individuals with hikikomori. This indicates that the family of individuals with hikikomori might not be able to supplement the insufficient cognition of contingency through their behavioral repertoire, even if they have a generally great behavioral repertoire. Therefore, to improve an individual's hikikomori *via* family support, the family will not only need to acquire a sufficient family behavioral repertoire, but also adequate cognition of contingency and functional family interaction.

Overall, the findings indicate that, although family behavioral repertoire and family interaction are not strongly associated with the expression process of hikikomori (20, 21), they do appear to have strong associations with the improvement process.

LIMITATIONS AND FUTURE DIRECTIONS

There are at least six key limitations of this study. First, we did not consider factors other than family behavioral repertoire and family interaction in relation to the adaptive behaviors of individuals with hikikomori. Family support efforts often target psychological stress and negative evaluations of family members, both of which may strengthen or weaken the influence of family cognitive behavioral factors on the adaptive behaviors of individuals with hikikomori. This point should be examined in future studies. It will be necessary to clarify the best interpretability model by examining a different model from that assumed in this research. Furthermore, although scene experience frequency and cognition of contingency were used as the factors controlling the influence of family interaction, it will be necessary to clarify the factors that moderate the influence of behavioral repertoire and family interaction on adaptive behaviors.

Second, in this study, because we targeted the families of individuals with hikikomori, we cannot deny the possibility of family reporting bias. Specifically, there may be the biases that are caused by recognizing hikikomori positively or negatively (34), and by the influence of the parent's own psychiatric disorders (22). Therefore, in addition to the factors examined in this study, the evaluation of parents' own hikikomori and psychiatric disorders should be comprehensively considered in the future. Furthermore, it is possible that families and individuals with hikikomori themselves would focus on different aspects of assessing the associations of family factors with adaptive behaviors. In the future, it will be necessary to confirm whether research on individuals with hikikomori themselves supports the findings of this study. Nevertheless, this study was the first to clarify the family's cognitive behavioral factors that influence the improvement of individuals with hikikomori, and showed important findings, because the inability to access individuals with hikikomori is the most significant characteristic of the hikikomori case.

Third, we employed a questionnaire study to examine the associations described above. In the future, it will be necessary to examine whether family support targeting family behavioral repertoire and family interaction can actually improve adaptive behaviors.

Fourth, because many in the control group lived separately from their children, these differences between the two groups may have influenced the results. We did not control the difference

between living together and separately, because we were examining the influence of parent factors in the hikikomori and control groups. Further studies are needed to examine the influence of demographic variables, including the duration of hikikomori and age, as well as the difference in living arrangements.

Fifth, many of the hikikomori group participants participated in family associations or support centers, suggesting that, to some extent, the family behavioral repertoire and family interactions of the hikikomori group had improved. Therefore, in the future, we should clarify the relationships between thes variables in this study and the severity of an individual's hikikomori.

Finally, as a secondary purpose to this study, we analyzed both the control and hikikomori groups, and compared both groups preliminarily, but did not compare them directly. It will therefore be necessary to compare both groups directly.

ETHICS STATEMENT

The study was approved by the Waseda University Academic Research Ethical Review Committee (2016–275). We obtained informed consent before conducting the study. In consideration of individuals' privacy, the study was carried out anonymously.

AUTHOR CONTRIBUTIONS

SN and HS designed the study. SN undertook the statistical analysis and wrote the first draft of the manuscript. All the authors have commented on the manuscript. All the authors contributed to and have approved the final manuscript.

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Role of School Bullying Involvement in Depression, Anxiety, Suicidality, and Low Self-Esteem Among Adolescents With High-Functioning Autism Spectrum Disorder

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This study aimed to compare the severities of psychopathologies and the level of self-esteem among 219 adolescents with high-functioning autism spectrum disorder (ASD) who were classified into pure perpetrators, pure victims, perpetrator-victims, and neutrals in Taiwan. The experiences of school bullying involvement in the previous 1 year were measured using the Chinese version of the School Bullying Experience Questionnaire. The severities of depression, anxiety, and suicidality were measured using the Center for Epidemiological Studies Depression Scale, the Multidimensional Anxiety Scale for Children, and the 5-item questionnaire from the epidemiological version of the Kiddie Schedule for Affective Disorders and Schizophrenia, respectively. The level of self-esteem was measured using the Rosenberg Self-Esteem Scale. The results indicated that compared with the self-reported neutrals, the self-reported perpetrator-victims and pure victims had more severe depression and anxiety. No difference in depression, suicidality, anxiety, and self-esteem was found among the four groups of various parent-reported bullying involvement experiences. Mental health problems in adolescents with ASD who experienced bullying victimization should be routinely surveyed.

Keywords: autism spectrum disorder, school bullying, depression, anxiety, suicidality, self-esteem

INTRODUCTION

The true extent of school bullying in adolescents with autism spectrum disorder (ASD) remains an underresearched area (1). This research gap is a concern because adolescents with ASD may be vulnerable to bullying given their difficulties in social relationships that are hallmarks of their characteristics (1, 2). A meta-analysis found that the estimated prevalence for school bullying

perpetration, victimization, and both school bullying perpetration and victimization among youth with ASD was 10%, 44%, and 16%, respectively (3). Moreover, school-aged youth with ASD are at a greater risk of school victimization than their typically developing peers (3). Studies have proposed several possible etiologies to account for the high risk of bullying victimization in adolescents with ASD, including communication problems (4), fewer friendships (5), stereotyped behavior and interests (6), and aggressive behaviors (7). A recent study based on the perspectives of adolescents and their parents found that involvement in bullying is one of major daily living stressors experienced by the adolescents with ASD, as well as that the experience of bullying involvement was resulted from the core symptoms and characteristic behaviors of ASD (8). Studies examining the experiences of adolescents with ASD could help develop individualized behavioral interventions to reduce the bullying-related stress for adolescents with ASD.

Studies on children and adolescents from the general population have found that compared with neutrals, bullying victims have significant risks of depression (9), anxiety (10), and suicidal ideation and suicide attempts (11). In recent years, an increasing number of studies have assessed the association of bullying involvement with mental health problems in children and adolescents with ASD (12. A longitudinal study found that social communication impairments at the age of 10 years were associated with depression at the age of 18 years, and bullying victimization explained a substantial proportion of this risk (13). Parent-reported bullying victimization was significantly associated with anxiety symptoms in youth with ASD (14, 15). Children and adolescents with ASD who were victims of school bullying had a higher risk of suicidality than did those with ASD who were not the victims of school bullying (16). These results of previous studies indicate that school bullying prevention programs are warranted, and that intervention programs should be implemented for children and adolescents with ASD who have experienced bullying victimization to prevent the consequences of mental health problems (14).

Several important concerns regarding bullying involvement and mental health in adolescents with ASD warrant further study. First, most of attention was drawn to the mental health problems of bullying victims; however, research has found that bullying perpetration was associated with depression (9) and suicidal ideation and suicide attempts in the general adolescent population (11). Whether the risk of mental health problems increases in adolescents with ASD who perpetrated bullying on peers is not known.

Second, the individuals can be categorized into four groups based on their roles in bullying. Those who bullied others but were not bullied by others are pure perpetrators. Those who were bullied by others but did not bully others are pure victims. Those who were bullied by others and also bullied others are perpetrator-victims. Those who neither bullied others nor were bullied by others are the neutrals. Perpetrator-victims have been found to be the most troubled among these four groups (17). Research on the adolescent population has found that perpetrator-victims have the higher risks of depression and suicidality than did pure perpetrators and pure victims (18). Research has found that perpetrator-victims have a unique formation process and role transition (19); they also have the stress coping strategies different with pure victims and pure perpetrators (20, 21). Further study is needed to examine whether the differences in the risk of comorbid mental health problems also exist among adolescents with ASD who are perpetrator-victims, pure victims, and pure perpetrators. The results of the studies can provide knowledge to develop prevention and intervention programs for mental health problems in bullying perpetrator-victims with ASD.

Third, because of different awareness, definitions, and attributions, self-reported bullying involvement by adolescents with ASD may be different from that reported by their parents (3). Given that the sources of information may influence what the clinicians know about ASD adolescents' bullying involvement, additional studies are required to examine whether the association between bullying involvement and mental health problems varies according to the various sources of information on bullying involvement.

The present study examined the differences in the levels of depression, anxiety, suicidality, and self-esteem among adolescents with high-functioning ASD categorized according to various experiences of school bullying involvement: those without any involvement in bullying (neutrals), pure victims, pure perpetrators, and perpetrator-victims. We have three hypotheses. First, based on the results of previous studies on ASD youth with bullying victimization (14–16) and general adolescent population with bullying perpetration (9, 11), we hypothesized that in adolescents with ASD, pure victims, pure perpetrators, and perpetrator-victims have more severe depression, anxiety, and suicidality and lower self-esteem than do neutrals. Second, based on the results of previous studies on general adolescent population (17, 18), we hypothesized that in adolescents with ASD, perpetrator-victims have more severe depression, anxiety, and suicidality and lower self-esteem than do pure victims and pure perpetrators. Third, given that adolescents with ASD may have different awareness, definitions and attributions of the experiences of bullying involvement compared with their parents (3), we hypothesized that the association of adolescent-reported bullying involvement with mental health problems is different from that of parent-reported bullying involvement with mental health problems.

MATERIALS AND METHODS

Participants

The study participants were enrolled from five child psychiatry outpatient clinics in Taiwan; three clinics were at university-affiliated teaching hospitals, one was at a regional teaching hospital, and one was an outpatient clinic specific for child psychiatry. Patients enrolled in the Taiwan National Health Insurance program are allowed to visit the outpatient clinics of teaching hospitals without referrals from general practitioners.

Therefore, the adolescents enrolled from these five child psychiatry outpatient clinics in the present study are representative of similar-age populations in Taiwan. We recruited adolescents who were at the age of 11–18 years and had high-functioning ASD consecutively to this study between August 2013 and July 2016. The diagnosis of ASD was determined according to the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* [DSM-5; (22)]. The criteria of "high-functioning" were that the adolescents had verbal communication ability with a full-scale intelligence quotient (FSIQ) of >80 as determined using the Wechsler Intelligence Scale for Children, Fourth Edition (23). Parents who had schizophrenia, bipolar disorder, intellectual disability, or any cognitive deficit that resulted in significant communication difficulties were excluded. A total of 228 adolescents with high-functioning ASD who complied with the criteria above were approached. Child psychiatrists explained the purpose and procedure of this study to adolescents and their parents and invited them into this study. Of them, 219 (96.1%) adolescents and their parents agreed to participate in this study and were interviewed by research assistants using the research questionnaire.

Measures

Chinese version of the School Bullying Experience Questionnaire (C-SBEQ)

The self-reported C-SBEQ contains 16 items evaluated on a 4-point Likert scale from 0 (never) to 3 (all the time) (24). This scale is composed of two 8-item subscales that evaluate whether an adolescent is a bullying victim (items 1–8, including social exclusion, being called a mean nickname, being spoken ill of, being beaten up; being forced to do work; and having money, school supplies, and snacks taken away) and a bullying perpetrator (items 9–16) in the previous 1 year. The participants who scored 2 or 3 on any item among items 1–8 and 9–16 by themselves and their parents were identified as self-reported and parent-reported bullying victims and perpetrators, respectively. The participants were further categorized into pure perpetrators, pure victims, perpetrator-victims, and neutrals. The results of factor analysis in a previous study on Taiwanese adolescents found that the values of indices met goodness-of-fit standards and support the factor structure of the C-SBEQ. The Cronbach α of the subscales for bullying victimization and perpetration on the C-SBEQ was 0.727 and 0.753, respectively, indicating acceptable internal-consistency reliability. The average intraclass correlation coefficients (ICC) for the subscales on the C-SBEQ was from 0.788 to 0.813, which indicated moderate to high levels of 1-month test–retest reliability. The consistency between the self-reported and nominated victims or perpetrators of bullying was examined using generalized kappa coefficients (κ). The κ coefficients for being victims and perpetrators of bullying were 0.547 and 0.478, respectively, which indicated moderate agreement between self-reported and nominated victims or perpetrators of bullying and supported the validity of the cutoff (≧2) to discriminating victims and perpetrators from nonvictims and nonperpetrators, respectively.

