MENTAL STRESS AND BEHAVIOUR PROBLEMS AMONG SPECIAL GROUPS: SOCIAL RESOURCES, INFLUENCES ON HEALTH, AND REDUCING HEALTH INEQUITIES

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Longitudinal Effects of Stressful Life Events on Problematic Smartphone Use and the Mediating Roles of Mental Health Problems in Chinese Undergraduate Students

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Background and Aims: This three-wave longitudinal study investigated the effects of stressful life events on problematic smartphone use and the mediating roles of mental health problems (i.e., depressive symptoms, poor sleep quality, and suicidal ideation) in Chinese undergraduate students.

Methods: A total of 197 undergraduate students completed the three-wave surveys. Their severity of stressful life events, mental health problems, and problematic smartphone use were assessed.

Results: Regression analyses revealed that stressful life events at T1 was significantly associated with problematic smartphone use at T3. Mediation analyses showed that mental health problems (i.e., depressive symptoms, poor sleep quality, and suicidal ideation) at T2 fully mediated the association between stressful life events at T1 and problematic smartphone use at T3 (B = 0.042, 0.034, and 0.022, respectively).

Conclusions: The present study revealed that stressful life events and mental health problems (i.e., depressive symptoms, poor sleep quality, and suicidal ideation) are predictors of problematic smartphone use in Chinese college students.

Keywords: stressful life events, depressive symptoms, sleep quality, suicidal ideation, longitudinal study, problematic smartphone use

INTRODUCTION

Mobile media use has become a necessity of life around the world. Mobile phones expedite communication without restrictions due to physical contiguity or spatial fixation and empower users to perform a variety of online activities, like online e-meeting, online gaming, and other online services (1–3). In the past decade, the frequency of smartphone use among young people in Asia and Europe has increased dramatically (4). For example, as of July 2020, there were about

932 million smartphone users in China, of which 23.7 percent were students (5). College students are generally highly motivated to use smartphones and update them quickly, and they are also the fastest adopters and users of new applications and new programs (6). Recent researches show that college students generally own smartphones (7, 8), excessive use of a smartphone can lead to problematic smartphone use (9, 10).

Problematic smartphone use (PSU) refers to the excessive use of the smartphone or smartphone addiction in daily life, accompanied by dysfunction and symptoms similar to substance use disorder (11). PSU severity is associated with a wide variety of indicators, such as stress (10, 12, 13), symptoms of depression (12, 14, 15), poor sleep quality (15, 16), and suicidal ideation (17). However, most of this research is based on cross-sectional studies, with only a few longitudinal studies examining risk or protective factors predicting PSU symptoms over time. Given the negative consequences of PSU, it is crucial to explore the possible psychological mechanisms of PSU symptoms utilizing longitudinal designs.

Stressful life events refer to the things that compel people to make changes in their ongoing life patterns (18), such as study pressure, and interpersonal tension (19). Stress has been well-documented as a risk element in the development of addiction and the vulnerability to relapse (10, 12, 20), and stressful life events have also been considered important factors potentially contributing to the development of PSU (13). Some authors conceptualize PSU as dysfunctional coping with everyday life (10, 13). Smartphone use has become a convenient and popular means for stress relief, entertainment, and social connection in young people (8). Empirical studies revealed that stressful life events were positively correlated with problematic or addictive online behaviors, such as online gaming addiction, Internet addiction, and problematic smartphone use (13, 21, 22). Longitudinal studies have also demonstrated that problematic smartphone use can be predicted by stressful life events (13, 23).

Undergraduate students are at an important transitional stage and may face various new challenges, such as adjustment to college life, poverty, academic pressures, part-time work, and identity changes (24–26). These stressors might increase the risk of stress-induced mental health problems in undergraduate students, such as depression (27), poor sleep quality (28, 29), and suicidal ideation (30). There is good evidence that one of the most important risk factors for mental health problems is stressful life events (31, 32).

According to the Diathesis Stress Model of Depression, depression may be the result of the combined effect of stress and individual susceptibility to diathesis (33). Several studies have confirmed that there was a positive correlation between stressful life events and depression (34, 35), stressful life events is a risk factor for depression (36), and have a direct impact on individuals' depressive symptoms (37, 38). Longitudinal findings have also revealed that stressful life events can predict depression symptoms over time (13, 39).

Stressful life events may also reduce poor sleep quality. Sterling and Eyer (40) put forward the concept of the "unsteady state," whereby an organism's stress response is the process of reaching a steady-state again. However, in the case of severe and prolonged stress, this process will gradually become disordered and collapse, leading to an "unsteady state." Stress triggers the body's physical and mental responses, and these regulatory effects can affect sleep quality. Previous studies have demonstrated the positive association between stressful life events and poor sleep quality, including both cross-sectional studies (41) and longitudinal studies (28, 29).

Suicidal ideation refers to thoughts about suicide and serious self-injury behaviors; it is the pre-clinical stage of suicide and can predict suicide behaviors (42). The stress theory of suicide proposes that long-term stress or coping failure can also cause suicidal ideation or behavior; stressful life events are the most common stressors of suicidal ideation (43–45). People with suicidal ideation have often experienced major stressful, negative, or traumatic sexual events (46), especially in adolescents (44). Longitudinal research has also shown that stressful life events significantly predicted suicidal ideation (30).

Nowadays, the smartphone's small size and portability enable persons to constantly access online (and offline) content, potentially causing overuse (47). Individuals who experience affective mental health problems (such as depression, poor sleep quality, and suicidal ideation) are more likely to increase smartphone use in daily life (48, 49). Therefore, mental health problems are considered as the influential risk factors for PSU (11, 49, 50). Associations between mental health problems and PSU have been evaluated through several studies. For instance, a systematic review and meta-analysis has found that mental health problems were significantly linked to PSU (51). Some studies have also suggested that PSU can be predicted by depression (11, 14), sleep problems (50), and suicidal ideation (49).

Theoretical Framework

The Interaction of Person-Affect-Cognition-Execution (I-PACE) model (52) presents a comprehensive theoretical framework that attempts to explain the mechanism of Internet-related overuse. According to the I-PACE model, predisposing characteristics are important for PSU, such as personality, mental health (e.g., anxiety and depression), genetics, and biology in general; Cognitive and affective consequences are important influences, such as coping styles, executive impairment, mood dysregulation, and internet-related cognitive bias. The I-PACE model assumes that these cognitive and affective consequences involve responses to predisposing characteristics and can lead to healthy enjoyment through technology or excessive use, including PSU (9). Empirical studies suggest that mental health problems such as depressive symptoms, sleep quality and suicidal ideation are products of stressful life events (28–30), and they can lead to PSU (11, 49, 50). Based on the I-PACE model (52) and existing literature, mental health problems (i.e., depressive symptoms, sleep quality, and suicidal ideation) may play mediating roles in the association between stressful life events and PSU.

The Present Study

The three-wave longitudinal surveys of Chinese undergraduates were used in this study. We hypothesized that stressful life events at T1 would positively predict PSU at T3 (Hypothesis 1). **Figure 1** presents Hypotheses 1. Furthermore, we hypothesized

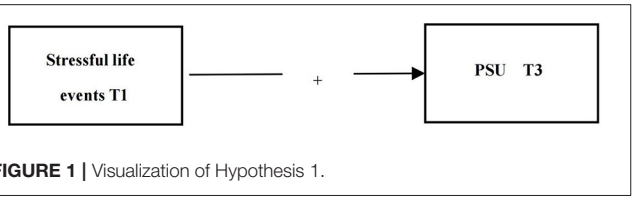

FIGURE 1 | Visualization of Hypothesis 1.

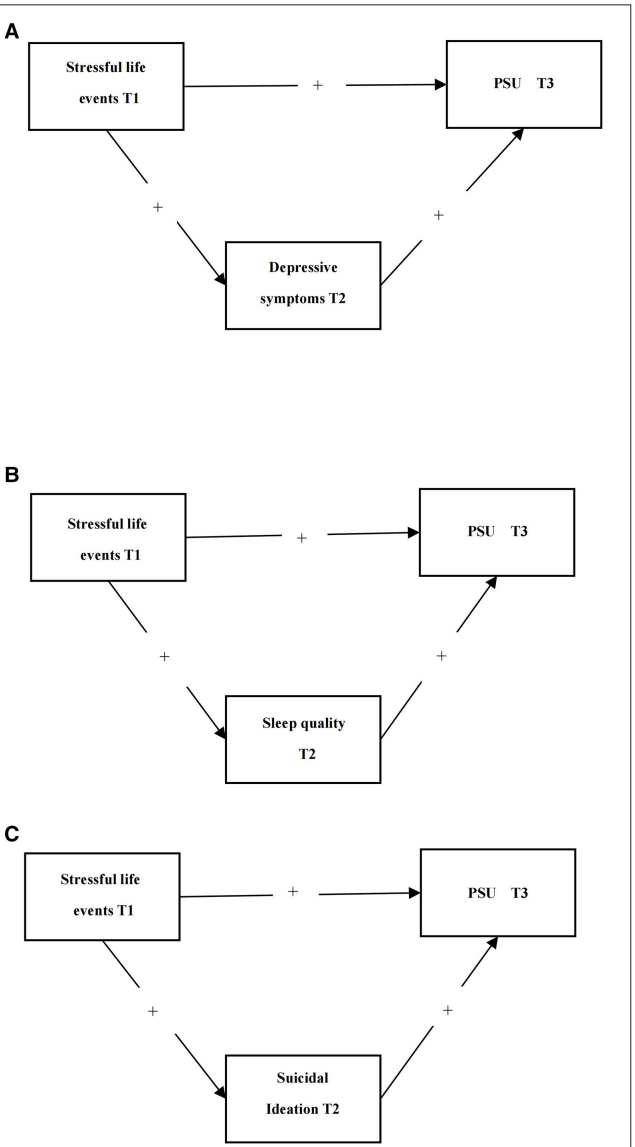

FIGURE 2 | Visualization of Hypothesis 2: **(A)** Hypothesis 2a; **(B)** Hypothesis 2b; and **(C)** Hypothesis 2c.

that depressive symptoms at T2 would mediate the positive relationships between stressful life events at T1 and PSU at T3 (Hypothesis 2a), and also proposes sleep quality at T2 would mediate the relationship between stressful life events at T1 and PSU at T3 (Hypothesis 2b), as well as suicidal ideation at T2 would mediate the relationships between stressful life events at T1 and PSU at T3 (Hypothesis 2c). **Figure 2** presents Hypotheses 2a, 2b, and 2c.

MATERIALS AND METHODS

Participants

Undergraduate students from Wenzhou Medical University in Wenzhou city, Zhejiang Province, China were the study samples. The inclusion criteria of this study were as follows: (1) willingness to participate in the baseline and follow-up surveys; and (2) having used a smartphone on an everyday basis in the past year. The study invited 219 students in four majors (i.e., Forensic Medicine, Stomatology, Anesthesia Medicine, and Traditional Chinese Medicine) to participate in the questionnaire surveys. A total of 212, 205, and 197 students completed the survey at baseline (T1; response rate: 96.8%), T2, and T3, respectively; 197 students completed all three waves of the survey. Of these 197 participants, 58.9% were female, 52.3% were from urban areas, 48.5% lived in the one-child family, and 58.6% spent more than 4 h a day on smartphones.

Materials

Adolescent Self-Rating Life Events Checklist

The 27-item Adolescent Self-Rating Life Events Checklist (19) was used to evaluate the intensity and frequency of stressful life events in undergraduate students in the past year. It is divided into six dimensions: learning pressure (e.g., heavy study burden), interpersonal relationship (e.g., discriminated against or ignored), punishment (e.g., criticized or punished), loss (e.g., friends and relatives died), health adaptation (e.g., being away from family for a long time), and other (e.g., a bad relationship or failure in love). Participants were told to recall whether such events had occurred during the preceding 12 months of their lives. If they answered "no, the score was 0; when answering "yes," they were required to assess the impact of the stressful life event from 1 (not at all) to 5 (very much), with higher sum scores (0–135) representing more experiences of stressful life events. The good reliability and validity of this scale have been shown in previous studies (53, 54), as well as in the current study (Cronbach's α T1 = 0.91, α T2 = 0.94, α T3 = 0.94).

Mobile Phone Addiction Index Scale

The Mobile Phone Addiction Index Scale (55) contains 17 questions, get adapted to measure the PSU. Eight items of Young's Internet Addiction Diagnosis Questionnaire (56) were adapted to form eight items (i.e., items 3, 5, 6, 7, 8, 10, 15, and 16) of this scale. An example item is "When you are feeling down, you play with your smartphone to improve your mood." Items are rated on a Likert scale ranging from 1 (never) to 5 (always), with higher sum scores representing higher levels of excessive smartphone use. The scale has been found to have good reliability and validity and to be suitable for assessing the excessive use of smartphones in Chinese populations (57). Reliability in the current study was good (Cronbach's α T1 = 0.85, α T2 = 0.88, α T3 = 0.91).

Center for Epidemiologic Studies Depression Scale

Depressive symptoms were assessed using the Chinese version of the 20-item Center for Epidemiologic Studies Depression (CESD) Scale (58) at T1, T2, and T3. The scale assesses

the current severity of depressive symptoms, emphasis is placed on the emotional component of depression (59). The CESD can be used to indicate possible depressive symptoms, and its outcome score is significantly associated with clinical assessment results (59, 60). Furthermore, possible depressive symptoms has been found to predict depression diagnosis (61). Over the past 7 days, participants scored on a 4-point scale from 0 (little or none) to 3 (almost all of all) on how often they experienced symptoms such as restless sleep and feeling lonely. Reliability in the current sample was good (Cronbach's α T1 = 0.90, α T2 = 0.92, α T3 = 0.89).

Pittsburgh Sleep Quality Index

The 18-item Pittsburgh Sleep Quality Index revised by Liu (62) was used to evaluate the sleep quality of the subjects for nearly 1 month. The scale measures the following seven factors, each factor is scored on a scale from 0 to 3, and the total score of all seven factors is the total score of the scale. The higher the score, the poorer the quality of sleep. An example item is "Have you had enough energy to do anything in the past month?" Because this scale has good reliability and validity, it is used to measure the sleep quality of Chinese populations (63). Reliability in this current study was acceptable (Cronbach's α T1 = 0.68, α T2 = 0.71, α T3 = 0.69).

Self-Rating Idea of Suicide Scale

The 26-item Self-Rating Idea of Suicide Scale was used to evaluate the suicidal ideation of undergraduate students (64). The 26 questions are used to assess the four following factors: despair (12 questions), optimism (4 questions), sleep (4 questions), and concealment (5 questions). Each item is scored as "yes" or "no"; For positive items, the score is positive, with a "yes" score of 1 and a "no" score 0, whereas for negative items, the score is reversed, with a "no" score 1 and a "yes" score 0. An example item is "I often feel pessimistic and disappointed." The scale has good reliability and validity and is suitable for measuring suicidal ideation in the Chinese population (65). Individuals with high levels of suicidal ideation scored high. If the masking factor (sometimes I also gossip about other people) score was ≥4, which indicates that the subject was unwilling, to tell the truth, the data were removed from the study. Reliability in this study was acceptable (Cronbach's α T1 = 0.67, α T2 = 0.72, α T3 = 0.71).

Procedure

The three-wave surveys were conducted at the end of each semester (December 2018/June 2019/January 2020) in the first year and the second year of college. All surveys were conducted in classroom settings. A well-trained and experienced research assistant explained to participants that their participation was voluntary, and refusal to participate would not result in any negative consequences. Data confidentiality was guaranteed and only the researchers could access the data. Student IDs were collected for data matching. Researchers were not able to access students' names or other identifying information. Participants who completed the study were paid 60 RMB (9.27 dollars).

Statistical Analyses

Statistical analyses were conducted with the Statistical Package for the Social Sciences 24 (SPSS, New York, NY, USA) and the PROCESS macro version 3.3 (www.processmacro.org/index.html) which the Process macro from SPSS. All variables of interest were normally distributed; the skewness and kurtosis of stressful life events, PSU and mental health problems (i.e., depressive symptoms, sleep quality, and suicidal ideation), fell within the acceptable range [i.e., skewness < |2.0| and kurtosis < |7.0|; (66)]. First, repeated-measures analyses of variance (within-subject ANOVAs) were applied to assess changes of the studied variables between T1, T2, and T3. Then, the correlations between all variables were investigated using zero-order bivariate correlations. Next, two-step hierarchical regression analyses (95% confidence intervals [CIs]) were performed to test the associations between independent variables and dependent variables. In the regression model, sex was included as a control variable in Step 1. In Step 2, stressful life events at T1 was entered as an independent variable, and PSU at T3 were entered as dependent variables (see Hypotheses 1). Finally, the mediation effects of mental health problems (i.e., depressive symptoms were tested using bootstrapping analyses (5,000 resamples) via Process (model 4; see Hypotheses 2a, 2b, and 2c) and 95% CIs are reported. Effect sizes (PM = the ratio of the indirect effect to the total effect) are also reported (67). Given the multiple testing, p-values were corrected by applying the Holm correction [level of significance: $p < 0.05$; (68)]. A priori power analyses (G*Power program, version 3.1) indicated that a sample size of at least $N = 86$ was required for valid results [Power >0.80, $\alpha = 0.05$; (69)].

RESULTS

We compared the characteristics of those who were followed up ($n = 197$) vs. those who were missing in the first and third follow-up surveys ($n = 15$). The two groups did not differ in socio-demographic characteristics (sex, age, and major) or the levels of the independent and dependent variables ($p > 0.05$).

As shown in **Table 1**, the levels of stressful life events, PSU, sleep quality, and suicidal ideation were significantly different. Namely, stressful life events and PSU were significantly lower at T2 and T3 than that at T1 (T2/T3<T1) ($F = 10.176$, $p < 0.05$; $F = 8.062$, $p < 0.001$). Sleep quality and suicidal ideation were significantly lower at T1 and T2 than that at T3 (T1/T2<T3) ($F = 88.370$, $p < 0.001$; $F = 296.026$, $p < 0.001$). The levels of depressive symptoms at T1, T2, and T3 were not significantly different ($F = 0.063$, $p = 0.802$).

Table 2 shows the correlations between the investigated variables at T1, T2, and T3. Stressful life events at T1 were significantly and positively associated with depressive symptoms, sleep quality, and suicidal ideation at T2, as well as PSU at T3.

TABLE 1 | Mean, SD, minimum, maximum, and repeated-measures ANOVAs (T1, T2, and T3) of all variables.

	T1		T2		T3				
	M (SD)	Min–Max	M (SD)	Min–Max	M (SD)	Min–Max	*F*	*p*	Partial η^2
Stressful life Events	30.05 (17.51)	0–103	25.46 (18.77)	0–98	25.84 (18.93)	0–102	10.176	<0.05	0.05
Depressive symptoms	14.63 (8.32)	0–41	15.36 (9.27)	0–43	15.87 (9.94)	0–50	0.063	0.802	0.00
Sleep quality	5.54 (1.98)	1–12	5.66 (2.40)	1–16	8.62 (2.49)	4–18	88.370	<0.001	0.31
Suicidal ideation	3.87 (2.78)	0–16	3.97 (2.87)	0–14	5.89 (3.32)	0–16	296.026	<0.001	0.60
PSU	48.27 (10.57)	17–74	44.72 (11.27)	16–73	46.06 (12.66)	17–85	8.062	<0.05	0.04

N, 197; PSU, problematic smartphone use; M, mean; SD, standard deviation; Min, minimum; Max, maximum; effect size, Partial η^2.

TABLE 2 | Correlations between variables at T1, T2, and T3.

	1	2	3	4	5
1. SLE T1	1	0.14*	0.28***	0.14*	0.17*
2. DST2		1	0.54***	0.53***	0.31***
3. SQT2			1	0.37***	0.26***
4. SIT2				1	0.39***
5. PSU T3					1

N = 197. SLE, stressful life events; DS, depressive symptoms; SQ, sleep quality; SI, suicidal ideation; PSU, problematic smartphone use.
****p < 0.001 and *p < 0.05.*

Regression analyses (**Table 3**) revealed that stressful life events at T1 was a significant predictor of the PSU at T3. These analyses revealed a predictive variance of 2.8% for PSU at T3.

Figure 3 shows the results of the mediation analyses. In the first model (**Figure 3A**), the total effect was significant (c: B = 0.168, $p < 0.05$), but the direct effect (c′: B = 0.126, $p > 0.05$) was not significant, which indicates that the depressive symptoms at T2 fully mediated the association between stressful life events at T1 and PSU at T3. The indirect effect (ab) was also significant (B = 0.042, 95% CI = [0.014, 0.098]; PM = 0.250); in the second model (**Figure 3B**), the total effect was significant (c: B = 0.168, $p < 0.05$), but the direct effect was not significant (c′: B = 0.134, $p >0.05$). This indicates that the sleep quality at T2 fully mediated the association between stressful life events at T1 and PSU at T3. The indirect effect (ab) was significant (B = 0.034, 95% CI = [0.003, 0.086]; PM = 0.202); In the third model (**Figure 3C**), the total effect was significant (c: B = 0.168, $p < 0.05$), but the direct effect was not significant (c′: B = 0.101, $p > 0.05$), which indicates that suicidal ideation at T2 fully mediated the association between stressful life events at T1 and PSU at T3. The indirect effect (ab) was significant (B = 0.067, 95% CI = [0.022, 0.124]; PM = 0.399).

DISCUSSION

The present three-wave longitudinal research was designed to examine the possible mediating roles of mental health problems (i.e., depressive symptoms, sleep quality, and suicidal ideation) at T2 in the linkage between stressful life events at T1 and PSU at T3 in a sample of Chinese undergraduate students. The current study is the first longitudinal study to highlight the significant mediating roles of mental health problems as a potential underlying mechanism that can explain the association between stressful life events and PSU. The results support our hypotheses.

We found that the levels of depressive symptoms at T1, T2, and T3 were not significantly different, while the levels of stressful life events, PSU, sleep quality, and suicidal ideation significantly changed over time. Exactly, the levels of stressful life events and PSU at T2 and T3 were significantly lower than that at T1, while the levels of sleep quality and suicidal ideation at T1 and T2 were significantly lower than that at T3. It is plausible that as students adjusted to college life and gained more access to different coping resources over time, they experienced fewer new stressful life events or were less likely to consider some events as stressful, and relied less on smartphones to cope with stress (70). Sleep quality decreased and suicidal ideation increased over time, which may be because of the pressures associated with graduation, job hunting, and lifestyle change as graduation approaches (71–73).

We found that stressful life events at T1 significantly predicted PSU at T3. Thus, Hypotheses 1 was supported. This finding corroborates the results of both cross-sectional (21, 74) and longitudinal studies (13, 23). Furthermore, our result is consistent with the I-PACE model (52). Stress is a hazardous trigger for problematic smartphone usage because it may reduce positive affect and impulse control and increase withdrawal in actual life, leading to passive stress coping, such as spending a great amount of time online to avoid real-life stress (75). Studying in universities, especially in the medical education environment is perceived to be stressful, and students may experience stressful events such as psychosocial and academic stress (76). In college students, the strong connection between stressful life events and problematic smartphone usage suggests that decreased stressful life events may decrease the risk of problematic smartphone usage. Smartphone addiction is not established in the study, but given the frequency of PSU amongst young people and its significant association with symptoms of common mental

TABLE 3 | Hierarchical regression analyses predicting PSU at T3.

	β	[95% CI]	*T*	Adjusted R^2	Changes in R^2
Step 1, $F_{(1,195)} = 8.895$, $p < 0.01$				0.007	
Sex	−0.112	[−0.511, 0.058]	−1.567		
Step 2, $F_{(2,194)} = 15.023$, $p < 0.001$				0.030	0.028
Stressful life events at T1	0.166*	[0.027, 0.305]	2.360		

N = 197. PSU, problematic smartphone use; In Step 2, only the newly included variable is presented. β, standardized coefficient beta; CI, confidence interval.
*$p < 0.05$.

disorders (51), the potential causative factors of PSU require urgent further exploration.

The direct association between stressful life events at T1 and PSU at T3 was not significant when the mediator depressive symptoms were inserted into the linkage, revealing that depressive symptoms fully mediated this relationship. The result is consistent with the Diathesis Stress Model of Depression (33) and the I-PACE model (52), and corroborates the prior research (13, 77, 78). This finding suggests that stressful life events might exacerbate the level of depressive symptoms (34), and in turn increase PSU levels (14, 79). One possible reason is that stressful life events experienced by college students may lead to depressive symptoms (34), and individuals with depressive symptoms may rely on surfing the internet to alleviate their negative emotions (14). Furthermore, we found that sleep quality at T2 fully mediated the association between stressful life events at T1 and PSU at T3, which is consistent with "unsteady state" (40) and expanded the I-PACE model (52). That is, individuals who experience stressful life events are more likely to unable to fall asleep on time, their sleep problems are more serious (29, 41), such as lack of sleep and have difficulty in sleeping. In turn, people who have sleep problems are more likely to use mobile phones to kill time or seek to satisfy sleep problems caused by the tired, anxious, and daytime dysfunction of negative feelings, making individuals more willing to focus on mobile phones and increasing the time spent using mobile phones, thus leading to PSU (50). Suicidal ideation at T2 fully mediated the association between stressful life events at T1 and PSU at T3, which is consistent with the stress theory of suicide (44) and enriched the I-PACE model (52). That is, stressful life events may lead to suicidal ideation (30), and the anonymity of the Internet and the diversity of information can help them seek social support to alleviate or eliminate suicidal ideation (80), but misuse or overuse of smartphone may lead to PSU.

In general, the results suggests that mental health problems (i.e., depressive symptoms, sleep quality, and suicidal ideation) are important mediators in the relationship between stressful life events and PSU. Previous studies have shown that different types of stressful life events have different effects on mental health problems. For example, some studies have found that interpersonal stress and academic stress are associated with depressive symptoms, sleep quality, suicidal ideation, and PSU (81–83); another study showed that punishment significantly predicted depressive symptoms, but have no effects on poor sleep quality and suicidal ideation (84). Future research should examine the effects of specific types of stressful life events on different mental health problems.

Implications

The results of this study have some important implications. First, these findings show that stressful life events may influence mental health problems in undergraduate students. Undergraduate students are faced with academic, lifestyle, and interpersonal pressures; thus, reducing the frequency and severity of stressful life events faced by undergraduate students early on could help to reduce future mental health problems (27, 29, 30, 34, 39). Second, by establishing mediation models, our findings can help practitioners understand the longitudinal relationship between stressful life events and PSU, and could aid the development of potential interventions. For example, implementing methods to enhance stress relaxation and adaptive stress coping skills, and increasing offline social support could help to reduce mental health problems and enhance sleep quality in undergraduate students, thereby reducing the negative effects of problematic smartphone use.

Limitations and Further Research

The limitations of this study are as follows. First, it may not be conducive to the generality of the results of this study due to the convenience of sampling, and future studies could use random sampling methods to obtain more objective results. Second, the self-reported measures may be biased by self-evaluation, and further research could collect data from multiple resources (e.g., peers, parents, and teachers) to validate the present findings. Third, PSU and suicidal ideation were not assessed using diagnostic tools, future studies could test our models with clinical samples (such as smartphone addiction or Internet addiction). Fourth, different stressful life events may have different influences on undergraduate students' mental health problems. Future research should investigate the influences of different sorts of stressful life events on undergraduate students' mental health problems. Fifth, the reliabilities of the Pittsburgh Sleep Quality Index (0.68, 0.71, and 0.69) and the Self-Rating

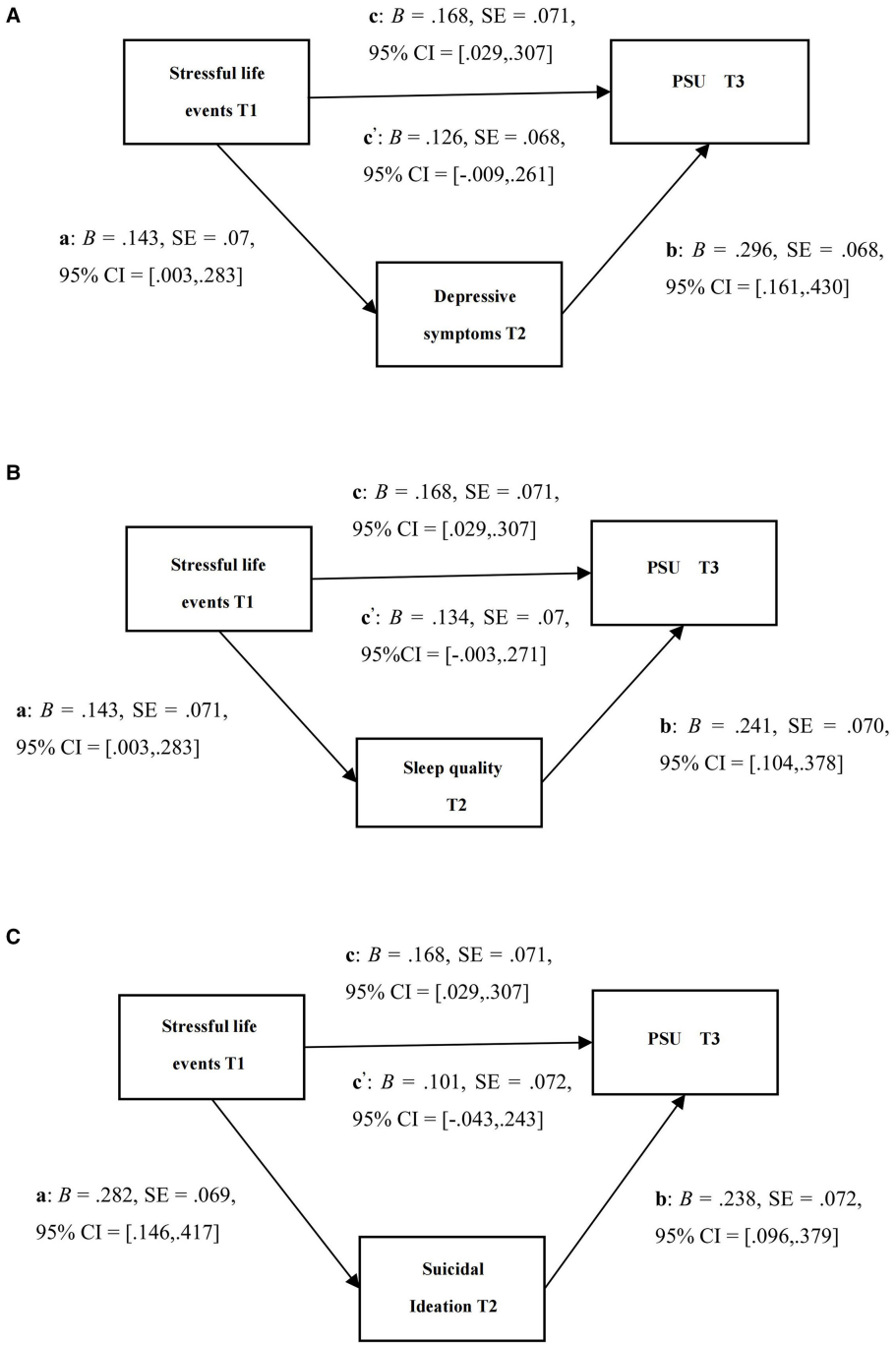

FIGURE 3 | (A) The mediation model including stressful life events at T1, depressive system at T2, and PSU at T3; **(B)** The mediation model including stressful life events at T1, sleep quality at T2, and PSU at T3; **(C)** The mediation model including stressful life events at T1, suicidal ideation at T2, and PSU at T3. Note c: total effect, c′: direct effect; b: standardized regression coefficient, SE: standard error, CI: confidence interval.

Idea of Suicide Scale (0.67, 0.72, and 0.71) were relatively low. Sixth, SEM was not used in this study to test the longitudinal relationships, which should be considered in future studies. Finally, measurement invariance is not taken into account when comparing mean values, which needs to be taken into account in future studies.

CONCLUSION

The present study revealed that stressful life events and mental health problems (i.e., depressive symptoms, sleep quality, and suicidal ideation) are risk factors for PSU, and that mental health problems (i.e., depressive symptoms, sleep quality, and suicidal

ideation) at T2 mediated the relationship between stressful life events at T1 and PSU at T3.

DATA AVAILABILITY STATEMENT

The datasets in the study are available from the corresponding author on reasonable request. Requests to access these datasets should be directed to zghcnu@wmu.edu.cn.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of the Wenzhou Medical University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

XY and GZ prepared the study concept and design. CZ wrote the main manuscript text, analyzed the data, and edited the draft. HX, XL, XT, and ND conducted investigation and data curation. YL, DX, and GZ provided funds to conduct the study. All authors had full access to all data in the study, and take responsibility for the integrity of the data and the accuracy of the data analysis. All authors have approved the final version of the manuscript.

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Appropriate Strategies for Reducing the Negative Impact of Online Reports of Suicide and Public Opinion From Social Media in China

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Suicide events may have a negative impact on all of society. The media plays a significant role in suicide prevention. Therefore, the aims of this study are (a) to understand the association between characteristics of suicide events and characteristics of who committed suicide, and event impact indexes (EIIs) of suicide reported on the internet; (b) to analyze violation of recommendations for reporting suicide by Weibo, and (c) to investigate the effect of online reports of suicide on public opinion. We carried out a content analysis of online reports of suicide. This study analyzed 113 suicide events, 300 news reports of suicide, and 2,654 Weibo comments about suicide collected from the WeiboReach between 2015 and 2020. We used a *t*-test and analysis of variance (ANOVA) to explore the potential factors associated with the EIIs of suicide events. The results found that (a) The suicide events reported on the internet during COVID-19 and those related to celebrities and students tend to have higher EIIs; (b) suicide reports on Weibo frequently violated WHO recommendations for suicide reporting in the media; and (c) public opinion of suicide reporting in the online media was mostly emotional and irrational, which is not beneficial for public mental health and suicide prevention. In conclusion, first, the situation of many people working from home or studying from home and spreading more time online during COVID-19 may lead to suicide events obtain more public attention. Online media could further improve public responsible reporting and daily media-content surveillance, especially taking particular care in those suicide events during COVID-19, and related to celebrities and students, which may have a higher event impact on the internet. Second, health managers should regular assessment of observance of the WHO recommendations for suicide reporting by online social media to prevent suicide. Third, health communication managers should use big data to identify, assess, and manage harmful information about suicide; and track anyone affected by suicide-related reports on social media to reduce the negative impact of public opinion to intervene suicide in the early stage of suicide.

Keywords: online media, suicide reporting, public opinion, negative impact, China

INTRODUCTION

Suicide is now a major public health problem. According to the World Health Organization (WHO), every year, more than 700,000 people die by suicide; that's one person every 40 s. Suicide occurs in all regions of the world, especially in developing countries (1). Some developing countries, including China, have experienced rapid economic development and social change. Such developments have produced higher social competition and the acceleration of the pace of life, which has caused people's work pressure, study pressure, and life pressure to increase. Nearly 40% of suicides each year occur in China or India (2). In China, every 2 min, one person dies by suicide and 8 people attempt suicide (3). Suicides have a strong impact on families, communities, and societies. Nearly 1.5 million people suffer long-term and severe psychological trauma every year due to suicide by family members or friends (3). Taking appropriate strategies to reduce the negative impact of suicide and public opinion toward suicide events is critical to achieving the optimistic situation for suicide prevention.