Taiwanese version of the Center for Epidemiological Studies Depression Scale (T-CES-D)

The self-reported T-CES-D comprises 20 items evaluated on a 4-point Likert scale from 1 (rarely or none of the time) to 4 (most or all of the time) that assess the frequency of depressive symptoms in the recent 1 month (25, 26). A higher total score on the T-CES-D indicates more severe depression. A previous study on Taiwanese adolescents supported the discriminatory validities of the T-CES-D by discriminating those with and without major depressive disorder and dysthymic disorder (27). Previous studies on Taiwanese adolescents have confirmed the congruent validity of the T-CES-D by establishing its significant correlations with suicide tendency (28), insomnia (29), and poor peer relationships (30). In the present study, Cronbach's α of the T-CES-D was 0.88.

Taiwanese version of the Multidimensional Anxiety Scale for Children (MASC-T)

The self-reported MASC-T comprises 39 items evaluated on a 4-point Likert scale that assess the level of anxiety symptoms in the recent 1 month (31, 32). A higher total score on the MASC-T indicates more severe anxiety symptoms. The results of a previous study proved that the MASC-T has acceptable internal-consistency reliability (Cronbach's alpha coefficients ranged from 0.871 to 0.895 in boys and 0.880 to 0.894 in girls), 1-month test–retest reliability (p values of single and average ICC < 0.001) and validity (p value of t test discriminating adolescents with anxiety disorder from those without anxiety disorders < 0.001) (32). In the present study, Cronbach's α for the MASC-T was 0.88.

Suicidality

The Suicidality module of the epidemiological version of the Kiddie Schedule for Affective Disorders and Schizophrenia (33) contains five self-reported items elicited a yes or no response that assess the occurrence of suicide attempts and four forms of suicidal ideation in the preceding year (28). In a previous study, Cohen's kappa coefficient of agreement (κ) between adolescents' self-reported suicidality and their parents' reports was 0.541 (p < 0.001) (28). A higher total number of yes responses for the items indicate a higher risk of suicidality. In the present study, Cronbach's α for the questionnaire on suicidality was 0.79.

Rosenberg Self-Esteem Scale (RSES)

The self-reported RSES comprises 10 items evaluated on a 4-point Likert scale that assess current self-esteem. This scale has acceptable reliability and construct validity (34). A higher total score on the RSES indicates a high level of self-esteem. A previous study on Taiwanese adolescents with ADHD found that the RSES had acceptable internal-consistency reliability (Cronbach's alpha coefficient = 0.861) and congruent validity by establishing negatively associations of RSES score with depressive (p < 0.001) and anxiety (p < 0.001) symptoms (35). In the present study, Cronbach's α was 0.86.

Chinese Social Responsiveness Scale (SRS)

The parent-reported Chinese SRS contains 25 items evaluated on a 4-point Likert scale that assess adolescents' reciprocal social behaviors. A higher total score indicates greater impairments of social responsiveness. Research has found that the SRS effectively distinguish between children and adolescents with and without ASD (36, 37).

Short form of the Swanson, Nolan, and Pelham Version IV Scale (SNAP-IV)-Chinese version

The parent-reported short form of the SNAP-IV-Chinese version comprises 26 items rated on a 4-point Likert scale from 0 (not at all) to 3 (very much) that assess adolescents' inattention, hyperactivity/impulsivity, and oppositional symptoms based on the DSM Fourth Edition (DSM-IV) criteria of attention-deficit/hyperactivity disorder (ADHD) (38, 39). Higher total scores on the subscales indicate greater ADHD and oppositional symptoms. In the present study, Cronbach's α values of the inattention, hyperactivity/impulsivity, and oppositional subscales were 0.91, 0.91, and 0.92, respectively.

Procedure

The adolescents with high-functioning ASD and their parents were invited to complete the research questionnaires. Two master-degree research assistants conducted an individual interview to collect data on the adolescents' self-reported school bullying experiences, depression, anxiety suicidality, and self-esteem. Before conducting the research interviews, research assistants received comprehensive training in the application of research questionnaires. The principal investigator (CFY) introduced the contents of research questionnaires to and had the discussion with research assistants. Then each research assistant conducted a research interview with an adolescent with high-functioning ASD under supervision of the principal investigator (CFY) and then received feedback for modification of the interview. Meanwhile, research assistants were requested to interview in accordance with the research questionnaire to make sure the inter-interviewer reliability. Research assistants introduced all questionnaires with standard guidance. For example, research assistants said when they started interviews based on the C-SBEQ: "I would like to learn about your feelings and the behaviors of your classmates. Your answers will help me to find out how to make things better at school for children. Please feel free to ask me for any other reason." All interviews were conducted individually in the interview rooms of outpatient clinics. Research assistants' performance during the interviews was supervised regularly to assess fidelity. The parents completed the C-SBEQ, Chinese SRS, and short form of SNAP-IV. Data analysis was performed using SPSS 20.0 statistical software (SPSS Inc., Chicago, IL, USA).

Statistical Analysis

Sex, age, social communication deficits, inattention, hyperactivity/impulsivity, and opposition among the groups of various self-reported and parent-reported bullying involvement (pure victims, pure perpetrators, perpetrator-victims, and the neutrals) were compared using chi-square test and analysis of variance (ANOVA). Because of multiple comparisons, a p-value of <0.005 (0.05/10) was considered statistically significant. Depression, anxiety, suicidality, and self-esteem among the groups of various self-reported and parent-reported bullying involvement were compared using multivariate analysis of variance (MANOVA). A p-value of <0.05 was considered statistically significant. The differences in the levels of depression, anxiety, suicidality, and self-esteem among four groups of adolescents with various self-reported and parent-reported bullying experiences of bullying involvement were further examined using multivariate analysis of covariance (MANCOVA), in which the effects of sex, age, social communication deficits, inattention, hyperactivity/impulsivity, and opposition were controlled for. Weight least square was used to adjust unequal variance for MANCOVA.

Ethics

All adolescents and their parents provided written informed consent. Parents also provided written informed consent to agree their children participating into this study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Kaohsiung Medical University Hospital (KMUHIRB-20120084).

RESULTS

In total, 219 (192 boys and 27 girls) adolescents and their parents participated in this study. Their mean age was 13.7 years [standard deviation (SD) = 2.1 years]. Their mean FSIQ was 95.4 (SD = 9.6). All participants had the ability to communicate verbally with others without any difficulty based on their parents' observation and clinical observation. Their mean score of social communication deficits on the SRS was 104.6 (SD = 29.2; range: 27–179). The means, standard deviations, and correlation matrices of the measured variables are shown in **Table 1**. The results revealed significant correlations among the measured variables.

Tables 2 and **3** present the ratios of the self-reported and parent-reported pure victims, pure perpetrators, perpetrator-victims, and the neutrals with high-functioning ASD. The rates of the self-reported neutrals, pure victims, pure perpetrators, and perpetrator-victims were 63.9%, 17.8%, 9.1%, and 9.1%, respectively. The rates of the parent-reported neutrals, pure victims, pure perpetrators, and perpetrator-victims were 41.6%, 23.7%, 5.9%, and 28.8%, respectively. The ASD adolescents self-reported a higher rate of being pure perpetrators than that reported by the parents (9.1% vs. 5.9%), whereas the parents reported higher rates of being pure victims (23.7% vs. 17.8%) and perpetrator-victims (28.8% vs. 9.1%) than those reported by the ASD adolescents. Low agreement was found between self-reported and parent-reported bullying involvement (kappa = 0.101). Only 10 (4.6%), 1 (0.5%), and 8 (3.7%) ASD adolescents were simultaneous self-reported and parent-reported pure victims, pure perpetrators, and perpetrator-victims, respectively.

TABLE 1 | The correlation matrix of measured variables.

	Mean (SD)	1	2	3	4	5	6	7	8	9	10
1. Bullying victimization	2.7 (2.8)	1	0.482**	0.173	0.118	0.120	0.025	0.335**	0.379**	0.238**	–0.140
2. Bullying perpetration	1.8 (2.4)		1	0.143	0.096	0.200*	0.195*	0.305**	0.333**	0.220*	–0.171
3. Social communication deficits	154.5 (27.2)			1	0.663**	0.531**	0.388**	0.197*	0.150	0.197*	–0.137
4. Inattention	14.7 (6.5)				1	0.671**	0.584**	0.216*	0.071	0.148	–0.161
5. Hyperactivity/impulsivity	10.0 (6.7)					1	0.661**	0.098	0.062	0.126	–0.053
6. Opposition	10.7 (6.3)						1	0.205*	0.079	0.216*	–0.189
7. Depression	14.6 (10.1)							1	0.617**	0.407**	–0.652**
8. Anxiety	35.2 (16.8)								1	0.264**	–0.356**
9. Suicidality	0.4 (1.0)									1	–0.372**
10. Self-esteem	19.9 (6.1)										1

*$p < 0.005$; **$p < 0.001$.

Table 2 presents the distribution of sex and the mean and SD of age, social communication deficits, inattention, hyperactivity/impulsivity, opposition, depression, anxiety, suicidality, and self-esteem among the groups of various self-reported bullying involvement. Because the data of suicidality was skewed, square root transformation is used to make the data of suicidality fit a normal distribution. The result of MANOVA revealed that there was a significant difference in depression, anxiety, suicidality, and self-esteem among groups classified based on self-reported bullying involvement. The further analysis indicated that the self-reported perpetrator-victims and pure victims had more severe depression and anxiety than the neutrals. Regarding suicidality and self-esteem, no significant group difference in suicidality could be identified in *post hoc* comparison.

Table 3 presents the distribution of sex and the mean and SD of age, social communication deficits, inattention, hyperactivity/impulsivity, opposition, depression, anxiety, suicidality, and self-esteem among the groups of various parent-reported bullying involvement. The parent-reported perpetrator-victims, pure victims, and pure perpetrators had more severe social communication deficits than the neutrals; the parent-reported perpetrator-victims and pure victims had more severe inattention and hyperactivity/impulsivity than the neutrals; the parent-reported perpetrator-victims had more severe opposition than the neutrals. The result of MANOVA revealed that the difference in depression, anxiety, suicidality and self-esteem among the four groups classified based on parent-reported bullying involvement was also significant. The results for group comparisons showed the parent-reported perpetrator-victims had more severe depression and anxiety than the neutrals.

Table 4 shows the results of MANCOVA comparing the levels of depression, anxiety, suicidality, and self-esteem among self-reported and parent-reported pure bullying victims, pure bullying perpetrators, bullying perpetrator-victims, and the neutrals after controlling for the effects of demographic data, social communication deficits, inattention, hyperactivity/impulsivity, and opposition. The results indicated that compared with the self-reported neutrals, the self-reported perpetrator-victims and pure victims had more severe

TABLE 2 | Sex, age, social communication deficits, inattention, hyperactivity/impulsivity, opposition, depression, anxiety, suicidality, and self-esteem among the groups of various self-reported bullying involvement ($N = 219$).

	Self-reported bullying involvement						*Post hoc* comparison
	Neutrals ($n = 140$; 63.9%)	Pure victims ($n = 39$; 17.8%)	Pure perpetrators ($n = 20$; 9.1%)	Perpetrator-victims ($n = 20$; 9.1%)	χ^2 or F	p	
Sex[a]							
Girls ($n = 27$)	17 (63)	4 (14.8)	2 (7.4)	4 (14.8)	1.349	0.718	
Boys ($n = 192$)	123 (64.1)	35 (18.2)	18 (9.4)	16 (8.3)			
Age (years)[b]	13.6 (2.1)	14.1 (2.0)	13.9 (1.7)	13.6 (2.2)	0.837	0.475	
Social communication deficits[b,c]	150.6 (25.9)	158.2 (32.3)	163.0 (29.3)	165.6 (18.2)	3.029	0.030	
Inattention[b,c]	14.3 (6.3)	14.3 (7.5)	17.5 (6.1)	15.5 (6.2)	1.562	0.200	
Hyperactivity/impulsivity[b,c]	9.2 (6.2)	9.9 (6.1)	12.9 (8.2)	12.3 (8.5)	2.676	0.048	
Opposition[b,c]	10.5 (5.9)	10.4 (6.5)	12.5 (6.9)	11.2 (7.6)	0.649	0.584	
Depression[b,d]	12.5 (8.9)	18.2 (11.5)	17.0 (8.8)	20.4 (12.1)	3.708	<0.001	Perpetrator-victims > Neutrals Pure victims > Neutrals
Anxiety[b,d]	31.1 (15.8)	40.6 (15.9)	40.7 (14.9)	47.9 (16.8)			Perpetrator-victims > Neutrals Pure victims > Neutrals
Suicidality[b,d]	0.2 (0.7)	0.7 (1.3)	1.0 (1.6)	1.0 (1.3)			
Self-esteem[b,d]	20.4 (6.0)	19.2 (6.0)7	20.6 (4.8)	17.4 (8.0)			

[a]*n (%);* [b]*mean (SD);* [c]*data were analyzed by ANOVA;* [d]*data were analyzed by MANOVA.*

TABLE 3 | Sex, age, social communication deficits, inattention, hyperactivity/impulsivity, opposition, depression, anxiety, suicidality, and self-esteem among the groups of various parent-reported bullying involvement (*N* = 219).

	Parent-reported bullying involvement						*Post hoc* comparison
	Neutrals (*n* = 91; 41.6%)	**Pure victims (*n* = 52; 23.7%)**	**Pure perpetrators (*n* = 13; 5.9%)**	**Perpetrator-victims (*n* = 63; 28.8%)**	**χ^2 or *F***	***p***	
Sex[a]							
Girls (*n* = 27)	11 (40.7)	8 (70.4)	0	8 (70.4)	2.290	0.514	
Boys (*n* = 192)	80 (41.7)	44 (22.9)	13 (6.8)	55 (28.6)			
Age (years)[b]	13.3 (2.1)	13.6 (2.2)	14.4 (1.8)	14.2 (1.9)	3.147	0.026	
Social communication deficits[b,c]	140.1 (27.8)	159.6 (22.5)	161.0 (20.5)	169. (20.6)	19.681	<0.001	Perpetrator-victims > Neutrals Pure victims > Neutrals Pure perpetrators > Neutrals
Inattention[b,c]	11.9 (6.2)	15.5 (5.7)	15.5 (5.3)	17.7 (6.3)	11.850	<0.001	Perpetrator-victims > Neutrals Pure victims > Neutrals
Hyperactivity/ impulsivity[b,c]	7.2 (5.7)	11.4 (6.4)	10.8 (7.6)	12.5 (6.9)	10.203	<0.001	Perpetrator-victims > Neutrals Pure victims > Neutrals
Opposition[b]	8.9 (1.0)	9.5 (6.3)	13.4 (7.1)	13.9 (6.5)	10.453	<0.001	Perpetrator-victims > Neutrals
Depression[b,d]	12.7 (9.6)	14.0 (8.5)	16.7 (9.8)	17.5 (11.4)	2.067	0.018	Perpetrator-victims > Neutrals
Anxiety[b,d]	31.3 (16.5)	35.3 (16.9)	39.5 (21.6)	40.0 (14.9)			Perpetrator-victims > Neutrals
Suicidality[b,d]	0.4 (1.0)	0.3 (0.7)	0.2 (0.6)	0.7 (1.3)			
Self-esteem[b,d]	20.3 (6.2)	21.1 (5.9)	17.0 (5.4)	19.1 (6.2)			

[a]*n (%);* [b]*mean (SD);* [c]*data were analyzed by ANOVA;* [d]*data were analyzed by MANOVA.*

depression and anxiety. However, no difference was found in depression and anxiety between the self-reported pure perpetrators and the neutrals or among the self-reported pure victims, pure perpetrators, and perpetrator-victims. No difference in suicidality and self-esteem was found among the four groups of various self-reported bullying involvement experiences. No difference in depression, suicidality, anxiety, and self-esteem was found among the four groups of various parent-reported bullying involvement experiences.

DISCUSSION

The present study conducted in adolescents with ASD found that the self-reported perpetrator-victims and pure victims had more severe depression and anxiety than the self-reported neutrals. No difference in depression, suicidality, anxiety, and self-esteem was found among the four groups of various parent-reported bullying involvement experiences.

The present study found that the rates of the self-reported neutrals, pure victims, pure perpetrators, and perpetrator-victims in adolescents with high-functioning ASD based on the C-SBEQ were 63.9%, 17.8%, 9.1%, and 9.1%, respectively. A previous study using the same questionnaire in the Taiwanese general adolescent population found that the rates of the neutrals, pure victims, pure perpetrators, and perpetrator-victims were 65.2%, 15.3%, 9.8%, and 9.8%, respectively (18). The results indicated that the rates of various types of bullying involvement in adolescents with high-functioning ASD were similar to those in general population. However, inconsistent with the results of a previous study on the general adolescent population (18), the present study found that only the self-reported pure victims and perpetrator-victims with ASD but not the pure perpetrators with ASD had poor mental health compared with those with ASD without any involvement in bullying. Although the severities of depression and anxiety of adolescents with high functioning ASD were not higher than those of the general Taiwanese adolescent population evaluated by the same measures (18), depression and anxiety are important mental health problems warranted intervention. The results of the present study evidenced that adolescents with high-functioning ASD who have experienced bullying victimization have more severe depression and anxiety than those who have never involved in bullying. We suggest that mental health problems are a clinical focus warranted routine survey in ASD adolescents who were the victims of bullying.

TABLE 4 | Comparisons of depression, anxiety, suicidality, and self-esteem among the groups of various self-reported and parent-reported bullying involvement: multivariate analysis of covariance[a].

	Self-reported bullying involvement			Parent-reported bullying involvement	
	F	***p***	***Post hoc* comparison**	***F***	***p***
Depression Anxiety Suicidality Self-esteem	3.436	<0.001	Perpetrator-victims > Neutrals[b]; Pure victims > Neutrals[b] Perpetrator-victims > Neutrals; Pure victims > Neutrals	1.278	0.228

[a]*Controlling for the effects of sex, age, social communication deficits, inattention, hyperactivity/impulsivity, and opposition.*
[b]*Weight least square used to adjust unequal variance.*

It is noteworthy that the self-reported perpetrator-victims but not the pure perpetrators had more severe depression and anxiety than the self-reported neutrals. The present study did not explore the motivation of the perpetrator-victims to perpetrate bullying. Although bullying is considered as an aggressive action in which someone intentionally inflicts injury or discomfort upon others (40), reactive aggression can be found in bullying victims to defend themselves accompanied by anger and retaliate against maltreatment (41, 42). The perpetrator-victims with ASD may perpetrate reactive aggression to defend themselves when they encounter provocation and trouble, which may result in anxiety simultaneously. Furthermore, proactive aggression that is only found in bullying perpetrators is a goal-directed, deliberate, offensive action implemented to achieve goals; it requires no stimulus, and may be characterized by pleasure or satisfaction (41, 42). The pure perpetrators with ASD may perpetrate bullying to others without regret and therefore experience less mental health problems.

In the present study conducted in adolescents with ASD, no significant difference was found in mental health problems between the perpetrator-victims and pure victims and between the perpetrator-victims and pure perpetrators. The results of the present study were not in accordance with those of the previous study on the general adolescent population in Taiwan, which found that perpetrator-victims had greater risks of mental health problems than pure victims and pure perpetrators (18). Perpetrator-victims have been considered to be the most vulnerable group, as they are at higher risks of suffering multiple psychopathologies than those with other experiences of bullying involvement (10). The results of the present study suggest that psychosocial processes in bullying involvement differ between perpetrator-victims with ASD and those without ASD. For example, deficits in theory of mind skills are the one of core psychopathologies in ASD. Theory of mind skills is the ability of individuals to attribute mental states to themselves and to others in order to explain and predict behavior (43). Because of the deficits in social awareness, adolescents with ASD may be less able to recognize the existence of bullying than adolescents without ASD (5). However, whether and how these differences in psychosocial processes influence the association between perpetration-victimization and mental health problems in adolescents with ASD warrants further study.

The present study found low agreement between self-reported and parent-reported bullying involvement of adolescents with ASD. Research on general adolescent population found that adolescents may have different interpretations of interacting behaviors with peers compared with their teachers and parents (44). Because of the core symptoms of ASD, adolescents with ASD may misinterpret bullying situations as non-bullying (45). The results of MANOVA revealed that the parent-reported perpetrator-victims had more severe depression and anxiety than the neutrals, though the differences became nonsignificant after controlling for the effects of demographic data and adolescents' social communication deficits, ADHD, and opposition symptoms. The results of the present study indicated that mental health professionals should take both self-reported and parent-reported bullying involvement into consideration simultaneously when developing prevention and intervention programs for bullying involvement in adolescents with ASD.

The findings of the present study had several clinical implications. First, parents reported higher rates of pure bullying victimization and victimization-perpetration than those reported by the adolescents with ASD. The results indicated that the parents of the adolescents with ASD were more likely to detect and report the adolescents' bullying victimization than did the adolescents themselves. Moreover, mental health problems were only found to be significantly associated with adolescent-reported bullying involvement, but not with parent-reported ones. The results indicated that mental health and educational professionals should not rely on information reported by the sole source. Both adolescents' self-reported and parent-reported bullying involvement should be collected to detect bullying involvement and related mental health problems in adolescents with ASD. Second, the present study found that both pure victims and perpetrator-victims had more severe depression and anxiety than the neutrals. Based on the results of the present study, bullying victimization, depression and anxiety should be routinely surveyed in adolescents with high-functioning ASD. Research found that the treatment program focusing on enhancing theory of mind performance ability could reduce bullying involvement in children and adolescents with high-functioning ASD (46). Moreover, there are some models of psychosocial approaches proposed to treat depression in children and adolescents with ASD (47). These prevention and intervention programs should be provided to those who need. Third, although the validity of the C-SBEQ warrants further examination in adolescents with high-functioning ASD, the C-SBEQ or other self-reported instruments can be used to collect ASD adolescents' subjective experiences of bullying involvement and provide the basis of intervention.