Due to rapid digitalization, there is a recent surge in online media reports of suicidal events. Increased social media/internet use was associated with suicide attempts (4). A previous study found that media reporting of suicide was related to an increase in actual suicide (5). The media plays a significant role in suicide prevention. Low-quality suicide reporting may harm the public and even lead to copycat suicide behavior. Repetitive reporting about the same suicide events and the reporting of suicide myths lead to an increase in suicide rates (6). The phenomenon of media suicide reporting increasing the risk of suicide is known as the "Werther Effect." The coverage of online media reports of suicide is extensive and prominent, and they may report suicide in an exaggerated and overly-detailed manner. These features make online reports of suicide receive more attention from the public, especially vulnerable individuals. According to social learning theory, the public may learn the solution of personal problems by suicide and then adopt suicidal behavior (7). The appropriate strategy for reducing the impact of harmful information about suicide events on netizens and enhancing the online media's responsibility for suicide reporting is needed for suicide prevention.

Explore the Potential Factors Associated With the Communicate Effect of Online Suicide Events

Based on social cognitive theory, the four major subfunctions governing observational learning include attentional, retention, production, and motivational processes (8). The attentional process is the first step of observational learning. A previous study found that subsequent online suicide-related search behaviors may increase among the general population in the weeks following celebrity suicide (9). Suicide events with high communication effects would be are easier to be seen by the public, and then generate copycats. Based on agenda-setting theory, those suicide events with high influence levels can enter into the hot search list. Therefore, it is important to investigate the association between the characteristic of suicide events and the communication effect of suicide events on the internet.

Previous studies have found that the characteristics of suicide events, including the gender, age, and social identity of the deceased, as well as suicide method, suicide-related headlines were associated with copycat suicides (10, 11). The celebrity status of the deceased is associated with an increased risk of a post-report increase of similar suicides (10–12). Thus, this study focused on the effect of the social identity of suicide on the communication effect of online reported suicide-related events.

In addition, the COVID-19 pandemic has affected all people across the globe. Mental stress has become a serious global public health issue, accentuated by the COVID-19 pandemic (13, 14). Mental health symptoms in China during the COVID-19 pandemic are prevalent (15). Some studies found that there were increased event rates for suicidal ideation, suicide attempts, suicidal behavior, and self-harm during the COVID-19 pandemic (16, 17). Besides, many people work from home or study from home during the COVID-19 pandemic. We may spend more time on the internet. Therefore, this study explored whether the communication effect of online suicide events has increased during the COVID-19 pandemic.

The event influence indexes (EIIs) are authoritative indexes to portray the communication effect of a single event on the internet, which is based on social media and network media data for the whole network. The first aim of our study was to explore the potential factors associated with the event impact indexes (EIIs) of suicide reported on the internet.

Analyze Violations of the WHO Media Guidelines of Suicide-Related Reporting

Internet use is also widespread in China. As of June 2020, the number of internet users reached 940 million, accounting for ∼67% of the country's total population (18). The number of internet users was positively associated with suicide rates in the general population (19). In addition, mobile access has become widespread, and 99.2% of internet users use mobile phones to surf (18). The average online time per person reaches 28.0 h per week (18). The internet, especially smartphones, has become the main channel through which most people obtain news and information in China. Social media can make the public more sensitive to external stimuli (20). One study revealed that suicide prevention programs need to target internet users in China (21). A previous study has explored the responsibility of online suicide stories in China from 2003 to 2015 on some newspapers and some internet-based media sources (22). It is also critical to focus on analyzing the quality of suicide-related reporting in social media platforms in China.

Sina Weibo, which emerged in 2010, has been a leading Chinese online social network (OSN), just like Facebook in other countries. There were more than 516 million active daily users by the end of 2019. Sina Weibo has distinctive characteristics of online media. These users use Weibo functions (e.g., like, @, tick, forward, comment function) to interact with each other in real-time. Sina Weibo data are emerging as a key online medium and data source for researchers to understand social problems in a

non-invasive way. As the number of netizens and Sina Weibo users in China has been increasing, this study would assess the use of media reporting recommendations in suicide news items during 2015–2020 in Sina Weibo. Therefore, the second aim of this study was to analyze violations of the WHO media guidelines of suicide-related reporting by Sina Weibo.

Investigate Public Opinion Toward Online Reports of Suicide

The situation of suicide topics discussed and communicated in the online media may lead to public negative moods increase, and more people obtain information about suicide methods (23). We need to explore measures to avoid this bad situation. The internet provided new channels for news reporting and created opportunities for the public to express their opinions and attitudes instantly through readers' comments (24). People express a higher degree of their attitude and emotion in social media than in face-to-face settings (25, 26). Therefore, analyzing readers' comments on online suicide-related news reports can provide valuable information about people's opinions and emotions.

At present, the public opinion of online media in China has the characteristics of original content, shock effects, zero cost, and diversification of subject and word expression (27, 28). The benefit of public opinion topics and the polarization effect make it easy for online public opinion to influence actual personal behaviors. If these behaviors are negative, they may cause very serious consequences to society. Sina Weibo can set the top trending searches according to the level of attention of the event. These events that arouse more attention and discussion will be ranked in the top rank of searches to attract wider attention and discussion, thereby generating a strong public opinion effect. However, few studies focus on the public opinion of online reports of suicide in Weibo in China.

Suicides among different social identities may have a varied influence on the subsequent suicides and public emotions. Unfortunately, it is unclear how the public's expression of social, emotional, and cognitive psychological responses to reports of suicide differ based on the social identities of the deceased. Thus, the third objective was to investigate the negative effect of public opinion toward online reports of suicide across different social identities of the deceased.

MATERIALS AND METHODS

Data Source and Procedure

The Process of the Collection of Online Reported Suicide-Related Events

Data were derived from the Harbin Institute of Technology Joint Laboratory for social networks and a data mining research team named WeiboReach, which is one of the most advanced new media (including Weibo, Wechat, and other online media) news propagation analysis tools in China.

To obtain online reported suicide-related events, this study firstly determined keywords. The people who committed suicide, the location of the suicides, and the cause of suicides are always various, while the methods of suicide are common. When reporting suicide-related events, people may pay attention to the method and then lead to copycat suicide. Thus, the keywords in this study included the word suicide itself and other keywords derived from suicide, and many suicide methods. The suicide methods referred to a previous study and an integrated national mortality surveillance system for death registration and mortality surveillance in China (29, 30). Keywords in this study included "suicide, commit suicide, exclusion of homicide, hanging, charcoal burning, jumping, high fall, slitting wrists, sleeping pills, drugs, cutting the neck, jumping into the sea and throwing into the lake." These keywords were related to suicidal behavior that was commonly reported in the news. This study applied these keywords in Chinese to obtain events that contain these keywords in the event titles in the WeiboReach database from 2015 to 2020 by a keyword maximization search method. WeiboReach database contains popular, classic, and influential events in the Chinese public opinion environment. Those events included corporate events, social events, and other types of events data. Finally, a total of 175 suicide-related online events were retrieved from 2015 to 2020 in the WeiboReach database.

Selecting Online Suicide Events for Analyzing Potential Factors Associated With the EIIs

This study included a total of 113 suicide events after excluding duplicate events and non-suicide events. We explored the potential factors (including characteristics of suicide events and characteristics of who committed suicide) associated with the EIIs among the 113 suicide events by single-factor analysis.

Collecting Suicide News to Understand the Situation in Violation of Recommendations for Reporting Suicide

We ranked the 113 online suicide events by EII. The top 30 suicide events with the EII more than 65 can include as many social identities of people who committed suicide as possible, such as celebrities, officials, entrepreneurs, students, and the general population. Since the EII of an event exceeds 65, some institutions would perform emergency management for this event (31). Therefore, the top 30 suicide events were selected for further detailed analysis.

According to the "top 10 effects" of public opinion in the cyberspace of the mainland of China, the opinions and comments of the top 10 netizens determine dozens or even hundreds of subsequent opinions and comments on certain news or social phenomena on the internet, thus forming an online public opinion (32). This study collected the top 10 most popular Sina Weibo news items for each of the 30 suicide events with high EII, based on a combination of web crawler for the Sina Weibo platform and Sina Weibo API (Application Programming Interface). Therefore, a total of 300 Sina Weibo suicide-related news reports were included. We analyzed the current situation in non-observance of the six do nots and observance of the six dos in Weibo suicide-related news reporting.

Collecting Weibo Comments to Analyze Public Opinion

The top 10 most popular Sina Weibo users' comments were collected below each of the above 300 Sina Weibo suicide-related news items, based on the combination of web crawler

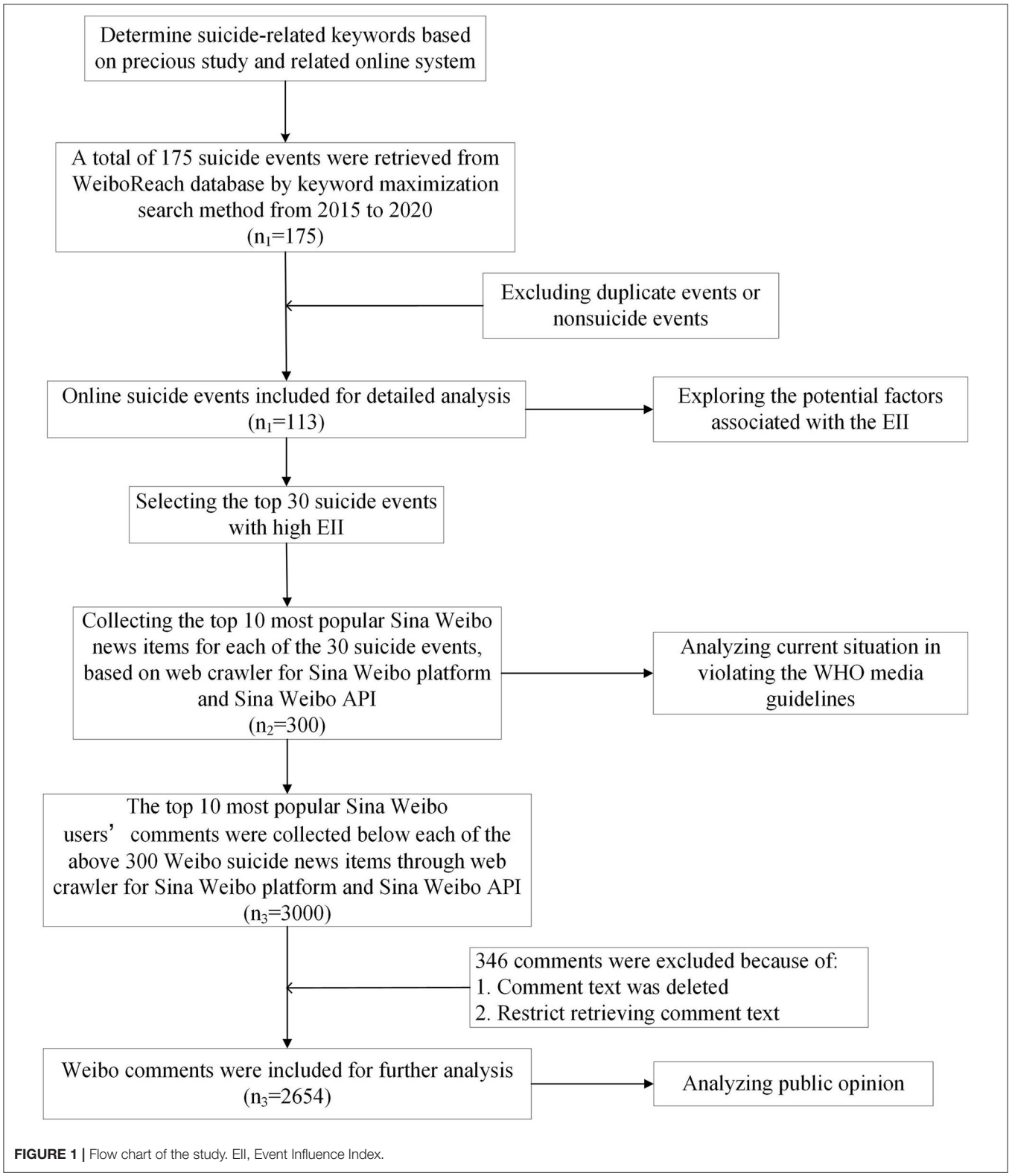

FIGURE 1 | Flow chart of the study. EII, Event Influence Index.

for Sina Weibo platform and Sina Weibo API. Since some comments were deleted and could not be retrieved, a total of 2,654 comments were included in this study. We further analyzed public opinion by different social identities of the deceased using quantitative content analysis. **Figure 1** shows the flow diagram used in our study.

The Measurement of the Event Influence Indexes

The EIIs can be used to portray the communication effect level of events. The communication effect level was calculated by taking into account the position of the keywords (i.e., Weibo headline or Weibo posts content), the weight of communication channels (i.e., Weibo, WeChat, and other online media), and the weight of event attributes. The communication effects of events on social media and online media were summarized, and then, the event influence was normalized to obtain the EIIs, which ranged from 0 to 100. One study has verified the effectiveness of the method of quantifying online events dissemination (33). The previous study also used EII to understand the communication effect level of events (31).

Data Analysis

First, content analysis was conducted on 113 online suicide events reporting text since it analyzes qualitative data by statistical formalism. The researchers carried out coding of suicide reports based on a preliminary draft coding manual. The coding involved the characteristics of suicide reporting, including time of suicide, first news release channel, the identity of first reporting on Weibo, the social identity of people who committed suicide, whether committed suicide was a student, gender of the deceased, age of the deceased, whether others were injured, suicide method, suicide location. After conducting descriptive statistics on the abovementioned data, we also carried out an analysis of variance (ANOVA) and *t*-tests to explore the relationship between different characteristics of suicide and the EIIs of suicide. Second, we further coded violations of the WHO media guidelines for 300 suicide-related news items between 2015 and 2020. Then, we calculated the violation rate, which was defined as the proportion of the number of news items violating the guidelines. Finally, to analyze the effects of suicide-related reporting on public opinions, we organized the psychological impact and coping patterns of netizens for the social identities of those who committed suicide using Weibo comments. The social identities of celebrities accounted for 10 of the 30 suicide events analyzed, students accounted for 9, and general people accounted for 11.

We used Microsoft Excel (Microsoft Corporation) and SPSS software 21.0 (SPSS Inc.) for statistical analyses, and $P < 0.05$ was considered significant.

RESULTS

The Association Between Characteristics of Suicide Events and Characteristics of Who Committed Suicide, and Event Impact Indexes

Table 1 shows the relationship between characteristics of suicide and EIIs of suicide events reporting on the internet. The characteristics of suicide events in our study included event time, first releasing channel, cause other deaths or victims, suicide method, suicide site, and identity of the first reporter on Weibo. Of the 113 suicide events, 74 occurred before the COVID-19 pandemic, with a mean value of 58.52 for the EII, while 39 occurred during the COVID-19 epidemic, with a mean value of 63.88 for the EII. The EII was significantly higher during the COVID-19 epidemic than before ($P = 0.017$). The relationships between other characteristics of suicide events and EIIs of suicide events were not statistically significant.

In addition, the characteristics of those who committed suicide included their social identity, gender, age, and country. The mean value of the EII for suicide events reporting the social status of the deceased as a celebrity was 64.47, while the mean value of the EII for students was 62.57 and the general population was 56.31. The social identity of the deceased was related to the EIIs of suicide events ($P = 0.012$). The results of *post-hoc* tests showed that the EII of suicide events related to celebrities and students was higher than that of the general population. Besides, there were no statistically significant associations between other characteristics of who committed suicide and EIIs of suicide events.

In summary, the suicide event time, and the social identity of the deceased were significantly associated with EII. The suicide events reported on the internet during COVID-19 and those related to celebrities and students tend to have higher EII.

The Rate of Online Reports of Suicide Violating the WHO Media Guidelines Between 2015 and 2020

Figure 2 shows the proportion of violations of the WHO media guidelines by Weibo news. Violations of don't number 1 (Avoid prominent placement and unique repetition of stories about suicide) were most severe. The number 1 don't was observed in all 300 Weibo suicide-related news items. Approximately 51% of the online reports violated the number 5 don't of "Avoid sensational headlines." Some of these reports included the word suicide in the headline, and others included the suicide method and the site of a suicide. Approximately 46.3% of Weibo news violations were related to don't number 3 (Avoid explicit description of the method used in a completed or attempted suicide), and 39.3% of violations were related to don't number 6 (Avoid using photographs, unedited video footage or links to electronic media).

In terms of the rates of violating the WHO list of dos for suicide reporting by Weibo news, the results showed that none of the news items observed the number 1 do (Provide information about where to seek help), number 2 do (Take the opportunity to educate the public about suicide and suicide prevention, without spreading suicide-related gossip) or number 3 do (Provide information on how to cope with life stress or suicidal thoughts and on helplines). Forty percent of the celebrity stories violated number 4 do (take particular care in reporting celebrity suicides). These Weibo reports described the site and method used in suicides among celebrities.

The Public Opinion Toward Online Reports of Suicide Events

To understand the public opinion toward suicide events based on different social identities of the deceased, we conducted text

TABLE 1 | Relationship between characteristics and EII of suicide reports on the internet ($n_1 = 113$ suicide events).

	No. of events	Mean of EII	*t* or *F*	*P*
Characteristics of suicide events				
Events time[c]			2.415[a]	0.017*
Before COVID-19	74	58.52		
During COVID-19	39	63.88		
First releasing channel			−1.285[a]	0.202
Weibo	29	63.14		
WeChat or other online media	84	59.41		
Other deaths or victims caused by suicide deceased			0.385[a]	0.701
No	89	60.11		
Yes	24	61.31		
Suicide method			0.560[b]	0.573
Falling	48	59.90		
Hanging	15	63.82		
Others	50	59.77		
Suicide site			1.117[b]	0.331
Home, hotel, apartment, rental house	31	62.72		
School	15	62.53		
Others	67	58.79		
Identity of the first reporter on Weibo			0.432[a]	0.668
Blue V	73	63.71		
Yellow V	32	62.65		
Characteristics of who committed suicide				
Social identity			4.598[a]	0.012*
Celebrity	37	64.47	(C, S > G)	
Student	25	62.57		
General people	51	56.31		
Gender			0.003[b]	0.997
male	58	60.40		
female	41	60.25		
Unknown or multi-person	14	60.57		
Age			0.377[b]	0.687
Up to 44 years old	76	60.24		
45∼59 years old	17	58.54		
Unknown or multi-person	20	62.39		
Country			−1.257[b]	0.211
China	94	59.65		
Others	19	63.92		

*[a]The value of t, [b]The value of F; [c]As for the events time, if online reported suicide events occurred from January 1, 2015, to December 30, 2019, was defined as "Before COVID-19"; and events occurred after December 31, 2019, was defined as "During COVID-19." *P < 0.05. We used post-hoc tests by Student-Newman-Keuls (SNK). Blue V represents the official authority, which is a logo that can only be certified by large organizations such as governments, businesses, schools, and media. Yellow V represents individual bloggers with more than 10 million readers per month.*

content analysis using Weibo comments below the top 300 most popular Weibo news items of 30 suicide events with higher EII. **Figure 3** shows the effect of high EII suicide-related news on public opinion and positive coping patterns of netizens by different social identities of the deceased, such as celebrities, students, and the general population. This study found that suicide reporting raised great public attention and negative sentiment on the internet in China. Netizens showed excessive blame for the deceased, people bereaved by suicide, and others related to committed suicide and discussed the cause of death regardless of the social identity of the deceased.

When the deceased person was a domestic or international celebrity, netizens feel shocked, sad, nostalgic, regretful, and unacceptable. Some people empathize with the deceased. People may sensationalize or normalize suicide online reports of suicide among celebrities. Suicide among celebrities makes some people heroize suicide, which in turn can lead to copycat suicides. If the deceased is an official and the cause of suicide is related to work, netizens would be interested in the cause of death and expect to determine the truth.

The public tends to object to blame the teachers, parents, and schools of the deceased, and they may even blame the

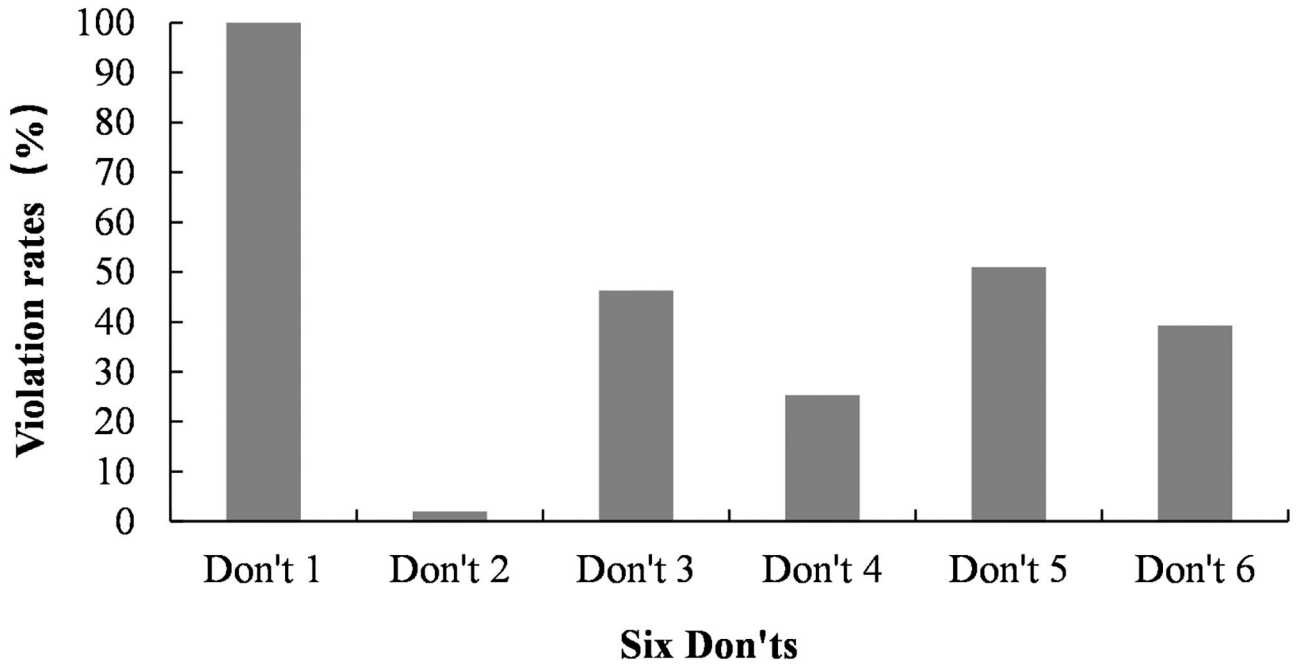

FIGURE 2 | Violation of the WHO recommended list of suicide reporting on Weibo ($n_2 = 300$ Weibo news items). Don't 1: Avoid prominent placement and unique repetition of stories about suicide; Don't 2: Avoid language which sensationalizes or normalizes suicide, or presents it as a solution to problems; Don't 3: Avoid explicit description of the method used in a completed or attempted suicide; Don't 4: Avoid providing detailed information about the site of a completed or attempted suicide; Don't 5: Avoid sensational headlines; Don't 6: Avoid using photographs, unedited video footage, or links to electronic media.

government, rumors, and netizens. In response to comments blaming teachers, netizens condemned online violence. If Weibo published news about a student dying by suicide due to social interaction, the public blames the deceased and their lovers. Public opinion tended toward grief and violence.

In terms of suicide events among the general population, netizens sympathize with people bereaved by suicide and innocent people who are victims or dead caused by the suicide event. For childhood suicide due to family factors, people sympathize with the deceased and blame their guardians. Netizens also posted extreme and violent comments. Moreover, people may interpret suicidal behavior through the lens of religious or cultural stereotypes. Online reports of suicide may lead to suicidal ideation among the general public.

Overall, the majority of public opinions about online reports of suicide were emotional and irrational, which are not conducive to the psychological health of netizens. However, when committed suicide is a celebrity, netizens develop positive coping patterns to prevent suicide. Netizens actively call for suicide prevention and hope that they will be happy in the next life. If the media reports that a student's suicide was due to academic factors, netizens would post comments that favor suicide prevention and suggest that suicide is not a solution to problems. Some netizens also call for education system reform, improvement of the law, and hope to formulate policies to ensure the virtue and responsibilities of the teachers.

DISCUSSION

To understand how to reduce the negative impact of suicide-related reporting and public opinion, this study not only investigated the associated factors with the impact index of suicide events but also assessed the quality of suicide-related reporting by indicators of harmful information and helpful information according to the WHO guidelines by Weibo using suicide events with high EIIs. Then, we further explored the specific connotation of online public opinion about suicide-related reporting and the unique psychological impact of current emotional and irrational online public opinion on the public by analyzing big data on Sina Weibo users' responses.

Focusing on Reducing the Communication Effect of Suicide Reports and Paying More Attention to Vulnerable People During COVID-19

Traumatic events such as the current COVID-19 pandemic undoubtedly affect all demographics of people. People were more sensitive to negative events during critics. A previous study found that several anticontagion policies were associated with search interest levels for the term "suicide" in the online media (34). This study found that the impact indexes of suicide events were higher during COVID-19 than before COVID-19 the pandemic. The event impact indexes could portray the communication effect of an event on the internet. Thus, this study verified that

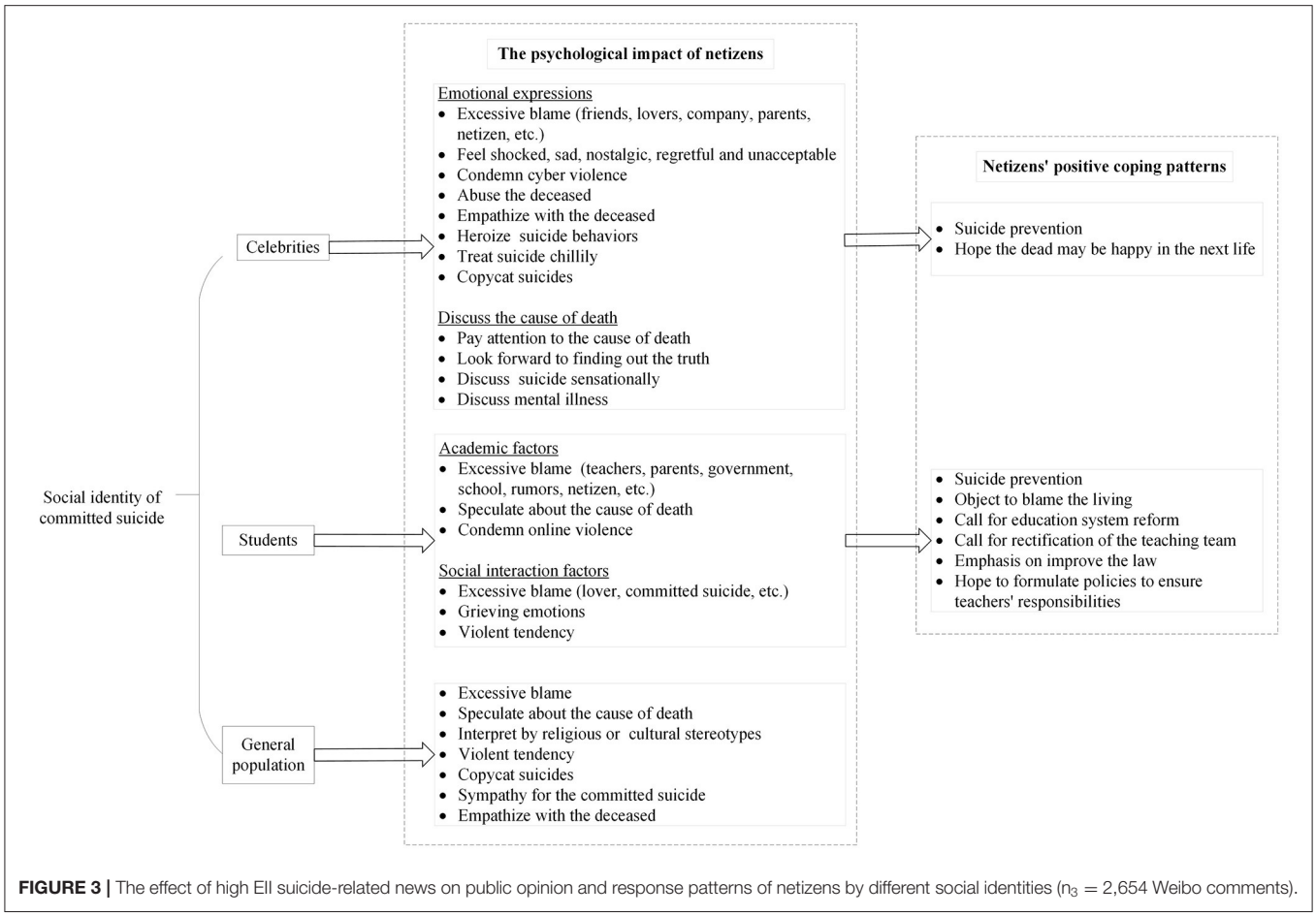

FIGURE 3 | The effect of high EII suicide-related news on public opinion and response patterns of netizens by different social identities (n_3 = 2,654 Weibo comments).

online suicide events spread more widely during COVID-19. The current COVID-19 pandemic has the potential to cause mental instability. During the pandemic, people have been experiencing psychiatric disorders, such as fear (35, 36), stress, anxiety (37), disappointment, irritability, depressive disorders, and even suicide (38). The COVID-19 pandemic also has a dynamic impact on suicide probability (39). This study indicated that we could take steps to reduce the spread of suicide reports during COVID-19. Health communication professionals also need to pay more attention to vulnerable people with psychiatric problems during the COVID-19 pandemic.

Taking Particular Care in Reporting Celebrity and Student Suicides

As for the relationship between characteristics of who committed suicide with the communicate effect of online reported suicide events, this study found that celebrity suicides were often regarded as being high impact indexes. The result was consistent with a previous study (40). Celebrity suicides are newsworthy, and reports of these events are more widespread. The celebrity status of the deceased tends to be an important driver of online engagement (41). Based on vertical identification theory (42), people tend to identify with those celebrities. In particular, suicide by entertainers with a large fan base has been found to draw more public attention and then trigger copycat effects. In addition, this study also found that student suicide generated more influence levels on the internet. The media prefer to report suicides among younger individuals and underreport suicides among those in late life (43). Suicide is the fourth leading cause of death among 15- to 29-year-olds globally (1), making it a serious global public health problem. Student suicides lead to a huge shock among families, schools, and society. However, only suicides generating a large amount of media coverage and a strong reaction on social media were followed by an increase in suicide rates (26, 44). To reduce the negative impact of online reports of suicide on the community, media professionals should take particular care in reporting celebrity and student suicides.

Improving Responsible Suicide Reports and Providing Suicide Prevention Measures on the Social Media Platform

The WHO has provided a resource for media professionals about how to report on suicide (45). Previous studies found that online reports of suicide had low adherence to the responsible suicide reporting WHO guidelines (46–48). The results also found that the content of suicide-related news was not sufficiently appropriate, with all of the news failing to adhere to the WHO's six dos and six don'ts of suicide-related reporting. Some of these

stories provide detailed information about the site of a suicide and explicit description of the method used in a suicide or suicide attempt by using photos and video footage. Some news even uses photos of the deceased without mosaics, and others report on suicide notes and social media posts of the deceased.

While the violation rates of don't No. 1 (Avoid prominent placement and unique repetition of stories about suicide) in this study were higher than previous results. Perhaps this is because we focused on suicide events with high impact, and we selected the top 10 news reports of each suicide event on Weibo. However, these reports are the ones that people focus on. There may be less proportion of suicide news stories violating the don't No. 5 (Avoid sensational headlines) of the WHO recommendations during 2015–2020 than during 2003–2015 (22). More coverage of online suicide-related news and suicide methods can lead to more opportunities to learn about suicide experiences by the public, and inappropriate content of suicide-related news can have a negative impact on suicide prevention. Regarding online suicide reports, we emphasized that media should not use photographs or video footage of the scene. While these media should word headlines carefully, and optimize algorithms to reduce the frequency of suicide events being settled as most searched hashtags.

According to agenda-setting theory, media can shape the public's perception of the importance of different issues by highlighting certain issues while downplaying others (49). The content and direction of the top information on the search engine may influence their attitude and behavior. This and a previous study found that helpful reporting practices were very limited (48). Therefore, media professionals could further prioritize suicide prevention issues to highlight problem-solving. That is, media strengthen the real-time gatekeeping of suicide-related news to downplay the negative impact of suicide reports and provide suicide help resources to encourage those at risk of suicide to seek help, such as mental health lines and contact information of social help agencies. Effective regulation and monitoring of suicide reporting appeared to have a positive impact on suicide prevention (50). We recommend that the social media platform establish an early suicide risk warning system with the functions of information warning, regular monitoring, and reporting, providing suicide intervention measures, preventing recurrence, etc. When recognizing suicidal thoughts, the platform can pop up a window or send a private message to provide suicide prevention measures, thereby improving the suicide prevention literacy of netizens.

Appropriate Strategies for Reducing the Negative Impact of Public Opinion From Social Media

Previous studies showed that suicide survivors experience severe mental health consequences and grief reactions, such as higher levels of blaming and a need to conceal the cause of death, rejection, and shame (51). This study focused on suicide events comments posted by the general population. The results showed that the majority of the public opinions were negative, and helpful guidance for suicide prevention was limited. This study also found the comments about suicide-related news of netizens were emotional, irrational, and violent. Besides, reproachful responses of the netizens were common in our study. Therefore, in terms of suicide events with more communicate effect on the internet, online social media should use true, objective, and comprehensive reports to trigger people thinking to reduce the speculation of the cause of suicide and then form rational and harmonious public opinion.

Both the national internet supervision platform and companies should take responsibility to conduct regular monitoring of suicide reports and public opinion, such as deleting harmful statements in a timely manner and minimizing the spread of negative information. At present, for one criminal case, the Weibo platform closed the wrongly oriented super talk, disbanded the offending groups, resolutely curbed irrational behavior, and resolutely dealt with extreme speech to maintain the ecological balance of the online community. In addition, the Weibo platform banned and permanently closed the accounts of those who violated the cyber-provision, such as provoking trouble, attacking government agencies, malicious marketing, etc. We think that suicide reports and public opinions regarding suicide events that are not conducive to suicide prevention should also be taken and dealt with seriously.

Advocating Positive Copying Patterns and Reducing Negative Public Opinion, Especially for Suicides of Celebrities and Students

Different social identities of deceased people generated various public opinions. One study showed that different careers of the deceased resulted in significant differences in emotional response, with entertainment careers creating more emotional responses (52). Public attitudes toward celebrity suicide and general people suicide differed (53). The results of our study also demonstrated that comments to a celebrity suicide revealed more emotional words, such as shocked, sad, nostalgic, regretful, and unacceptable. This was consistent with other studies (54, 55). Our study proves the accuracy and adaptability of social learning theory and vertical identification theory using public comments on celebrity suicide reporting on Weibo. Given the high social status of celebrities, some people may glorify celebrity suicide and view suicide as a sign of heroic behavior, which makes the task of suicide prevention more challenging.

However, these suicide reports of cerebritis could raise positive psychological coping patterns, which was helpful for suicide prevention. Evidence of this phenomenon was also revealed in another study; celebrity suicide-related news reports not only evoked negative, internalized emotions but were also related to the expression of positive emotions of the users (54). In our study, the results also indicated that when committed suicide is a student, netizens also expressed opinions on public affairs with some system reforms and suicide prevention. We thought that the government should take some system reforms according to the netizens' appeal into consideration to reduce the suicide rates. In addition, we recommend that health communication managers focus on the improvement of public

risk awareness and popularizing positive psychological reactions during information dissemination to promote the success of suicide prevention programs.