This study has several limitations. First, the causal relationships between bullying involvement and mental health problems in adolescents with ASD could not be concluded in this cross-sectional study. The temporal sequence of different levels and types of involvement in bullying and mental health problems warrant longitudinal studies to examine. For example, a longitudinal study revealed that internalizing behaviors at the age of 13 years predicted victimization experiences at the age of 15 years in adolescents with ASD (48). Second, the study participants were adolescents with high-functioning ASD who visited medical units for treatment or survey. Therefore, the results of this study might not be generalizable to all adolescents with ASD. Third, although we collected data on adolescents' and parents' reports on bullying involvement, we did not collect the reports from school teachers and peers. Fourth, we did not examine the influences of treatment that the adolescents have received on the association between bullying involvement and

mental health problems. As mentioned before, there have been psychosocial approaches proposed to reduce bullying involvement (46) and treat depression in children and adolescents with ASD (47). Previous experiences of receiving intervention for bullying involvement and mental health problems may influences the association between bullying involvement and mental health problems. Fifth, Olweus (40) proposed that bullying is a negative or malicious behavior intended to harm or distress others. The present study inquired neither the intention of adolescents with high-functioning ASD nor the intention of their classmates to perpetrate aggressive behaviors. Given that the adolescents with high-functioning ASD may not figure out their own or classmates' intention to perpetrate aggressive behaviors, the rates of bullying involvement in adolescents with high-functioning ASD found in the present study may be not the same as the studies using the definition of bullying proposed by Olweus. Further study warrants to examine the findings using different definitions of bullying involvement.

CONCLUSION

The present study found that ASD adolescents who self-reported to be the pure bullying victims or perpetrator-victims have more severe depression and anxiety than those who self-reported no involvement in bullying. Mental health and educational professionals should collect information from both adolescents and their parents to detect bullying involvement, and they should consider comorbid mental health problems when assessing adolescents with ASD who are involved in bullying.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of Institutional Review Board (IRB) of Kaohsiung Medical University with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki. The protocol was approved by the IRB of Kaohsiung Medical University.

AUTHOR CONTRIBUTIONS

Conceptualization: W-JC, C-FY. Data analysis: C-FY, P-WW. Funding acquisition: W-JC, C-FY. Draft writing: RH, H-FH, C-FY.

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Family Features of Social Withdrawal Syndrome (Hikikomori)

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Background: Family may play an important role in the origin, maintenance, and treatment of people with social withdrawal. The aim of this study is to analyze family factors related to social withdrawal syndrome.

Methods: Socio-demographic, clinical, and family data, including family psychiatric history, dysfunctional family dynamics, and history of family abuse were analyzed in 190 cases of social withdrawal with a minimum duration of 6 months that started an at-home treatment program. Data were analyzed at baseline and at 12 months.

Results: In 36 cases (18%) neither the patient nor the family allowed at home evaluation and treatment by the Crisis Resolution Home Treatment (CRHT) team. Patients had high rates of dysfunctional family dynamics ($n = 115$, 61.5%), and family psychiatric history ($n = 113$, 59.3%), especially maternal affective ($n = 22$, 42.9%), and anxiety disorders ($n = 11$ 20.4%). There was a non-negligible percentage of family maltreatment in childhood ($n = 35$, 20.7%) and single-parent families ($n = 66$, 37.8%). Most of the cases lived with their families ($n = 135$, 86%), had higher family collaboration in the therapeutic plan ($n = 97$, 51.9%) and families were the ones to detect patient isolation and call for help ($n = 140$, 73.7%). Higher social withdrawal severity (as defined by at least one of: early age of onset, no family collaboration, lack of insight, higher CGSI score, and higher Zarit score), was associated with family psychiatric history, dysfunctional family dynamics, and family abuse history. All of these predictive variables were highly correlated one to each other.

Conclusions: There is a high frequency of family psychiatric history, dysfunctional family dynamics, and traumatic events in childhood (family maltreatment), and these factors are closely interrelated, highlighting the potential role of family in the development and maintenance of social withdrawal.

Keywords: hikikomori, social isolation, social withdrawal, family factors, family psychiatric history, home treatment, dysfunctional family dynamics, childhood maltreatment

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INTRODUCTION

Social withdrawal syndrome was first described in Japan as hikikomori, and defined as the state of confining oneself to one's house for more than 6 months and strictly limiting communication with others (1). In recent years its existence has been described in other countries and cultures, noting that other factors besides Japanese culture may also influence its origin and development (2–4).

We have previously assessed which factors determine withdrawal relapse or persistence (3). Among them, some factors, such as age or comorbid diagnostics, may result in being difficult to modify. However, intensive treatment care, which showed a positive effect on prognosis (3), could be extended with the collaboration of different settings and familial environment.

More than half of the patients affected by social withdrawal maintain a relationship with their families (3, 5), which opens the door for one of the few opportunities for intervention and reinforces the relevance of studying family factors in social withdrawal. However, to our knowledge, few studies have reported data regarding family factors in relation to onset, persistence, or relapse in social withdrawal (6–9).

Family factors that have been identified with the appearance of social isolation include: insecure attachment (10), death of a family member (11), nuclear family without extended family support (12–14), fragmented family (15), dysfunctional family and parenting dynamics (8, 16–18), as well as emotional neglect and child abuse (19). A higher risk has been observed in families with a high economic level, as well as those with a high parental educational level (6). It has been described that some parents who do not know how to start a conversation or worry about their children (8) may not teach their children empathy, how to establish trusting relationships with others, and how to engage in healthy communications (20). Other features, such as traumatic childhood experience and family maltreatment history, have been described as risk factors for developing social withdrawal syndrome (6, 12, 18, 19).

In relation to dysfunctional family dynamics, hikikomori in Japan has been related to the concept of "*amae*" (21), which describes the Japanese dependent behavior in which a person implores, or alternatively acts with selfishness and indulgence, knowing that the caregiver will forgive them. Traditionally, in Asian societies, this is a frequent phenomenon that begins in childhood, generating a family dynamic in which the child uses manipulation to gain parental care, chronifying themselves in time, and thus, becoming economically dependent upon their parents (17, 22, 23). Adding to this phenomenon, the current generation of Japanese young adults has experienced a decrease in desire and motivation (18). In addition, the economic comfort afforded by Japanese families has led to a decrease in the value of work. Finally, it has been pointed out that parents are less strict in the upbringing of their children (24). In Western culture there is no word equivalent to "*amae*," which may be related to a lower prevalence, although it may also exist.

In relation to the possible influence of parental psychopathology as a risk factor, there are few studies. Panic disorder in the mother has been described as a risk factor (6), suggesting that this association could be attributable to parenting behavior that reinforces the patient's anxiety and avoidant coping strategy. In our research setting, our team described a high frequency of family psychiatric history, mostly maternal affective, and anxiety disorders. Fathers were more likely to have psychotic and drug use disorders (2); however, no other studies have investigated family history by separating the two parents.

In addition, it is undoubted that the family plays a very important role in the detection and treatment of the social withdrawal of their children (8, 23), as they usually alert health services about the situation and ask for help. However, due to prejudice and lack of knowledge, in many cases family members are unable to intervene at all, and the socially withdrawn person tends to hide for many years without seeking help (4). That is why, after the initial consultation, the first step is to alleviate the psychological burden on the parents themselves, support them and relieve their feelings of despair and self-condemnation (7, 8), perform family psychoeducation (4), and facilitate understanding and acceptance of the diagnosis and treatment of social withdrawal. It is also relevant for early detection in relatives or descendants of people with mental illness (2).

All of these aspects lead to the importance of the role of family and hereditary factors in social withdrawal, to understand its influence on the origin of the syndrome, and to apply this knowledge in early detection and treatment, both at the individual and family levels. Therefore, the objective of this study is the analysis of family factors related to social withdrawal and its evolution.

MATERIALS AND METHODS

Participants

The participants were 190 subjects with social withdrawal and their families, who were attended by the Crisis Resolution Home Treatment (CRHT) program from 2008 to 2014 in Barcelona (Spain). The diagnostic inclusion criteria were (25–28): (1) spend most of the day and almost every day at home; (2) avoid social situations, such as attending school or going to work; (3) avoid social relationships, such as friendships or contacts with family members; (4) discomfort or significant deterioration due to social isolation; (5) minimum duration of 6 months. These symptoms should be primary and predominant over any other symptoms, in case there were others. The exclusion criteria were subjects with diagnosed cognitive disorders, such as dementia, drug dependence without other comorbid psychiatric disorders, age younger than 12 years old, and subjects for whom the only treatment option was involuntary inpatient therapy. Diagnosis was made by the psychiatrists of the CRHT team through clinical evaluation.

Home Visitation Program

The CRHT team comprised two psychiatrists and two nurses. The target population were patients with severe mental disorders disengaged from outpatient monitoring, and people with no psychiatric history who presented behavioral disorders suggestive of mental disorders. Cases were referred to the CRHT by

social workers, primary and psychiatry outpatient teams, and/or psychiatric emergency services. When a case was referred to the CRHT, a first interview was performed with the family or caregiver, if it existed, to collect the medical and psychiatric history, socio-demographic data, determine which was the clinical situation, and coordinate the home visit. After, once at home, the diagnostic approach was made and pharmacological treatment was prescribed if necessary. Several home visits were performed until clinical stabilization. The mean number of visits was 4, with a wide range, from 1 to 21 visits. A review of the previous articles will provide more information on the operation of the equipment (2, 3). When CRHT home treatment was completed, cases were referred to the most appropriate device in an individualized manner: outpatient psychiatric or medical center, hospitalization, or others. Following this referral, the clinical condition and situation of isolation was evaluated by contacting the mental health team currently in charge of the subject at 4, 8, and 12 months after referral.

Measurement Instruments

All cases were prospectively studied according to a routine computerized protocol that included demographic and clinical information. Socio-demographic data included age, gender, social network, and living situation. The latter included screening for dysfunctional family relationships. A dysfunctional family was defined as one whose interrelationships serve to detract from, rather than promote, the emotional and physical health and well-being of its members, with continuous conflict and instability, and with traits such as poor communication, excessive control, perfectionism, lack of empathy, and excessive criticism. The degree of family collaboration in the therapeutic plan was also evaluated. Clinical characteristics included referral source, family psychiatric history, and personal psychiatric history. This included medical history, family abuse history in childhood, and previous contact with any outpatient-type mental health service. The socially withdrawn period and the age at onset of social withdrawal were also recorded. The patient diagnoses were evaluated using the DSM-IV-TR criteria, grouping the major mental disorders into six categories: psychotic, affective, anxiety, drug abuse, personality, and other Axis I diagnoses. The service to which the CRHT referred the case after follow-up was also recorded. Illness severity was assessed using the Spanish version of the Severity of Psychiatric Illness (SPI) scale (29, 30). Subjects were also evaluated using the Global Assessment of Functioning (GAF) (31, 32), the Clinical Global Impressions Scale (33, 34) and the World Health Organization Disability Assessment (WHO/DAS) (35) to measure functioning, the Zarit Burden Interview (36) to assess caregiver burden, and the Scale of Unawareness of Mental Disorder (SUMD) (37) to evaluate insight. Internet addiction was clinically evaluated using the diagnosis criteria more widely accepted (38, 39): (1) excessive Internet use (compulsive striving for Internet usage, growing importance of Internet in the system of personal values, (2) withdrawal symptoms (mood swings like anger, depression, and anxiety when Internet is unavailable), (3) tolerance (need for increased use of the Internet to relieve negative emotional symptoms), (4) negative consequences due to Internet use (excessive engagement in Internet use, loss of previous hobbies and entertainments, loss of social relations, educational and sport opportunities, quarrels and lies). Social network was evaluated according to criteria developed by our team based on clinical experience as follows: (1) null relationship, (2) relationship with family with whom we live, (3) relationship with a friend outside the home, and (4) normalized social relation.

An evaluation of the subject's connection to the mental health network at 4, 8, and 12 months after program discharge was performed by contacting the responsible medical service. This assessment included clinical status evaluated using the GAF and WHO/DAS scales, as well as the persistence of social isolation and its severity.

Statistical Analysis

First, a descriptive analysis of the sample at baseline was performed. A specific descriptive analysis on the diagnostic family data separated by parent was carried out due to previously described high rates of anxiety disorders in mothers of socially isolated subjects, and the lack of reports of the psychiatric history of fathers.

Second, univariate analysis between baseline family characteristics and severity measures of withdrawal at baseline were calculated using Pearson's correlation coefficient. To this purpose, the variables reflecting severity were age at onset of social withdrawal, social withdrawal time, family collaboration with treatment, null social network, internet addiction, inpatient treatment, and SPI, WHO/DAS, CGI, CGSI, SUMD, ZARIT, and GAF scores. The variables related to family characteristics were family psychiatric history, dysfunctional family dynamics, family maltreatment history, and single-parent family. Those family variables with significant correlation with severity measures were selected for the next step. The same procedure was repeated for severity measures at 12 months adding successful linkage at this point in time. Third, to test the interrelation between the family variables predicting severity, the selected family variables were tested for correlations between each other using chi-square test to test association between categorical variables. Then, to determine the level of clustering within this set of family variables, the selected variables were introduced in two separate hierarchical clustering analyses: first, the subjects' dataset for the selected variables was converted to a Euclidean distance matrix. This matrix was entered in a clustering model using averages as the grouping criteria. The same procedure was repeated for the selected variables, except that the distance matrix was created subtracting the square of the correlation matrix to one. The two resulting dendrograms were plotted one to each other to visualize the correspondence of the grouping of subjects and variables. The subjects' dendrogram was divided into as many groups as the subjective visualization of the dendrogram suggested. Finally, to control the possible confounding effect of gender and age in the relation between family factors and severity of isolation, we computed a multivariate regression analysis. To this purpose, among the initial pool of variables of severity of social withdrawal, we selected those that showed significant

correlation with family factors in the univariate analysis (age at onset of social withdrawal, family collaboration with treatment, CGSI, SUMD, ZARIT) and entered them as dependent variables. As independent variables, we entered the previously mentioned family factors (family psychiatric history, dysfunctional family dynamics, family maltreatment history, and single-parent family), and age and sex.

Analyses were conducted using SPSS 24 (SPSS, Chicago, IL, USA), except for cluster analysis and multivariate analysis that were conducted using R (RStudio, v. 1.1.423—© 2009–2018 RStudio, Inc).

RESULTS

The global sociodemographic and clinical characteristics of cases treated at home are shown in **Table 1**. A more detailed description of the socio-demographic data of this sample can be found in our previous work (2, 3). In 36 cases (18%), neither the patient nor the family allowed the CRHT evaluation and treatment at home. Each of the family variables was significantly related to at least one of the severity variables as described below (see **Table 2**). These family variables were strongly interrelated (see **Table 3**). The difference between the ultrametric distances of the cluster analysis and the original distances was 0.0007 for the cluster analysis of the variables, and 0.0875 for the cluster analysis of the subjects, indicating good cluster modeling. **Figure 1** shows the dendrogram plot for the selected variables and subjects.

Family Psychiatric History

Family psychiatric history is described in **Table 1** and separated by gender of the parents in **Table 4**. In 21 cases, the family psychiatric history was unknown.

Having family psychiatric history was significantly associated with younger age at onset (mean age years 31.5 [*SD* 15.3] vs. 40.2 [*SD* 20.1], $p = 0.002$) and higher rates of internet addiction ($n = 41$ [36.9%] vs. $n = 18$ [23.4%], $B = 0.136$, $p = 0.049$) as measures of withdrawal severity. In regard to 12-month variables of severity, this variable was inversely related to linkage at 12 months ($B = -0.152$, $p = 0.048$). Regarding the associations with other family variables, having psychiatric history was positively related to history of family maltreatment ($n = 29$ [28.7%] vs. $n = 6$ [9%], $X\text{-}sq = 9.534$, $p = 0.002$), single-parent family ($n = 50$ [45.9%] vs. $n = 17$ [24.3%], $X\text{-}sq = 8.481$, $p = 0.004$), and familial dystocia ($n = 76$ [69.1%] vs. $n = 39$ [50.6%], $X\text{-}sq = 6.506$, $p = 0.011$).

Dysfunctional Family Dynamics

The existence of dysfunctional family dynamics was significantly related to some measures of withdrawal severity: younger age at onset of withdrawal (mean age 31.6 [*SD* 16.8] vs. 40.6 [*SD* 18.2], $p = 0.001$), higher internet addiction ($n = 43$ [37.4%] vs. $n = 16$ [22.5%], $B = 0.149$, $p = 0.034$), and less family collaboration ($n = 39$ [33.9%] vs. $n = 58$ [80.6%], $B = -0.466$, $p < 0.001$). Dysfunctional family dynamics was related with other family variables, such as having family psychiatric history ($n = 76$ [66.1%] vs. $n = 34$ [47.2%], $X\text{-}sq = 6.505$, $p = 0.011$), single-parent family ($n = 56$ [50.5%] vs. $n = 11$ [16.7%], $X\text{-}sq = 20.081$, $p < 0.001$), and family maltreatment history ($n = 30$ [29.7%] vs. $n = 5$ [7.7%], $X\text{-}sq = 11.515$, $p = 0.001$). It was also inversely related

TABLE 1 | Global sociodemographic and clinical characteristics of social withdrawal cases attended by CRHT.

Variables	Total social withdrawal cases ($n = 190$) *n* (%)
Gender, Male	137 (72.1)
Age, mean (*SD*)	39.1 (18.1)
Isolation period, months, mean (*SD*)	38.1 (52.3)
Age at onset of isolation, mean (*SD*)	36.2 (17.9)
WHO DETECTS SOCIAL ISOLATION	
- Family (vs. medical services)	140 (73.7)
LIVING SITUATION	
- Alone	30 (15.8)
- Family	160 (84.2)
- Family of origin	131 (81.8)
- Own family	29 (18.2)
Single-parent family	68 (37.8)
- With mother	64 (94.1)
- With father	4 (5.9)
EDUCATION LEVEL	
- Secondary or higher	77 (40.7)
- University	22 (11.6)
EMPLOYMENT STATUS	
- Unemployed	117 (61.6)
- Student	18 (9.5)
- Worker	0 (0)
- Old age pensioner	17 (8.9)
- Medical pensioner	32 (16.2)
- Sick leave	6 (3.2)
Dysfunctional family dynamics	115 (61.5)
FAMILY PSYCHIATRIC HISTORY	
- First grade	87 (76.9)
- Mother	51 (59.7)
- Father	17 (19.5)
- Brother	19 (20.7)
Second grade	26 (23.1)
Internet addiction	59 (31.4)
REFERRED SERVICE BY THE CRHT	
- Medical outpatient team	26 (16.6)
- Psychiatric outpatient team	62 (39.5)
- Hospitalization	48 (30.6)
- Other	21 (13.4)
WHO/DAS total, mean (*SD*)	12,8 (3.7)
GAF initial, mean (*SD*)	40,7 (15)
GAF final, mean (*SD*)	45,7 (16.7)
SUMD Total, mean (*SD*)	10 (4.2)
CGIS, mean (*SD*)	2,5 (1.6)
CGIC, mean (*SD*)	4,1 (1.1)
SPI total, mean (*SD*)	12,6 (4.9)
Zarit total, mean (*SD*)	44,7 (19.8)

TABLE 2 | Summary of the univariate analysis between variables of severity of isolation and family factors.

	Age at onset of isolation	Isolation time	Family collaboration with treatment	Null social network	Inpatient treatment	SPI score	WHO/DAS score	SUMD score	CGIC score	CGIS score	Zarit score	GAF score
Family psychiatric history	x											
Single-parent family											x	
Dysfunctional family dynamics	x		x							x		
Family maltreatment history			x									

x, significant correlation; $p < 0.05$.

TABLE 3 | Correlations between family variables that predict the severity of social withdrawal.

	Family maltreatment history *chi-square*	Dysfunctional family dynamics *chi-square*	Single-parent family *chi-square*	Family psychiatric history *chi-square*
Family maltreatment history	NA	11.515*	24.943*	9.534*
Dysfunctional family dynamics	11.515*	NA	20.081*	6.506*
Single-parent family	24.943*	20.081*	NA	8.481*
Family psychiatric history	9.534*	6.506*	8.481*	NA

**The Chi-Square statistic is significant at the 0.05 level.*

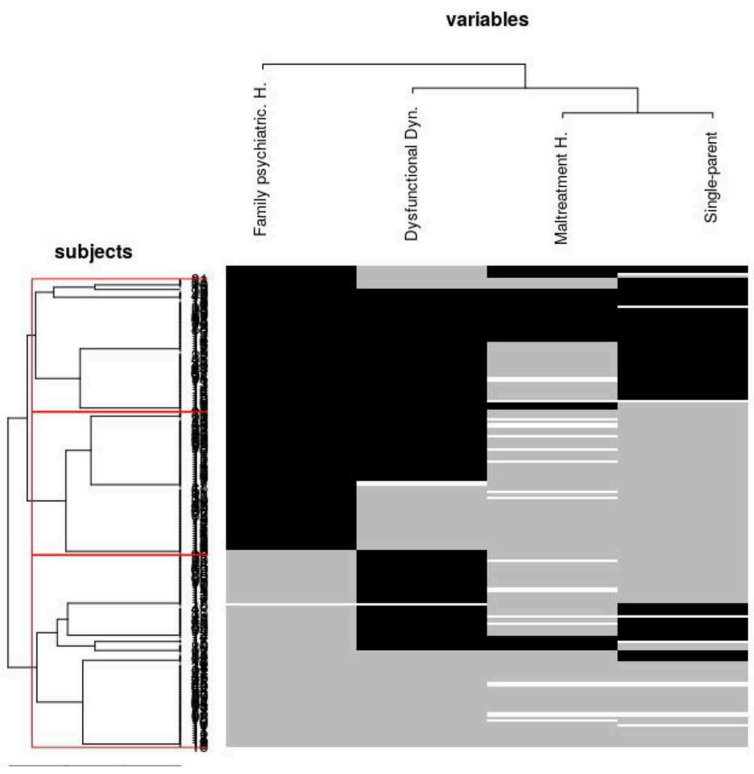

FIGURE 1 | Dendrogram showing hierarchical cluster analysis of those family variables most related to social withdrawal severity and subjects. Black color in the matrix represents a dichotomous "yes" value for the variable. Gray color represents "not present" for the variable. White color represents missing data. A small proportion of subjects endorsed for all the family variables that predicted severity of isolation (black stripe at the bottom of the plot). A thicker proportion of subjects did not endorse for many of the selected variables (subjects middle group), and finally, another significant proportion of subjects endorsed for almost all the variables. Family variables were clustered in the following order Single-parent family and Maltreatment history -> Dysfunctional family dynamics -> Family psychiatric history.

TABLE 4 | Family psychiatric diagnosis separated by parent of social withdrawal cases attended at home by CRHT.

Family psychiatric diagnosis	Mother *n* (%)	Father *n* (%)	*p*
Drug use disorder	3 (6.1)	5 (31.2)	0.01
Psychotic disorder	6 (12.2)	9 (50)	
Affective disorder	22 (42.9)	2 (12.5)	
Anxiety disorder	11 (20.4)	1 (6.2)	
Personality disorder	3 (6.1)	0 (0)	
Other	6 (12.2)	0	

with linkage at 12 months follow-up ($n = 10$ [26.3%] vs. 0 [0%], $p = 0.041$, $B = -0.161$).

Family Maltreatment History

Regarding family maltreatment history, statistically significant differences were found in withdrawal severity measures: less family collaboration with treatment ($n = 11$ [31.4%] vs. $n = 78$ [59.6%], $B = -0.281$, $p = 0.003$) and higher Zarit scores (mean 58.3 [*SD* 18.4] vs. mean 41.4 [18.9 *SD*], $p = 0.048$). No significant differences were found in the 12 months follow-up. As regards to other family variables, family maltreatment history was related with having family psychiatric history ($n = 29$ [82.9%] vs. $n = 72$ [54.1%], *X-sq* = 9.534, $p = 0.002$), dysfunctional family dynamics ($n = 30$ [85.7%] vs. $n = 71$ [54.2%], *X-sq* = 11.515, $p = 0.001$, $B = 0.263$) and single-parent family ($n = 25$ [78.1%] vs. $n = 40$ [30.1%], *X-sq* = 24.943, $p < 0.001$).