Theoretical Contributions to Suicide Prevention From a Public Health Perspective

This study could also provide some implications from a public health perspective. The results in this study indicated that the suicide events reported on the internet during COVID-19 and those related to celebrities and students tend to have higher EII. A single event with high EIIs represents that it has a widespread effect communication effect on the internet. Based on social cognitive theory, people get motivated through several processes including attention, retention, and production (8). For suicide death to occur, a person must have sufficient capability to enact a suicide attempt. A previous study also found that the frequency of exposure to negative events was associated with increased capability (56). When the suicide events spread more widely on the internet, it may have more impact on netizens' suicide ideas and suicide attempts. The one-to-many transmission dynamics characterized by the mass media were shown to generate copycat suicides (57). However, people may increase social media usage during the COVID-19 pandemic (58). This study proved that the communication effect of suicide events was high during the period of the pandemic prevention and control period. Thus, it is important to take measures to reduce the negative influence of suicide events for suicide prevention during COVID-19 and other crises or pandemics. Thus, it is important to take measures to reduce the negative influence of suicide events for suicide prevention. Health managers could supervise social media platform to carefully report on suicide events, especially for those suicide events during COVID-19, and those suicide events related to celebrities and students.

In addition, a previous study found Sina suicide Weibo users tended to express negative emotion-related words, anger-related words, sadness, or death-related word than Sina Weibo users without suicide ideas (59). This study also found the public opinion of suicide events was emotional, irrational, and violent. Thus, health communicators should take appropriate strategies for reducing negative public opinion, and track anyone affected by online reports of suicide on social media constantly to intervene in suicide in the early stage of suicide. Besides, some studies focused on analyzing the word expressing of suicide survivors and those people with suicide ideas (59, 60), while our study discussed the negative impact of suicide-related online reports from the perspective of public opinion. This study would provide theoretical contributions to suicide prevention. In order to intervene suicide in the early stage of suicide, it is recommended to set up a special agency to conduct unified management of public opinion in conjunction with relevant departments such as public health, health communication, and public security. When extreme negative emotions and suicide comments are monitored, the public security and platform managers need to locate the speaker's IP under the premise of protecting their privacy rights, to block impulsive suicide and suicide followers as soon as possible.

STRENGTHENS AND LIMITATIONS

This study conducted text content analysis to understand the association between characteristics of suicide and the communication effect of suicide events, assess the quality of suicide-related reporting on online social media and explore public opinion on suicide-related reporting. We proposed appropriate strategies for health communication practitioners to take regulatory actions to prevent suicide and improve public perception and literacy of suicide prevention, thereby reducing suicide rates and preventing suicide in the early stage.

Although this study has made several contributions to the existing research, there are several limitations to this work. First, not all respondents in China were registered as members of the social media platform, which limits the possibility of generalization. Second, this study focused on the Sina Weibo platform to analyze the quality of suicide-related reporting and public opinion, which may lead to selection bias of suicide-related news and public reactions. However, Sina Weibo has been a leading Chinese online social network. This study can discuss the theoretical contributions of Sina Weibo to reducing the negative impact of suicide reporting. The violation of suicide reporting guidelines on other social media platforms also needs to be monitored. The researchers could use other social medias to understand public opinion toward reports of suicide events in the further. Third, this study only analyzed the content of suicide-related reports and did not investigate readers. Further study may conduct interviews or cross-sectional surveys of netizens to understand the impact they receive from reports of suicide and their attitude to suicide events of different social identities of the deceased people. Finally, we searched online reports of suicide and Sina Weibo comments from 2015 to 2020 to explore the quality of online suicide reports and public opinion in recent years. Future studies could use data about online suicide reports before 2015 from Sina Weibo and other social media platforms to understand how to reduce the negative impact of suicide events and public opinion, thereby reducing suicide rates.

CONCLUSION

This study conducted quantitative research to understand the influence of the communication effects of suicide events and the quality of suicide reporting and used text content analysis to explore public reactions to social media in China. We found that the observance of six don'ts was common, while helpful information was limited. The event impact index of celebrity and student suicide events was greater than that of suicide events among the general population, and the suicide-related reporting during the COVID-19 pandemic was greater than before the COVID-19 pandemic. Public opinion of suicide reporting in the online media mostly was emotional and irrational. Social media lacked public opinion guidance in favor of suicide prevention. We recommend promoting responsible suicide-related reporting in the social media environment worldwide. In addition, health

communication practitioners should provide ways to address emerging public concerns after suicide events to avoid the spread of negative emotions and copycat suicides. Practically, the findings of this study can serve as the baseline for the design of intervention strategies, for instance, more discussion about the scene of improving suicide-related reporting on social media to reduce the negative impact of online reports of suicide and public opinion.

DATA AVAILABILITY STATEMENT

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

Y-CC has full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Y-CC, C-YL, MC, and HL conceived of the study, participated in its design, and coordination and drafted the manuscript. QM performed the data acquisition and sampling. HL, SL, XC, XL, S-HC, and XZ performed the data analysis. All authors approved the final version and all take responsibility for its content.

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Benevolent Childhood Experiences and Depressive Symptoms Among Chinese Undergraduates: A Moderated Mediation Model Examining the Roles of Uncertainty Stress and Family Relationship

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Background: The evidence on the association between benevolent childhood experience (BCE) and depressive symptoms in students is complex. This study aims to explore the underlying mediation mechanism of BCE toward depressive symptoms and whether this link was moderated by the family relationship among Chinese undergraduates.

Methods: From March 2021 to May 2021, a cross-sectional study was conducted in China, and 1821 undergraduates were recruited in this study. Participants were asked to complete a self-reported electronic questionnaire. The software SPSS PROCESS macro was used to test the mediation and mediated moderated modeling analysis.

Results: Mediation analysis indicated that uncertainty stress (US) partly mediated the link between BCE and depressive symptoms (indirect effect = −0.47, 95% bootstrap CI = −0.55, −0.39). The indirect effect of the US accounted for 39.63% of the total variance in depression. Moderation analysis indicated that the association between the US and depressive symptoms was significantly modified by family relationships (interact effect = −0.019, $P < 0.001$). An integrative moderated mediation analysis indicated that the indirect effect from BCE to depressive symptoms through the US was also moderated by family relationships (interact effect = −0.012, $P = 0.014$).

Conclusion: Uncertainty stress plays a key role in bridging BCE and depressive symptoms while the family relationship can buffer the impact of the US on depressive symptoms among Chinese undergraduates. Enhancing tolerance of uncertainty and improving family relationships are needed to protect undergraduates from depressive symptoms.

Keywords: benevolent childhood experiences, depressive symptoms, uncertainty stress, family relationship, undergraduates

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INTRODUCTION

The Depressive Symptoms of Undergraduate Students as a Growing Concern

Depressive disorder is a worldwide problem, as well as the most common mental health problem. The existing study indicated that depressive symptoms with a lifetime prevalence of 16.2% and a one-year prevalence of 6.6% among the general population (1). A systematic review showed that about 19.6–30.6% (2–4) of undergraduates suffered from depressive symptoms, which is higher than the prevalence in the general population (1). A meta-study indicated that all of the gender, family origin, academic grade, only-child, ethnic group, education of parents, left-behind experiences on childhood (3), and economic condition (5) are risk factors of Chinese college students. Students suffering from depressive symptoms may adversely affect their academic performance (6), quality of life (6) and even lead to suicidal ideation (7).

'Adverse childhood experiences (ACE) have been defined as 'potentially traumatic events or chronic stressors that occur before the age of 18 and are uncontrollable to the child' (8), such as sexual abuse, emotional abuse, and so on, which has a positive association with depressive symptoms (9–11). However, ACE is not the only form of early experience that has long-term associations with mental health outcomes (12), the impact of benevolent childhood experiences (BCE) on depressive symptoms was also gradually focused on by many researchers (13).

BCE and Depressive Symptoms: A Confirmed Link

Contrary to the early negative effects of ACE, BCE represents the positive early experiences under 18 years old (14), including growing up with at least one safe caregiver, having one or more close friends, and having a predictable home routine, etc. (13, 14). To date, most studies related to BCE were carried out in developed countries (15–17), while there are no studies conducted in Asia. Influenced by traditional Chinese cultural concepts and parents' work pressure, Chinese children receive more intergenerational education (18), which makes their BCE worth watching. Findings suggested that BCE may have lifelong consequences for mental health (19) and physical health (15, 20). One cross-sectional study shows that the high level of BCE can buffer the negative effects on the mental health caused by ACE (21). Moreover, other studies indicated that BCE can also predict better adult mental health dependently (13, 14, 19, 21). Although these studies have confirmed the association between BCE and depressive symptoms, however, the underlying mechanisms underlying the association between childhood experiences and adult mental health are multifactorial and complex. So far, little empirical research has been done to explore the underlying mechanism of how BCE is related to depressive symptoms among undergraduates in China.

BCE, US, and Depressive Symptoms: A Mediation Pathway

Uncertainty stress (US) refers to the stress caused by the condition of being unsure about someone or something (22). As we all know that university students are more prone to experience high levels of uncertainty stress (23), not only including future uncertainty but also current uncertainty, for example, rapid socio-economic transition, increased job competition, immature social values, and feelings of social anomie (24, 25), which are collectively known as uncertainty stress (US). China is now one of the world's fastest-growing economies (26), many policies were also changed in recent years in China. For example, the one-child policy has been abolished by the Chinese government (27), China is still expanding enrollment at universities (28). All these changes not only reflect a dramatic change in the social environment but also may have an impact on the psychological characteristics of university students in China (3). The rapid change of the social environment and the fierce competition for jobs and the uncertainty of the future all lead to the Chinese and Chinese college students becoming the biggest victims of the pressure of uncertainty stress (29, 30).

Research indicated that uncertainty cues can arouse higher stress than certainty cues (31). Due to the traditional culture, Chinese college students are more intolerant of ambiguous states and regard uncertainty as a threatening and unacceptable presence (32, 33). A cross-sectional study found that Chinese university students who suffer from US (19.6%) are higher than life stress (11.5%) (25), and uncertainty stress had a more negative influence and adverse consequences on college students' mental health than life stress (34), which might be a unique precursor to depressive symptoms (34). The association between US and mental problems has been well established in Chinese another study (35). Although the association between the US and depressive symptoms has been well established in these studies, however, there is currently not much evidence that uncertainty stress links BCE to depressive symptoms.

The stress sensitization model (36) proposed that stressful life events that occurred in the past year may serve as a trigger in the pathways from childhood experience to adulthood mental disorders (37, 38), and the stress sensitization effect was strong among people with multiple childhood adversities (37). We speculate that BCE could reduce the perception of stress events, and reduce the risk of the US turning into depressive symptoms. Doom et al. also made a point that the stressor will influence the relationship between childhood experiences and current mental health problems (13). To sum up, we hypothesis that BCE can affect depressive symptoms through a mediation pathway of US among undergraduates.

Potential Role of Family Relationship in Moderating the Association Between BCE and Depressive Symptoms

Family relationship, including child-parent relationship, parent relationship, and family climate, which has been suggested as the main predictors of depressive symptoms among child

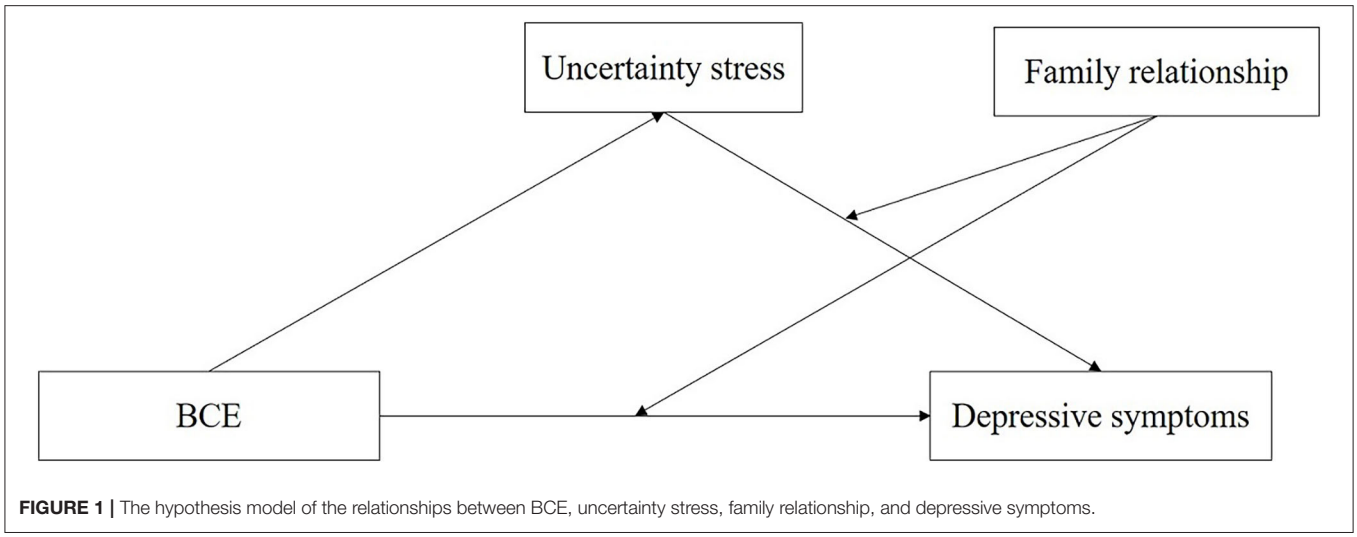

FIGURE 1 | The hypothesis model of the relationships between BCE, uncertainty stress, family relationship, and depressive symptoms.

(39, 40). All of the less warmth, more inter-parental conflict, over-involvement in the family can cause a higher risk of depression (41). Attachment theory proposed that the close relationship between parents and child serves as affective support and a safe base, which could contribute to multiple aspects of psychosocial adaptations (42). This implies that better family relationships could shape a person's beliefs about the acceptability and expression of emotions when they encounter the US, preventing the US switch to depressive symptoms (42). In addition, the change of family and household could arouse the relapse into episodes of mental problems which recovered from stress events before (43). This suggests that the family relationship may have a protective effect prevent the US switch to mental problems. The family relationship can also provide a foundation for creating better BCE (44), which implies that family relationships could strengthen the protective effect for depressive symptoms. Therefore, we assumed that family relationship moderates the linkage between uncertainty stress and depressive symptoms which mediate the association between BCE and depressive symptoms.

To date, none of the studies constructed an integrative moderated mediation model to explore the underlying mechanism between BCE, US, and depressive symptoms, as well as the effects of family relationships. To bridge these knowledge gaps, our research investigated BCE, US, and depressive symptoms in a random sample of undergraduates in China, and tested whether: (1) US mediate the link between BCE and depressive symptoms; (2) Family relationship moderates the link between BCE and US, as well as the link between the US and depressive symptoms (See **Figure 1**). Basic characteristics and variables that may affect the outcome variables were used as control variables.

METHODS

Study Design and Data Collection

From March 2021 to May 2021, a cross-sectional study was conducted among undergraduate students in three cities (Xuzhou, Nanjing, and Wuhan), China, by using an online survey platform (www.wjx.com). Undergraduate students were randomly selected from a total of 25 universities by using a stratified multistage cluster sampling method. First, a stratified sampling method was used to select schools by taking the school levels as the indicators. A total of 25 universities were selected. In each university, a stratified (according to the majors) random sampling method was used to select the classes, and cluster sampling was then used in each class. A questionnaire guider accepted train before the survey was set in every class. Completion of the questionnaire was voluntary, no incentive was provided, and anonymity was assured. Among 2022 undergraduate students who completed the questionnaire, 201 were excluded because of the not reliable answers or timeout answers ($<$100 s). Finally, a total of 1,821 participants were included in our study with an effective response rate of 90.06%.

The Ethics Committee of Xuzhou Medical University has reviewed and approved the study protocol.

ASSESSMENT

Basic Characteristics

Information regarding the participants' gender, age, grade, sibling, ethnicity and residence, parent's marriage and education, living expenses, sexual orientation, and academic performance were asked to understand the characteristics of the participants.

Benevolent Childhood Experiences

Benevolent childhood experience (BCE) was measured by the BCEs scale (14) which includes 10 items of positive childhood experiences occurring before 18 years old. Items include (1) having at least one safe caregiver, (2) having at least one good friend, (3) having beliefs that gave comfort, (4) enjoying school, (5) having at least one teacher who cared, (6) having good neighbors, (7) having an adult (not a parent/caregiver) who could provide support or advice, (8) having opportunities to have a good time, (9) having a positive self-concept, and (10) having a predictable home routine. Each "Yes" response was scored as a

TABLE 1 | Sociodemographic characteristics of undergraduate students (n = 1,821).

Characteristics	Frequency (Mean)	Percentage (SD)
Age[a]	20.07	1.24
Gender[b]		
Male	556	30.53
Female	1,265	69.47
Grade		
Freshman	279	15.32
Sophomore	831	45.63
Junior	668	36.68
Senior	43	2.36
Only-child		
Yes	910	49.97
No	911	50.03
Ethnicity		
Ethnic Han	1,768	97.09
Ethnic minorities	53	2.91
Residence		
Urban	1,031	56.62
Rural	790	43.38
Parents divorced		
Yes	1,668	91.60
No	153	8.40
Father education		
Junior high school or below	793	43.55
Senior high school	586	32.18
College	421	23.12
Master or doctor	21	1.15
Mother education		
Junior high school or below	954	52.39
Senior high school	532	29.21
College	319	17.52
Master or doctor	16	0.88
Sexual orientation		
Heterosexual	1,630	89.51
Homosexual	40	2.20
Bisexuality	108	5.93
Other	43	2.36
Fail in exam within a year		
Yes	325	17.85
No	1496	82.15
Living expenses (yuan)		
≤1000	92	5.05
1001–2000	1441	79.13
2001–3000	227	12.47
≥3000	61	3.35

[a] *Below data are shown as mean (SD).*
[b] *Below data are shown as n (%).*

one and a "No" response answer as a 0. A total score of BCEs was summed by 10 items (range = 0–10), and the higher score reflects more positive childhood experiences. The Cronbach's α of the scale was 0.729 in the present study.

Uncertainty Stress

The US Questionnaire is a measure of uncertainty stress and has shown good reliability and validity (34, 45). The scale consists of four subscales (10 items) including current status uncertainty, social change uncertainty, goal uncertainty, and social value uncertainty. The items were rated on a standard 5-point Linkert rating scale from 0 (no stress) and four (excessive stress). A total stress score was summed by every single item score. A higher score indicates a high level of stress. The Cronbach's α of the scale was 0.951.

Family Relationship

Family relationship was measured by four questions that individuals self-reported the relationship in family and the family atmosphere. Items include: (1) The relationship with father, (2) The relationship with mother, (3) The relationship between parents, (4) The atmosphere in the family. The scale was rated on a standard 4-point Linkert rating scale from one (very discordant) and four (very harmonious). The score of each four items was summed up to calculate the total score. A higher score indicated a better family relationship. In this current sample, the Cronbach's alpha for the Family relationship was 0.866.

Depressive Symptoms

Depressive symptoms in the past week were measured by a 10-items questionnaire (Center for Epidemiologic Studies Depression [CESD]-10), which is a short version of the CESD-20. The scale was rated on a Linkert rating scale from 0 (rarely or none of the time, < 1 day) and three (all the time, 5 to 7 days). Item five and Item eight are scored inversely. The total score of 10-items is calculated to assess the depressed mood, the higher score represents the higher depressive symptoms (46, 47). The Cronbach's α of the scale was 0.869 in the current study.

Data Analyses

Descriptive analyses of the participants' demographic characteristics and Spearman's correlation analysis of BCE, US, Family relationship, and depressive symptoms were calculated by using SPSS 25. We used Process version 3.5 (48, 49) based on SPSS 25 (IBM Corporation, Armnok, NY, USA) to test the mediation model, moderation model, and moderated mediation model. We conducted a mediation analysis following Baron and Kenny's approach (50). Bootstrapping method (48) based on 5,000 bootstrap samples was used to estimate the confidence interval (CI) for the indirect effect and assess the significance of estimated indirect effects. A moderation analysis was conducted to test the moderation effect of the family relationships on the link between BCE and depressive symptoms, as well as the link between the US and depressive symptoms. Finally, we performed an integrative moderated mediation analysis to test the role of family relationships in moderating the purposed mediation model. Significant at $P \leq 0.05$ (two-sided) were included as controls in all statistical analyses. In addition, covariates were controlled in all main analyses, such as gender, age, grade, only-child, nation, residence, parent's marriage, and education, living expenses, sexual orientation, and academic performance.

TABLE 2 | Correlation between BCE, uncertainty stress, family relationship, and depressive symptoms among adolescents.

Variables	Mean	SD	1	2	3	4
1. BCE	18.67	1.78	1.000			
2. Uncertainty stress	23.19	9.03	−0.388**	1.000		
3. Family relationship	13.94	2.21	0.307**	−0.260**	1.000	
4. Depressive symptoms	17.57	5.93	−0.461**	0.612**	−0.316**	1.000

*(1) Date (r) is correlation coefficient: **P < 0.01.*

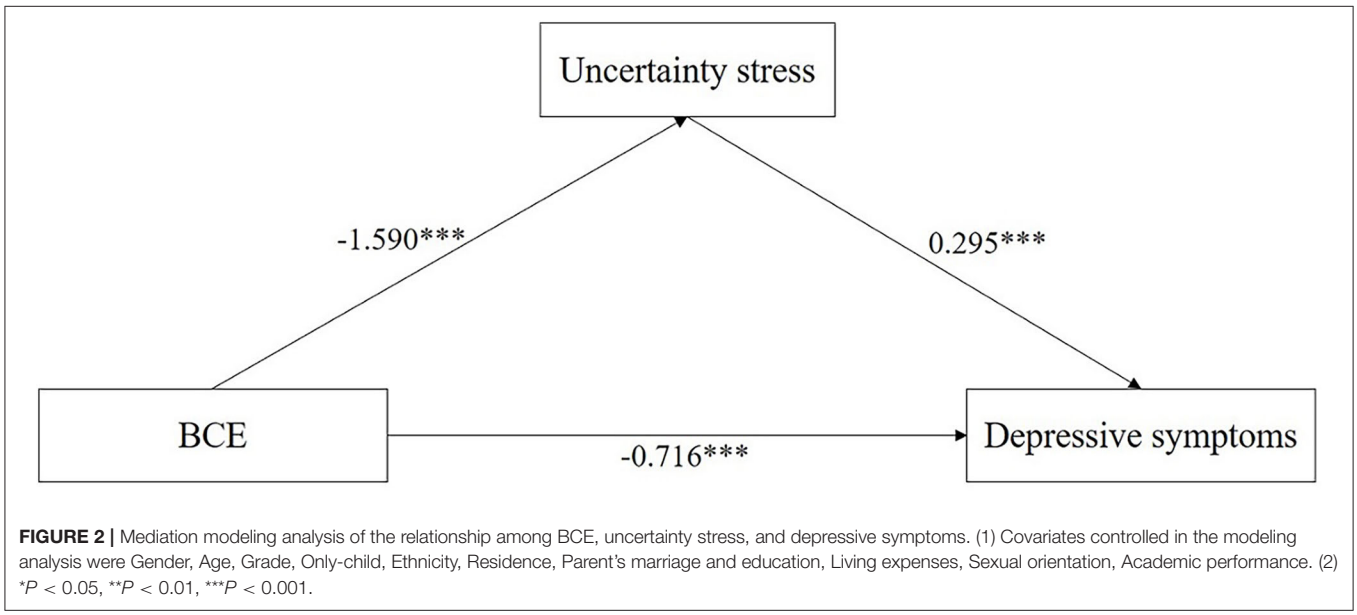

FIGURE 2 | Mediation modeling analysis of the relationship among BCE, uncertainty stress, and depressive symptoms. (1) Covariates controlled in the modeling analysis were Gender, Age, Grade, Only-child, Ethnicity, Residence, Parent's marriage and education, Living expenses, Sexual orientation, Academic performance. (2) *P < 0.05, **P < 0.01, ***P < 0.001.

RESULTS

Sociodemographic Characteristics

As is shown in **Table 1**, a total of 1,821 undergraduates completed the surveys. Of all the participants, most of them are female (69.47%) and ethnic Han (97.09%). The average age was 20.07 and about 82.31% of respondents are in the sophomore year and junior year. About half (50.03%) of participants have a sibling and 56.62% of participants come from urban, while 43.38% come from rural areas. Only 153 (8.4%) participants' parents divorced and a majority of participants' parents have a junior high school or below degree (43.55 and 52.39%, respectively). Most of the participants are heterosexual (89.51%). Regarding academic performance, 82.15% of participants didn't fail the exam within a year while 17.85% of participants failed the exam within a year. Finally, 1,441 (79.13%) respondents spent 1,001–2,000 yuan within a month.

Preliminary Correlation Analyses

Table 2 shows the results of Spearman's correlational analyses, which indicate that BCE was negatively associated with US ($r = -0.388$, $P < 0.01$) and depressive symptoms ($r = -0.461$, $P < 0.01$). While the US was positively associated with depressive symptoms ($r = 0.621$, $P < 0.01$) and negatively associated with family relationships ($r = -0.26$, $P < 0.01$). Moreover, the family relationships were negatively associated with depressive symptoms ($r = -0.316$, $P < 0.01$) and positively associated with BCE ($r = 0.307$, $P < 0.01$). These results support further test of mediation and moderated mediation models while controlling for covariates.

Mediation Modeling Analysis

A mediation model analysis was established to examine the association between BCE, US, and depressive symptoms followed by the results of correlation analyses. **Figure 2** illustrated the mediation model, along with standardized path coefficients which indicates that BCE was significantly associated with the US ($\beta = -1.59$, $P < 0.001$), and depressive symptoms ($\beta = -0.72$, $P < 0.001$) when controlled for covariates. in addition, the results of the non-parametric bootstrapping method suggested that the US has a significant indirect effect in mediating the association between BCE and depressive symptoms (effect = −0.47, 95% bootstrap CI = −0.55, −0.39). The direct effect of BCE on depressive symptoms was also significant (effect = −0.71, 95% bootstrap CI = −0.83, −0.6), indicating a partial mediation of the depressive symptoms when controlled for covariates. The indirect effect of the US accounted for 39.63% of the total variance in depression. These findings are consistent with our hypothesis that the US may play a mediator role in the association between BCE and depressive symptoms.

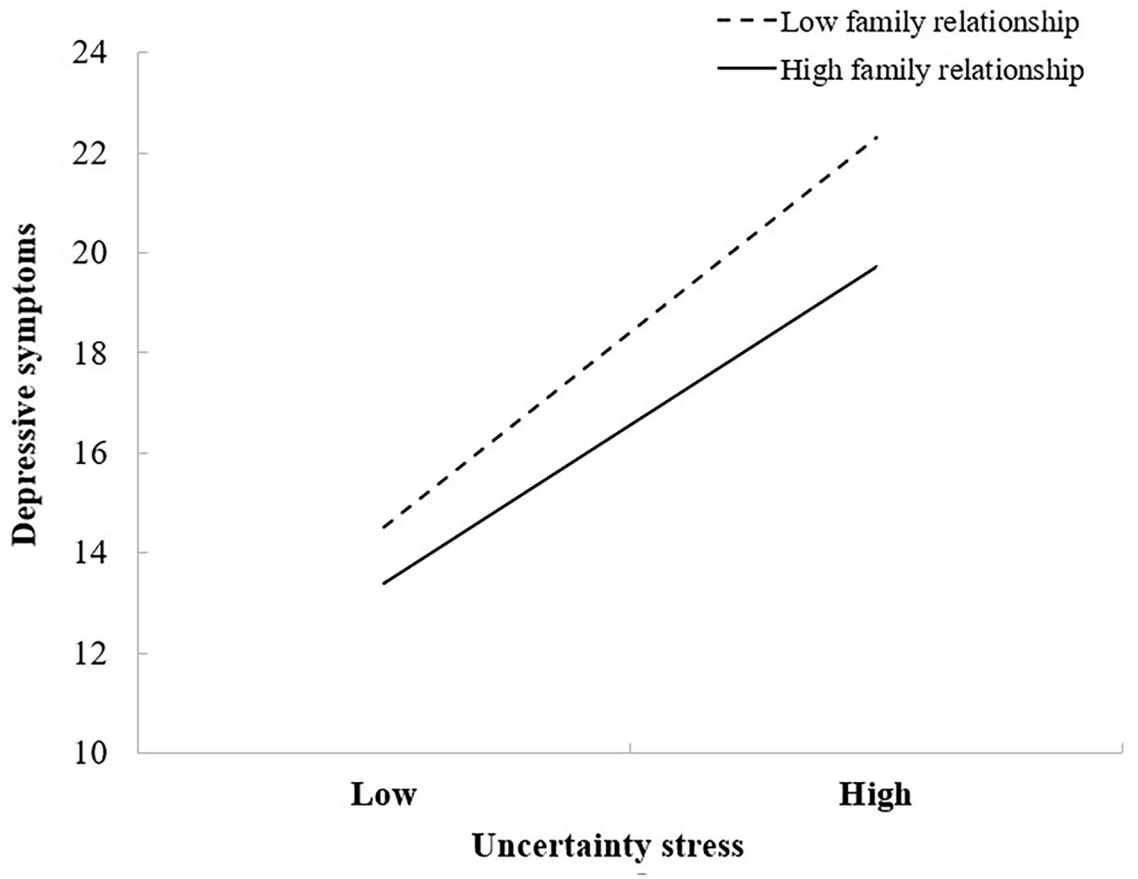

FIGURE 3 | Family relationship moderates the effect of uncertainty stress on depressive symptoms. Covariates controlled in the modeling analysis were the following: Gender, Age, Grade, Only-child, Ethnicity, Residence, Parent's marriage and education, Living expenses, Sexual orientation, and Academic performance.

Moderation Analysis

Only a significant interaction between US and family relationship in predicting depressive symptoms was found in results of moderation analysis ($\beta = -0.019$, $P < 0.001$), while the interaction between BCE and family relationship in predicting depressive symptoms was insignificant ($\beta = 0.008$, $P = 0.773$). We calculated the simple slopes using the "pick-a-point" approach (51) to examine the changes in the relationship between the US and depressive symptoms with the increase of family relationships. We used the one standard deviation below and above mean to represent the "Low" and "High" levels of family relationships and the US, respectively. Results in **Figure 3** illustrates the different slopes associated with different levels of family relationship, as family relationships increased, the effect of US on depressive symptoms decreased: the simple slopes were 0.351 and 0.432 ($Ps < 0.001$) at low and high levels of family relationship.

Moderated Mediation Analysis

Table 3 and **Figure 4** suggested a significant moderated mediation model: $R^2 = 0.577$, $F = 128.927$, $P < 0.001$. The results indicate that the interaction term (BCE*Family relationship) was not significant ($\beta = 0.011$, $P = 0.659$) while the interaction term (US*Family relationship) was significant ($\beta = -0.012$, $P = 0.014$), which means Family relationship significantly moderated the association between the US and depressive symptoms while the moderation effect of Family relationship on the link between BCE and depressive symptoms was not statistically significant. In addition, the conditional indirect effect of family relationship range low (1 *SD* below the mean) to the high level (1 *SD* above the mean) indicated that the indirect effects of BCE on depressive symptoms through the US were significant across the levels of family relationship. When the family relationship increased from −0.255 (1 *SD* below the mean) to 2.055 (1 *SD* above the mean), the indirect effect of US on depressive symptoms changed from −0.504 to −0.423. Moreover, all of low ($\beta = -0.504$, 95% CI −0.603, −0.414), moderate ($\beta = -0.462$, 95% CI −0.544, −0.387), and high ($\beta = -0.423$, 95% CI −0.513, −0.343) level of family relationship significantly moderated the association between BCE and depressive symptoms.

DISCUSSION

To our knowledge, our research is the first study focusing on the underlying mechanisms of BCE, US, and depressive

TABLE 3 | Regression coefficients predicting depressive symptoms, family relationship as moderator (moderated mediation model).

Explanatory variables	Uncertainty stress				Depressive symptoms			
	β	SE	*t*	*P*	β	SE	*t*	*P*
BCE	−1.593	0.114	−13.939	<0.001	−0.643	0.064	−10.030	<0.001
Family relationship					−0.162	0.048	−3.390	<0.001
Uncertainty stress					0.290	0.012	25.272	<0.001
BCE*Family relationship					0.011	0.025	0.441	0.659
Uncertainty stress *Family relationship					−0.012	0.005	−2.469	0.014
Model summary	$R^2 = 0.222$, $F = 34.310$, $P < 0.001$				$R^2 = 0.577$, $F = 128.927$, $P < 0.001$			

Conditional indirect effect of BCE on depressive symptoms

Mediator	Family relationship	β	Boot SE	Boot LLCI	Boot ULCI
US	−2.055	−0.504	0.049	−0.603	−0.414
	0.000	−0.462	0.040	−0.544	−0.387
	2.055	−0.423	0.044	−0.513	−0.343

(1) Covariates controlled in the modeling analysis were the following: Gender, Age, Grade, Only-child, Ethnicity, Residence, Parent's marriage and education, Living expenses, Sexual orientation, and Academic performance. (2) SE, standard error; LLCI, lower levels for confidence interval; ULCI, upper levels for confidence interval.

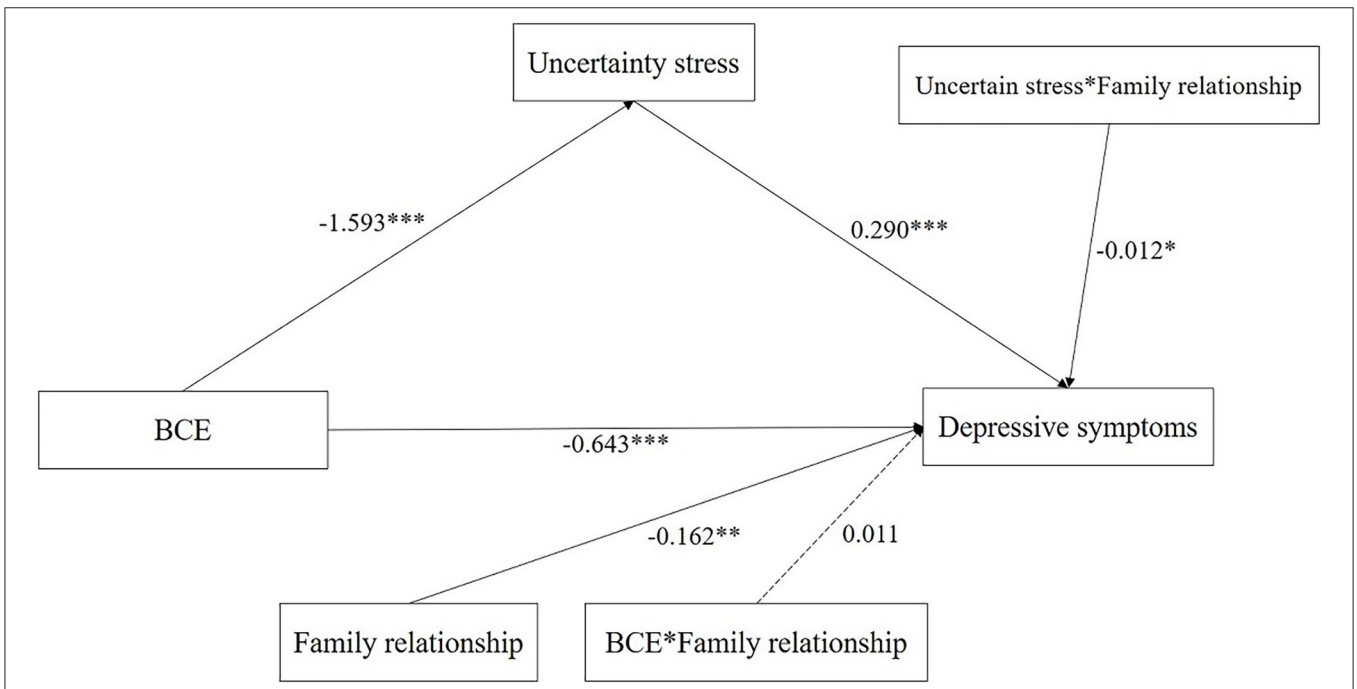

FIGURE 4 | Moderated mediation modeling analysis of the complex relationship among BCE, US, family relationship and depressive symptoms. (1) Covariates controlled in the modeling analysis were the following Gender, Age, Grade, Only-child, Ethnicity, Residence, Parent's marriage and education, Living expenses, Sexual orientation, and Academic performance. (2) $^*P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$. (3) Solid lines represent statistically significant paths. Dotted lines represent non-significant paths.

symptoms. Our study finds that BCE has a negative effect on depressive symptoms, which is consistent with the previous study (19, 21, 52). Besides, our research indicates a partial mediation effect of US from BCE to depressive symptoms. Moreover, the family relationship has a significant moderated mediation effect on the indirect relationship from BCE toward depressive symptoms, while the moderated mediation effect of the family relationship on the direct relationship from BCE toward depressive symptoms is insignificant.