Single-Parent Families

In relation to cases from single-parent families, compared to two-parent families, statistically significant differences were found in some severity variables: age at onset of withdrawal (mean 25.9 [*SD* 12.1] vs. mean 38.3 [*SD* 18.3], $p < 0.001$), social withdrawal time (months mean 27.2 [*SD* 28.1] vs. mean 43.7 [*SD* 62.9], $p = 0.001$), higher internet addiction ($n = 31$ [46.3%] vs. $n = 27$ [24.3%], $B = 0.219$, $p = 0.002$), and higher Zarit scores (mean 53.42 [*SD* 19.37] vs. mean 39.06 [*SD* 19.11], $B = 14.361$, $p = 0.055$). Regarding other family variables, there was more frequent history of family abuse ($n = 25$ [38.5%] vs. $n = 7$ [7%], *X-sq* = 24.943, $p < 0.001$), higher family dystocia ($n = 56$ [83.6%] vs. $n = 55$ [50%], *X-sq* = 20.081, $p < 0.001$) and less family psychiatric history ($n = 50$ [45.9%] vs. $n = 59$ [54.1%], *X-sq* = 8.481, $p = 0.004$). No significant differences were found in the 12 months follow-up.

No other statistically significant differences were found between variables related to family characteristics and sociodemographic, clinical, and severity variables, and variables about follow-up for 12 months.

The multivariate regression analysis controlling for age and sex revealed a non-significant effect of sex ($F = 0.7$, $p = 0.634$), a significant effect of age ($F = 224.4$, $p < 0.001$). Dysfunctional family dynamics ($F = 6.1$, $p = 0.013$) and being single-parent family ($F = 4.8$, $p = 0.025$) remained significant to predict severity of social withdrawal, while family maltreatment history reached only trend level ($F = 3.1$, $p = 0.078$) and family psychiatric history was non-significant ($F = 0.6$, $p = 0.684$).

Twenty-eight subject (out of 162) had at least one missing value in the variables describing the four selected family factors and thus, they were not entered in the multivariate analysis. In the univariate analysis, all subjects with available data for each analysis were used. Subjects with missing values did not differ with the rest of subjects in terms of CGIS (mean = 4.0 vs. 4.2, $p = 0.616$), GAF at baseline (37.5 vs. 41.2, $p = 0.254$), Zarit score (mean = 34.2 vs. 46.3, $p = 0.142$), or duration of social withdrawal (31.6 vs. 39.2, $p = 0.264$). However, subjects with missing values were significantly older than the rest (mean age 45.7 vs. 32.9, $p = 0.002$).

DISCUSSION

To our knowledge, this is the first study to investigate family factors related to social withdrawal syndrome in a culture other than Japanese. We found that social withdrawal had a high frequency of family psychiatric history, dysfunctional family dynamics, and traumatic events in childhood (family maltreatment). All of these factors were closely interrelated.

Family Psychiatric History

Our study shows that there is a high frequency of family psychiatric history associated with social withdrawal syndrome, as pointed out in our previous study (2). Compared to one of the few epidemiological reports of family psychiatric history (40), the rates of family psychiatric history in our population were much higher than those of the general population. Cases with a family psychiatric history experienced earlier onset of isolation. In turn, they present more unfavorable family data, such as higher frequency of childhood maltreatment history and family dystocia, suggestive of the existence of dysfunctional family dynamics that make them a high-risk group for these factors as a whole.

It is known that children of parents with severe mental illness are at risk for a variety of psychiatric disorders and a third of them may develop a serious mental illness in early adulthood (41, 42). The most frequent family psychiatric disorders are affective and anxiety, the majority occurring in mothers. These results coincide with the few previous studies on family psychopathology and social withdrawal syndrome (6), as well as with other studies on maternal anxiety disorders and children with anxious school-refusal (43) and anxiety disorders in childhood (44). This association has been related to parenting behavior specific to mothers with anxiety disorders, in which mothers tend to reinforce the anxiety of children and their coping strategies of avoidance, and would interfere with their exploration and social activity. It could also be related to some hereditary genetic factors, requiring more research on this phenomenon.

In relation to the psychopathology of the father, our data reflect a higher frequency of psychotic and substance abuse disorders. Parental drug use disorder has been reported as a risk factor for depression, anxiety, social isolation, behavioral problems, and lower academic achievement (45–48). However, to our knowledge, this is the only study that

has described the relationship between the psychopathology of the father and the offspring social withdrawal, which is not found in previous studies of social withdrawal syndrome (6).

An impairment in parenting has been reported in subgroups of parents with psychosis and low educational attainment, unemployment, poverty, and social isolation (49); the greater the difficulties in parenting, the greater the severity of the symptoms (50). These reports, together with our findings, point out impairment in parenting as a mediator in the association between parental mental disorder and risk factor for the development of the social withdrawal syndrome. This fact highlights the importance of prevention and early detection programs in this risk group (51) and the need for interventions to optimize successful parenting outcomes in the risk population. In addition, access to services and support programs by fathers is significantly lower than mothers (7), highlighting the need to emphasize aid programs for them.

Dysfunctional Family Dynamics

In relation to family functioning, 61.5% of cases present family dystocia, demonstrating its high frequency, and coinciding with previous studies in which family function and social isolation syndrome have been related (6, 8, 10, 11, 52). Family dynamics, such as lack of problem-solving skills, poor communication, lack of emotional exchange in the family, and the difficulty of family members in sympathizing with each other's negative feelings, are attributed to the development of social withdrawal (8, 11). It is known that parenting styles, such as authoritarian, controlling, rejecting, and overprotective attitude, influence the development and stabilization of social withdrawal syndrome (6, 12, 53). It has been described that children with an absent father figure, together with a very close maternal bond, could experience difficulty in becoming independent adults (4, 23). Parental ambivalent attachment has been linked with social withdrawal syndrome (10). In turn, in the case of Japanese culture, hikikomori has been related to *amae*. Although the concept of *amae* was originally considered to be uniquely Japanese, recent opinions suggest that it is actually more universal and exists in other cultures (54, 55). In addition, especially as observed in social withdrawal syndrome, the development of basic interpersonal skills during the early stages of life seems to be insufficient, which could lead to vulnerability to stress in school/work environments and the tendency to escape from social situations (4, 23).

In our study, in 36 cases (18%), neither the patient nor the family allowed the CRHT to perform an initial in-home evaluation of the case. This phenomenon has been described previously and understood as an inability of the family to accept help, due to shame in revealing the problem and fear of symptom exacerbation or violence (4).

In addition, once home treatment had been started by our team, families with familial dystocia collaborated less (33.9 vs. 80.6%) with the therapeutic team in the guidelines and indications. This shows the difficulty and high stress that parents experience, their difficulty to intervene, their tendency to minimize or deny the problem, chronifying the situation for years without asking for help. In fact, in most cases (86%) the subjects with social withdrawal coexist with the family, which usually detects the problem and ultimately requests help (73.7%). Therefore, psychoeducation and family support for parents could help to lower their psychological distress, minimize the family's anxiety, solve the problems in family relationships, and consequently make a positive impact on the withdrawn patient (4, 7, 8).

Family Maltreatment History

It is known that child maltreatment affects development and is related to various mental disorders, such as schizophrenia (56), bipolar disorder (56), and depressive and anxiety disorders (57). In relation to social withdrawal syndrome, the role of child maltreatment has been described as a risk factor for its development (6, 12, 19). In our study, we observed that 20.7% of cases have a history of maltreatment in childhood by the family, providing more evidence for the relationship of childhood abuse with social withdrawal syndrome, and confirming its role as a risk factor for development of social withdrawal. Cases with family abuse history present dysfunctional family dynamics more frequently, engage in less family collaboration with treatment, and are more likely to come from single-parent families. All of these factors contribute to an unfavorable familial environment, and probably increase the difficulty in detection, treatment, and clinical improvement of the syndrome. The data reinforce the need for effective programs and policies that reduce the occurrence of family abuse and facilitate early detection and treatment.

Single-Parent Family

Almost 40% of cases live in a single-parent family, out of which 94% live with the mother. These data coincide with previous studies (5, 9) in which the predominance of the mother is suggested as a figure of coexistence and care of subjects with social isolation. Cases with single-parent families are younger and have less time for the evolution of withdrawal, maybe because the family previously sought help. These cases have less family psychiatric history, but more often show a history of childhood maltreatment and dysfunctional family dynamics, both factors that may be related to the fact that, at the time of consultation, the family has already fragmented and the mother has been the child's primary caretaker. Furthermore, single-parent cases have a higher frequency of hospital admissions after in-home treatment and higher Zarit scales scores, suggesting the difficulty in managing the social withdrawal of family at home.

STRENGTHS AND LIMITATIONS

This study has several limitations and strengths. The main strength is that it is the first study in a culture other than Japanese, focusing on the family features related to social withdrawal syndrome, and providing more evidence on this phenomenon. One of the study's main limitations is not having used any objective measure by means of evaluation scales on variables, such as internet addiction, family dysfunctional dynamics, or

the degree of family collaboration. In addition, the personal history, such as family abuse history, is provided by the subject or family member, without objective corroboration of the facts. Moreover, no information was collected on the time point and length of parental divorce, so it has not been possible to analyze whether it occurred before or during the period of isolation. The results of the multivariate regression model should be considered with caution as important correlation between the independent variables is known.

CONCLUSIONS

Our study shows that negative family circumstances frequently accompany social withdrawal syndrome, and that most of them are related to isolation severity. These familial determinants of social isolation severity mainly co-occur rather than appear separately. Thus, community programs targeting social isolation should be designed to detect and evaluate each of these factors. Interventions targeting these familial determinants should be more cost-effective when offering a global family intervention rather than separate interventions for each factor, as more than one factor may co-occur, and mutual reinforcement may exist between some of them.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

This study was carried out in accordance with the recommendations of the Parc de Salut Mar Barcelona Clinical Research Ethical Committee. Anonymized data were extracted from the routine clinical follow-up performed in the Crisis Resolution Home Treatment, and no additional complementary examinations have been used or any intervention or treatment has been tested for this study. The main principles outlined in the Declaration of Helsinki were followed and the final protocol was approved by the Parc de Salut Mar Barcelona Clinical Research Ethical Committee.

AUTHOR CONTRIBUTIONS

ÁM-A and DB were involved in the initial conception, design of the study and development of the study protocol. ÁM-A, DC, MB, and AG were involved in the organization of logistics, recruitment of patients, and data collection and management. ÁM-A and DB were involved in the analysis and interpretation of data and wrote the manuscript. LM-L, VP, AB, and AT provided critical revision of the manuscript.

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STUDY PROTOCOL
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The Developmental Implications of the Use of Reproductive Technologies for Transgender People: A Comparative Cross-Section Protocol

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Background: Today, individuals and couples with fertility issues can use advances in biomedical technologies to conceive. Transgender persons also benefit from these advances and can not only actualize their self-identified gender identities but also experience parenthood. These strategies for persons to self-actualize and to access parenthood have improved the condition of transgender persons. However, some may question the welfare of the offspring because such transfamily forms are often confusing to many. The sparse research on the psychological well-being of children of transgender people is reassuring. However, the limited empirical research justifies more studies to be conducted with an evidence-based methodology to assess whether these new methods of parenting have any adverse impact on children.

Aims: The current report details the protocol we built to compare cognitive development, mental health, gender identity, quality of life, and family dynamics in children of transgender fathers and donor sperm insemination (DSI) and two control groups matched for age and gende typically developing (TD) children and children from cisgender parents and DSI.

Hypothesis: To calculate sample sizes, we hypothesize no significant difference between groups.

Subjects and Methods: Since 2008, married couples that include a transgender father have been able to access DSI and have started conceiving children in France. They are always invited to participate in research to assess their children's well-being. To date, the cohort includes 53 children in 37 families. We propose to carry out a cross-sectional

comparative study exploring cognitive development with the Brunet–Lézine Psychomotor Development Scale or Wechsler's Intelligence Scales according to age; mental health with the Child Behaviour Checklist; gender identity with the Gender Identity Interview for Children; quality of life with the KIDSCREEN and the Adolescent Coping Questionnaire; and family dynamics with the Parental Bonding Instrument, the Inventory of Parent and Peer Attachment, the Five-Minute Speech Sample, and Corman's Family Drawing Test. To assess possible subtle differences between children's family drawings, we will use a generalization of the "lady-tasting-tea" procedure to link qualitative and quantitative approaches in psychiatric research. Twenty raters [four child and family psychoanalysts (CHILDPSY), four adult psychiatrists (ADUPSY), four biologists working in assistive reproduction technology (BIOL), four endocrinologists working with transgender individuals (ENDOC), and four students (STUD)] will be randomly shown the drawings and asked to blindly classify them using a Likert scale according to whether the child has a transgender father.

Statistical Analysis: After testing normality, comparisons between the three groups will be performed with appropriate statistical tests (Kruskal–Wallis, ANOVA, Chi2 or Fisher's exact test). For the "lady-tasting-tea" procedure, we will use a permutation test.

Ethics: The study protocol has been approved by the CERES (*Comité d'Ethique de Recherche en Santé*) of Paris 5 University. Registration number is 2015/31.

Keywords: transgender, reproductive technologies, adolescent, psychological well-being, child

STRENGTHS AND LIMITATIONS OF THE PROTOCOL

- It is the first evidence-based protocol to assess the psychological well-being of the offspring of transgender persons.
- A number of outcomes will be used to comprehensively assess the development of the offspring of transgender persons.
- When the study is completed, the results should extend our understanding of the development of children born to anonymous cisdonors, as we will include two control groups.
- An original method will be applied to capture eventual subtle differences in the family dynamics through Corman's Family Drawing Test.
- The limitations include (i) the mean age of the children, knowing that only one-third will have reached adolescence and none will have reached adulthood; (ii) the heterogeneity of children's ages, meaning that some assessments will not be completed with all participants; (iii) the sample size, meaning that minor differences will be difficult to catch due to lack of statistical power; and (iv) the lack of exact matching expected for the children from cisgender parents and DSI. Indeed, cisgender parents who conceived with DSI do not usually inform their children; also, this group has been proposed to be contacted for developmental research more recently, meaning that we expect this group to be younger.

INTRODUCTION

Today, biomedical technological advances have allowed individuals and couples with fertility issues to conceive (1). Medical advances in assisted reproduction technology have also created ways for human couples to access parenting. Additionally, medical progress in the field of gender dysphoria (GD) has allowed subjects to change their physical appearance and adopt the gender that they perceive to match their psychological identity. Consequently, transgender persons can not only actualize their self-identified gender identities, they can also benefit from advances in medically assisted reproduction (MAR) and experience parenthood. These new strategies for persons to self-actualize and to experience parenthood have improved conditions for transgender persons (2). However, they have raised several issues. In many countries, these advances have led to not only lively societal debates but also real ethical issues, the ultimate challenge being the well-being of the unborn child.

To enable transpersons to become parents outside the context of adoption, biomedical advances have introduced ways to conceive a child. In doing so, they have also introduced new changes in the ancestral logic of conceiving. The traditional bounds of gender identity, sexuality, conception, gestation, procreation, and filiation are deeply challenged (3). If the spread of contraception over the last 50 years has caused an effective separation between sexuality and procreation, the

current disruptions in conservative thinking are going much further. Accessing parenthood with new MAR methods implies distinguishing the social father, the social mother, the genetic mother (oocyte donor), the genetic father (sperm donor), and the gestational mother (2). These advances are confusing to many and have led to lively societal debates opposing 2 different views: bio-catastrophists, on the one hand, and bio-prophets, on the other hand (4). The former think that science serves as a driving force to bring about apocalyptic times. It contributes to the destruction of norms and traditional modes and understandings of the meaning of life, with severe consequences for society and, ultimately, the resulting end of the human species. The latter believe that science offers the promise of a paradisiac future: a new redemptive era with a pure incorporeal spirit emerging from thinking machines.

In addition to provoking societal debates, these ways to self-actualize and conceive a child prompt several ethical issues, including first, puberty suppression and early school transition in adolescents with GD, which are largely allowed in several countries (e.g., Netherlands) but are not yet common in others (e.g., France) (5). Second, when a transgender person decides to enter into gender transition, the preservation of fertility raises specific issues for this individual, although this question is also relevant to other medical situations such as chemotherapy (6). Third, MAR technologies directed at transgender people also have specific consequences to be discussed: e.g., is it legitimate to have oocyte donors and gestational mothers tackling risks inherent to ovarian stimulation and to pregnancy, delivery, and eventually their own families to provide infertile parents with access to parenthood? Finally, some may question the welfare of the offspring because they think such transparenthood may be confusing for children. The current protocol aims to address this question.

The literature on the psychological well-being of transgender people's children is sparse. However, it does not support the idea that transparenthood negatively impacts children's development. The four studies in which children were born before their parent's transition are summarized in **Table 1** None of the children developed gender identity problems, but some individuals had psychiatric problems. Although Green published an anecdotal report of three cross-generational GD families (11), there is no known causative link in these cases, and compared to the total population of transgender people accessing parenthood, the cross-generational families are few in number (9).

However, the best situation to study the eventual impact of transgender parenthood is to explore children who are conceived by transgender people after their transition. In that case, children do not have to adapt to a new parental identity and are less confronted by socially aversive reactions. To our knowledge, only one study has been issued so far on this topic: 52 children born between 2000 and 2015, from donor sperm insemination (DSI) for couples with a transgender man (female to male), have been followed every two years. The qualitative results show that the children have normal development without any major psychological morbidity or GD (12). Most of the children participants knew that they were born by third-party MAR and that their fathers were born as females. However, the study did not include quantitative standardized evaluations and control groups; also, the assessments of the children were not blind.

TABLE 1 | Summary of the literature studying the psychological well-being of transgender people's children

	N	Age	Gender identity problem
Green et al. (7)	37	5-16	None
Green et al. (8)	36	3-20	None
Freedman et al. (9)	18	3-15	None
White et al. (10)	55	8-35	None

In continuity with this last study, we propose to carry out a two-year cross-sectional comparative study of this cohort, now including 53 children in 37 families, using standardized quantitative assessments. We aim to compare cognitive development, mental health, gender identity, quality of life and family dynamics in children from transgender fathers and DSI and in two control groups matched for age, gender, and family status (in-couple vs separated): typically developing (TD) children and children from cisgender parents and DSI. To take into account the specificities that can be linked to the DSI as a mode of conception, we felt it was essential to have a control group of children born by conventional DSI as well as a control group of children who were conceived naturally. Additionally, to avoid questions about the results generated from the study being influenced by research staff opinions or beliefs, we will ensure that several comparisons of the children's status will be performed blind.

HYPOTHESIS

Our hypothesis is that the psychoaffective development of children born by DSI whose father is a transgender man does not significantly differ from that of children born with conventional DSIs or conceived by sex between cisgender parents. We aim to compare psychoaffective development in children conceived by DSI whose father is a transgender man (female to male) by conventional DSI and conceived by sex. To perform this protocol, we will collect objective data regarding cognitive development, mental health, gender identity, life quality, and family dynamics of children with an uncommon parenthood configuration, namely, transgender parenthood. We believe that this research will also improve healthcare for transgender couples and their children in a society where access to healthcare is potentially limited and remains difficult for this population (13). To calculate sample sizes, we hypothesize no significant difference between groups.

To explore more subtle differences between children born from DSI with a father of transsexual origin (female to male) and children born from natural conception, the protocol will include an experimental procedure previously developed to explore how traumatic experience could be predicted without explicit information through participants' responses to an experimental task using a permutation test (14, 15). In Cohen et al.'s study, the

authors aimed to assess whether specific abilities enhance the recognition of implicit knowledge related to individual self-experience (15). To do so, they collected a series of videos from healthy adults who had experienced a sibling's cancer during childhood and matched controls. Subjects and controls were asked to give a 5-minute spontaneous free-associating speech following specific instructions created to activate a buffer zone between fantasy and reality. Then, several groups of raters were randomly shown the videos and asked to blindly guess which speaker had a sibling with cancer using a Likert scale. Using a permutation test, they found that only psychoanalysts were able to recognize, above levels of chance, healthy adults who had experienced sibling cancer during childhood without explicit knowledge of this history. In contrast, medical students, oncologists, cognitive behavioral therapists and individuals who had the same history of a sibling's cancer were unable to do so. In our protocol to explore children's family experiences, we will ask all participating children to provide a family drawing that will be subsequently blindly shown and classified by raters to guess the children's group. We hypothesize that no group of raters will guess the children's group above the level of chance.

METHODS AND ANALYSIS

Design and Recruitment of the Participants

The study design is a monocentric cross-sectional comparative protocol study over 2 years. Of note, the CECOS-Cochin center is unique; itis authorized to treat couples from all over France. We will establish three groups of children of the same size, matched by age and sex. Two groups will be recruited from couples who have already met at the CECOS-Cochin and have at least one child born by DSI. The first group of children consists of those born by DSI where the father is transgender (female to male). Fifty-three children (from the 37 families) were recruited, which is considered to be the maximum number of participants.

The second group of children consists of those born by conventional DSI. Approximately 75 couples have a progressive pregnancy by DSI at CECOS-Cochin annually. It is common for these couples to return with a second or third request for insemination. These couples will be invited to participate in the study. This proposal may be formulated during a consultation requested by the couple for whatever reason, if the couple already has a child. Another way to contact other couples may be by telephone, provided that they have given their written consent to be contacted again by the CECOS at the time they enrolled to receive the DSI.

The third group includes controls born by sex between cisgender parents. They will be recruited by announcement in the meetings of the departments involving the families of the professionals who will agree. Our goal is to conduct the protocol with at least 45 subjects (1 subject = 1 child) in each of our three cohorts (see *Data Processing, Statistics, and Power Calculation* below). Inclusion criteria include a target population of girls and boys aged between 18 months and 15 years of age, born by DSI or naturally conceived for the control group, who agreed to participate in a one-day evaluation with the consent of their parents. Exclusion criteria are (i) a poor understanding of written and/or spoken French, which would not allow participants to correctly fill in the questionnaire forms or pass the standardized interviews, and (ii) a refusal from at least one parent to sign the consent form.

Measures and Procedure

Each child and family will undergo a thorough evaluation within the Department of Child and Adolescent Psychiatry at the Pitié-Salpêtrière Hospital in Paris. The department is well suited to a 1-day welcoming of children for these assessments. The protocol explores five axes (**Table 2**): (i) cognitive development using an adapted rating according to age (Brunet–Lézine psychomotor development scale(16) from 2 to 30 months, the WPPSI-III (17) from 30 months to 7 years old, and the WISC-4 (18) from 7 years old and up); (ii) mental health using Achenbach's Child Behaviour Checklist (CBCL) (19); (iii) gender identity appreciation using the Gender Identity Interview for Children (GIIC) (20); (iv) quality of life using KIDSCREEN 52 (21) and the Adolescent Coping Scale (ACS) (22, 23); and (v) family dynamics and interaction using the Parental Bonding Instrument (PBI) (24), the Inventory of Parent and Peer Attachment (IPPA) (25), the Five-Minute Speech Sample (FMSS) (26), and the Corman's Family Drawing Test (27).