The US as the Underlying Mechanism for the BCE-Depressive Symptom's Link

As hypothesized, we found BCE was negatively associated with the US, which in turn buffer the depressive symptoms. The mediating effect of the US might be attributed to

the following reasons. Coping resources theory proposes that coping with stress must be based on good resources, either individual resources (self-esteem, self-efficacy, etc.) or social resources (social support) (30, 53). BCE can increase the acceptance of adult psychosocial resources (54) and social support (13) and then enhance the ability to manage stress, thus reducing the risk of uncertainty stress (55). Secondly, BCE may promote life meaning and strengthen the ability of self-mastery (56), which can help individuals cope with stress and strain (57–59). What's more, our findings indicate that the increase of US can deteriorate the extent of depressive symptoms (60), which is consistent with the previous study (60). In certain situations, the US may become be an obstacle in school study (61), and arouse irrational action in other situations among undergraduates (62). Both situations can contribute to depressive symptoms of undergraduates (63).

Because the future is inherently uncertain, so human beings are always faced with uncertainty. There is no need to treat all uncertainty as a monster. It is severe uncertainty that needs to be prevented and managed. Individuals should develop confidence, give hope, need information, develop skills to cope with uncertainty, etc. (30). Enhance tolerance of uncertainty has been proved effective in the previous study (64, 65). Therefore, Reflective writing (66), Mindfulness-based interventions (67) are needed to raise the level of tolerance of uncertainty.

Increase Family Relationship as a Potential Intervention Component

One of the most important findings in our study is that family relationships play a moderator in the mediation pathway from BCE to depressive symptoms, which suggests a new way to intervene and reduce the risk of depressive symptoms. Firstly, the better family relationships play as a foundation of BCE (44), which can promote the development of family-related BCE, increasing the protective effect of BCE on the US (55). Secondly, family is one of the most important resources of social support (68) and family resilience (60), the better relationship in the family often represents the higher family social support and family resilience, which can both enhance their BCE and enable them to flourish with warmth, support, and cohesion by successfully coping with the US (60). The attachment theory indicated that one's emotional needs can be satisfied by warm and supportive parenting and a positive family atmosphere, leading to less preoccupation with one's negative mild mental problems (69). Less preoccupation with the US can avoid the US switching to more serious psychological problems (depression, suicidal ideation) effectively (69).

In addition, a better family context is helpful to improve the adjustment of the individual (internalizing, externalizing, social competence) and develop emotion regulation (70), which can enable students to make friends, develop good community and school relations, thus developing good BCE. The ability emotion regulation developed by a good family relationship can help students respond to the US and other emotional experiences in a socially appropriate, adaptive, and flexible manner (71–73). Moreover, adolescents are tending to study the emotion regulation from parents' emotional displays and interactions. The parents' emotional profiles implicitly teach children which emotions are acceptable (74). For example, if parents often display negative emotions in the family, children may perform inappropriate emotional responses when confront with stressful events, which may contribute to depressive symptoms (75). This also highlights the good family relationship can help to ease depressive symptoms for college students.

Although undergraduates mostly leave their families and live with their classmates, however, attachment theory also pointed out that the security, adaptations, and maturity fostered by their parents are more dependent on the role of their parents "competent allies" role and less on their actual presence (76, 77). In other words, the ability of environment adaption fostered by positive family relationships continues to exist when they leave their parents.

With the family structures becoming increasingly complex, at present, less than half of children lived in the family units which used to be the norm in the past, such as two-parent, married, biological parents (78, 79). This suggests that parents should provide a complete family to children. Moreover, positive engagement in family interactions (80) and improving family communication (81) are also helpful to create a positive family relationship.

LIMITATIONS

Some limitations should be noted in our study. Firstly, we can't judge the causality between variables because of the cross-section study. Secondly, the samples were collected from three provinces, China, thus the representativeness of samples is questionable. Also, the self-report questionnaire could exist the bias in this study. Finally, our study only explored the effect of family factors and personal level factors toward depressive symptoms whereas the sociocultural factors may also influence the depressive symptoms of undergraduates. In the future study, we would consider sociocultural factors such as school-related factors and social support in predicting depressive symptoms.

CONCLUSIONS

In summary, the findings of our study provide information not only on the mediate mechanism of how BCE eases depressive symptoms through the US but also the protective mechanism of how the family relationship can buffer the impact of the US on depressive symptoms among undergraduates. Our findings suggest that enhance tolerance of uncertainty and improving family relationships to protect undergraduates from depressive symptoms.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Ethics Committee of Xuzhou medical University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

WW and HH: conceptualization, methodology. CZ, HH, and YZ: data curation, writing-original draft preparation. HH, CH, YP, and JW: supervision, validation. WW and XG: writing-reviewing and editing. WW: revising. All authors contributed to the article and approved the submitted version.

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Post-traumatic Stress Disorder Symptoms in COVID-19 Survivors 6 Months After Hospital Discharge: An Application of the Conservation of Resource Theory

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COVID-19 survivors who had acute respiratory symptoms might experience prolonged post-traumatic stress disorder (PTSD) due to further rehabilitation, somatic symptoms and related distress. The conservation of resource (COR) theory is a well-developed theory to understand how people develop PTSD symptoms in traumatic events. The current study aimed to examine the potential factors of PTSD symptoms and interrelationships among this factors among COVID-19 survivors based on the COR theory. This cross-sectional telephone survey enrolled 199 COVID-19 patients (Mean age = 42.7; 53.3% females) 6 months after their hospital discharge in five Chinese cities (i.e., Wuhan, Shenzhen, Zhuhai, Dongguan, and Nanning). The results showed that 7% of participants were classified as having probable PTSD. The significant potential factors relating to PTSD symptoms included socio-demographic status, hospitalization experiences, post-hospitalization experiences, and psychological status. Besides, the proposed statistical mediation model based on the COR framework showed good model fit, χ^2(df) = 17.286 (5), p = 0.004, CFI = 0.962, NNFI = 0.951, RMSEA = 0.077. Perceived resource loss/gain fully mediated the association between exposure to other patients' suffering during hospitalization and PTSD symptoms, and partially mediated the relationships from somatic symptoms/perceived impact of being infected with COVID-19 after discharge to PTSD symptoms. On the other hand, resilience was a full mediator in

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the relationship from ICU experience to PTSD symptoms and a partial mediator in the relationship from perceived impact to PTSD symptoms. The results provide preliminary support on applying the COR theory to understand the factors of PTSD symptoms among COVID-19 survivors. Interventions to reduce PTSD symptoms in this population can be developed based on the modifiable psychosocial mediators.

Keywords: post-traumatic stress disorder (PTSD), hospitalization-related factors, resource loss and gain, resilience, conservation of resource theory (COR)

INTRODUCTION

Post-traumatic stress disorder (PTSD) is defined as the development of symptoms related to intrusion, avoidance, negative alterations in cognition and mood, and arousal and reactivity following exposure to a traumatic event (1). Post-traumatic stress symptoms (PTSS) have also been associated with functional impairment among individuals who do not meet full diagnostic criteria (2). Based on information garnered from human coronavirus outbreaks in the past, specifically SARS and MERS, PTSD and PTSS may become a significant health concern among COVID-19 survivors (3, 4). To our knowledge, only five studies on PTSD among COVID-19 survivors have been reported (sample size range: 126–675); the prevalence of PTSD ranged from 12.4 to 28% (5–9). For example, a Chinese study reported that among 675 survivors, 12.4% were diagnosed with PTSD (5.2% had been in intensive care-ICU; 14.2% had been given substantial doses of corticosteroid during hospital treatment; 2.4% had received invasive mechanical ventilation) (7). The prevalence suggests that health care providers should be prepared to evaluate the associated risks and make recommendations in response to the increase of PTSD and PTSS among COVID-19 survivors.

Potential Causes of PTSD in COVID-19 Survivors

Severity of symptoms, treatment-related negative experiences and pain, and collective trauma during hospitalization are potential causes of PTSD in COVID-19 survivors (10). Patients with COVID-19 might experience respiratory symptoms and respiratory failure (11), such experiences create extreme stressors for patients, including fear of death, pain from medical interventions, limited ability to communicate, and feelings of loss of control (10). Invasive ventilation and longer duration of mechanical ventilation could cause post-traumatic stress to ICU treatment survivors (12–15). Such treatments have been associated with an increased risk for PTSS (16, 17) and associated PTSD prevalence was estimated to range from 14 to 51% (18). Patients who required mechanical ventilation at ICU also reported symptoms including feelings of guilt, mood swings, sleep disturbance, and memories of panic and suffocation (19). COVID-19 survivors who had acute respiratory symptoms might experience prolonged PTSD due to further rehabilitation, somatic symptoms and related distress (20). Additionally, COVID-19 survivors might experience collective trauma during hospitalization from witnessing other patients' suffering or death, potentially causing PTSD (7). Existing literature on these factors is rare and reported inconsistent results. A study in Italian reported that one out of five patients hospitalized for COVID-19 was diagnosed with PTSD or subthreshold PTSD at 3-month follow-up (9). However, negative correlations between hospitalization experiences and PTSD, insignificant correlations between residual clinical damage and PTSD (8), and negative correlations between duration of hospitalization and PTSD (6) were reported in other cultures. The inconsistent results highlight the necessity of more empirical studies to understand these relationships between hospitalization/post-hospitalization experiences and PTSD and their underlying mechanisms.

Potential Mediators and Framework of PTSD

Resources can be referred to anything that a person values, such as objects (e.g., house and phone), conditions (e.g., stable employment and good health), personal characteristics, (e.g., optimism and hope), energies (e.g., knowledge), and social resources (e.g., interpersonal relationships) (21). Trauma-related experiences may reduce COVID-19 survivors' core resources that support their well-being and help them to cope with stress during the epidemic and afterwards. For example, severe symptoms of COVID-19 and comorbid conditions such as hypertension, coronary artery disease and stroke, and diabetes may increase one's perception of personal resource loss, such as deteriorated physical and emotional health status, sleep quality, quality of life, and working capacity and opportunity (22). Limited face-to-face interactions with others during and after treatment due to concern of infection may reduce perceived social resources (e.g., reduced social network, social connection, and social support, and increased social stigma) among patients with COVID-19 and survivors. Experiencing pain and witnessing others patients' suffering during treatment and hospitalization may damage their sense of mastery, self-efficacy, and resilience (18, 23). In turn, such perceived losses may explain why and how these COVID-19 survivors develop and maintain PTSD after recovery or discharge from hospitals. Based on the Conservation of Resource (COR) theory, the mediation role of "loss of resources" may explain the link between traumatic events and PTSD (24). This theory was originally developed to understand the processes of experiencing, coping with, and overcoming chronic and traumatic stress, and how and why people develop PTSD (24). According to the theory, losing core resources, including both personal and social resources due to traumatic events (e.g., health-related crises) and related negative experiences can prolong PTSD, while gaining

such resources can facilitate recovery from PTSD (25). Personal, physical and psychological resources are internal resources that can be possessed and mobilized by the self (e.g., psychological resilience, self-efficacy, sense of control over one's life, and optimism) (26). Social resources refer to external resources that are embedded within the physical environment and interpersonal interactions (27). This theory emphasizes that accelerated loss of resources, particularly those that are most valued by the individual, can lead to traumatic stress. Furthermore, it postulates that regarding PTSD, loss of resources has greater impact than gain because individuals tend to strive to protect themselves from resource loss. The COR theory has been widely used to explain the development of PTSD and psychological distress in the contexts of natural disasters (28, 29), diseases (30), and socio-political movements (31). We, however, did not identify any study which have applied this theory in explaining the development of PTSD in COVID-19 survivors.

The Present Study

The study aimed to investigate the prevalence and potential factors relating to PTSD in COVID-19 survivors. We were particularly interested in factors related to the experiences and perceptions during and after treatment and hospitalization (e.g., the severity of COVID-19 symptoms, perceived impact of COVID-19, somatic symptoms after hospitalization, and witnessing other patients' suffering during hospitalization) (10, 20, 32). Furthermore, this study applied the COR framework and tested a statistical mediation model in which negative experiences and perceptions related to COVID-19 and hospitalization (e.g., the severity of COVID-19 symptoms, perceived impact of COVID-19, somatic symptoms after hospitalization, and witnessing other patients' suffering during hospitalization) would be positively associated with resource loss (e.g., personal and social resources and psychological resilience) and in turn increase the risk of PTSD in COVID-19 survivors. It is hypothesized that (1) negative experiences and perceptions during and after treatment and hospitalization would be positively associated with PTSD; and (2) these associations would be mediated by perceived loss of resources (e.g., reduced personal and social resources and psychological resilience).

METHODS

Study Design and Data Collection

This is a cross-sectional telephone survey among 199 COVID-19 patients, conducted 6 months after their hospital discharge. Our participants were: (1) patients who were diagnosed with COVID-19 and hospitalized, regardless of severity level at admission, or duration of stay, ICU admission or treatment received during hospitalization; (2) recovered from acute infection by COVID-19 and were discharged; (3) least 18 years old, and (4) confirmed to have given informed consent to participate in the survey.

The study was conducted between August and September 2020. Two-stage cluster sampling was used, with five hospitals being conveniently selected and all the survivors discharged from the hospitals between February 1 and April 30 2020 were invited. Specifically, the conveniently selected study sites included five hospitals located in five Chinese cities (i.e., Wuhan, Shenzhen, Zhuhai, Dongguan, and Nanning,). Wuhan is the capital city of Hubei Province which is the most heavily affected city by the COVID-19 epidemic in China. Shenzhen, Zhuhai, and Dongguan are cities in Guangdong Province; this Province has the second largest number of confirmed COVID-19 cases in China. Nanning is the capital city of Guangxi Province, which is relatively less affected by COVID-19 epidemic. According to the treatment guidelines in China, COVID-19 patients discharged from hospitals are required to quarantine at centralized facilities for 14 days, followed by an additional 14-day home quarantine. Hospitals will keep their contact information for follow-up assessments and services after discharge. Thus, staffs from the five participating hospitals facilitated the recruitment process for this study. Hospital staffs contacted all the COVID-19 survivors discharged from the hospitals and screened for eligible participants under verbal consent. Eligible participants were briefed about the purpose and logistics of the study and were invited to attend a 30–40-min telephone interview, conducted by trained interviewers (33). Telephone interviews were arranged on an appointment basis (33). Informed consent was obtained from each participant before the interview. Participants were assured that identifiable information would be kept confidential and they are free to withdraw without affecting their access to other medical services. No incentives were given to the participants. Ethics approval was obtained from the Sun Yat-sen University (Shenzhen) (Ref#2020-031).

Participants

Among 317 discharged COVID-19 patients from the five hospitals, 27 were excluded for being under 18 years old, 22 were unreachable due to change of telephone number and one was deceased in a car accident. The research team contacted the remaining 267 eligible patients and 68 refused to participate due to lack of time. One hundred and ninety-nine eligible participants provided consent and completed the telephone survey. The average response rate was 74.5% (Wuhan: 31/49, 63.3%; Shenzhen: 38/50, 76.0%; Zhuhai: 39/51, 76.5%; Dongguan: 35/45, 77.8%; and Nanning: 56/72, 77.8%).

Measures

A panel consisting of one epidemiologist, two public health researchers, a health psychologist, and a clinician was formed to develop the questionnaire used in the current study.

Independent Variables

During Hospitalization

Exposure to/witnessing of other patients' suffering during hospitalization was measured by two questions (i.e., "Did you witness other patients suffering from pain due to COVID-19 symptoms during hospitalization" and "Did you witness death of other patients with COVID-19 during hospitalization"). Participants answered with "Yes" or "No" to the questions.

Information about severity level of COVID-19 at hospital admission, days in the hospital, ICU admission, use of invasive ventilation and corticosteroid therapy, and presence of

severe complications of COVID-19 were extracted from their medical record.

After Discharge

Somatic symptoms after discharge were measured by the Patient Health Questionnaire (PHQ-15) (34). PHQ-15 is a somatic symptom subscale derived from the full PHQ. It inquires about 15 somatic symptoms or symptom clusters that account for more than 90% of the physical complaints (excluding upper respiratory tract symptoms) reported in the outpatient setting (34). The symptoms inquired in the PHQ-15 include 14 of the 15 most prevalent DSM-IV somatization disorder somatic symptoms (i.e., those with a prevalence of 3% or greater in the general population) (35). Participants rated the severity of each symptom as 0 ("not bothered at all"), 1 ("bothered a little"), or 2 ("bothered a lot"). A higher total score indicates a greater somatic symptom severity. The internal consistency of the scale was acceptable in the current sample (Cronbach's alpha = 0.88).

Perceived impact of being infected with COVID-19 was assessed by three questions constructed by the research team. Participants were asked to what extent do they think COVID-19 infection has adverse impacts on their life, work, and socializing, respectively. Questions were rated on Likert scales, ranging from 0 (no influence at all) to 10 (severe influence). A higher score indicates a greater negative influence of COVID-19 infection on the survivors. The reliability of the three questions was good (Cronbach's alpha = 0.89).

Mediators

Resource loss/gain was measured by eight questions that were constructed to assess loss or gain of personal resources (i.e., activities of daily living, working capacity, financial status, quality of life, emotional status, and sleep quality) and social resources (i.e., relationships with family and friends). The items were derived from a comprehensive literature review (25, 36) and created by the research team that includes psychologists and epidemiologists. The items were rated by using three-point Likert scales (1 = loss, 2 = no change, 3 = gain). A lower score indicates a tendency of perceived resource loss as a result of COVID-19 infection, while a higher score indicates a tendency of perceived resource gain. The Cronbach's alpha of the scale was relatively low but marginally acceptable (Cronbach's alpha = 0.66).

Resilience was measured by the 2-item Connor-Davidson Resilience Scale (CD-RISC2). The two items ("Able to adapt to change" and "Tend to bounce back after illness or hardship") were rated on Likert scales, ranging from 1 (strongly disagree) to 5 (strongly agree). A higher total score indicates a higher level of psychological resilience. The Cronbach's alpha of the scale was 0.90 in the current sample.

Outcome

PTSD symptoms due to being infected with COVID-19 were measured by the 8-item Post-Traumatic Stress Disorder scale (PTSD-8) (37). The items correspond to the DSM-IV criteria for PTSD to measure three core symptoms of PTSD, including intrusion, avoidance, and hypervigilance. The measure is short and feasible for telephone surveys. The items were answered on a Likert scale, ranging from 1 (not at all) to 5 (all the time). The summed score of the eight items' scores provides a score for symptom severity. Probable PTSD was defined using a threshold of at least one symptom from each PTSD subscale with an item score that was $\geq$3 (37). Many studies used the summed score of PTSD-8 as a continuous variable with the score ranging from 8 to 40 (38–41). The Chinese version has been used in previous studies (42, 43). The internal consistency as measured by Cronbach's alpha (0.89) was good in the current sample.

Data Analyses

The percentage of missing data was low (<5%) and they were replaced by multiple imputation. Descriptive statistics were computed for both background and psychological variables. Simple linear regression analyses involving the analysis of a single independent variable were conducted to identify the potential significant background or psychological factors of PTSD symptoms. Standardized regression coefficients (β) and 95% of their confidence intervals (CIs) were reported. The significant variables were further included in path analyses. Path analyses with maximum likelihood estimation approach were conducted to test the proposed statistical mediation models of PTSD symptoms. The Comparative Fit Index (CFI) > 0.90, the NNFI (Non-Normed Fit Index) > 0.90 and the Root Means Square Error of Approximation (RMSEA) < 0.08 suggest acceptable model fit. Bootstrapping based on 5,000 bootstrap samples was performed to test indirect effects. A statistically significant indirect effect would be observed when the CI did not include zero. The level of statistical significance was 0.05. SPSS version 21.0 and AMOS were used. This was a secondary analysis of a study investigating the behaviors and mental health of COVID-19 survivors in China.

RESULTS

As **Table 1** showed, the mean age of the participants was 42.7 years. Over half of the participants were female (53.3%), were married or cohabited with a partner (81.9%), did not have permanent residency in the city (73.4%), had personal income less than RMB 6,000 (USD 850) per month (74.4%), had a full-time work (59.8%), and had children (80.4%, n = 160). 43.2% of the participants had college education or above. During hospitalization, most of the participants did not have ICU, invasive assisted ventilation, hormone therapy, serious complications, or sequelae of COVID-19. Half of the participants were classified as having common symptoms of COVID-19. The average length of stay at the hospital was 20.9 days. Of the participants, 7% were classified as having probable PTSD (n = 14). The continuous variable of PTSD would be used in the following analyses.

As **Table 2** showed, the significant background factors of PTSD symptoms included age, sex, marital status, having children, and occupation. In addition, ICU experience, exposure to/witnessing other patients' suffering during hospitalization, somatic symptoms after discharge, perceived impact of being infected with COVID-19, resource loss/gain, and resilience were significantly associated with PTSD symptoms ($p < 0.05$).

TABLE 1 | Background characteristics, physical status and psychosocial status of the participants ($n = 199$).

	n	%	Mean	SD
Background characteristics				
Age group (years)			42.723	17.528
18–30	33	16.6		
31–40	59	29.6		
41–50	35	17.6		
51–60	33	16.6		
>60	39	19.6		
Sex				
Male	93	46.7		
Female	106	53.3		
Relationship status				
Currently single	36	18.1		
Married/cohabited with a partner	163	81.9		
Having children				
No	39	19.6		
Yes	160	80.4		
Highest education attained				
Middle school or below	53	26.6		
High school	57	28.7		
College and above	86	43.2		
Refuse to disclose	3	1.5		
Permanent residents of the city				
No	146	73.4		
Yes	53	26.6		
Monthly personal income (¥)				
No fixed income	71	35.7		
<3,000	25	12.6		
3,000–5,999	52	26.1		
6,000–9,000	24	12.1		
≥10,000	27	13.6		
Employment status				
Full-time employment	80	40.2		
Free-lanced	31	16.1		
Students	15	7.5		
Unemployed	17	8.5		
Retired	55	27.6		
Experiences during hospitalization				
Clinical classification of COVID-19 at entry				
Asymptomatic	3	1.5		
Mild	42	21.1		
Common	111	55.8		
Severe	25	12.6		
Critically severe	18	9.0		
ICU experience (No)	194	97.5		
Invasive assisted ventilation (No)	192	96.5		
Hormone therapy (No)	175	87.9		
Serious complications (No)	188	94.5		
Length of stay (days)			20.883	15.831
Sequelae of COVID-19 before discharge (No)	187	94.0		
Exposure to other patients' suffering during hospitalization			0.376	0.673
Psychosocial perceptions after discharge				
Somatic symptoms after discharge			4.191	5.516
Perceived impact of being infected with COVID-19			10.155	9.186
Resource loss/gain			14.819	2.305
Resilience			7.518	1.854

Figure 1 presented the proposed statistical mediation model of PTSD symptoms. The model showed good model fit, $\chi^2(\text{df}) = 17.286\ (5)$, $p = 0.004$, CFI = 0.962, NNFI = 0.951, RMSEA = 0.077. Perceived impact, somatic symptoms, and exposure to other patients' suffering were significantly negatively associated with gain of resources. In addition, perceived impact and ICU experience were significantly negatively associated with resilience. In turn, both resource gain and resilience were negatively associated with PTSD symptoms. High levels of perceived impact ($B = 0.10$, $\beta = 0.10$, 95%CI = 0.03, 0.18) and somatic symptoms ($B = 0.08$, $\beta = 0.15$, 95%CI = 0.08, 0.23) were indirectly associated with high levels of PTSD symptoms. Specifically, high perceived impact was indirectly associated with high PTSD symptoms through both reduced resource gain ($B = 0.06$, $\beta = 0.10$, $p < 0.05$) and resilience ($B = 0.03$, $\beta = 0.04$, $p < 0.05$), while somatic symptoms were indirectly associated with PTSD symptoms through resource loss/gain ($B = 0.08$, $\beta = 0.08$, $p < 0.05$). There were significant direct paths between high perceived impact and somatic symptoms and high PTSD symptoms. Thus, the partial statistical mediation effects of resource gain and resilience were demonstrated.

DISCUSSION

The results suggested several potential predictors, including socio-demographic, hospitalization and post-hospitalization variables, significantly associated with PTSD symptoms among COVID-19 survivors at 6 months after discharge. The results also illustrated the interrelationships among hospitalization variables, post-hospitalization variables, PTSD symptoms and the potential mediators based on the COR framework. The hypotheses were generally supported by the results.

The prevalence of probable PTSD at 6 months after discharge was less than that in other studies in which PTSD was measured during quarantine period or at 1 or 2 months after discharge (5–7). This seems consistent with the assertion that PTSD symptoms are often high among individuals hospitalized due to COVID-19, which may be due to the overlap between PTSD symptoms and acute illness (i.e., difficulties sleeping, feeling cut off from others,

TABLE 2 | Background factors, physical factors and psychological factors of PTSD symptoms.

Variables	β	95%CI	*P*	*F*(df)	R^2
Age	0.18	0.01, 0.10	0.008	7.348 (1/197)	0.03
Sex				10.61 (1/197)	0.04
Male	Ref				
Female	0.21	0.83, 3.67	0.002		
Relationship status				15.22 (1/197)	0.06
Currently single	Ref				
Married/cohabited with a partner	0.25	1.44, 4.55	<0.001		
Having children				11.80 (1/197)	0.07
Yes	Ref				
No	−0.27	−4.97, −1.75	<0.001		
Highest education attained				0.06 (2/196)	0.01
Junior high or below	Ref				
Senior high	0.07	−1.11, 2.72	0.41		
College and above	0.05	−1.21, 2.26	0.55		
Permanent resident of the city				0.03 (1/197)	0.00
Yes	Ref				
No	0.02	−1.36, 1.77	0.79		
Monthly income (RMB)					
<6,000	Ref			0.05 (2/196)	0.01
6,000 or above	−0.09	−2.91, 0.75	0.25		
No fixed income	−0.04	−2.16, 1.28	0.61		
Employment status				7.20 (4/194)	0.09
Full-time employment	−0.22	−4.24, −0.61	0.009		
Free-lanced	−0.03	−2.74, 1.78	0.68		
Students	−0.31	−7.14, −2.47	<0.001		
Unemployed	−0.12	−4.49, 0.49	0.12		
Retired	Ref				
Clinical classification of COVID-19 at entry				0.06 (4/194)	0.01
Asymptomatic	−0.06	−6.20, 2.90	0.476		
Mild	−0.07	−3.67, 1.86	0.520		
Common	0.15	−0.91, 4.12	0.210		
Severe	0.13	−0.96, 5.26	0.175		
Critically severe	Ref				
ICU experience				10.88 (1/197)	0.06
No	Ref				
Yes	0.23	3.43, 12.74	0.001		
Invasive assisted ventilation				0.26 (1/197)	0.00
No	Ref				
Yes	0.04	−2.81, 5.31	0.550		
Hormone therapy				0.79 (1/197)	0.00
No	Ref				
Yes	0.07	−1.07, 3.50	0.296		
Serious complications				0.07 (1/197)	0.00
No	Ref				
Yes	0.03	−2.66, 3.89	0.711		
Length of stay (days)	−0.04	−0.06, 0.03	0.538	0.64 (1/197)	0.00
Sequelae of COVID-19 before discharge				0.76 (1/197)	0.00
No	Ref				
Yes	−0.05	−4.38, 1.89	0.435		
Somatic symptoms after discharge	0.52	0.39, 0.62	<0.001	67.83 (1/197)	0.26
Exposure to other patients' suffering during hospitalization	0.23	0.74, 2.84	<0.001	16.46 (1/197)	0.08
Perceived impact of being infected with COVID-19	0.52	0.23, 0.37	<0.001	66.55 (1/197)	0.25
Resource loss/gain	−0.56	−1.59, −1.06	<0.001	55.63 (1/197)	0.22
Resilience	−0.38	−1.45, −0.73	<0.001	32.63 (1/197)	0.14

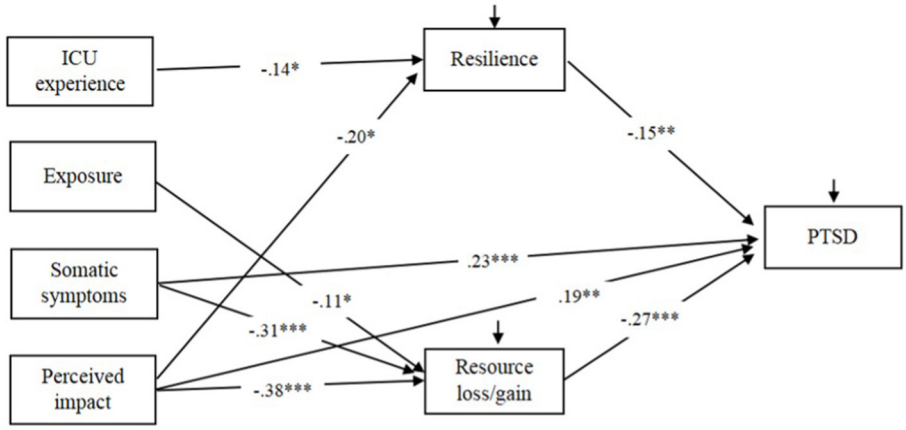

FIGURE 1 | Proposed mediation model of PTSD symptoms with standardized path coefficients. The non-significant path and covariance between resilience and resource loss/gain were not showed for simplicity reasons (*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$).

and difficultly concentrating), and may diminish after discharge (7). Notwithstanding, 7% of probable PTSD at 6 months after discharge indicate a great need for mental health care for this population. Follow-up studies should be conducted to estimate mental health care needs in COVID-19 survivors who are at high risk of PTSD.

Consistent with recent studies (5, 7), older, retired, non-single, or female survivors and those having children experienced more PTSD symptoms than their counterparts. These groups may be more vulnerable regarding their physical and socioeconomic status, and thus traumatic stress has more influence on them. Attention from health care providers should be warranted and more mental health promotion efforts should take place (44). ICU experience, witnessing other patients' suffering during hospitalization, somatic symptoms after discharge, and perceived impact of being infected with COVID-19 after discharge were significantly associated with PTSD symptoms. Such association may suggest that COVID-19 can have a long-term effect on survivors' well-being and quality of life even 6 months after their recovery and discharge. It also suggests that both hospitalization experience and post-hospitalization experience can play as continuous sources of stress which can fuel and prolong PTSD symptoms. Consistently, a recent study in Wuhan, China, also found that severity of disease and somatic symptoms after discharge were significant risk factors for PTSD among COVID-19 survivors (7). However, two studies in other cultures did not found such positive correlations (6, 8). Whether cultures play a role in the inconsistent findings is worth exploring in future studies (e.g., whether hospitalization experiences were different across cultures or people in some cultures are more sensitive to collective trauma). The two psychological factors, perceived resource loss/gain and resilience, were significantly associated with PTSD symptoms, suggesting that survivors who perceived more resource loss related to daily life functions and interpersonal relations, and reduced resilience experienced more PTSD symptoms. This is the first study testing these psychological correlates of PTSD among COVID-19 survivors, and the results are consistent with non-COVID-19 studies (25, 45). Other psychological factors that were not included in this study may also be important and can be tested in future work. For example, the fear of a new pandemic, worries amplified by media reporting, and uncertainty about the condition may aggravate PTSD symptoms among survivors. In addition, unlike other traumatic events (e.g., earthquake), COVID-19 survivors are, to this day, facing other problems related to COVID-19 such as lockdowns, business closing and unemployment, and thus may likely suffer from mental health problems.

Furthermore, the results support the statistical mediation roles of perceived resource loss/gain and resilience in explaining the potential effects of experience of hospitalization and post-hospitalization on PTSD symptoms. Specifically, perceived resource loss/gain fully mediated the association between witnessing other patients' suffering during hospitalization and PTSD symptoms as the indirect association *via* the mediator was statistically significant but not the direct association; perceived resource loss/gain partially mediated the associations between somatic symptoms/perceived impact of being infected with COVID-19 after discharge and PTSD symptoms as both the indirect and direct associations were statistically significant. Witnessing other patients' suffering might particularly reduce ones' personal resources through poor emotional status and quality of life, while somatic symptoms and perceived impact might affect ones' perceived resource loss in personal (e.g., sleep quality), social (e.g., relationship quality) and financial (e.g., job loss) aspects. Resilience was a full mediator of the association between ICU experience and PTSD symptoms as the indirect association *via* the mediator was statistically significant but not the direct association; it was also a partial mediator of the association between perceived impact and PTSD symptoms as both the indirect and direct associations were statistically significant. Being treated in ICU could be an extremely stressful event that might harm survivors' sense of mastery and psychological resources (12–14). These resources

played critical roles in affecting survivors' stress coping and recovery from PTSD. In general, the relationship between in-hospital exposure to others' suffering and resource loss/gain and ICU experience to resilience are relatively weaker than those for post-hospital somatic symptoms and perceived impact. It may suggest that the lasting effects may be more important in contributing to PTSD symptoms than the acute in-hospital effects. The results of partial mediation and full mediation effects also seem to suggest that experience during hospitalization would not directly lead to PTSD at 6 months after discharge but would indirectly increase PTSD through perceived reduced psycho-social and personal resources, while experience after discharge had both direct and indirect effects on PTSD through reductions in such resources. Thus, experience after discharge might have more direct effects on PTSD than experience during hospitalization. It may echo the assertion in a recent study that PTSD symptoms from COVID-19 are high among hospitalized individuals, which may be due to the overlap between PTSD symptoms and acute illness (i.e., difficulties sleeping, feeling cut off from others, and difficultly concentrating), and diminish substantially after discharge (7).

Theoretically, the acceptable model fit and statistically significant mediation effects provide evidence for applying the COR theory (21) to understand how COVID-19-related experiences (e.g., hospitalization and post-hospitalization) may induce and prolong PTSD symptoms after discharge. From the COR perspective, people strive to develop, maintain or restore important resources in traumatic events, and a loss of these resources plays a critical role in developing PTSD (21). The COR theory has been applied in understanding mental health issues of survivors under other types of adversities (e.g., natural disasters and negative life events). To our knowledge, this is the first study that has extended and applied this theory to explain the development and maintenance of PTSD symptoms among COVID-19 survivors. Namely, the post-hospitalization experiences (somatic symptoms and perceived impacts on daily life, work, and socializing) rather than hospitalization experiences were highlighted as potential key sources of perceived resource losses which, in turn, might lead to PTSD. Other potentially important negative experiences and personal/interpersonal resources, such as physical pain, information deficiency, and loneliness due to COVID-19 infection, may also increase their PTSD symptoms and should be explored in future work.

Practically, the findings suggest some directions regarding the interventions for mental health promotion among COVID-19 survivors. Although adverse experiences during traumatic events are inevitable, the identified psychosocial status (e.g., resilience and interpersonal resources) can be modified through and the related negative consequences can be buffered by interventions. For example, some psychological interventions (e.g., the family-focused resilience enhancement program and the READY program) have been demonstrated to enhance resilience effectively after traumatic events (46). Timely social support from local governments and important others (e.g., family members and friends) of the survivors may help to buffer their perception of resource loss and facilitate their development of post-traumatic growth (47).

Limitations

Our study has several limitations. First, this study used a cross-sectional design which limits causal inference. Although this study defined the mediators and outcome based on the theoretical model of COR, it is worth noting that the relationships between resilience/resource loss and PTSD might be reciprocal. In other words, individuals with resource losses would likely develop PTSD, while those with PTSD tend to perceive or experience actual resource losses. Thus, follow-up longitudinal studies are warranted to better understand their dynamic relationships and monitor to what extent hospitalization experience affects PTSD in the long run. Second, the study conveniently selected the hospitals where participants were recruited, making it potentially susceptible to sample bias. Only a few participants had ICU or ventilator treatment or had serious complications. Therefore, our results may not be generalizable to those more serious cases. This may partially explain the low probable PTSD estimate. Third, most measures (except the hospitalization records) were self-reported and might induce recall bias. In addition, the measures of perceived impact of being infected with COVID-19 and resource loss/gain were self-constructed by the research team based on previous studies. Although they showed acceptable reliability, it is worth noting that they have not been well-validated. Resilience was measured by the 2-item short-version scale. The long-version resilience scale including multiple dimensions may measure resilience in a more comprehensive way. Future studies should validate the findings using more robust measures. In addition, a limitation of the resource loss/gain measure and the PTSD measure is that they may be confounded by the effects of overall exposure to the pandemic (and related traumas and losses) vs. the specific effects of COVID-19 infection. Future studies may further specify the sources of resource loss/gain and PTSD in the measures or compare the levels of these factors with those among people without COVID-19 infection. Fourth, we did not have the records of mental health status before hospitalization of the participants. This is a significant limitation, as prior depression, anxiety, or PTSD due to other trauma exposure would be significant risk factors for symptom recurrence during and after hospitalization. Future studies should collect and control for this information to better understand the burden due to COVID-19 infection. In addition, we were not able to access refusers' medical records without their approval or collect other information from the refusers. Therefore, we were not able to compare the characteristics between refusers and participants. Fifth, due to the small sample size of the whole sample and those with probable PTSD, we did not use the binary variable of PTSD in our analyses. Last but not least, caution of interpreting the prevalence of PTSD should be made as the tool is not a diagnostic instrument. The cutoff has not been clinically validated in Chinese populations. Future studies need to validate the cutoff of the PTSD scale and investigated the prevalence of PTSD in a larger and representative sample.

CONCLUSION

The effects of COVID-19 on survivors can extend beyond the physical affliction and continue even after recovery and hospital discharge. The significant potential factors relating to PTSD symptoms included socio-demographic status (age, sex, marital status, having children, and occupation), hospitalization experiences (ICU experience and witnessing other patients' suffering during hospitalization), post-hospitalization experiences (somatic symptoms after discharge and perceived impact of being infected with COVID-19), and psychological status (resource loss/gain and resilience). In addition, the psychological status served as significant mediators in explaining the associations between experiences of hospitalization and post-hospitalization and PTSD symptoms. Such psychosocial mechanisms are modifiable through psycho-social interventions. Efforts to enhance survivors' resilience and resource gain are warranted to reduce and prevent PTSD.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Sun Yat-sen University (Shenzhen). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements. Each participant's informed consent was confirmed before the interview.

AUTHOR CONTRIBUTIONS

HZo, BW, and LF conceived the idea. XY, YF, PChan, and ZW organized a questionnaire. HZo, FX, SY, JYu, Y-QC, XX, BW, and LF designed the investigation. BW, LF, YHu, DL, XX, NJ, WZ, HX, ZX, PChen, JH, HZh, HT, DH, ZH, XM, YHa, LC, and JYa carried out this investigation. XY and BW prepared the manuscript with ZW and HZo. XY, BW, and ZW critically reviewed the manuscript. All authors contributed to the article and approved the submitted version.

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Rumination, Posttraumatic Stress Disorder Symptoms, and Posttraumatic Growth Among Wenchuan Earthquake Adult Survivors: A Developmental Perspective

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This study examined the long-term effects of the Wenchuan earthquake among adult survivors. Specifically, it explored the role of perceived social support (PSS) in the relationship between rumination and posttraumatic growth (PTG) and posttraumatic stress disorder (PTSD) symptoms. Data were collected from March to July 2020 using a youth survivor sample (n = 476) of the 2008 Wenchuan earthquake. Participants were divided into three groups depending on their age when the quake occurred: 6–11 years (n = 227), 12–15 years (n = 83), 16–19 years (n = 166). The results indicated that long-term PTG and PTSD symptom levels varied by age group. Both intrusive and deliberate ruminations had a significant effect on PTG as well as PTSD symptoms. PSS played a mediating role between rumination and PTG, and the mediation mechanisms varied by age group (developmental stages). Moderated analyses revealed that PSS from significant others significantly buffered the indirect effect of rumination on PTSD symptoms. Our findings demonstrated the universal nature of traumatic events encountered during childhood and adolescence development and underscore the importance of examining the developmental context of PTG in investigations on traumatic experiences and their consequences.

Keywords: earthquake rumination, posttraumatic growth, perceived social support, developmental perspective, posttraumatic stress disorder symptoms

INTRODUCTION

Traumatic events such as sexual and physical assault, illness, accidents, and natural disasters are common worldwide (1–5). They are a risk factor for mental health disturbance development. Posttraumatic stress disorder (PTSD) symptoms are a frequent negative psychological outcome after traumatic event exposure in both developed (4, 6–8) and developing countries (9, 10). PTSD results in extreme distress and functional impairment, and as a long-term consequence, it increases the risk of developing physical health problems (e.g., pain, heart disease, and stroke), psychological

distress (e.g., depression, anxiety disorders, and suicide attempts), poor quality of life, and low life satisfaction (4, 6).

Nevertheless, a positive psychological perspective that changes the focus of trauma research to concepts such as posttraumatic growth (PTG) has been increasingly recognized, especially in the non-artificial trauma psychology field [such as earthquake and COVID-19 pandemic; (11, 12)]. Stewart (13) defined PTG as positive life changes that follow traumatic events. The concept of PTG has become more commonly used alongside posttraumatic stress to describe psychosocial functioning, especially in adults (14). However, less is known about the long-term consequences of trauma occurring during childhood and adolescence, a stage of rapid development when cognition and emotion are susceptible to trauma impact (7).

PTG and PTSD Symptoms

Cross-sectional (4) and longitudinal (5, 15) evidence indicate that PTG and PTSD symptoms are independent constructs, which co-occur in survivors after traumatic exposure to a natural disaster. However, the relationship between PTG and PTSD symptoms remains inconclusive (4). Studies have reported a significant positive relationship (9), negative relationship (2), or no relationship at all (1, 5, 16). These inconsistent findings confound our understanding of PTSD symptoms and PTG constructs. It is necessary to clarify the relationship between PTG and PTSD symptoms. Therefore, based on this suggestion, this study aims to simultaneously examine risk and predictive mechanisms of PTG and PTSD symptoms among Wenchuan earthquake adult survivors.

Rumination and PTG

Rumination has been described as a cognitive vulnerability typically beginning in the aftermath of a traumatic exposure that challenges the individual's framework for understanding the world (17). A distinction exists between two types of rumination about the negative stimulus, and includes intrusive and deliberate ruminations. Intrusive rumination represents thoughts that involuntarily invade one's cognitive world and generally involve a negative focus on the trauma, whereas deliberate rumination involves the deliberate reexamining of and contemplation about the experience (1, 15). The impact of intrusive and deliberate ruminations on PTG is demonstrated in cross-sectional studies (18, 19) and longitudinal research (1, 15, 20–22) on natural disasters, but some contradictions remain. For examples, deliberate rumination, not intrusive rumination was the only significant factor positively predicting PTG in children survived Hurricane Katrina (20) and adolescents after earthquake (1, 15, 21) or after a tornado (19). Deliberate rumination contributes individuals to thinking the positive aspects about traumatic events, which helps them actively construct their understanding of the post- traumatic world and attribute meaning to the trauma, thus promotes PTG (1, 21). However, Kilmer et al. (22) re-analyzed the traumatized children after Hurricane Katrina nearly 2 years after the disaster, finding baseline intrusive rumination as the only positive and significant predictor of PTG in the same sample. Therefore, further research, especially on the long-term effect on PTG is needed to clarify discrepancies.

Perceived Social Support and PTG

The availability of PSS can facilitate the process of change by initiating communication about traumatic experiences (23, 24), leading individuals to reframe and reconstruct worldviews after a traumatic event, and creating the potential for PTG. The main-effect hypothesis of social support suggests that social support plays an independent role in reducing stress (25), and is a protective factor for PTG (11, 26). Tedeschi and Calhoun's (24) model regarding cognitive processing of PTG suggests that social support provides trauma-exposure survivors a safe environment where they can talk freely to others about their experiences, associated perceptions, and emotions. Wang et al. suggest that social support encourages survivors to establish good relationships, and promotes PTG (16). Therefore, PSS seems to lead survivors to reframe traumatic events and reconstruct their worldviews, and thus could be an important factor in predicting PTG.

Rumination and PTG: Mediating Role of PSS

Both deliberate rumination and PSS, in addition to the reappraisal of core beliefs, reflect higher levels of PTG (18, 21). Direct correlations between deliberate rumination and PTG were found in numerous studies across various cultures (1, 27). Deliberate rumination could help individuals seek and receive more PSS to understand traumatizing events. Specifically, deliberate rumination can motivate trauma survivors to enhance their cognition regarding traumatic events, and this process encourages them to rethink their view of the self, others, and the world, and thus can be beneficial in their perception of social support (1, 19). For example, Wang et al. found that deliberate rumination contributed to PTG in adolescent trauma survivors after the Ya'an earthquake in China (1). Additionally, PSS can lessen the negative impact of intrusive rumination on individuals and increase positive experiences, leading to PTG (21). Therefore, PSS may be a mediator in the relationship between deliberate rumination and PTG.

Rumination and PTSD Symptoms

Rumination in PTSD symptoms may reflect a deliberate attempt to understand the traumatic event and "work through" it, albeit unproductively. Over time, this may become a more automatic, default response style (28). Individuals who ruminate often report feeling they are adaptively coping by finding reasons for their distress (29). Furthermore, rumination has been shown to prospectively predict PTSD symptoms (30). The cognitive PTSD model of PTG (31) suggests that the predominant emotions experienced by trauma survivors provide an invaluable clue to cognitive themes; feelings such as fear and sadness can lead survivors to engage in maladaptive cognitive processing styles such as rumination. Ruminative thinking maintains symptoms through both cognitive and emotional processes. Specifically, individuals may ruminate to avoid traumatic memories and associated negative emotions, which temporarily alleviates

distress, but ultimately interferes with the process of adaptive recovery (32).

PSS and PTSD Symptoms

PSS is also a preventive factor for PTSD development, especially in trauma-affected communities (10). According to the buffering effect model, survivors with strong PSS can reduce the adverse psychological response caused by stress (25). Specifically, the incidence of post-traumatic stress increased in those with low PSS. PSS can provide necessary resources for adolescents surviving an earthquake to cope with negative mental reactions (4), thereby promoting coping self-efficacy. Therefore, PSS can buffer the effects of traumatic experiences on PTSD symptoms.

Rumination and PTSD Symptoms: Moderating Role of PSS

PSS interacts with intrusive rumination and the perceptions of entrapment, thereby resisting PTSD symptom development (33). As Lepore (34) outlines in his social-cognitive theory, social support is crucial in perpetuating or breaking the pathway from trauma experiences to PTSD symptoms via rumination. Therefore, although rumination increases attention on negative aspects of a traumatic experience, the derived negative emotions should be ameliorated by others' understanding. Thus, PTSD symptoms will ease. By contrast, it is hard for people to process and regulate rumination-elicited negative emotions when they lack support (35). Thus, we propose that PSS might moderate the function of rumination on PTSD symptoms.

Developmental Perspective on PTG and PTSD Symptoms

Age has been found to contribute to the development of psychiatric disorders (36), and both linear and curvilinear relationships have been reported between age and PTSD symptom development risk following a vehicle accident (37). The developmental periods of childhood, adolescence, young adulthood, and older adulthood are marked by age-related changes in cognitive, emotional, and social processes that may influence the likelihood of negative psychological outcomes following trauma exposure, beyond the role of sociodemographic factors (7). In a study of the COVID-19 pandemic, adolescents were significantly more likely to report clinical PTSD symptoms than adults (38). A comparative study from Saõ Paulo involving young people (aged 15–24 years) and adults reported that exposure to traumatic events was higher in the young compared with adults (39). The specific vulnerability of children and adolescents to traumatic events happens because they are in a critical developmental stage when the brain is still maturing; when the physical and psychological and personal strengths are not crystallized, and robust individual coping strategies and socioeconomic stabilities have not been fully attained (40). A rising trend with age is often found, particularly during the drastic transition period from childhood to adolescence. In a sample of children aged 10–16 years old exposed to war experiences in Lebanon, older children had more severe anxiety and depression symptoms than younger children (26). Longitudinal investigation demonstrated that adolescents at the age of 12 or 13 years suffer more frequent and serious psychological distress than their younger counterparts aged between 9 and 11 years (41, 42). Similarly, McDermott and Palmer (43) found children of grades 7–9 reported the most emotional distress compared with younger children (grades 4–6) and older adolescence (grades 10–12), following a bushfire disaster. Added to this, childhood and adolescence trauma-exposed depressive symptoms may last many years or even increase in adulthood (44, 45). However, little is known about developmental differences in response to post-disaster trauma especially regarding earthquakes. Based on previous studies, and from a developmental perspective, we assumed that the impact of the 2008 Wenchuan earthquake on adolescents would be more severe than other younger survivors.

Aims and Hypotheses

The purpose of our study is to clarify the relationship between rumination and PTG, studying the long-term effects of trauma during childhood and adolescence using a youth survivor sample of people who experienced the 2008 Wenchuan earthquake, and to explore the mediating and moderating role of PSS in the relationship between rumination and PTG and PTSD symptoms, respectively. The current study expands the literature by providing counseling implications for prevention and intervention practice in the field of trauma-exposed psychopathology.

Specifically, we hypothesized that: 1) Long-term affected PTG and PTSD levels would be significantly different among different age groups of children who lived through the same earthquake; 2) There would be a significant correlation between intrusive rumination and deliberate rumination; both would have a significant effect on PTG; 3) PSS would mediate the link between rumination and PTG, and the mediation mechanisms would vary by age group; 4) Both intrusive and deliberate ruminations would have a significant effect on PTSD symptoms; 5) PSS would be a significant moderator for the path between rumination and PTSD symptoms.

METHODS

Participants and Procedure

The study was conducted in Dujiangyan city in Sichuan province, which was most severely affected by the 2008 Wenchuan Earthquake in China (46). Convenience sampling offline and online approach was used to recruit young adults from March to July 2020. Psychological master-student volunteers living locally conducted participants invitation from communities and supermarkets as well as social network resources from families/relatives and friends. Additionally, volunteers also invited participants using social networking platforms such as Sina Weibo, Wechat, and QQ groups related to Dujiangyan city themes. Informed consent was obtained from all participants by their reading the description and purpose of the study and clicking "continue" to complete a questionnaire available at the professional survey Web site Wenjuanxing. Out of 560 replies, 84 were discarded from the analysis due to the incomplete psychometric instruments or excluded if they: 1) were not in

Dujiangyan when the earthquake occurred; 2) were younger than 18 or older than 31. The final sample was comprised of 476 youth survivors with a mean age of 24.69 years ($SD = 4.25$), 44.54% of the sample were female ($n = 212$). Survivors were each valid participant completed written informed consent forms and was provided with 15 RMB as compensation. This study was approved by the Ethics Committee of the West China Medical Center of Sichuan University.

Measures

PTG

PTG was measured using the Posttraumatic Growth Inventory (24) of the Chinese version (47). This 21-item scale consists of five subscales: 4-item personal strength, 5-item new possibilities, 7-item relating to others, 3-item appreciation of life, and 2-item spiritual change. Each item was scored on a 6-point scale (ranging from 0 = no change to 5 = very great change) and higher scores indicated better PTG. The PTG inventory has good internal consistency and good construct, convergent, and discriminate validities (24). The scale was translated into Chinese and then back-translated by three English professionals. This instrument had adequate internal reliability ($\alpha = 0.96$).

PTSD Symptoms

PTSD symptoms over the previous month were assessed using the PTSD Checklist-Civilian Version (48). This 17-item scale has three dimensions: 5-item intrusion (e.g., "Suddenly acting or feeling as if a stressful experience were happening again"), 7-item avoidance (e.g., "Avoid thinking about or talking about a stressful experience from the past or avoid having feelings related to it"), and 5-item hyper-arousal (e.g., "Feeling jumpy or easily startled"). Each item was scored on a 5-point scale (ranging from 1 = not at all to 5 = extremely) and higher scores indicated more severe psychological distress symptoms. Probable PTSD Symptoms was classified when individual's score $\geq$50 (49). The Chinese version of the scale was translated by Shi and colleagues (50). Cronbach's alpha of this instrument was 0.95.

Rumination Inventory

Rumination was measured using the revised Event-Related Rumination Inventory (51, 52). This 20-item scale included two dimensions: 10-item intrusive rumination (such as "I cannot help thinking about the Wenchuan earthquake") and 10-item deliberate rumination (such as "I thought about what I could learn from the Wenchuan earthquake experience"). Each item was scored on a 4-point scale (0 = not at all to 3 = always). The Chinese version of the scale was translated by Wu and colleagues (15, 52) and examined in Chinese adolescent samples, the fit indices from a confirmatory factor analysis were good and the internal reliability assessment yielded Cronbach's α of 0.88 and 0.89 for intrusive and deliberate ruminations, respectively. In this study, Cronbach's alpha for intrusive and deliberate ruminations were 0.96 and 0.96, respectively.

PSS

PSS was measured using the revised Perceived Social Support Scale (53). This 20-item scale consists of three subscales relating to the source of the support: 8-item regarding family (such as "My family really tries to help me"), 8-item regarding friends (such as "I can count on my friends when things go wrong"), and 4-item regarding a significant other (such as "There is a special person in my life who cares about my feelings"). Each item was scored on a 7-point scale (1 = very strongly disagree to 7 = very strongly agree) and higher scores indicated more PSS. The Chinese version of the scale was translated by Huang and colleagues, and it had adequate internal reliability and validity (54). Cronbach's alpha for family, friends, and a significant other of PSS subscales were 0.95, 0.94, and 0.92, respectively.

Data Analysis

Frequency and descriptive analyses were conducted. Independent-sample *T*-test was performed to compare the gender characteristic. One-way ANOVA was used to examine the effects of age at the commencement of rumination, PSS, PTG, and PTSD symptoms. Pearson's and Spearman's rho correlations were computed to examine the relationships between variables. Analyses were conducted using SPSS (version 22.0). Structural equation modeling (SEM) with maximum

TABLE 1 | Means, standard deviations, and differences of variables of 2008 Wenchuan earthquake youth survivors by age ($n = 476$).

	Age 6–11 (227)	Age 12–15 (83) M ± *SD*	Age 16–19 (166)	*F*	*p*	*Post-hoc* comparisons[a]
Intrusive rumination	16.61 (6.78)	10.76 (7.42)	16.78 (6.85)	6.81	0.001	2 > 1 = 3
Deliberate rumination	18.94 (7.34)	22.88 (7.01)	19.67 (7.34)	9.97	< 0.001	2 > 1 = 3
PSS from family	43.57 (10.23)	46.19 (9.35)	45.99 (8.28)	4.15	< 0.001	2 = 3 > 1
PSS from Friends	44.38 (7.93)	45.01 (7.15)	43.63 (8.58)	0.89	0.410	–
PSSSO	20.58 (5.27)	21.98 (4.66)	19.60 (5.98)	5.36	0.005	2 > 1 = 3
PSS	108.53 (20.23)	113.18 (18.80)	109.58 (19.93)	1.70	0.183	–
PTG	87.22 (22.98)	97.22 (19.71)	88.80 (23.85)	5.99	0.003	2 > 3 = 1
PTSD symptoms	33.48 (14.47)	38.27 (14.35)	32.89 (15.87)	3.96	0.020	2 > 1 = 3

PSS, perceived social support; PSSSO, PSS from significant others; PTG, posttraumatic growth; PTSD, posttraumatic stress disorder.
[a]*p at 0.05 level.*

TABLE 2 | Correlations of variables of Wenchuan earthquake youth survivors.

All participants	1	2	3	4	5	6	7	8	9	10
1. Age	1	-	-	-	-	-	-	-	-	-
2. Sex	−0.08	1	-	-	-	-	-	-	-	-
3. Intrusive rumination	0.03	−0.11*	1	-	-	-	-	-	-	-
4. Deliberate rumination	0.05	−0.18**	0.83**	1	-	-	-	-	-	-
5. PSS from family	0.14**	−0.04	0.18**	0.24**	1	-	-	-	-	-
6. PSS from friends	0.01	0.00	0.14**	0.21**	0.69**	1	-	-	-	-
7. PSSSO	−0.01	−0.05	0.22**	0.26**	0.51**	0.60**	1	-	-	-
8. PSS	0.06	−0.04	0.20**	0.27**	0.90**	0.90**	0.76**	1	-	-
9. PTG	0.04	−0.16**	0.40**	0.46**	0.38**	0.34**	0.34**	0.41**	1	
10. PTSD symptoms	−0.04	−0.01	0.74**	0.60**	0.04	0.01	0.12**	0.06	0.30**	1
Age 6–15 (n = 310)										
1. Age	1	-	-	-	-	-	-	-	-	-
2. Sex	−0.15**	1	-	-	-	-	-	-	-	-
3. Intrusive rumination	0.18**	−0.11*	1	-	-	-	-	-	-	-
4. Deliberate rumination	0.26**	−0.16**	0.84**	1	-	-	-	-	-	-
5. PSS from family	0.22**	−0.09	0.19**	0.25**	1	-	-	-	-	-
6. PSS from friends	0.10	−0.04	0.13*	0.22**	0.71**	1	-	-	-	-
7. PSSSO	0.17**	−0.05	0.19**	0.26**	0.56**	0.53**	1	-	-	-
8. PSS	0.19**	−0.07	0.19**	0.28**	0.93**	0.88**	0.74**	1	-	-
9. PTG	0.19**	−0.15**	0.37**	0.42**	0.40**	0.38**	0.30**	0.42**	1	-
10. PTSD symptoms	0.13*	−0.04	0.71**	0.59**	0.02	0.01	0.11	0.04	0.27**	1
Age 15–19 (n = 187)										
1. Age	1	-	-	-	-	-	-	-	-	-
2. Sex	0.06	1	-	-	-	-	-	-	-	-
3. Intrusive rumination	−0.18*	−0.13	1	-	-	-	-	-	-	-
4. Deliberate rumination	−0.26**	−0.22**	0.82**	1	-	-	-	-	-	-
5. PSS from family	−0.11	0.09	0.20**	0.27**	1	-	-	-	-	-
6. PSS from friends	−0.02	0.06	0.15*	0.19**	0.70**	1	-	-	-	-
7. PSSSO	−0.11	−0.02	0.25**	0.26**	0.49**	0.72**	1	-	-	-
8. PSS	−0.08	0.04	0.22**	0.27**	0.86**	0.93**	0.81**	1	-	-
9. PTG	−0.24**	−0.14*	0.45**	0.54**	0.38**	0.32**	0.43**	0.42**	1	-
10. PTSD symptoms	−0.10	0.02	0.76**	0.60**	0.11	0.06	0.17*	0.12	0.36**	1

PSS, perceived social support; PSSSO, PSS from significant others; PTG, posttraumatic growth; PTSD, posttraumatic stress disorder.
*$p < 0.05$. **$p < 0.01$.*

likelihood estimation was employed to explore the hypothesized mediation model using AMOS (version 22.0). Indices used to evaluate the model fit were the Comparative Fit Index (CFI), Normed Fit Index (NFI), Incremental Fit Index (IFI), and the Root Mean Square Error of Approximation (RMSEA). Linear regression analyses were used to examine the moderation roles of PSS between intrusive and deliberate ruminations and PTSD symptoms.

RESULTS

Preliminary Analyses

In the overall sample, the mean score of PTG was 89.51 (SD = 23.00); the prevalence of PTSD symptoms was 16.18% (scores ≥ 50, n = 77). Participants were divided into three groups depending on their age of developmental characteristics (41) when the Wenchuan Earthquake occurred: 6–11 years (childhood, n = 227), 12–15 years (early adolescence, n = 83), 16–19 years (late adolescence, n = 166). Means and SD of the variables are shown in **Table 1**. As age increased, PTG scores increased from ages 6–15 years (although age 11 was the lowest, PTG mean = 81.97), and then it decreased for ages 15–19 years old. One-way ANOVA results showed significant differences among the three age groups: intrusive rumination (F = 6.81, p = 0.001), deliberate rumination (F = 9.97, p < 0.001), PTG (F = 5.99, p < 0.01), PTSD symptoms (F = 3.96, p < 0.05). *Post-hoc* pairwise comparisons indicated that based on the degree of scores, the three age groups ranked in the following order: early adolescence, and childhood equals late adolescence on intrusive rumination, deliberate rumination, PTG, and PTSD symptoms. Men were significantly higher than women on PTG (t = 3.31, Cohen's d = 0.30, p < 0.01), while there were no significant differences by gender on PTSD symptoms.

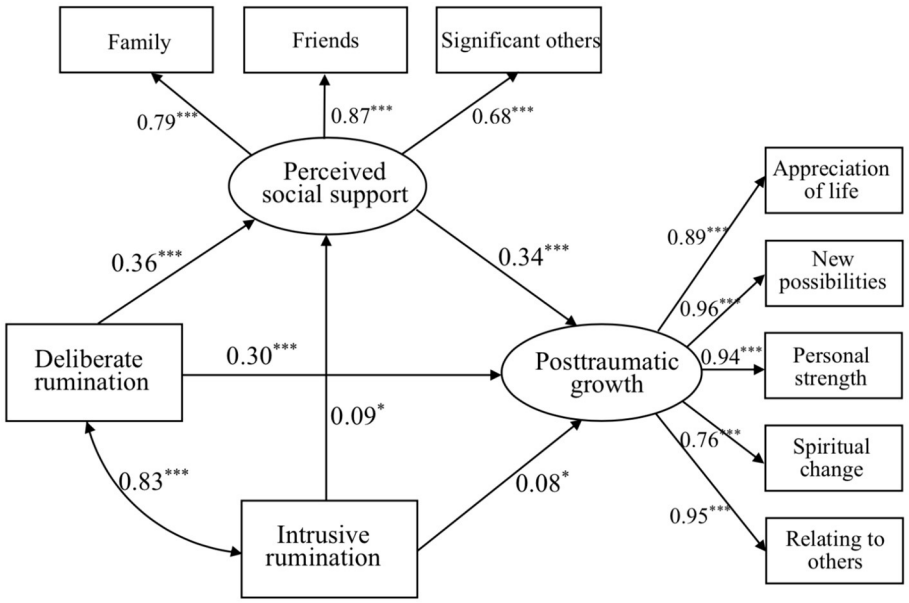

FIGURE 1 | Mediation model of deliberate and intrusive ruminations to PSS and to PTG. *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$.

TABLE 3 | Fit statistics for mediation models.

Mediation model	χ^2	*df*	χ^2/df	GFI	NFI	IFI	TLI	CFI	RMSEA	*p*
1	81.86	31	2.62	0.97	0.98	0.99	0.98	0.99	0.058	<0.001
2a	70.05	38	1.84	0.96	0.98	0.99	0.98	0.99	0.052	0.001
2b	92.36	38	2.43	0.92	0.95	0.97	0.95	0.97	0.088	<0.001

Correlation Analyses

Correlations are shown in **Table 2**. Significant correlations exit between PTG and PTSD symptoms ($r = 0.30$, $p < 0.01$) but partial correlation analysis (intrusive and deliberate ruminations, and PSS as covariates) were not related between PTG and PTSD symptoms ($r = 0.07$, $p > 0.05$).

Deliberate rumination was most significantly associated with PTG ($r = 0.46$, $p < 0.01$), followed by PSS ($r = 0.41$, $p < 0.01$), intrusive rumination ($r = 0.40$, $p < 0.01$), and gender ($r = -0.16$, $p < 0.01$). Age was not significantly related to PTG in all participants but positively correlated in the childhood group ($r = 0.19$, $p < 0.01$), while it was negatively correlated in the late adolescence group ($r = -0.24$, $p < 0.01$). Intrusive rumination was most significantly associated with PTSD symptoms ($r = 0.74$, $p < 0.01$), followed by deliberate rumination ($r = 0.60$, $p < 0.01$) and PSS from significant others (PSSSO, $r = 0.12$, $p < 0.01$).

Mediation Analyses of PTG

Mediation effects of PSS on the associations between intrusive rumination, deliberate rumination, and PTG of mediation model 1 are shown in **Figure 1** and **Table 3**. The SEM model revealed that deliberate rumination ($B = 0.30$) and PSS ($B = 0.34$) had significant direct effects on PTG; intrusive rumination was related to deliberate rumination. Intrusive rumination had an indirect effect on PTG via PSS: Intrusive rumination → PSS → PTG ($B = -0.03$). Deliberate rumination had an indirect effect on PTG via PSS: Deliberate rumination → PSS → PTG ($B = 0.12$). Model 1 showed an acceptable fit for the data ($\chi^2/df = 2.62$, RMSEA = 0.058, CFI = 0.99, NFI = 0.98).

Age was added to mediation model 1 to explore its main effect. Results indicated no significant effect on PTG in the full sample, while age had a positive but non-significant effect on PTG: ages 6–15 → PTG ($B = 0.04$, $p = 0.47$; mediation model 2a, see **Figure 2**); but a marginally negative effect on PTG: ages 15–19 → PTG ($B = -0.11$, $p = 0.08$; mediation model 2b, see **Figure 3**). Both models 2a and 2b showed an acceptable fit for the data, presented in **Table 3**.

Moderation Analysis of PTSD Symptoms

Additionally, we examined the moderation models as proposed in hypotheses 4 and 5 using PROCESS to see if the effect of intrusive rumination or deliberate rumination and PSS on PTSD symptoms had interactions, as shown in **Table 4**. In moderation model 1 (full sample), the main effect of intrusive rumination on PTSD symptoms was significant ($t = 8.53$, $p < 0.001$).

PSSSO and its interactions with intrusive rumination were added to moderation model 1, as shown in **Figure 4**. The main effect of PSSSO was significant ($t = -2.28$, $p < 0.05$), while both

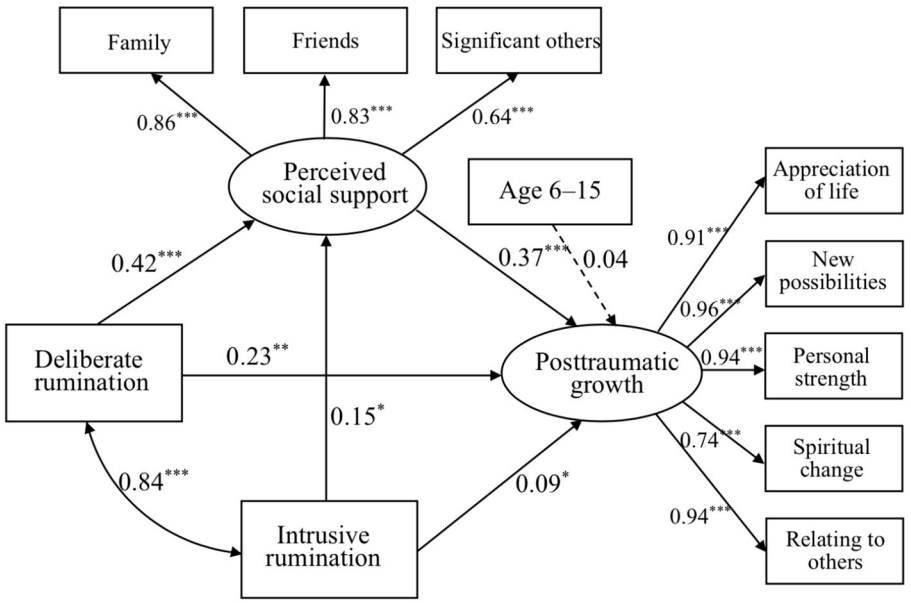

FIGURE 2 | Mediation model of deliberate and intrusive ruminations to PSS and to PTG in age 6–15 sample. *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$.

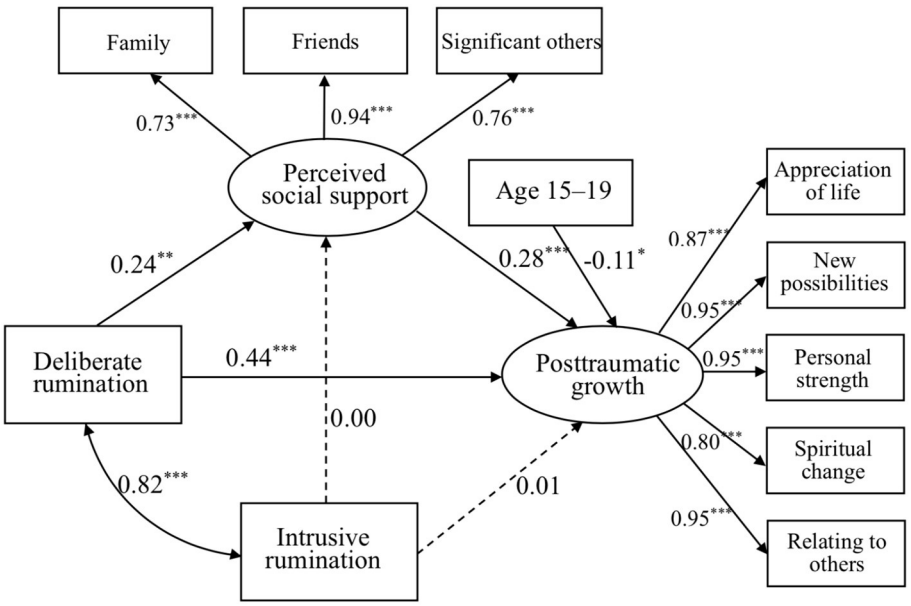

FIGURE 3 | Mediation model of deliberate and intrusive ruminations to PSS and to PTG in age 15–19 sample. *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$.

interactions of intrusive × deliberate rumination ($t = -2.37$, $p < 0.05$) and intrusive rumination × PSSSO ($t = 2.00$, $p = 0.05$) were significant on PTSD symptoms.

A moderation model was also performed to explore subgroups of age. Similar to the full sample of moderation model 1, the main effect of intrusive rumination and PSSSO, and the interaction of intrusive × deliberate rumination and intrusive rumination × PSSSO, was significant for both age 6–15 (moderation model 2) and age 15–19 (moderation model 3) samples.

DISCUSSION

This study was to clarify the relationship of rumination and PTG, studying the long-term (12 years after) effect on PTG

TABLE 4 | Linear regression analysis: main and moderate factors associated with PTSD symptoms.