The protocol will take place on a single day, in the psychiatry department of the Pitié-Salpêtrière or at home if the parents wish. During cognitive assessment of the children, each parent (both mothers and fathers) will fill out the Standardized Sociodemographic Questionnaire, which collects information about the child and his or her living environment and education, and the CBCL parent questionnaire. Then, the FMSS will be made with both parents by one of our trained clinicians. After the lunch break, parents will have a semi-structured interview, conducted by a psychiatrist, who will focus on their parenting experience. Meanwhile, a clinical psychologist will evaluate the mental health of the child using the CBCL child questionnaire if his or her age allows it and will ensure the passing of the GIIC. Self-administered questionnaires will then be offered to the child according to his or her age: the KIDSCREEN 52 for the evaluation of her or his quality of life, the Coping Scale for Adolescents, the PBI and the IPPA. Finally, the child will be asked to provide a family drawing. At the end of the day, and after an exchange between the involved clinicians, one of the psychiatrists will offer feedback to the child and his family regarding the immediate results of the clinical evaluation, and advice can be given if needed.

To maintain blind assessments, the psychologist who will follow how children and parents fill in the self-report questionnaires will remain blind to the children's group. Additionally, the cognitive assessment and the experimental procedure (the family drawing) will be performed in a blinded manner. Finally, we will also run all ratings and statistical analyses in a blinded manner. However, the parents' semi-structured interviews with the psychiatrist will not be blind, as some questions focus on parenting.

TABLE 2 | Study measures.

Name of the instrument	Characteristics
	Cognitive development
Brunet–Lézine Developmental Examination (16)	It estimates a developmental quotient (DQ) based upon normative data available for 2-year-old French toddlers.
WPPSI (17)	It is a standardized developmental test for preschool-age children to measure intelligence skills
WISC-4 (18)	It is a standardized developmental test for school-age children to measure intelligence skills
	Mental health
CBCL (19)	It assesses global psychopathology. It is a parent-report measure designed to record the behaviors of children. Each item describes a specific behavior, and the parent is asked to rate its frequency on a three-point Likert scale. The scoring gives, among others, three main scores (Internalizing, Externalizing, Total Problems): a T-score of 63 and above is considered clinically significant; values between 60 and 63 identify a borderline clinical range; and values under 60 are considered non-clinical.
	Gender identity
Gender Identity Interview for Children (20)	It assesses affective and cognitive gender confusion within the child.
	Quality of life
KIDSCREEN 52 (21)	It assesses the child's global quality of life. It presents as a questionnaire for children and young people and measures 10 health-related quality of life dimensions: Physical- (5 items), Psychological Well-being (6 items), Moods and Emotions (7 items), Self-Perception (5 items), Autonomy (5 items), Parent Relations and Home Life (6 items), Social Support and Peers (6 items), School Environment (6 items), Social Acceptance (Bullying) (3 items), and Financial Resources (3 items).
Adolescent Coping Scale (22, 23)	It assesses how adolescents cope with a situation or resolve a problem by scoring three main factors: (a) productive coping); (b) non-productive coping; and (c) reference to others.
	Family dynamic and interaction
Parental Bonding Instrument (24)	It measures fundamental parental styles as perceived by the child. The measure is 'retrospective', meaning that young adults (over 16 years) complete the measure of how they remember their parents during their first 16 years. The measure is to be completed for both mothers and fathers separately. There are 25 item questions, including 12 'care' items and 13 'overprotection' items.
Inventory of Parent and Peer Attachment (25)	It measures various qualities of the child's relationships with parents and peers, including trust, quality of communication, and feelings of anger and alienation. It contains three sub-questionnaires, one concerning the mother, one concerning the father and one concerning peers.
Five-Minute Speech Sample (26)	It assesses expressed emotions within the family. It measures levels of criticism, emotional over-involvement, warmth and positive remarks made by a relative toward the child.
Corman's Family Drawing Test (27)	It assesses the child's perception of the family relationship. After the child has finished the drawing, she or he is asked some questions to determine her or his feelings and thoughts and gain a better understanding of the drawing.

WPPSI, Wechsler Preschool and Primary Scale of Intelligence; WISC-4, Wechsler Intelligence Scale for Children (4th edition); CBCL, Child Behaviour Checklist.

Data Processing, Statistics, and Power Calculation

As requested by French regulations, all data will be processed anonymously and confidentially. Data will be identified only by a code number, and correspondence between this code and the participants' name/surname can only be established through a private list kept separately in another office. We will use the Pitié-Salpêtrière child psychiatry computerized database for the processing of these data (CNIL declaration n° 1303778). The data will be directly integrated into computer software on a laptop regularly entrusted for analysis to the statistician engineer of the Department of the Child and Adolescent Psychiatry of the Pitié-Salpêtrière hospital.

Taking into account the purpose of the study, statistics will be essentially descriptive: frequencies and percentages for the qualitative variables, means, standard deviations, minimum, maximum, and median for the quantitative variables. In addition, the norms in the general population (or even by age category/sex if available) of the different instruments used will make it possible to calculate for each patient a Z-score according to the following formula: $Z = (X - \mu)/\sigma$, where μ and σ represent the mean and standard deviation in the general population of the variable X measured by the instrument. This Z-score reflects the distance of an individual from an average person. This should estimate finely how many patients have scores significantly far from the average. For example, with a 5% threshold, a Z-score greater than 1.96 in absolute value corresponds to an individual significantly different from the norm.

In addition to an analysis based on the standard available to the general population, the results will be compared to those obtained for children in the control groups. As we hypothesize that the psychoaffective development of children born by DSI whose father is a transgender man will not significantly differ from that of other groups, we need to ensure that the number of individuals included is high enough to ensure that if we had no difference between groups, the statistical power is sufficient. The minimum size of the sample was calculated to be able to show with an alpha error probability of 5% and a statistical power of 80% a significant difference between two groups on the CBCL, one of our main objectives. We used the Multicultural Supplement to the Manual for the ASEBA School-Age Forms & Profiles (28) baseline data that present means and standard deviations of the French population for each scale. We calculated for each scale the sample size needed using the statistical program R, version 3.3.1 (R Foundation for Statistical Computing) (29) with the formula n.for.2means (m1, m2, sd1, sd2, ratio, alpha, power). The minimum size ranged between 3 and 24 per group according to CBCL subscales. Only the CBCL total score required a minimum size of 38 per group. Therefore, to take into account missing data, we aimed to include approximately 45 patients in each group.

To explore more subtle differences between children born by DSI and a father of transsexual origin (female to male) and children born from natural conception, the protocol will include

an experimental procedure that was previously developed to explore how traumatic experience could be predicted without explicit information, through participants' responses to an experimental task using a permutation test (14, 15).

Here, the task we will propose to the children is the family drawing (27). We hypothesize that children born by DSI and transsexual fathers would be more likely during the family drawing test to use atypical representations (e.g., of men/fathers, of sexual indices). Raters with diverse experiences would eventually be in position to guess the children's group by viewing the drawings. To explore which experiences in raters may be helpful, the family drawings will be analyzed by 20 raters (4 child and family psychoanalysts (CHILDPSY), 4 adult psychiatrists (ADUPSY), 4 biologists working in assistive reproduction technology (BIOL), 4 endocrinologists working with transgender individuals (ENDOC) and 4 students (STUD)). They will be randomly shown the drawings and asked to blindly classify them according to whether the child had a transgender father using a four-level Likert scale. Differences between children's family drawings will be evaluated with a generalization of the "lady-tasting-tea" procedure to link qualitative and quantitative approaches in psychiatric research (14). Qualitative interviews will be conducted with the contributors if differences are found. Given that the family drawing is possible with children aged 4 years and older, we expect to recruit between 15 and 20 children per group for this task. **Table 3** enables power and sample size calculation.

DISCUSSION

As of today, we have no knowledge of an evidence-based study to assess whether new ways of parenting have any adverse impact on children. Nevertheless, such literature is essential, as physicians are currently confronted with transgender families on a regular basis. On the medical side, the results of this study, when completed, will provide a better understanding of the development of children born by anonymous transparents and will help increase knowledge about children born by DSI more generally. On the psychological level, the results will help to deepen our knowledge concerning the representation for the child of the father and the paternal function. The results could constitute support for reflection by ethics committees and doctors subjected to certain questions concerning the future of these children. This may also help general practitioners, child psychiatrists and psychologists take care of children born by these donations. The results of psychological assessments can be communicated to children and parents in accordance with the child's wish. If any problem is detected during the assessment of a child that could lead to identified care or require special precautions, parents will be informed. When appropriate, help by a trained psychiatrist or psychologist will be proposed to parents who wish to reveal to their child how they were conceived but are having difficulty doing this on their own.

TABLE 3 | Power and sample size calculation for the family drawing experiment [extracted from Falissard et al. (14)]

	n = 2 × 15	n = 2 × 20
k = 1	0.24	0.28
	0.5	0.62
	0.82	0.9
k = 2	0.34	0.40
	0.74	0.85
	0.97	0.99
k = 3	0.43	0.51
	0.87	0.95
	>0.99	>0.99
k = 5	0.58	0.67
	0.97	0.99
	>0.99	>0.99

Statistical power of the experimental procedure for three alternative hypotheses (sensitivity and specificity of raters equal to 0.6 (above), 0.7 (medium) 0.8 (below)) for n drawings scored by k raters (two-sided test with a type-1 error equal to 0.05).
Example: for n = 2 × 20 drawings scored by three raters, the statistical power is equal to 0.95 for the alternative hypothesis that the raters discriminate the two groups with a sensitivity and a specificity of 0.7.

Ethics and Dissemination

The study protocol was approved by the CERES (*Comité d'Ethique de Recherche en Santé*) of Paris 5 University. Registration number is 2015/31. Informed and written consent will be obtained from parents and children for participation in the study. Appropriate information will be provided to parents and the children or adolescents according to their age, orally up to 11 years old and with a written document for parents and for children and adolescents aged 12 to 15 years old.

When parents did not give their child born by DSI information about how he or she was conceived, we will respect their wish and will not reveal it. Children and adolescents will therefore be informed of the general objectives of the study in which they will participate but not of their status among the three possible groups. The information will be given to them as follows: "*Children are most often conceived by their parents, but parents may not be able to have children without the help of doctors. This research tries to find out if the way a child has been conceived can have effects on his psychological and emotional development.*" However, if parents manifest the wish to use these interviews to reveal to the child their mode of conception, we will propose accompaniment.

We seek to publish the results of our study when completed for peer review in an academic journal. Findings will also be presented to researchers and clinicians at suitable conferences.

ETHICS STATEMENT

The study protocol was approved by the CERES (Comité d'Ethique de Recherche en *en Santé*) of Paris 5 University. Registration number is 2015/31. Informed and written consent will be obtained from parents and children for participation in

the study. Appropriate information will be provided to parents and the child or adolescent according to their age, orally up to 11 years old and with a written document for parents and for children and adolescents aged 12 to 15 years old.

AUTHOR CONTRIBUTIONS

AC, DC, VD, and BF designed the protocol. AC, CL, JW, NM, JB, FM, and VD are in charge of the recruitment and assessment of the participants. AC, DC, VD, NG, and FA discussed ethical aspects and made the regulation submissions. GM, DC, AC, and BF designed the statistical analyses. GM, CL, AC, and DC drafted the first version of the MS. All authors approved the final version of the MS.

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