	All participants (476)			Age 6–15 (310)			Age 15–19 (187)		
	Estimate	*T*	*P*	Estimate	*t*	*p*	Estimate	*t*	*p*
Intrusive rumination	1.61	4.73	<0.001	1.19	2.75	0.006	1.41	2.56	0.01
Deliberate rumination	0.23	1.27	0.21	0.27	1.23	0.22	0.40	1.41	0.16
PSSSO	−0.55	−2.28	0.02	−0.77	−2.47	0.01	−0.91	−2.41	0.02
Intrusive × Deliberate rumination	−0.02	−2.37	0.02	−0.02	−2.03	0.04	−0.03	−2.46	0.01
Intrusive rumination × PSSSO	0.28	2.00	0.05	0.04	2.40	0.02	0.06	2.53	0.01

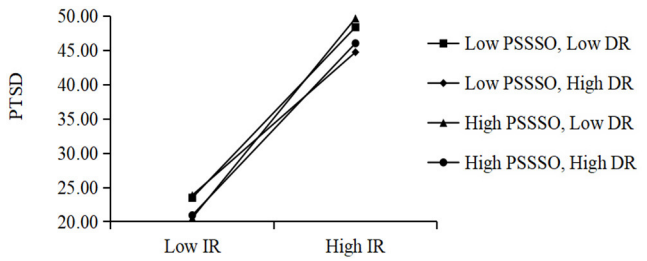

FIGURE 4 | Moderation model of deliberate rumination (DR) and intrusive rumination (IR) and perceived social support from significant others (PSSSO) to PTSD symptoms.

and PTSD symptoms regarding an earthquake trauma during childhood and adolescence in young survivors, and explore the mediating and moderating role of PSS in the relationship between rumination and PTG and PTSD symptoms. To our knowledge, this was the first study to examine the role of rumination and PSS in PTG and PTSD symptoms among adult Wenchuan earthquake survivors, focusing on samples of people who were children and adolescents at the time of the event.

This study showed substantial long-term consequences of traumas that occurred during childhood and adolescence, affecting PTG and PTSD in young adulthood. Remarkably, the present study found that PTG level differed significantly among participants at different age stages when the earthquake occurred. As age increased, PTG scores nearly increased from ages 6–15, and then decreased from ages 15 to 19. In addition, the results showed that PTSD symptom level also significant differed among different age stages, specifically, survivors aged 12–15 reported the highest level of PTSD symptoms. Results indicated that long-term effects of PTG and PTSD symptoms would significantly differ among different non-adult age groups who suffered the same earthquake. As age increased, PTG scores increased from ages 6–15, while they decreased from ages 15–19. A possible explanation for the difference is that survivors in early adolescence who experienced the earthquake were in a stage of rapid physical, psychological, and brain development when cognition and emotion are susceptible to trauma impact, compared with survivors in childhood and late adolescence (7, 40). This finding complements current views of child development and highlights that the drastic transition period from childhood to adolescence is marked by age-related changes in cognitive, emotional, and social processes that may influence the likelihood of psychological outcomes following trauma exposure beyond the role of sociodemographic factors (7). Trauma exposure in adolescence should be of particular concern and targeted in psychological prevention and protection.

Deliberate rumination was found to be most positively associated with PTG, followed by intrusive rumination. For adolescent survivors during the Wenchuan earthquake, PTG was affected by many factors, especially related to rumination and PSS for youth survivors. As a form of vulnerable cognition, rumination began in the aftermath of the earthquake, and it challenged the framework by which the children understood the world. Rumination, both negative, distressing thoughts, and deliberate, repetitive thinking, may play a key role in PTG (20). Additionally, intrusive rumination was most significantly associated with PTSD symptoms—this finding was consistent with previous studies (20, 30), followed by deliberate rumination. Our study also supported the idea that cognitive models of PTSD, such as ruminative cognitive styles, compelled individuals to recall negative traumatic memories and perceptions, but ultimately interfered with the process of psychological distress recovery (29, 32).

In line with prior cross-sectional and longitudinal work (1, 15, 21), despite the common co-occurrence between PTG and PTSD after traumatic exposure, this finding supported the notion that PTG and PTSD symptoms are two independent variables (4, 16), but it did not parallel other studies (2, 5, 8). A potential explanation might be attributed to variance in PTG and PTSD symptom measurement instruments and that participants and traumatic experiences varied [for example, war and earthquake experience; (8, 15)]. Given the inconclusive associations between PTG and PTSD symptoms, more research is needed to examine different traumatic experiences.

Rumination and PTG: PSS as a Mediator

Using the full sample, as well as both the age 6–15 and 15–19 subgroups separately, our study supported the view that PSS is a protective factor for PTG (11, 55). PSS provides trauma-exposure survivors a safe environment where they can talk freely with others about traumatic experiences and associated perceptions and emotions, and reframe traumatic events and reconstruct their worldviews, thus promoting their PTG (24). These findings were in accordance with the main-effect hypothesis of social support (4) and Tedeschi and Calhoun's model of PTG (24).

Most importantly, these findings indicated that PSS mediated the relationship between intrusive rumination, deliberate rumination, and PTG for earthquake youth survivors, providing empirical evidence for the long-term effects of traumatic rumination on adulthood PTG related to PSS. Mediation model 1 revealed that intrusive rumination has an indirect effect on PTG via PSS. Deliberate rumination also has an indirect effect on PTG *via* PSS. This finding confirmed the notion that deliberate rumination could help individuals seek and receive more PSS to understand traumatic events, while PSS can lessen the negative impact of rumination on individuals and increase positive experiences, leading to PTG (19). Young adult survivors' age during the earthquake was added to mediation model 1 and indicated no significant effect on PTG among the full sample, while age had a positive effect on PTG but did not reach significance: age 6–15 → PTG (mediation model 2a); but had a marginally negative effect on PTG: age 15–19 → PTG (mediation model 2b). Findings of the mediation results confirmed hypothesis 3 that PSS would mediate the link between rumination and PTG, and the mediation model varied by age group. This finding is important because it demonstrated children and adolescents' age need to be taken into account especially for trauma-exposed PTG in the field of child development.

Rumination and PTSD Symptoms: PSS as Moderator

In the moderation model (full sample, as well as both age 6–15 and 15–19 subgroups), the main effect of intrusive rumination on PTSD symptoms was significant and the interaction of intrusive × deliberate rumination was significant on PTSD symptoms. This finding was consistent with a previous study that suggested that intrusive rumination (but not deliberate rumination) prospectively predicts PTSD symptoms (30). The negative focus on trauma may initially invade one's cognitive world, leading one to ruminate to avoid traumatic memories and emotions, which temporarily alleviates psychological distress, but ultimately interferes with the process of adaptive recovery (29, 31). Interestingly, the findings suggest a distinct variation in intrusive rumination functioning between different levels of deliberate rumination, highlighting the critical role of the interactions in two distinct rumination dimensions for the effect on survivors' PTSD symptoms. Building upon prior rumination to PTSD research, we believe this study expands the literature by providing evidence for the significant rumination interaction mechanisms on trauma-exposed PTSD symptoms.

Additionally, in the moderation model (full sample, as well as both age 6–15 and 15–19 subgroups), the main effect of PSSSO and interaction of intrusive rumination × PSSSO were significant on PTSD symptoms. It demonstrated a variation in intrusive rumination functioning on PTSD symptoms regarding different PSSSO levels. This interaction was consistent in all three age group samples. First, we did not find family or friends' PSS as main effects or moderators on PTSD symptoms besides PSSSO. Cultural/regional diversity may account for associations between different resources of PSS and PTSD symptoms (56, 57). For example, in the long-term effects following a Turkish earthquake, neither PSS from friends nor from teachers was significantly associated with PTSD symptoms among adolescent survivors (58). After the Wenchuan earthquake, support from significant others—the Chinese government, soldiers, volunteers, psychologists, and social enterprises—provided necessary resources for children and adolescents surviving the earthquake to cope with loss and distress, especially in their house reconstruction, medical services, and psychological recovery (56, 59). Therefore, PSSSO can buffer the effects of traumatic experiences on PTSD symptoms. In addition, survivors with frequent intrusive rumination may more frequently express their dissatisfaction with their PSSSO networks and may engage in co-rumination during social interactions, which will in turn precipitate or exacerbate PTSD symptoms (47). Although rumination increases attention on negative aspects of the trauma experience, the derived negative emotions from these thoughts should be ameliorated by others' understanding and help provided in a supportive environment, and thus PTSD symptoms will be also ease (35). Therefore, PSSSO can buffer the effects of traumatic experiences and cognitions on PTSD symptoms (10). This finding confirmed the social-cognitive theory (60) that PSS was crucial in perpetuating or breaking the pathway from trauma experiences to PTSD via rumination. Our findings provide evidence that PSSSO is a preventive factor for the development of PTSD (10) and has implications for practical PTSD symptom interventions for earthquake survivors, by taking into account PSS especially PSSSO.

Clinical Implications

It is crucial to enhance clinical outcomes for those who are considered at high risk for trauma-related psychopathology such as PTSD symptoms. Our data suggest that one potential way to prevent the onset or mitigate the extent of PTSD symptom is to provide clients with substantial social support. The availability of social support can facilitate a process of change by eliciting communication about traumatic experiences (23, 24) and lead individuals to reframe these and reconstruct their worldviews after trauma, thus potentiating PTG and mitigating PTSD symptoms.

Some individuals may ruminate to avoid traumatic memories and associated negative emotions, which temporarily alleviates distress, but ultimately interferes with the process of adaptive recovery. Therefore, counseling psychologists need to take notice of this cognitive process in clients. While helping their clients to cope with PTSD symptoms, counseling psychologists should be aware of the possibility of positive change after the trauma. In doing so, counseling interventions might focus on techniques that help clients to view PTSD symptoms and their cumulative impact with greater self-directed compassion. On that basis, counseling services may provide an opportunity to offset trauma-disclosure inhibitions that may hinder the experience of situational adaptation in the aftermath of traumatic events.

Remarkably, our findings suggest that PTG levels significantly differed in different age stages. Specifically, older adolescents reported higher levels of PTG. This may be

of particular importance for emergency service professionals, especially for those who deal with the problems of children and adolescents.

Limitations

This study employed a mono-method of gathering data by using questionnaires that could be impacted by self-report issues such as social desirability biases. As this study was cross-sectional, the causality and time-dependent fluctuations between rumination, PSS, PTG, and PTSD symptoms could not be proven. It was also noted that PTSD symptoms may have been caused by shared factors not examined in this study. Third, it is unknown whether the effects of trauma exposure persisted continuously since the event, increased over time, reappeared after periods of remission, or followed other non-linear trajectories. Prospective, longitudinal studies of trauma are needed to examine longitudinal changes in the course of posttraumatic outcomes. Except for gender and age, this study did not consider socio-demographic characteristics.

CONCLUSION

Children and adolescents who experienced the Wenchuan earthquake reported a high level of PTSD symptoms as well as PTG. This study contributes new knowledge through a developmental perspective to previous theoretical and empirical studies of the relationship between rumination, PSS, and PTG/PTSD symptoms, and further suggests that PSS plays a mediating role between rumination and PTG and a moderating role between rumination and PTSD symptoms. From intervention and health-enhancement perspectives, this study highlights important implications for child and adolescent survivors of the Wenchuan earthquake.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of Sichuan University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

WX and CF contributed to conception and design of the study, organized the database, performed the statistical analysis, and wrote the first draft of the manuscript. WX managed data collection. WX, CF, WT, and YY contributed to manuscript revision. YY contributed to potential funding support. All authors contributed to the article and approved the submitted version.

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The Mediating Effect of Depression on the Relation Between Interpersonal Needs and Suicidal Ideation Among Chinese Transgender Women

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Background: Transgender women are at high risk of depression and suicidal ideation. The interpersonal theory of suicide proposes that suicidal ideation could be a consequence of high interpersonal needs (thwarted belongingness and perceived burdensomeness). The current study tests this theory and investigates whether depression could mediate the relationship between interpersonal needs and suicidal ideation among transgender women in Shenyang, China.

Methods: A total of 198 transgender women were recruited by snowball sampling. A cross-sectional study was conducted through a structured questionnaire. Suicidal ideation, depression, and interpersonal needs were assessed. Path analysis was used to carry out the research goals and the mediating effect of depression was tested.

Results: There were nearly 37% of the participants reported lifetime suicidal ideation. Suicidal ideation was positively correlated with thwarted belongingness ($t = -5.53$, $p < 0.01$) and perceived burdensomeness ($t = -5.02$, $p < 0.01$). The direct effect from thwarted belongingness to suicidal ideation *via* depression was statistically significant (Std. $\beta = 0.232$, $p < 0.01$). Depression could also mediate the indirect path from perceived burdensomeness to suicidal ideation through depression (Std. $\beta = 0.222$, $p < 0.01$) although the direct path between them was not significant (Std. $\beta = 0.046$, $p = 0.693$).

Conclusions: Depression fully mediated the relationship between perceived burdensomeness and suicidal ideation, and partially mediate the relationship between thwarted belongingness and suicidal ideation. To reduce the risk of suicidal ideation among transgender women, interventions targeting thwarted belongingness, perceived burdensomeness, and depression are needed.

Keywords: transgender women, suicidal ideation, depression, mediating effect, interpersonal theory of suicide

INTRODUCTION

Transgender women are individuals who were assigned male at birth but identify themselves as women (1). It is estimated that transgender women accounted for 0.5–1.3% of the world's population (2). In China, there are about 7,000,000 transgender women, accounting for 7.28–18.92% of the overall world transgender women population. Transgender women are vulnerable to mental health problems, such as suicidal ideation, depression, anxiety, and suicide (3–6). A large representative study among 1,309 transgender population across 32 provinces and municipalities in China found that transgender women had a higher prevalence of suicidal ideation (56.4%) (7) than the general population (3.1%) (8). Based on the suicide theory, suicidal ideation has a close association with suicide attempt, suicide-related injury, and deaths (9). Studies investigating the facilitators of suicidal ideation could inform effective interventions to reduce the suicide attempt, injuries, and deaths among transgender women (10).

Prior research had conceptualized the mechanisms of suicidal ideation among various populations. Joiner's interpersonal theory of suicide assumes that people with the most determined suicidal ideation often experience interpersonal needs (high thwarted belongingness and perceived burdensomeness) (11). Thwarted belongingness refers to the belief that someone has no social connectedness, which could result in a desire for death (12). Perceived burdensomeness represents the feeling that one is a burden on significant others or the society, including but not limited to family members (12). As a highly vulnerable and marginalized gender minority, transgender women in China (13) often suffer stigma and discrimination in their daily life, take high risks of losing jobs and better education opportunities, and face barriers accessing healthcare services. Thus, they are more likely to experience depression and suicide and more attention should be paid to the social support and mental health of transgender women (14, 15). Social isolation induced from rejection from people around, and life situations, such as homelessness and unemployment, which are of high incidence among transgender women, may result in feelings of both thwarted belongingness and perceived burdensomeness (16). The interpersonal theory of suicide could be applied to transgender women and provide an in-depth understanding of the high prevalence of suicide in this unique population. Several studies have also tested the interpersonal theory of suicide among transgender people (16, 17). Testa demonstrated in an analysis of a convenience sample of 816 transgender and gender non-conforming (TGNC) adults that the interpersonal theory of suicide conferred risk for suicidal ideation among TGNC individuals. However, the processes or mechanisms are understudied, few studies have explored whether psychological disorders mediate the pathway from interpersonal needs to suicidal ideation.

Depression is closely associated with suicidal ideation (18), with about a half to two-thirds with suicidal ideation having depression in transgender people (19, 20). A study among transgender women in Canada found that more than 60.0% of them suffered from depression, which was much higher than the cisgender populations (21). A meta-analysis of longitudinal studies found that unipolar depression is one of the most well-investigated factors for suicidal thoughts and behaviors (22). In addition, thwarted belongingness and perceived burdensomeness could bring about depression (23, 24). Thus, we assume that depression may play an important role in the relationship between interpersonal needs and suicidal ideation.

To address the knowledge gaps, this study aims to investigate the mediating role of depression in Joiner's interpersonal theory of suicide model among transgender women in Shenyang, China. We assumed that: (1) interpersonal needs are directly associated with suicidal ideation among transgender women, and (2) depression could mediate the relationship between interpersonal needs and suicidal ideation among transgender women.

METHODS

Study Site and Participants

With the collaboration with China Love Aid, we recruited our participants in Shenyang, China from April to July 2017. China Love Aid is a non-governmental organization (NGO) with a mission to improve the physical and mental health of transgender women. The inclusion criteria were individuals who were at least 18 years old, self-identified as transgender women, living and working in Shenyang, and agreed to participate in the study after a description of the study purposes and assurance of confidentiality. Those with obvious mental illnesses, psychological illnesses, intellectual disabilities, and unable to cooperate in completing the survey questionnaire were excluded. Finally, a total of 198 transgender women were recruited in the study.

Recruitment and Procedures

Participants were recruited by snowball sampling, which has been commonly used to engage stakeholders from hard-to-reach vulnerable communities (25, 26). Local research assistants recruited five eligible transgender women as the "seeds." The selected participants then recruited other eligible transgender women until the saturation met (the recruited participants could no longer introduce new participants).

Upon obtaining the informed consent among participants, research assistants provided brief instructions on how to answer the questionnaire. Then, the participants were invited to complete a paper-based questionnaire in a private room. The interviewers would assist with the request. It took an average of 30–40 min to finish the questionnaire. Upon completion, each participant received an incentive equivalent to 30 U.S. dollars as a token of appreciation for their participation. The study protocol was approved by the Institutional Review Boards at the School of Public Health of Shanghai Jiao Tong University, China (Protocol # 2016022).

MEASURES

Sociodemographic Characteristics

Demographic characteristics included age group by quartiles (1 = 18–27, 2 = 28–38, and 3 = 39–62), levels of education (1 ≤ Primary school, 2 = Junior school, 3 = High school, and 4 ≥

College school), current marital status (1 = Never married, 2 = Married with a female, and 3 = Divorced or widowed), monthly income in Chinese currency Yuan (CYN; one Yuan equals to about 0.1428 USD at the time of the survey) (1 ≤ 3,150 CYN, 2 = 3,150–6,300 CYN, 3 = 6,300–12,600 CYN, and 4 ≥ 12,600 CYN), and duration of staying in Shenyang (1 = Local, 2 = Not a local and lived for <1 year, 3 = Not a local resident and lived for 1–5 years, and 4 = Not a local and lived for over 5 years). Participants were also asked to report their sexual orientation (1 = Heterosexual, 2 = Homosexual, and 3 = Bisexual/ others), whether have received HIV-related education (1 = Yes and 0 = No), and ever made feminization changes (1 = Yes and 0 = No). HIV status was recorded based on self-report (1 = Positive, 2 = Negative, and 3 = Unknown).

Suicidal Ideation

Participants were asked whether they had ever considered suicide in their lifetimes. Participants who answered "yes" were considered as having suicidal ideation. Several studies have used this method for suicidal ideation measurement (27–31).

Interpersonal Needs

Both thwarted belongingness and perceived burdensomeness were measured using the Interpersonal Needs Questionnaire-15 (INQ-15) derived from the interpersonal theory of suicide (32). The INQ-15 (33, 34) is a self-report measurement with response options ranging from 1 (not at all true for me) to 7 (very true). On this scale, there were 9-item for assessing thwarted belongingness and 6 items for perceived burdensomeness. Item sample of thwarted belongingness is "These days I feel like I belong" (reverse scored) and that of perceived burdensomeness item is "These days I think I am a burden on society" (32). With appropriate recoding, sum scores were calculated to reflect thwarted belongingness and perceived burdensome, with higher scores indicating higher thwarted belongingness and perceived burdensomeness. Both measures of thwarted belongingness and perceived burdensomeness had good reliabilities (thwarted belongingness: Cronbach's $\alpha = 0.81$; perceived burdensomeness: Cronbach's $\alpha = 0.84$) in the current study.

Depression

Depression was assessed using the 9-item Patient Health Questionnaire (PHQ-9). PHQ-9 assesses affective, cognitive, behavioral, and somatic symptoms of depression in the past 2 weeks (e.g., "Little interest or pleasure in doing things"). Response options are rated from 0 (not at all) to 3 (almost every day) (35–37). The sum score (ranging from 0 to 27) was used to reflect levels of depression, with a higher score indicating more depressive symptoms. A cutoff of 10 was used to define the depressive symptoms (38, 39). The reliability of the scale for the current study was acceptable (Cronbach's $\alpha = 0.90$). The continuous score of depression was used for the path model.

Statistical Analysis

Descriptive statistics was conducted to describe sociodemographic characteristics, depression, interpersonal needs, and suicidal ideation. The chi-squared analysis and *t*-test were used to examine the association between sociodemographic characteristics, interpersonal needs, depression, and suicidal ideation.

Path analysis was employed to test the mediating role of depression in the relationship between interpersonal needs and suicidal ideation after adjusting for potential confounders. The direct and indirect effects were examined by a bias-corrected bootstrap procedure based on 1,000 bootstrap samples (40). As suicidal ideation is a binary variable, the parameters were estimated using the robust weighted least squares (WLS) approach (estimator = WLSMV in Mplus). Bias-corrected confidence intervals for the direct and indirect paths were reported.

Multiple indices were used to evaluate model fits. These indices included χ^2/df, comparative fit index (CFI), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), and weighted root mean square residual (WRMR). $\chi^2/df < 3$, CFI > 0.95, RMSEA ≤ 0.06, SRMR ≤ 0.08, and WRMR ≤ 1.00 indicated better model fit (41).

Descriptive statistics and bivariate analyses were performed using the SPSS Statistics (version 23.0 for Windows9, IBM, Armonk, NY, USA). Path analysis was performed using Mplus version 7.0.

RESULTS

Descriptive Statistics

The results of the descriptive analysis are demonstrated in **Table 1**. The majority (77.27%, $n = 153$) of participants were unmarried. There were nearly 50% of the participants aged between 28 and 38 years. Nearly 70% of the participants were homosexual. All the participants have ever made feminization changes. More than half of the participants had received HIV-related education (65.66%). About 13.13% of the participants reported an unknown HIV status and 24.75% had been diagnosed as HIV-positive.

Correlations Between Demographic, Interpersonal Needs, and Suicidal Ideation

Nearly 37% of the participants reported lifetime suicidal ideation. Only marital status was significantly associated with suicidal ideation. Suicidal ideation is significantly higher among the divorced or widowed ones than among the married or unmarried ones (55.88 vs. 45.45%, 32.02%, $p < 0.05$). Since age had been found to have a strong correlation with suicidal ideation in previous studies, it was controlled as a covariate in the multivariate analysis although it was not significant in the univariate test. Thwarted belongingness and perceived burdensomeness were significantly and positively associated with suicidal ideation.

The multivariate logistic regression showed that suicidal ideation was significantly associated with thwarted belongingness ($OR_m = 1.068$ and 95% CI = 1.030–1.108) and perceived burdensomeness ($OR_m = 1.072$ and 95% CI = 1.017–1.121) after adjusting for both age group and marital status (**Table 2**).

TABLE 1 | Background characteristics of transgender women ($N = 198$).

Variables	Number of participants	Have suicidal ideation			
	N (row%)	Yes [*n* (row%)/ Mean ± SD]	No [*n* (row%)/ Mean ± SD]	χ^2/t	*p*
Total	198 (100)	73 (36.87)	125 (63.13)		
Age (y)				2.44	0.295
18–27	57 (28.78)	25 (43.86)	32 (56.14)		
28–38	95 (47.98)	30 (31.58)	65 (68.42)		
39–62	46 (23.24)	18 (39.13)	28 (60.87)		
Education level				0.79	0.852
<Primary school	15 (7.58)	6 (40.00)	9 (60.00)		
Junior school	83 (41.92)	31 (37.35)	52 (62.65)		
High school	50 (25.25)	16 (32.00)	34 (68.00)		
>College school	50 (25.25)	20 (40.00)	30 (60.00)		
Marital status				0.01*	0.012
Unmarried	153 (77.27)	49 (32.02)	104 (67.97)		
Married with a female	11 (5.56)	5 (45.45)	6 (54.55)		
Divorced or widowed	34 (17.17)	19 (55.88)	15 (44.12)		
Monthly income				5.89	0.117
<3,150 CYN	46 (23.23)	22 (47.83)	24 (52.17)		
3,150–6,300 CYN	96 (48.48)	30 (31.25)	66 (68.75)		
6,300–12,600 CYN	41 (20.71)	13 (31.71)	28 (68.29)		
>12,600 CYN	15 (7.58)	8 (53.33)	7 (46.67)		
Duration of stay in this city				3.11	0.374
Local	70 (35.35)	31 (44.29)	39 (55.71)		
Not local and lived for less than1 year	19 (9.60)	5 (26.32)	14 (73.68)		
Not local and lived for 1 to 5 years	50 (25.25)	16 (32.00)	34 (68.00)		
Not local and lived for over 5 years	59 (29.80)	21 (35.59)	38 (64.41)		
Sex orientation				0.79	0.851
Heterosexual	20 (10.10)	7 (35.00)	13 (65.00)		
Homosexual	138 (69.70)	49 (35.51)	89 (64.49)		
Bisexual	32 (16.16)	14 (43.75)	18 (56.25)		
Others	8 (4.04)	3 (37.50)	5 (62.50)		
Ever made feminization changes				–	–
Yes	198 (100)	73 (36.87)	125 (63.13)		
No	0				
Ever received HIV education				0.36	0.550
Yes	130 (65.66)	46 (35.38)	84 (64,62)		
No	68 (34.34)	27 (39.71)	41 (60.29)		
HIV testing result				3.77	0.152
Positive	49 (24.75)	26 (53.06)	23 (46.94)		
Negative	123 (62.12)	42 (34.15)	81 (65.85)		
Unknow	26 (13.13)	5 (19.23)	21 (80.77)		
Thwarted belongingness	25.83 ± 10.44	31.03 ± 10.44	22.80 ± 9.05	−5.53*	0.000
Perceived burdensomeness	12.02 ± 6.89	15.23 ± 7.48	10.14 ± 5.76	−5.02*	0.000
Depressive symptom				35.47*	0.000
Depressive (≥10 score)	50 (25.25)	36 (72.00)	14 (28.00)		
Not depressive (< 10 score)	148 (74.75)	37 (25.00)	111 (75.00)		

*M, mean; IQR, interquartile range; VCT, voluntary counseling and testing; PHQ-9, patient health questionnaire. *$p < 0.05$.*

TABLE 2 | Logistic regression model of the suicidal ideation based on the interpersonal theory of suicide.

Variable	OR_u (95%CI)	AOR (95%CI)	OR_m (95%CI)
Thwarted belongingness	1.089 (1.053–1.127)	1.086 (1.050–1.124)	1.068 (1.030–1.108)
Perceived burdensomeness	1.125 (1.070–1.183)	1.113 (1.058–1.172)	1.072 (1.017–1.131)

ORu, crude odds ratio; AOR, adjusted OR, odds ratios adjusted for age group and marital status; ORm, odds ratio obtained from forward stepwise multivariate logistic regression using significant variables from the univariate analysis as input.

TABLE 3 | Path coefficients of mediation model ($n = 198$).

Paths	β	Std. β	95% CI	SE	*p* value
Thwarted belongingness → suicidal ideation	0.027	0.232	0.005–0.051	0.012	0.021
Perceived burdensomeness → suicidal ideation	0.008	0.046	−0.028–0.053	0.020	0.693
Thwarted belongingness → depression	0.121	0.462	0.050–0.191	0.034	0.000
Perceived burdensomeness → depression	0.347	0.222	0.229–0.458	0.057	0.000
Depression → suicidal ideation	0.098	0.420	0.052–0.126	0.018	0.000

Std. β, standardized estimate; SE, standard error.

Path Model

After adjusting for marital status and age group, path model showed a good model fit ($\chi^2 = 0.000$, CFI = 1.000, RMSEA = 0.000, SRMR = 0.000, and WRMR = 0.17). Suicidal ideation was positively associated with thwarted belongingness and depression, and the standardized path coefficients were 0.232 ($p = 0.021$) and 0.420 ($p < 0.01$), respectively. Thwarted belongingness and perceived burdensomeness were positively associated with depression, and the standardized path coefficients were 0.462 ($p < 0.01$) and 0.222 ($p < 0.01$), respectively. The path coefficients of the final path model are shown in **Table 3**.

Mediation Analysis

Results of mediation analysis were shown in **Table 4** and **Figure 1**. The path model revealed that both the direct and indirect paths from thwarted belongingness to suicidal ideation through depression were statistically significant. There was a partial mediation effect of depression on the relationship between thwarted belongingness and suicidal ideation (indirect effect = 0.103; $p = 0.007$). The indirect path from perceived burdensomeness to suicidal ideation was statistically significant while the direct path between was not significant. There was a full mediation effect of depression on the relationship between perceived burdensomeness and suicidal ideation (indirect effect = 0.194; $p = 0.000$).

DISCUSSION

Transgender women suffer from elevated suicidal ideation. The study tested the interpersonal theory of suicide and examined the mediating effect of depression between interpersonal needs and suicidal ideation among transgender women in Shenyang, China. Depression fully mediated the path between perceived burdensomeness and suicidal ideation, and only showed a partial mediating effect between thwarted belongingness and suicidal ideation.

Transgender women suffered from elevated suicidal ideation. The prevalence of suicidal ideation was much higher than the general population (3.1%) in China (8). The result was consistent with the previous research (17). "Transgender" used to be regarded as a kind of mental disease until 2018 when this diagnosis was abolished by the World Health Organization. Due to the late legal identification and protection by law, transgender women are also at risk of stigmatization in China. Therefore, transgender women are marginalized in society and suffer from discrimination, including sexual abuse, verbal abuse, and are more likely to have thwarted belongingness and perceived burdensomeness than other sexual minorities populations, which may result in suicidal ideation.

Depression mediates the relationship among thwarted belongingness, perceived burdensomeness, and suicidal ideation. This finding was aligned with that of previous studies. A study by Pate and Anestis found that perceived burdensomeness and thwarted belongingness were correlated to suicidal ideation among heterosexual and sexual minorities in Mississippi, and suggested the associations between perceived burdensomeness and depression (42). People with perceived burdensomeness are more likely to have depression, which increases their risk of suicidal ideation. Thwarted belongingness is highly related to loneliness, which is also a risk factor for suicidal ideation. For thwarted belongingness, it may cause suicidal ideation through depression and other mental disorders, such as loneliness. The results of the current study suggest that transgender women experiencing increased symptoms of perceived burdensomeness and thwarted belongingness may be more likely to endorse higher levels of depression, which in turn may lead to suicidal ideation. The possible explanation for why depression incompletely mediates the relationship between thwarted belongingness and suicidal ideation while completely

TABLE 4 | Result of mediation analysis for suicidal ideation, adjusting for the effect of marital status and age group ($n = 198$).

Effects	Estimate	Std. estimate	95%CI	SE	*p* value
Path 1 Thwarted belongingness → Depression → Suicidal ideation					
Total effect	0.039	0.334	0.016–0.062	0.011	0.001
Indirect effect	0.012	0.103	0.004–0.021	0.004	0.007
Direct effect	0.027	0.231	0.005–0.051	0.012	0.021
Path 2 Perceived burdensomeness → Depression → Suicidal ideation					
Total effect	0.042	0.240	0.012–0.083	0.019	0.024
Indirect effect	0.034	0.194	0.018–0.050	0.009	0.000
Direct effect	0.008	0.046	−0.028–0.053	0.020	0.693

Total effect, = indirect effect + direct effect; Std. β, standardized estimate; SE, standard error.

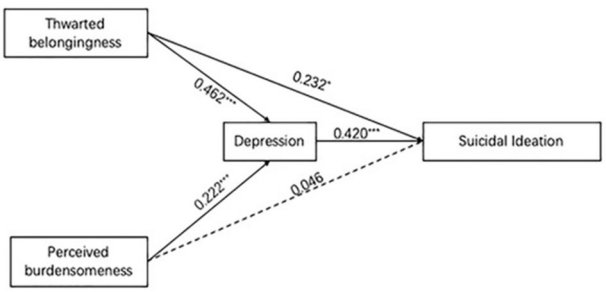

FIGURE 1 | The final model of experiences of thwarted belongingness, perceived burdensomeness, depression, and suicidal ideation among transgender women ($n = 198$). All factor loadings were significant at $p < 0.05$ level. *: $p < 0.05$; ***: $p < 0.001$. Age and marital status were adjusted as covariates in the mediation model.

mediating the relationship between perceived burdensomeness and suicidal ideation is that perceived burdensomeness may not be as independently predictive of suicidal ideation as is thwarted belongingness. It may be that thwarted belongingness is most predictive of suicidal ideation when it is in the presence of perceived burdensomeness.

Unmarried transgender women were at lower risk of suicidal ideation than those who were married, divorced, or widowed. In China, transgender women are required by law to get married based on their birth sex/the sex that is documented on their birth certificates. The impact of cultural and societal stressors due to separation and divorced and financial problems may contribute to the mental disorders and suicidal ideation among them. It could also be a traumatic and stigma event for transgender women (43, 44). Also, the small sample size of this population may limit the statistical power to detect significant relationships. Future studies with a large sample size are needed to confirm our findings.

This research provides a theoretical basis for future prevention and control of suicide behaviors among transgender women. To our knowledge, this is the first study of transgender women with the interpersonal theory of suicide in China. The finding from this study could explain the causes of suicidal ideation among transgender women and provide empirical evidence for future interventions. However, there are some limitations needed to acknowledge. First, a study design of cross-sectional limits our ability to confirm the causal relationships among variables of interest. Longitudinal studies are needed to further examine our research hypotheses. Second, self-report measures were employed in this study, and self-report bias might exist. For instance, due to social desirability bias, the rate of suicidal ideation might be underestimated. Third, transgender women sampling is a very difficult process and with potential for selection bias. In this study, selection bias may lead to findings that are biased not only in the description of important data (e.g., the prevalence of suicide) but also in measures of association. Besides, suicidal ideation was assessed using one question. Although the measurement scale has been proved in previous studies, it might not have strong reliability and threaten the internal validity of our findings. Finally, the study samples were recruited from one NGO, which might limit the generalizability of our findings to other areas of China or other countries.

CONCLUSION

The interpersonal theory of suicide and the mediation model could be applied to transgender women and explain the elevated suicidal ideation among them. Both perceived burdensomeness and thwarted belongingness are the facilitators of suicidal ideation, and depression could mediate between them. To reduce suicidal ideation in this population, interventions targeting both interpersonal needs and depression are needed.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Boards at the School of Public Health of Shanghai Jiao Tong University, China (Protocol # 2016022).

Written informed consent was obtained from the participants of the study. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

YC, YW, and RC designed the study. RC and CZ selected and processed the data and wrote the manuscript. XL, SQ, and HW edited and revised the manuscript. CX, XY, and TM provided useful information. All authors contributed to the subsequent drafts, reviewed, and endorsed the final submission.

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Associations Between Uncertainty Stress, Life Stress and Internet Addiction Among Medical Students

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Objectives: Internet Addiction (IA) is a growing issue predominate in adolescents and young adults. Although the effects of diverse stressors on IA have been highlighted, there is little consensus about the specific underpinnings of IA. The current study aims to investigate associations between uncertainty stress, life stress and IA among Chinese university medical students.

Methods: A cross-sectional survey employing multi-stage sampling was used. Data were collected from 6,061 students from 27 university medical programs across China. Associations between uncertainty stress, life stress, and IA were examined by means of multivariate logistic regression.

Results: The findings indicated that the overall IA prevalence was 12.6% (95% CI 11.7-13.5), life stress prevalence was 8.1% (95% CI 7.4-8.8), and uncertainty stress prevalence was 19.1% (95% CI 18.1-20.1). Multivariate logistic regression showed that uncertainty stress [adjusted OR 2.60 (95% CI 2.14-3.15), $P < 0.001$] and life stress [adjusted OR 1.71 (95% CI 1.32-2.23), $P < 0.001$] were positively associated with IA. Population Attributable Risk (PAR) of uncertainty stress associated with IA was 29%, and that of life stress was 15%.

Conclusions: The contribution of uncertainty stress to IA is significantly higher than that of life stress. High uncertainty stress, being male and born in a region of higher economic status were associated with excessive Internet use and IA.

Keywords: internet addiction, uncertainty stress, life stress, regional economic status, medical college students

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INTRODUCTION

Statistics from the Chinese Internet Network Information Center indicate that there are 960 million internet users in China, one-fifth of the world's total (1). The high and rising internet usage has boosted gross domestic product (GDP) and economic development whilst bringing dramatic lifestyle changes that have influenced the emergence of Internet addiction (IA) (2). IA refers to the lack of control over Internet use and can include addiction to online games and use of virtual social networks.

IA has a great impact on student's physical, psychological and social performance. In terms of physical health, it can lead to a range of problem behaviors, such as social problems (3), eating disorders (4), sleep disorders (5, 6), risky sex (7), and even suicide (8). A meta-analysis confirmed that Problematic Internet Use (PIU) is a predictor of eating disorders in students (9). In terms of mental health, internet addiction can increase negative emotions and low happiness (10). Many serious mental illnesses have also been linked to Internet addiction, such as bipolar disorder, social anxiety disorder, and severe depression (11). In addition, in terms of social performance, students with Internet addiction are unable to concentrate on class, truancy and academic performance decline (12, 13). Moreover, they seldom participate in actual social activities, which affects normal interpersonal relationships (3).

IA is increasing in Chinese college students, with addiction rates between 8.12 and 12.83% (14). Chinese medical students have a higher prevalence of IA compared with the other college students, and five times that of the general population (15).

Medical schools are typically competitive environments with prevailing pressures on students (16). The fierce competition for grades can decrease peer support and leave little time or energy for establishing collaborative relationships or meaningful social connections (17). The Association of American Medical Colleges (AAMC) indicated that managing such stresses among medical students is a central component of improving the quality of future medical care (18). In China, the stress of medical workers has also increased (19) with many Chinese doctors expressing reluctance for their children pursue a career in medicine due to such potential occupational dangers and demands (20).

Stress is a major risk factor for addiction behaviors. The uptake of many types of addictive behaviors is a result of a compensatory mechanism that temporarily relieves stress. Research suggests that stressful life events can exacerbate mild to severe IA among college students (21). Differentiating life stress as a general state of concern, uncertainty stress is characterized by anxiety in facing ambiguous situations and problematic environments (22). High life stress levels have also been shown to be predictive of IA for pornography use (23). In a German study of IA, spikes in internet usage were highlighted as an inadequate stress coping strategy (24). While these studies were focused on life stress and IA, uncertainty stress has drawn less attention. However, strong evidence reveals that uncertainty is an influential foundation of stress (25). Previous research has shown that stress from uncertainty can affect the health of medical students. Uncertainty stress of Chinese medical students was associated with a short 27.4% (95% CI 23.9%-30.8%) and long-term illness prevalence 20.0% (95% CI 17.0-23.1%) (26). Besides, as an important variable correlated with mood and social connectedness, uncertainty stress is a critical issue for IA research.

To better understand the associations between stress and IA, we hypothesis that uncertainty stress and life stress would have an impact on IA among Chinese University medical students, and compared the impact of these two pressures on IA.

METHODS

Study Area and Participants

The current study employed a multi-stage sampling design. In Stage 1, a total of 60 Chinese medical universities were differentiated by regional location. Seven provinces were randomly selected; Jilin, Beijing, Anhui, Shanghai, Zhejiang, Fujian, and Guangdong. Four provinces in the Center; Hubei, Shanxi, Hunan, and Jiangxi. Three provinces in the West; Sichuan, Shanxi, and Tibet. In stage 2, we selected one or two cities as the recruitment sites according to the distribution and number of medical universities in each province. Finally, twenty-seven colleges accepted invitations to participate in this study.

Data Collection

Based on the multi-stage sampling method, a total of 6,061 students from 27 universities across China were investigated. Of the 27 universities, 11 were in the west, 7 in the middle, and 9 in the east. A standardized questionnaire was administered privately to respondents in schools during regular lectures and class sessions. The inclusion criteria were that respondents learn medical knowledge and skills from the first year of their university studies. Informed consent was received before the respondents began the questionnaire. Ethical approval of the study was obtained from the Human Subjects Ethics Committee of the first authors' institution. All data collected in the study were kept strictly confidential and analyzed in an aggregated manner.

Measures

Sociodemographic data. Demographic measures included age, sex, and monthly expenses. Monthly expenses (in RMB, the abbreviated form of currency in China) was measured through a question: "How much money do you spend daily each month?" Both the school location and students' birthplace were coded according to the three demarcations of regional economic status. The three regions comprised the following sub-samples; eastern birthplace (68.7%) and school location (53.4%), central birthplace (20.2%) and school location (17.6%) and Western birthplace (11%) and school location (29.0%).

Stress (Independent Variables)

The independent variables were life stress and uncertainty stress, measured separately using standard questionnaires designed by Yang et al., which had good reliability and validity (27, 28). Items to evaluate uncertainty stress levels: "Life is subtle, fate is unpredictable," "The world changes too fast to keep up with it," "Don't' know what to do to realize my goal," and "Values of chaos and disorientation." ($\alpha = 0.81$) Life stress items included: "Not interested in the professional courses; Feeling bored," "Learning tasks are heavy," "Poor learning and living environment," and "Strained relationships with classmates." Respondents indicated their stress levels with a five-point scale; "no stress" (1); "little stress" (2); "some stress" (3); "considerable stress" (4); and "excessive stress" (5). A mean score above 3 on any item signified higher stress (28).

Internet Addiction (Dependent Variable)

The Internet Addiction Diagnostic Questionnaire (IADQ) outcome variable was adapted from the pathological gambling instrument to evaluate respondents' IA over a 6-months (29, 30). The cutoff score of "five" (of the eight items) was used to differentiate IA. It has been widely employed in China with excellent psychosomatics qualities (31, 32). Yes/No responses were solicited for the eight items.

Analyses

All data were entered into a database using EpiData 3.1, and entry reliability was assured by double data entry. All statistical analyses were performed using SPSS26.0. We conducted descriptive analyses for all sociodemographic, stress, and internet addiction variables. For the categorical variables, numbers and percentages were used. Besides, we described the prevalence of IA in different gender, age, and other sociodemographic characteristics. Then, the Chi-square test was used to compare the differences of IA rate under different sociodemographic characteristics. Moreover, after controlling for the above sociodemographic characteristics, we conducted multivariate logistic regression to analyze the influence of uncertainty stress and life stress on IA. To determine the contribution of uncertainty stress and life stress to IA, we use the population attributable risk (PAR) statistical analyses. Population attributable risk (PAR) is the proportion of the incidence of disease in the population (exposed and unexposed) due to exposure. It is the incidence of disease in the population that would be eliminated if exposure were eliminated. It measures the potential impact of control measures in a population and is relevant to decisions in public health.

TABLE 1 | Descriptive statistics and Chi-square test for IA prevalence of different sociodemographic characteristics ($N = 5{,}644$).

Demographic characteristics	*n*	% of sample	Prevalence (%)	adjusted Rao-Scott χ^2	*P*
Gender				108.88	<0.001
Male	2,057	36.4	19.2		
Female	3,587	63.6	8.8		
Age (Year)				6.78	0.15
≤20	1,201	21.3	11.1		
21	1,165	20.6	13.1		
22	1,402	24.8	14.1		
23	1,208	21.4	12.1		
≥24	668	11.8	12.1		
Monthly expense (Yuan)				26.14	<0.001
<500	721	13.0	9.1		
500∼	2,833	51.1	11.1		
1,000∼	1,584	28.6	15.1		
1,500∼	260	4.7	16.1		
≥2,000	145	2.6	16.1		
Birthplace region				7.74	0.02
West	607	11.0	14.1		
Center	1,113	20.2	10.1		
East	3,780	68.7	13.1		
School province region				2.06	0.38
West	1,473	29.0	13.1		
Center	894	17.6	11.1		
East	2,713	53.4	13.1		

Missing data exited in each category.

RESULTS

The mean age of the respondents was 21.79 years old. 95.5% of the respondents were *han* (China's main nationality). Life stress was found in 8.1% (number of people was 5,993), while uncertainty stress was present in 19.1% (number of people was 6,018) of respondents, and 12.6% indicated IA (number of people was 5,644), with significant sex differences wherein 19.2% of males compared to 8.8% of the females reported IA ($\chi^2 = 108.88$, $P < 0.001$). In addition, different monthly expenses ($\chi^2 = 26.14$, $P < 0.001$) and birthplace ($\chi^2 = 7.74$, $P = 0.02$), there are statistical differences in the IA prevalence of students. Descriptive statistics and Chi-square test for IA prevalence of different sociodemographic characteristics are shown in **Table 1**.

Multivariate logistic regression analysis with the Enter procedure was employed to assess the effects of gender, birthplace region, monthly expense, uncertainty stress and life stress on IA. Due to the missing values of gender, birthplace region, monthly expense, uncertainty stress and life stress, the logistic regression sample size analysis was 5,359. Finally, the logistic model was statistically significant ($\chi^2 = 282.76$, $P < 0.001$), and the Hosmer-Lemeshow goodness-of-fit test yielded a p-value > 0.05 ($P = 0.63$). Besides, results showed that students born in a region of higher economic status were associated with higher odds of having IA, with stresses having discrepant effects on IA (as shown in **Table 2**). As expected, the uncertainty stress increased the odds of IA by more than double [OR = 2.60 (95% CI 2.14–3.15)]. However, life stress had a weaker association with IA [OR = 1.71 (95% CI 1.32-2.23)]. PAR of uncertainty stress associated with IA was significantly higher (29%) and that of life stress (15%). Finally, we have obtained the IA prediction equation as below:

$$\begin{aligned}\text{logit IA} &= -3.01\beta_0 + 0.85\,\text{gender} \\ &+ 0.28\,\text{birthplace region (2)} \\ &+ 0.57\,\text{monthly expense (2)} \\ &+ 0.95\,\text{Uncertainty Stress} + 0.54\,\text{Life Stress}\end{aligned}$$

birthplace region (2): the participants' birthplace was east (The reference is "Center"), monthly expense (2): the participants' monthly expense was 1,000∼ (The reference is "<500").

DISCUSSION

IA Among University Medical Students

The current study examined associations between uncertainty stress, life stress and IA. Previous studies have established the linkages between life stress and IA (33, 34). Coping strategy and problematic Internet use were predictors of perceived stress in 267 college seniors in the US (34). Turkish research has also demonstrated among college students that stress was positively associated with, and predicted IA (33). Other estimates of IA

TABLE 2 | Multivariate logistic regression analysis of the odds of IA by stress type and selected sociodemographic characteristics, Chinese medical students ($N = 5,359$).

Demographic characteristic	*n*	% of sample	Prevalence (%)	Internet addiction			
				B	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	PAR (95% CI)
Gender							
Female	3,417	63.8	8.8	0	1	1	0
Male	1,942	36.2	19.2	0.85	2.47 (2.10,2.91)***	2.35 (1.98,2.78)***	0.20 (0.16,0.25)
Birthplace region							
Center	1,091	20.4	10.1	0	1	1	0
West	600	11.2	14.2	0.31	1.47 (1.09,1.99)*	1.36 (1.00,1.87)	0.04 (0.00,0.11)
East	3,668	68.4	13.0	0.28	1.33 (1.07,1.66)*	1.31 (1.05,1.65)*	0.03 (0.01,0.08)
Monthly expense (Yuan)							
<500	1,538	28.7	10.1	0	1	1	0
500∼	3,225	60.2	12.9	0.16	1.32 (1.08,1.60)**	1.17 (0.96,1.44)	0.02 (−0.01,0.05)
1,000∼	456	8.5	17.3	0.57	1.87 (1.39,2.51)***	1.77 (1.31,2.41)***	0.12 (0.05,0.20)
1,500∼	78	1.5	17.9	0.28	1.95 (1.07,3.56)	1.32 (0.70,2.50)	0.05 (−0.06,0.21)
≥2,000	62	1.2	12.9	0.17	1.32 (0.62,2.83)	1.18 (0.54,2.61)	1.02 (−0.06,0.17)
Uncertainty stress							
Low	4,356	81.3	11.4	0	1	1	0
High	1,003	18.7	26.0	0.95	2.98 (2.50,3.55)***	2.60 (2.14,3.15)***	0.29 (0.23,0.36)
Life stress							
Low	4,936	92.1	9.8	0	1	1	0
High	423	7.9	24.4	0.54	2.74 (2.17,3.47)***	1.71 (1.32,2.23)***	0.15 (0.07,0.23)

All ORs were adjusted by gender, monthly expense and birthplace region, which are significantly associated with IA in ***Table 2****. *P < 0.05, **P < 0.01, ***P < 0.001. Considering the different types of stress in population, we have got the risk ratio in population (PAR) through PAR = P(OR − 1)/[P(OR − 1) + 1].*

for European adolescents reported between 1 and 9%, Middle Eastern prevalence was between 1 and 12%, and Asian countries between 2 and 18% (35). The rate of IA in the current sample was 11.8% (95% CI 11.7-12.43%), which falls into the higher levels worldwide and in Asia.

The sex effect confirms previous study findings (36, 37). The sample sex distribution is relatively balanced (63.6% females vs. 36.4% males), $P < 0.001$. The results show the importance of assessing IA risks in Chinese university medical students. In a previous Chines medical student study demographic variable including male, lower grades, one-parent family, and higher monthly expenses were indicated as risk factors for IA (38). These factors are confirmed in other research (39–41).

Uncertainty Stress, Life Stress, and IA

Though the higher OR of both life stress and uncertainty stress are associated with IA, being male and spending more was also associated with IA. However, PAR of uncertainty stress associated with IA was 25%, that of life stress only was 5%, the former is significantly higher than that of the latter. This means that one in four people's IA was affected by uncertainty stress in the current sample; in contrast, life stress has only a small effect.

Our study supports arguments that stress, especially uncertainty stress acts as a risk factor for IA. Since China has been transitioning from a centralized to a market-based economy, massive social change has occurred along with the erosion of traditional systems. These phenomena provoked considerable uncertainty for residents. As Innes noted, the late-modern experience is the combined outcome of these social forces, giving the sensation of a world that is constantly undergoing change, moving at pace, and based upon a more fluid form of social order. During this epoch, many people feel vulnerable and crave a sense of security and certainty (42).

Our results are consistent with previous research suggesting China's high-stress levels are caused by inequalities and uncertainties embedded in centrally planned and controlled rapid social changes, which in turn impact Chinese peoples' mental health (43) and addiction behaviors (44). Yang et al. have found that uncertainty stress is associated with a range of negative health outcomes, including problematic alcohol use, self-harm, suicidal ideation and poor self-rated health (22). Therefore, uncertainty stress needs more attention.

As the most economically developed region, the (*East*) had better conditions for accessing the internet, which increased the risk for IA. For teenagers in that region, the rapid development of technology increased the ease-of-use for computer technologies; the relatively high GDP also decreased the costs for computer and internet services; and the increasing diversity promoted the availability of internet services, along with social norms around internet usage (45).

PAR of uncertainty stress associated with IA was significantly higher (29%) and that of life stress (15%). Although the life stress is also significantly associated with IA. It is worth noting that the PAR of the former is significantly higher than that of the latter. What's interesting is that we did not observe this for life stress.

Limitations

Limitations include the cross-sectional survey design. Future work could use follow-up tests and interventions to map changes across time and the life course of respondents who graduate

and practice as doctors. That respondents were medical students also limits the generalizability to wider Chinese populations, and college students more generally.

CONCLUSIONS

Uncertainty stress predicted IA among medical college students more significantly than life stress. Being male, richer (which could be seen in the amount they spend every month), and born in a region of higher economic status also heightened the risk for IA prevalence. In conclusion, this study provides preliminary evidence for public health policymakers and educators, and suggests an approach for intervening to prevent or reduce IA among university students. We recommend that IA interventions include management of uncertainty stress, especially targeting males in the East region.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Zhejiang University School of Public Health Ethics Committee. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

QY and XY contributed to the conception of the study. SJ and DW collected the data. QY, ZW, and JO carried out data cleaning. QY and ZW performed the data analyses and wrote the manuscript. XY and JO contributed to critically revising the manuscript for important content. All authors contributed to the article and read and agreed to the published version of the manuscript.

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What Prompted the Adoption of Self-Protective Behaviors in Response to COVID-19? Evidence From Women Living in the Rural Areas of Western China

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Background: Self-protective behaviors, such as handwashing and mask-wearing, are effective to reduce the spread of coronavirus disease (COVID-19), but few studies have focused on women living in rural areas who bear the brunt of the impacts of the pandemic due to their economic and social vulnerabilities. This study explores what prompted the adoption of self-protective behaviors in response to COVID-19 among women living in rural areas of western China.

Methods: The study sample consisted of 1,524 women from 116 townships across 10 counties in rural western China. We collected data in May and August 2020 on women's socioeconomic characteristics, exposure to COVID-19-related information, psychological response to COVID-19, and adoption of self-protective behaviors. Structural equation modeling (SEM) analyses were conducted to analyze the relations among the variables.

Results: During the lockdown, 1,221 (80.12%) of the 1,524 women in the study sample reported wearing a mask every time when they went outside and 1,021 (66.99%) reported handwashing with soap every time after they came home. Perceived efficacy had the strongest association with self-protective behaviors ($\beta = 0.38$; $p < 0.001$). Receiving public health guidance ($\beta = 0.18$; $p < 0.001$) was indirectly associated with more self-protective behaviors via greater perceived efficacy. Higher socioeconomic status was also directly associated with increased adoption of self-protective behaviors ($\beta = 0.24$; $p < 0.001$). Other variables, such as receiving surveillance and risk information, communication channels, perceived risks, and fear, were indirectly associated with the adoption of self-protective behaviors with smaller effect sizes (all β were lower than 0.10).

Conclusions: Not all women were able to adopt self-protective behaviors, such as mask-wearing and handwashing, during the COVID-19 pandemic in western China. To further encourage behavioral changes in response to public health crises, the government should develop clear and actionable guidelines and adopt targeted

health communication strategies to reach the most disadvantaged groups of society. These findings may inform tailored responses to COVID-19 in other low- and middle-income countries.

Keywords: perceived efficacy, self-protective behaviors, COVID-19, women, rural western China

INTRODUCTION

The novel coronavirus disease (COVID-19) has become not only a public health crisis but also a serious threat to social and economic development (1, 2). According to the World Bank, COVID-19 has triggered the deepest global recession in decades, led to a 5.2% contraction in the global economy, and left lasting scars on productivity (1). Within China, COVID-19 was first identified in December 2019 and declared a Chinese national emergency on January 29, 2020. As of August 2021, there were more than 93,100 confirmed cases in China (3). Evidence indicated that the control measures to reduce the spread of COVID-19 resulted in a substantial productivity loss that amounted to over US$382 billion in China (4).

In response to the COVID-19 outbreak, the government worldwide adopted a series of prevention and control measures, including early reporting and situation monitoring, large-scale contact tracing, and health communication campaigns (5, 6). International evidence from USA, Iran, UK, and China showed that people in resource-limited communities are generally more likely to have worse health behaviors during COVID-19 (7–11). In the USA, only 20% of rural participants wore a mask, compared to 47% of urban participants (7). In Iran, 45.7% of participants washed their hands regularly, and handwashing was less common among rural than urban residents (8). Additionally, one UK study indicated that better practice in mask-wearing was significantly associated with living in an urban environment (12). In particular, a study in China indicated that 72.22% of rural residents and 85.70% of urban residents wore a mask when they were outside (10). Compared with urban residents, rural residents are less aware of disease prevention and control measures because of their remote residence and poorer economic conditions (9, 11). In addition, 60% of rural residents are migrant workers in China. Their mobility could have increased rural communities' risk of infection (11). The rural area has become an important battlefield for epidemic prevention and control (13).

Evidence also indicated that gender-responsive policies are required to avoid worsening health and social inequities associated with the COVID-19 pandemic. Specifically, women on average report more days of poor physical and mental health than men despite utilizing more preventive care services (14). These health inequities are larger in women with intersecting identities, such as those living in rural areas (14, 15), potentially due to limited access to healthcare resources and inequitable gender norms that may lead to delayed or forgone healthcare and worse health outcomes (16–18). In addition, as the main caregivers in the family, women often have to spend more time on unpaid domestic work due to the lockdown measures in many countries, including China. Previous studies showed that women often make key dietary choices for their families and act as role models for their children regarding healthy behaviors (19, 20). However, despite their greater burden, lack of support, and potential of influencing other family members, few studies have looked at how to support behavioral changes to promote health and reduce disease risks among women living in rural areas of western China (21–23).

Previous studies underscored the associations between individuals' socioeconomic status, exposure to health information, psychological responses, and behavioral responses during COVID-19. A study in Germany suggests that educational background was positively associated with protective behaviors among the general public (24) while a study from Switzerland suggests the opposite association among young people (25). In Bangladesh, information on the proper use of protective measures from the government were identified as the drivers of COVID-19 protective behaviors (26). Findings from Nigeria and the USA showed that individuals who perceived greater risks of COVID-19 infection were more likely to adopt protective behaviors (27, 28). In China, a study conducted in primary schools showed that educational background of the mother was associated with handwashing and mask-wearing practices of the children (29). Another study in China indicated that perceived risk and severity of the participants were associated with excess protective behavior (30). One study indicated that perceived susceptibility to COVID-19 was associated with consistent mask-wearing among Chinese pregnant women (31). However, no studies have examined the direct and indirect associations among these variables, especially among women in rural areas of western China.

To develop the conceptual framework for our analysis, we turned to the Extended Parallel Process Model (EPPM) that examines how media exposure influences perceptions and behaviors of people in the midst of public health emergencies (32–34). The main components of EPPM include exposure to message communication, perceived efficacy, perceived risk, fear, and behaviors. According to the EPPM, when individuals are exposed to a health message, they would make a cognitive appraisal of the message, including the appraisal of risk and the appraisal of efficacy, which are two key factors that influence the health behavior in response to the health risk. The EPPM also suggests that exposure to health communication messages leads to the belief that individuals are able to reduce the risk (higher perceived efficacy), which in turn prompts individuals to adopt protective behaviors. On the other hand, if individuals do not have enough confidence in their ability to act (lower perceived efficacy), they would not adopt protective behaviors (32–34).

Informed by the evidence from the literature and the EPPM, our study examines the relations among socioeconomic status, exposure to COVID-19-related information, psychological response to COVID-19, and self-protective behaviors among

women in rural western China. We hypothesized that there are direct and indirect effects among these variables.

MATERIALS AND METHODS

Study Design, Participants, and Data Collection

The study sample included participants from two surveys. The first survey was part of an ongoing randomized control trial (RCT) among caregivers of children in rural areas of western China. We conducted the baseline survey in May 2020 (35, 36). For this RCT, we used a multistage cluster sampling method to select the study sample. First, we randomly selected four counties from the list of national poverty-stricken counties (defined as counties with an average annual net income of <2,300 RMB, about $1.9 per day) in Sichuan Province (37, 38). Second, 20 townships were randomly selected within each sampled county. Townships that housed the county seat (which are typically more urbanized) were excluded. A total of 80 townships were selected. Third, all primary caregivers with a child aged under 6 months were recruited for the baseline survey. A total of 829 female caregivers were included as the first sub-sample of the present study.

The second survey was from a cohort study among caregivers of the children in rural areas of western China. The cohort study focused on the adherence of the caregivers to a micronutrient home fortification program. We completed the cohort study in August 2020 (39, 40). We used a similar multistage cluster sampling method to select our sample. First, six rural counties were randomly selected from the list of national poverty-stricken counties in Sichuan Province (37, 38). Second, six townships were randomly selected within each sampled county. Townships that housed the county seat were excluded as well. A total of 36 townships were selected. Third, all primary caregivers with a child aged under 24 months were enrolled in the cohort study. In the last round of the data collection for the cohort study, a total of 823 primary caregivers completed all questions on socioeconomic status, health communication, psychological responses, and behavioral responses during COVID-19. Since we focused on women from rural areas in the present study, we excluded 116 male caregivers from the cohort study. Thus, 723 women from the cohort study were included as the second sub-sample of the present study.

Both the 80 townships in the first survey and 36 townships in the second survey were from the list of national poverty-stricken counties in Sichuan Province (37, 38). In total, we included 1,552 participants from the RCT or the cohort study in the present study. Of the 1,552 caregivers who enrolled in this study, 1,494 participants (96.3%) completed the survey. An additional 30 women failed to answer the questions on household assets and health communication, and we imputed these missing values using the regression-based imputation method. Our final analytical sample includes 1,524 participants.

In the first survey, trained enumerators collected data through telephone interviews using a structured questionnaire. In the second survey, trained enumerators used the same questionnaire and collected data via face-to-face interviews. Studies were approved by the Sichuan University Medical Ethical Review Board (approval number of studies: KS2020246). All participants provided written or oral informed consent to participate in the study.

Measurements

The main variables included demographic and socioeconomic characteristics, exposure to COVID-19-related information, psychological response to COVID-19, and self-protective behaviors in response to COVID-19.

Demographic and Socioeconomic Variables

Demographic and socioeconomic characteristics included age, educational level (high school or above), occupation, and household asset level based on household's ownership of or access to a water heater, washing machine, refrigerator, air conditioner, television, computer, motorcycles, and car or truck.

Exposure to COVID-19-Related Information

Exposure to COVID-19-related information consisted of communication channels and messaging content. Communication channel was measured by the question "from which channel did you receive most COVID-19 information?" with three response options that included social media (e.g., WeChat, QQ, and TikTok), traditional media (e.g., radio, leaflets, posters, bulletin boards, and newspapers from village and township officials), and interpersonal communication (e.g., face-to-face conversations with family, relatives, and friends). Messaging content was measured by the question "what type of information related to COVID-19 did you received most?" with two response options that included public health guidance (e.g., government-endorsed individual precaution measures, science briefs on disease origin and transmission, infection control measures from the government, and information on local supply of daily necessity and personal protective equipment) and surveillance and risk information (such as risks of infection for family members, local statistics on new cases, the trend of in-migration which might increase a community's risk of exposure to COVID-19, and the epidemic in high-risk areas). All items that measure exposure to COVID-19-related information were binary variables (0 = no, 1 = yes).

Psychological Response to COVID-19

We defined psychological response to COVID-19 as a multi-dimensional construct based on empirical evidence (32, 34, 41–44), which included perceived efficacy, perceived risk, and fear emotion. First, according to the EPPM, perceived efficacy was defined as the effectiveness, feasibility, and ease with which a recommended response impedes or averts a threat, such as self-efficacy and response-efficacy (41, 42). Perceived self-efficacy refers to "beliefs about one's ability to perform the recommended response to avert the threat" (41, 42), which was measured with the question "when taking precautions measures, if you had a problem, to what extent do you believe you could address it well." Perceived response-efficacy is "beliefs about the effectiveness of the recommended response in deterring the threat" (41, 42).

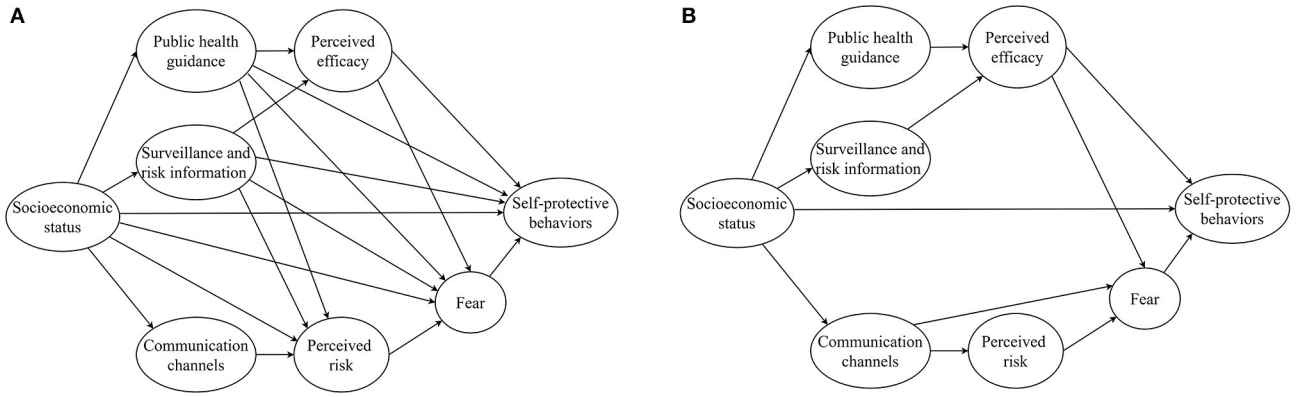

FIGURE 1 | Basic and parsimonious model to map the associations between socio-economic status, exposure to COVID-19-related information, psychological response during COVID-19, and self-protective behaviors in response to COVID-19. **(A)** The basic model. **(B)** The parsimonious model. (Data source: Authors' study).

Perceived response efficacy was measured by the question "to what extent do you believe that your personal precaution could protect you from getting infected with the coronavirus."

Perceived risk is the subjective evaluation of the risk contained in the message (43), which is a cognitive construct that comprises two dimensions: perceived susceptibility and perceived severity (34, 43, 44). Perceived susceptibility refers to the perceived likelihood that the risk will directly affect an individual (34, 43, 44), which was measured with two items: "What was the probability of getting infected with COVID-19 to you?" and "What was the probability of getting infected with COVID-19 to your family members?" Perceived severity describes the perceived seriousness of the risk (34, 43, 44), which was assessed by two items: "If you were infected with COVID-19, did you think that it was very fatal for you?" and "If your family members were infected with COVID-19, did you think that it was very fatal for them?"

Fear is conceptualized as a negative emotional reaction to a perceived threat (32, 43). The mood adjectives were the most common measures of self-reported fear in related studies (32). In our study, two items were used to assess fear, i.e., "whether COVID-19 made you feel scared?" and "whether COVID-19 made you feel anxious?"

Self-Protective Behaviors in Response to COVID-19

Self-protective behaviors in response to COVID-19, the outcome variables of this study, were defined as behavioral responses of the participants to the COVID-19 pandemic. This definition was based on the guidelines from the WHO for healthy people in response to COVID-19 and previous studies (24, 25, 28, 30, 45). Self-protective behaviors in our study included mask-wearing, measured by the question "during the lockdown, did you wear a mask when you went outside?" and handwashing, measured by the question "during the lockdown, did you wash hands using the soap or detergent when you came back home?" Responses to both questions were rated on a 5-point Likert scale that ranged from 1 for "not at all" to 5 for "very frequent."

Statistical Analysis

We first conducted descriptive analysis by computing means and SDs for continuous variables and frequencies and percentages for categorical variables. Based on the EPPM, we hypothesized that women's socioeconomic status, exposure to COVID-19-related information, and psychological response to COVID-19 would have direct and indirect effects on self-protective behaviors. To examine the relations among these variables, we conducted structural equation modeling (SEM) analyses. In this study, SEM was conducted using latent variables (not directly observed but estimated from directly measured variables) and measured variables (directly observed variables). We first included all potential pathways between the variables in a basic model (panel A of **Figure 1**). Results were presented as standardized β coefficients. The association is considered to be statistically significant if the value of 2-sided p is smaller than 0.05. We then fitted a more parsimonious model by removing pathways that had a value of p 0.05 or higher (panel B of **Figure 1**). Multiple tests were used to evaluate the fitness of the model, including normed fit index (NFI), goodness-of-fit index (GFI), comparative fit index (CFI), root mean square error of approximation (RMSEA), and Chi squared/degrees of freedom (χ^2/df).

Data analyses were performed with Stata statistical software (version 14.1, StataCorp, College Station, TX, USA) and AMOS 21.0 statistical software (IBM, Armonk, NY, USA).

RESULTS

Descriptive Statistics of Women in Rural Western China

Table 1 shows the individual characteristics of the study sample. The average age of the sample was 32.7 years (SD = 11.2). Among the 1,524 women in the sample, only 28.5% completed high school education and more than half were stay-at-home parents. Regarding the household economic status, nearly halfowned a lower or low level of household fixed asset (42.5%; panel A of **Table 1**). Most women had been exposed to COVID-19-related information via social media (52.9%) or traditional

TABLE 1 | Descriptive statistics of women in rural western China ($N = 1,524$).

Descriptive statistics	Mean (std. dev.)/No. (%)
Panel A: Demographic and socioeconomic variables	
Age (year)	32.7 (11.2)
High school or above	434 (28.5)
Stay-at-home parent	977 (64.1)
Household fixed asset lev	
Low	282 (18.5)
Lower	365 (24.0)
Higher	484 (31.7)
High	393 (25.8)
Panel B: Exposure to COVID-19-related information	
Communication channels	
Social media (e.g.,WeChat, QQ, Kuai Shou, and Dou Yin.	806 (52.9)
Traditional media (e.g., radio, leaflets, posters, bulletin boards, newspapers from village and township officials)	243 (15.9)
Interpersonal communication (e.g., face-to-face conversations with family, relatives, and friends)	81 (5.3)
Public health guidance	
Government-endorsed individual precaution measures	52 (3.4)
Science briefs on disease origin and transmission	104 (6.8)
Infection control measures from government	219 (14.4)
Information on local supply of daily necessity and personal protective equipment	114 (7.5)
Surveillance and risk information	
Risks of infection for family members	49 (3.2)
Local statistics on new cases	97 (6.4)
Trend of in-migration which might increase a community's risk of exposure to COVID-19	35 (2.3)
The epidemic in high-risk areas	37 (2.4)
Panel C: Psychological response to COVID-19	
Perceived efficacy	
The confidence one's to solve problems when preventing COVID-19	
Not at all	36 (2.4)
Probably not	86 (5.6)
Neutral	330 (21.7)
Probably	662 (43.4)
Definitely	410 (26.9)
The confidence to protect oneself from getting infected COVID-19	
Not at all	6 (0.4)
Probably not	63 (4.1)
Neutral	273 (17.9)
Probably	794 (52.1)
Definitely	388 (25.5)
Perceived risk	
The probability one's infected with COVID-19	
Not at all	595 (39.0)
Probably not	605 (39.7)
Neutral	173 (11.4)
Probably	124 (8.1)
Definitely	27 (1.8)
The probability one's family infected with COVID-19	
Not at all	600 (39.4)
Probably not	603 (39.6)
Neutral	186 (12.2)
Probably	118 (7.7)
Definitely	17 (1.1)
COVID-19 is a serious disease to oneself	
Not at all	57 (3.7)
Probably not	236 (15.5)
Neutral	257 (16.9)
Probably	595 (39.0)
Definitely	379 (24.9)
COVID-19 is a serious disease to one's family	
Not at all	73 (4.8)
Probably not	224 (14.7)
Neutral	275 (18.0)
Probably	622 (40.8)
Definitely	330 (21.7)
Fear	
COVID-19 makes oneself scared	
Not at all	221 (14.5)
Probably not	187 (12.3)
Neutral	274 (18.0)
Probably	540 (35.4)
Definitely	302 (19.8)
COVID-19 makes oneself anxious	
Not at all	364 (23.9)
Probably not	243 (15.9)
Neutral	347 (22.8)
Probably	394 (25.9)
Definitely	176 (11.5)
Panel D: Self-protective behaviors in response to COVID-19	
Wearing mask when go outside during the lockdown	
Not at all	16 (1.1)
Not often	14 (0.9)
Sometimes	69 (4.5)
Often	204 (13.4)
Very frequent	1221 (80.1)
Washing hands using soap or detergent when came back home during the lockdown	

(Continued)

TABLE 1 | Continued

Descriptive statistics	Mean (std. dev.)/No. (%)
Not at all	35 (2.3)
Not often	24 (1.6)
Sometimes	133 (8.7)
Often	311 (20.4)
Very frequent	1021 (67.0)

media (15.9%), but few (5.3%) had face-to-face conversations with family or friends about this topic. In terms of specific messaging content, <10% of the participants reported having received any COVID-19-related information we asked about in the questionnaire. The only exception is government policies, where 14.4% of the participants reported having received the information of infection control measures from the government (panel B of **Table 1**).

In terms of the psychological response to COVID-19, 70.3% of participants believed that they could cope with the problems related to COVID-19 and 77.6% believed that they could protect themselves from getting infected. A small proportion of participants thought both themselves and their family members were likely to be infected (9.91 and 8.86%, respectively). However, if they were infected, nearly two-thirds of participants believed that COVID-19 would have had severe consequences to themselves (63.91%) and to their family members (62.46%). Over half of the participants reported feeling scared and 37.40% reported feeling anxious about COVID-19 (panel C of **Table 1**). Regarding self-protective behaviors in response to COVID-19, 80.12% of women wore a mask every time when they went outside and 66.99% of women used soap or detergent to wash hands every time after they came back home (panel D of **Table 1**).

Associations Between Latent Variables and Measured Variables

Associations between latent variables and measured variables are shown in **Figure 2**. The measured variables were adequate indicators of respective latent variables. For example, participants' educational level ($\beta = 0.58$, $p < 0.001$) and household fixed asset level ($\beta = 0.58$, $p < 0.001$) were adequate indicators of social economic status (SES). Self-efficacy ($\beta = 0.46$, $p < 0.001$) and perceived control efficacy ($\beta = 0.59$, $p < 0.001$) when encountered the difficulties of preventing COVID-19 were used to represent the perceived efficacy variables. Self-protective behaviors were well-represented by mask-wearing ($\beta = 0.62$, $p < 0.001$) and handwashing ($\beta = 0.54$, $p < 0.001$).

Factors Associated With Self-Protective Behaviors in Response to COVID-19

Results from the SEM analyses are presented in **Table 2**. Perceived efficacy had the strongest association to self-protective behaviors with the standardized total effect of 0.38, including a direct effect of 0.39 and an indirect effect of −0.01 through fear. We further examined the factors associated with perceived efficacy. **Table 2** indicates that receiving public health guidance had the strongest correlation with perceived efficacy, the standardized total effect is 0.18.

Social economic status was also directly and indirectly correlated with self-protective behaviors. The standardized total effect of SES was 0.24, with a direct effect of 0.26 and an indirect effect of −0.02, mainly through public health guidance, surveillance and risk information, or communication channels. Other perceived risks and fear were indirectly correlated with self-protective behaviors, but the effects were smaller with a coefficient <0.10.

In **Table 3**, each latent variable in the model is further broken down into its components to assess the relations of these measured variables with self-protective behaviors. Among the measured variables, perceived control efficacy was the most powerful predictor with a correlation coefficient of 0.22. Within the SES indicators, the educational level and household fixed asset level had the same correlation coefficient of 0.16 with self-protective behaviors. As to perceived efficacy, government-endorsed individual precaution measures were the strongest predictors of self-protective behaviors, the correlation coefficient was 0.13.

DISCUSSION

Women in rural areas of China are disproportionally affected by COVID-19 but little is known about how they cope with the pandemic and whether they could adopt self-protective behaviors to reduce their risks of infection. This study reached a relatively neglected and vulnerable sample during the peak period of the COVID-19 outbreak, which found that not all women were able to adopt self-protective behaviors, such as mask-wearing and handwashing during the COVID-19 pandemic in western China. By examining the associations between exposure of individuals to COVID-19-related information, psychological response to COVID-19, and self-protective behaviors, we found that perceived efficacy and socioeconomic backgrounds were important factors directly associated with the adoption of self-protective behaviors during the COVID-19 pandemic among women in rural western China. Moreover, exposure to information of public health guidance was associated with self-protective behaviors indirectly via increased perceived efficacy. Such findings may help in tailoring efficacious interventions for improving the COVID-19 pandemic response among women in rural western China.

In the ongoing COVID-19 pandemic, non-pharmaceutical protective measures, such as mask-wearing and handwashing, remain crucial. In our study, most women were able to adopt these protective behaviors (80.1% in mask-wearing and 60.0% in handwashing), which is higher compared to another study in Nigeria where 37.7% of women from the rural areas reported always wearing a face mask when going out and 46.8% responded always washing hands (46), also higher than another study in African where 22.5% of women from the rural areas reported good practice of preventive measures against COVID-19 infection, including hand washing, wearing a mask, and maintain social distance (47). But our behavior results were

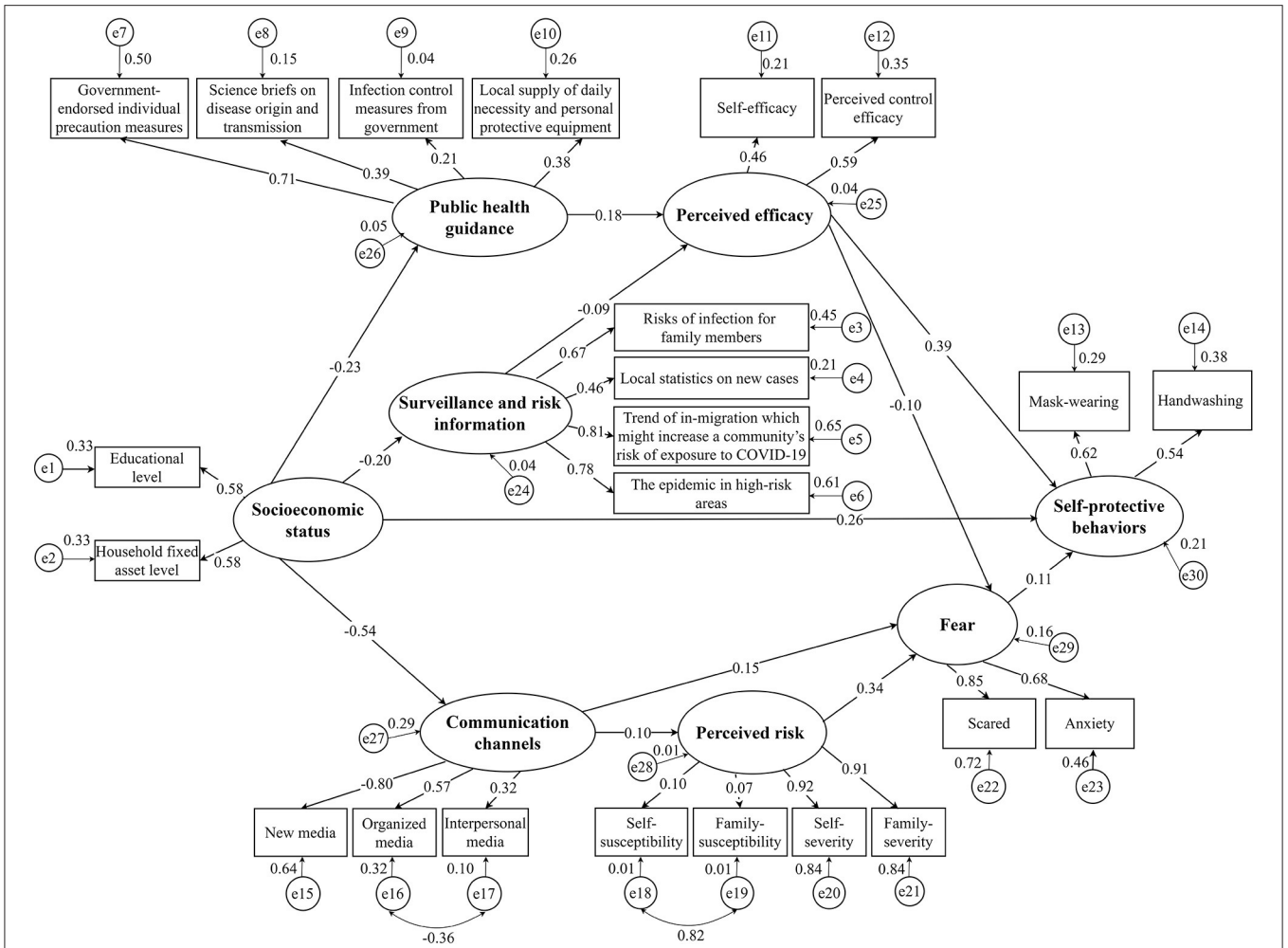

FIGURE 2 | Structural equation modeling examining pathways to self-protective behaviors in response to COVID-19 among women in rural western China (N = 1,524). The final adjusted model had a better fit than the basic model with the following indicators: NFI = 0.85, GFI = 0.94, CFI = 0.87, RMSEA = 0.06, and χ^2/df = 5.88. Coefficients are standardized path coefficients. Variables in ellipse represent latent variables, in squares represent observed variables. Self-efficacy indicates the confidence one's to solve problems when preventing COVID-19. Perceived control efficacy indicates the confidence to protect oneself from getting infected COVID-19. Self-susceptibility indicates the probability of one's being infected with COVID-19. Family-susceptibility indicates the probability of one's family being infected with COVID-19. Self-severity indicates COVID-19 is a serious disease to oneself. Family severity indicates COVID-19 is a serious disease to one's family. Scared indicates COVID-19 makes oneself scared. Anxiety indicates COVID-19 makes oneself anxious. NFI, normed fit index; GFI, goodness-of-fit index; CFI, comparative fit index; RMSEA, root mean square error of approximation. (Data source: Authors' study).

TABLE 2 | Standardized direct, indirect, and total effects of dominants on self-protective behaviors and perceived efficacy in response to COVID-19 among women in rural western China (N = 1, 524).

Variables	Total effect		Direct effect		Indirect effect	
	Self-protective behaviors	Perceived efficacy	Self-protective behaviors	Perceived efficacy	Self-protective behaviors	Perceived efficacy
Socioeconomic status	0.24	–	0.26	–	−0.02	−0.02
Communication channels	0.02	–	–	–	0.02	-
Public health guidance	0.07	0.18	–	0.18	0.07	-
Surveillance and risk information	−0.04	−0.09	–	−0.09	−0.04	-
Perceived efficacy	0.38	–	0.39	–	−0.01	-
Perceived risk	0.04	–	–	–	0.04	-
Fear	0.01	–	0.11	–	–	-

TABLE 3 | Relationship of the measured variables, latent variables with self-protective behaviors and perceived efficacy in response to COVID-19 among women in rural western China ($N = 1524$).

Variables	Standardized regression coefficients	
	Self-protective behaviors	Perceived efficacy
Socioeconomic status	**0.24**	–
Educational level	0.14	–
Household fixed asset level	0.14	–
Communication channels	**0.02**	–
Social media (e.g., WeChat, QQ, Kuai Shou, and Dou Yin.	0.02	–
Traditional media (e.g., radio, leaflets, posters, bulletin boards, newspapers from village and township officials)	0.01	–
Interpersonal communication (e.g., face-to-face conversations with family, relatives, and friends)	0.01	–
Public health guidance	**0.07**	**0.18**
Government-endorsed individual precaution measures	0.05	0.13
Science briefs on disease origin and transmission	0.03	0.07
Infection control measures from government	0.01	0.04
Information on local supply of daily necessity and personal protective equipment	0.03	0.07
Surveillance and risk information	**0.04**	**0.09**
Risks of infection for family members	0.03	0.06
Local statistics on new cases	0.02	0.04
Trend of in-migration which might increase a community's risk of exposure to COVID-19	0.03	0.07
The epidemic in high-risk areas	0.03	0.07
Perceived efficacy	**0.37**	–
The confidence one's to solve problems when preventing COVID-19	0.17	–
The confidence to protect oneself from getting infected COVID-19	0.22	–
Perceived risk	**0.04**	–
The probability one's infected with COVID-19	0.00	–
The probability one's family infected with COVID-19	0.00	–
COVID-19 is a serious disease to oneself	0.04	–
Fear	**0.11**	–
COVID-19 makes oneself scared	0.09	–
COVID-19 makes oneself anxiety	0.07	–

The bold values all highlight standardized regression coefficients of latent variables.

lower than those reported in an Ecuadorian study where the local women had a higher engagement in mask-wearing (91.9%) and handwashing (96.7%) (48) and still lower than an Iranian study where the local women had a high performance in protective behaviors (97.3%) (49). We additionally found a different trend between the behavior results from ours and the international study. Our study found that mask-wearing was more common than handwashing, which differs from the findings of the above Nigeria and Ecuadorians studies (46, 48), also differs from the studies in Ethiopia and the USA. A study in Ethiopia found that half of the women (51.61%) would wear masks compared with that 90% of wash hands (50). Similarly, in the USA, handwashing (87.2%) was common than mask-wearing (23.1%) among women (51). This difference could be explained by the fact that the public in China is more open to mask-wearing due to the experience of previous outbreaks, such as the severe acute respiratory syndrome (52), early recognition of asymptomatic transmission, government's effort to increase public awareness of the importance of mask-wearing, and strict enforcement of the mask mandate (53).

We found that greater perceived efficacy in coping with COVID-19 is associated with increased self-protective behaviors, which echoes the findings from a growing number of studies that demonstrate the link between self-protective behavior and efficacy (31, 34, 54, 55). EPPM proposed that when faced with health risks, people would perceive that they themselves are able to perform recommended self-protective behaviors and that these behaviors are effective in responding to the threat. This perception would in turn lead to more self-protective behaviors. On the other hand, this result offers new insight into strategies to promote health behaviors through enhancing response efficacy. The reason may be that response efficacy was a type of action perspective to remove the risk (54, 56), individuals are more likely to adopt self-protective behaviors if they believe they can easily, feasibly, and effectively prevent a health threat with serious consequences. Greater perceived response efficacy may indicate stronger confidence that guideline-recommended measures are effective in reducing the risk of COVID-19 infection, which in turn would increase individuals' protective behaviors. More research is needed to identify effective strategies to increase perceived efficacy, especially response efficacy, to promote self-protective behaviors against COVID-19 and other infectious disease crises.

Furthermore, according to EPPM, the behavioral response is directly affected by perceived efficacy of people, which can be targeted by health messages (54, 56). We examined this potential association and found that exposure to public health guidance, particularly the government-endorsed individual precaution measures, was associated with greater perceived efficacy. Previous evidence has shown that official reports by the government and health education campaigns that promote self-protective behaviors were critical in slowing the spread of disease (57, 58). Most women in rural areas are not well-educated and have limited household assets (59, 60). Thus, it might be difficult for them to access health information from a variety of sources (39). To them, the public health guidance from the government could

be the most reliable and accessible information source during the COVID-19 pandemic (61). In addition, clear and specific guidance on individual protective measures, such as how to properly and effectively wear masks and wash hands, may have enhanced individuals' confidence in engaging in self-protective behaviors. To reach a broad audience, the government should use specific and actionable messages in their health communication campaigns against COVID-19.

Although communication channel, risk perception, and fear were direct or indirect predictors of behavioral outcomes, they only had modest effects on self-protective behaviors in this study. As explained by EPPM (32, 33), response of an individual to a risk-based message involves two distinct cognitive appraisals. The first appraisal is related to the degree to which the message is perceived as threatening, i.e., perceived susceptibility and severity. If the individual perceives that they are personally vulnerable and that the risk is severe, the second appraisal occurs whereby the individual considers whether the message provides effective and useful strategies to reduce the risk. In other words, perceived susceptibility and severity alone are not sufficient and appraisal of effective actions is needed to prompt actions, as suggested by our primary finding that perceived efficacy was the main precursor of self-protective behaviors.

Consistent with previous studies conducted in China, Brazil, and the United States (62–64), women with higher SES, such as educational and economic levels, were more likely to adopt self-protective behaviors in our study. This might be because women with higher levels of SES had better access to public health information and understand better the government-recommended precautious measures (61, 62). To better promote self-protective behaviors against COVID-19 in the rural areas, health communication interventions should be tailored to accommodate the needs of individuals with low health literacy to reach women from disadvantaged backgrounds.

Taken together, the findings will shed light on direct and indirect factors contributing to the self-protective behaviors during the COVID-19 pandemic among women living rural areas of western China based on EPPM. Within a risk situation, participants may perceive high levels of risk, they may need more information to enhance their efficacy of responding to the risk. The communication message provided therefore should aim at enhancing the efficacy of women from the rural areas by strengthening the government-endorsed individual precaution measures and giving clear guidelines on how the self-protective behaviors can be undertaken, which might be increased their engagement in the self-protective behaviors. SES was also the important precursor of self-protective behaviors, those women with a lower level of SES should be paid more attention during the COVID-19 pandemic. These findings implied to us, that efforts to foster the high efficacious message and strengthen the disadvantaged populations during and in the aftermath of COVID-19 may mitigate the inequitable risks posed by pandemics and other times of healthcare stress."

STUDY LIMITATIONS

The findings should be interpreted in the context of a few limitations. First, data in the study were collected after the lockdown was over, we did not collect any data at the beginning of COVID-19, and we were unable to rule out the possibility of recall bias. However, we emphasized in our survey questions that we were asking about experience of the participants "during the lockdown" and trained enumerators to follow a standard survey manual when asking these questions. Second, we collected data only via structured interviews to measure how dynamic individual characteristics, such as exposure to health information and psychological response, affect health behaviors. Future research could incorporate qualitative approaches to develop a more in-depth understanding of the interplay between these factors and the way they affect health behaviors. Third, the analysis sample was constructed from two surveys conducted 3 months apart at the peak of COVID-19 in our study. Despite similarities between these two sub-samples in background characteristics of the participants, the time difference might have introduced biases from unmeasured co-founders. We attempted to analyze the two sub-samples separately, but the model was under-fitting. To get a larger sample size for model fitting, we thus combined the two sub-samples in the analysis. Fourth, our study sample consists of women from rural areas of Sichuan Province, which is the province with the largest population in western China. However, our finding might not be generalizable to other areas of western China due to differences in population characteristics, cultural customs, social norms, and physical environments across various regions of western China (65, 66). Since the majority of previous studies in China were conducted in urban areas (6, 67, 68), future research on women from other resource-limited settings is needed to understand their health behaviors and develop more targeted health communication strategies. Fifth, for women from rural areas with limited resources, access to personal protective materials, such as masks and soap, maybe other environmental determinants of self-protective behavior. A study in China has shown that an adequate supply of masks and soap was associated with higher odds of mask-wearing and handwashing among the general population (68). Unfortunately, we did not measure access or supply in our study.

CONCLUSION

This study examined how individual characteristics, exposure to COVID-19-related information, and psychological response to COVID-19 affected self-protective behaviors of women in rural areas of western China. To the best of our knowledge, this is the first study that focused on this often-overlooked vulnerable group and their health behaviors during the peak of the COVID-19 outbreak. Our findings suggested that targeted messages and group-specific risk communication strategies may encourage self-protective behaviors among women from the rural areas of western China. More broadly, to promote behavioral changes in response to public health crises, the government should develop clear and actionable guidelines and adopt targeted

health communication strategies to reach the most disadvantaged groups of the society.

DATA AVAILABILITY STATEMENT

The datasets analyzed for the current study are not publicly available due to ethical restrictions related to the consent given by participants at the time of study commencement. An ethically compliant dataset may be made available by the corresponding author on reasonable request and upon approval by the Sichuan University Medical Ethical Review Board. Requests to access the datasets should be directed to zhouhuan@scu.edu.cn.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Sichuan University Medical Ethical Review Board (approval number of studies: KS2020246). The participants provided their written or oral informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

RY and YW drafted the paper plan, developed the data analysis plan, and led the writing of the manuscript. RY, YW, CS, QW, and HZ designed the study. YM, WC, and HZ critically reviewed, discussed, and modified the manuscript. All authors contributed to the article 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/fpubh.2021.756933/full#supplementary-material

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The Psychosocial Correlates of Non-suicidal Self-Injury Within a Sample of Adolescents With Mood Disorder

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Background: According to the integrated theoretical model, adolescents' behaviors were the outcome of the complex interplay between multiple levels. Non-suicidal self-injury (NSSI) is a serious and high prevalent problem among adolescents with mood disorders. However, a systematic perspective on psychosocial correlates among Chinese clinical adolescents is still rare.

Method: The impact of several factors at the individual (i.e., sex, age, self-esteem, and psychological distress), family (i.e., family structure, family income, and family support), and social level (i.e., living environment, peer support, and teacher support) on the frequency of NSSI behaviors were investigated in the current study. This research included 621 Chinese adolescents with mood disorders from 20 hospitals.

Results: Three-steps hierarchical regression analyses indicated that lower levels of psychological distress and higher levels of self-esteem were most associated with less frequency of NSSI behaviors. In addition, family support was negatively associated with the frequency of NSSI behaviors. After controlling the factors at individual and family levels, no significant association was found between the factors at the social level and the frequency of NSSI behaviors.

Conclusion: These findings provide preliminary support for the notion that adolescent self-esteem and family support may effectively shield them from problematic behavior; nevertheless, adolescents suffering from more emotional pain can be even riskier. Thus, further intervention strategies should consider the non-independence of individual capacities, co-combinatory effects of mood disorder, and family environment in treating those vulnerable Chinese adolescents.

Keywords: psychosocial factors, non-suicidal self-injury, adolescent, mood disorder, self-esteem, family support

INTRODUCTION

Non-suicidal self-injury (NSSI) has been defined as a direct self-harm behavior without death intention (1, 2) and is particularly dangerous during adolescence (3). NSSI is far more common in China than in Western countries (4), with 20–57% of community adolescents reporting at least one incident (5–7). Notably, NSSI is particularly frequent in adolescents with mood disorders, such as depression (8), anxiety disorder (9), bipolar disorder (10), and post-traumatic disorder (11), with a prevalence rate of up to 60% (12). In turn, this co-morbidity between mood disorders and NSSI may further increase the maladaptive psychological outcomes, such as suicidal behavior, which has attracted significant attention from researchers and practitioners (13). Thus, it becomes imperative to identify modifiable factors associated with NSSI, which are of great reference for developing preventive measures and plausible interventions for these vulnerable populations.

According to the integrated theoretical model (14) and socio-ecological framework (15), individuals' risk behavior is not a straightforward outcome of their own beliefs but a complex interplay between multiple levels, including individual, family, and social levels. The individual factors emphasize internal characteristics (e.g., capacities, mental health); whereas, family and social factors focus on social relationships or environments (e.g., family relationships, peer relationships, and teacher relationships). However, to the best of our knowledge, only a few studies have examined the potential factors of NSSI behaviors among Chinese clinical adolescents by using a systematic framework, which only offers a limited understanding of the NSSI behaviors.

Individual-Level

At the individual level, mixed findings were observed for sex on the NSSI behaviors. For example, most studies showed that NSSI prevalence was 1.5–3 times higher in girls than boys (16, 17). This disparity may increase the clinical adolescent population (18), with girls significantly outnumbering boys (19). However, several studies suggest no significant relationship between sex and adolescents' self-harm behaviors (20, 21). Paradox findings were also found regarding the age difference. Barrocas et al. have recruited 655 American children aged from 7 to 16 years old. Their findings showed that older children report higher rates of NSSI than younger children (22). Nevertheless, these results were not replicated in a South African student sample (23). Taken together, there is still a need to clarify the sex and age difference in Chinese clinical adolescents' NSSI behavior, especially since the majority of the existing literature has been limited to community samples in the Western population (22).

There has been a link between the level of psychological distress and the NSSI behaviors (24–26). According to the emotional cascade model (27), NSSI would be served as a distraction strategy to rapidly reduce an individual's intensive negative feelings, leading to a sense of relief and even increasing their positive feelings. For example, Houben et al. found that individual with higher levels of negative emotion was more prone to NSSI behaviors (28). However, Hasking et al. indicated that psychological distress was not associated with NSSI frequency among students (29). Again, these inconsistent findings highlighted that more studies on the relationship between the level of psychological distress and NSSI frequency among our targeting population are required.

Moreover, some individual capacities negatively correlate with NSSI, including self-esteem (30). As explicitly noted by researchers, a lower level of self-esteem is often characterized by an overly harsh and negative attitude toward oneself (e.g., I am not a good or worthwhile person). In line with the experiential avoidance model (31), adolescents may engage in NSSI with a wish to escape from or avoid their unwanted poor psychological feelings (e.g., self-critical, negative attitudes). Self-esteem may also be an essential factor associated with Chinese clinical adolescents' NSSI frequency. Taken together, the first block of potential predictor factors in the present study involved individual factors, including sex, age, self-esteem, and psychological distress.

Family Level

The supportive home environment (i.e., family support) may be a safeguard against engaging in NSSI for adolescents with emotional problems (32). Previous research has demonstrated that social support from family members can help community adolescents stop exhibiting NSSI (7, 33, 34). According to Bowlby (35, 36), inadequate parental support may exacerbate children's maladaptive coping techniques in the face of pressures, including suicide attempts (37). Thus, adolescents with emotional disorders may practice more NSSI behaviors to escape from the overwhelming and intolerable affect in the absence of supportive figures from their families.

Research on the familial structure has so far focused primarily on parent-child dyads, while remarkably little is known about siblings that adolescents were reported to spend more time with them than other family members (38). Siblings may act as protective factors against stressors or may further serve as triggers for more NSSI behaviors due to the interpersonal competition and conflicts (39), which is also an interesting thing to be confirmed in our study.

Several findings showed that lower family economic status was associated with more NSSI behaviors among adolescents. For example, a Swedish cohort study found that low parental socioeconomic status was associated with community adolescents' self-harm behaviors (40). However, a few research found no evidence for an association between family income and NSSI behavior, including Chinese adolescents (41) and Western adolescents with mood disorders (42). To clarify the findings on the frequency of NSSI behaviors within family contexts, the demographic characteristics (i.e., family income), family structure (i.e., only child or with siblings), and the level of family support were used in the second block as potential factors.

Social Level

Prior research on the relationship between social environments and the frequency of NSSI behaviors in adolescents, especially those with a mood disorder, has been limited. Adolescents' adaptive outcomes are linked to their relationships with peers

and teachers (43). For example, a previous study found that the quality of peer connections is strongly associated with children's internalizing difficulties (44), which are, in turn, positively associated with NSSI behaviors (13). Furthermore, adolescents who feel supported by their teachers are less likely to engage in NSSI behavior (45–47).

Chinese economic and cultural systems have differentiated rural and urban areas. Generally, the economic development level is relatively lower in rural regions, and cultural norms are more conservative (17), limiting their schema on NSSI. It's also possible that residing in a remote area with fewer social resources (e.g., social services, mental health clinics, and school counseling centers) would be a risk factor for the frequency of NSSI behavior. Plener et al. (48), on the other hand, discovered no difference in NSSI frequency between people living in German cities and those living in rural regions. Therefore, the third block contained three possible predictors: living environment, peer support, and teacher support.

The Present Study

It is still unclear to what extent the prior findings among western adolescents can be generalized to clinical adolescents in China and whether any specific factor contributes to more frequent NSSI behaviors in this population. Thus, the purpose of this study was to investigate the association between those psychosocial factors above from individual level, family level to a social level, and the frequency of NSSI behaviors among adolescents with mood disorders.

METHODS

Participants

A three-stage sampling procedure was adopted in this investigation. To begin, nine provinces were chosen to recruit cooperative hospitals based on the economic situation of each province in China as measured by the good, medium, and general economy levels. These samples represent the diversity of geography, economic development, and public health resources. Among 20 hospitals from nine provinces, convenience sampling was used to enroll adolescents with mood disorders.

The data was collected from September 2020 to November 2020. Participants had to meet the following criteria to be included: (a) had engaged in at least one non-suicidal self-injury behavior in the past year; (b) have been diagnosed with a mental disorder by senior psychiatrists using the Diagnostic criteria and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV-TR); (c) aged 12–18 years old. In addition, adolescents who were unable to complete the survey (for example, severe physical illness and cognitive impairment) were excluded from this study. The research's introduction and consent forms were distributed to participants and their legal guardians prior to the start of the study. Written informed consent was obtained from the participants and their legal guardians. The participants did not receive any incentive. Before the study, ethical approval was granted. The final sample included 621 adolescents: 93 boys and 528 girls. On average, participants were 15 years old (SD = 1.7, range = 12–18). In total, 32% of participants lived in cities, while 68% lived in rural areas. The vast majority (70%) of participants had siblings.

Measures

Demographic data were collected, including sex (i.e., 0 = boys; 1 = girls), age, family structure (i.e., 0 = have siblings, 1 = do not have siblings), family income (i.e., 0–80,000 CNY yearly coded as 1; 80,000–200,000 CNY yearly coded as 2; 200,000–300,000 CNY yearly coded as 3; over 300,000 CNY yearly coded as 4) and living environment (i.e., 1 = living in rural areas, 2 = living in cities).

NSSI

The Functional Assessment of Self-Mutilation (FASM; Lloyds, 1997) is a self-reported questionnaire that assesses the techniques, frequency, and function of self-mutilation. Participants were asked if they participated in any of the 11 different types of NSSI and how often they did so.

Experts advised that NSSI behavior (such as punching walls or objects) be included because it is highly frequent among adolescents (49). Following the procedure used in the previous study (1, 50), the frequency scores were recoded into a 5-point scale, indicating the frequency of the NSSI in the previous 12 months: 1 (0 times), 2 (1 time), 3 (2–5 times), 4 (6–10 times), and 5 ($\geq$11 times). Total scores of these 12 items were used, with higher scores indicating a higher level of NSSI frequencies. Cronbach's alpha was 0.807 in this study.

Self-Esteem

The 10-item Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965) was used. The scale has been widely used among Chinese children and adolescents (8, 51). A high score denotes a strong level of self-esteem. The Cronbach's alpha in this study was 0.849, showing good internal consistency.

Family Support, Peer Support, and Teacher Support

The 12-item Multidimensional Scale of Perceived Social Support [MSPSS; (52)] was used to assess three sources of support: *Family*, *Friends,* and *Significant others*. In this study, the term *Significant others* were replaced by teachers to adapt to the target population. A higher score indicates a higher level of perceived social support. The Chinese version of this scale has been used in Chinese adolescents, and all subscales demonstrate good internal consistency (53). In the current study, the Cronbach's alphas of the three subscales were above 0.83, showing good internal consistency.

Psychological Distress

Kessler Psychological Distress Scale was used [K-10; (54)]. A higher score indicates a higher level of psychological distress. The Chinese version has been used in children and demonstrates good psychometric properties (55). In the current study, Cronbach's alpha was 0.89, showing good internal consistency.

Statistical Analysis

All statistical analyses were performed using IBM SPSS 28.0. Categorical variables were dummy-coded. First, the means and standard deviations were compared by *t*-tests to explore the

difference of gender, family structures, and living environments in the frequency of NSSI behaviors. Next, the bivariate and point biserial correlations were examined to test the associations among variables.

Then, the hierarchical regression analyses were performed to investigate the effects of different psychosocial factors on the frequency of NSSI behaviors. The potential factors involved in the individual level, including sex, age, self-esteem, and psychological distress, were entered in the first block. After controlling for variables in the first block (level 1), the family structure (i.e., only child or with siblings), family income, and family support were entered in the second block (level 2). The living environment (i.e., rural area or cities), peer support, and teacher support were input in the third block while controlling for variables in the first and second blocks (level 3). Given the multiple variables, adjusted *p*-values using the Benjamini and Hochberg (56) false discovery rate correction were calculated to maintain the Type I error rate below 0.05 and are reported in **Table 2**.

RESULTS

"Cut or carved on skin" was the most common NSSI behavior occurrence (90%, M = 2.72, SD = 1.2); "Burned your skin" was the least common (9%; M = 0.19, SD = 0.65). Girls (85%, M = 15.89, SD = 9.18) reported a considerably greater frequency of NSSI behavior than boys (15%, M = 13.11, SD = 9.53; $t = 2.67$, $p = 0.008$). In addition, the only child in the family (30%, M = 14.21, SD = 9.09) showed a less rate of NSSI behaviors than the child with siblings (70%, M = 16.00, SD = 9.32; $t = 2.21$, $p = 0.03$). However, there was no difference in the frequency of NSSI behavior among adolescents from cities (32%, M = 16.07, SD = 9.53) or rural areas (68%, M = 15.19, SD = 9.16; $t = 1.10$, $p = 0.21$).

Table 1 shows descriptive statistics and bivariate correlations among the variables. Sex, age, self-esteem, psychological distress, family structure, family support, peer support, and teacher support were correlated with the frequency of NSSI behaviors ($p < 0.05$).

The findings of the hierarchical regression analysis are shown in **Table 2**. The results revealed that only block 1 and block 2 contributed significantly to the regression model, and these variables at the individual and family level explained 24% of the total NSSI behaviors variance. A higher level of self-esteem remained significantly associated with a lower frequency of NSSI ($B = -0.25$, $SE = 0.06$, $\beta = -0.19$, $p < 0.001$). Psychological distress also showed a substantial positive effect on the frequency of NSSI ($B = 0.38$, $SE = 0.05$, $\beta = 0.30$, $p < 0.001$). Other demographic characteristics (i.e., sex and age) had no bearing on the occurrence of NSSI. Perceived social support from family had a negative impact on the frequency of NSSI at the family level ($B = -0.20$, $SE = 0.06$, $\beta = -0.01$, $p = 0.01$). None of the other factors (i.e., siblings, income) were significantly associated with the frequency of NSSI. At the social level, factors (i.e., rural/local cities, perceived support from peers, perceived support from teachers) did not significantly correlate with the frequency of NSSI.

DISCUSSION

The present study examined the effects of different psychosocial factors across multiple levels on the frequency of Chinese clinical adolescents' NSSI behaviors. Higher self-esteem and lower psychological distress can reduce the risk of adolescents' engaging in the higher frequency of NSSI behaviors. Adolescents who reported receiving more family support were less likely to engage in NSSI behaviors.

Individual-Level

Self-esteem was the strongest protective factor for the frequency of NSSI behaviors among adolescents with mood disorders. Specifically, adolescents with higher self-esteem were less likely to participate in NSSI behaviors. The findings were consistent with the prior research among Western inpatient adolescents (57) and a non-clinical sample of Chinese adolescents (8, 58). There are two possible explanations. According to the Experiential Avoidance Model (31), adolescents with poor self-esteem have more hostile, critical, and unpleasant self-perception types, making them more likely to engage in problematic behaviors (e.g., NSSI) to avoid or cope with distressing inner states (57). Second, people with poor self-esteem struggle with body awareness, which can lead to a lack of feelings when it comes to inflicting physical pain on themselves, leading to increased self-injury behaviors (59, 60). More research is needed to clarify the underlying mechanism between self-esteem and NSSI behaviors.

In accordance with earlier research among Western adolescents, psychological distress was the strongest risk factor for the NSSI frequency among adolescents (61). The most popular models of NSSI conceptualized it as an emotional regulation strategy (27, 62). For example, (63) reported that inpatient adolescents used NSSI behaviors to reduce their dysphoric affect. Thus, it is likely that Chinese adolescents with mood disorders who experience more psychological distress than community samples may also engage NSSI to cope with their excessive emotional distress (62). Therefore, intervention programs to teach adaptive emotional regulation strategies for clinical adolescents who experience higher levels of psychological distress may also reduce their engagement in NSSI (64).

Family Level

For the family-level factors, consistent with previous research, we found that family support was a protective factor for adolescents' engaging in NSSI behavior and vice versa (58). A possible explanation is that adolescents with poor familial support systems perceive their parents as untrustworthy, feeling unworthy of being cared for or loved (65). Specifically, by operating fundamental psychological defense mechanisms unconsciously, adolescents may internalize and experience the hostile image of their parents as self-hatred to reduce their painful feelings (65, 66), in turn, be more inclined to engage NSSI as a self-punishment (61).

Alternatively, NSSI was more likely to serve as a strategy to escape from the intolerable effect without more adaptive mechanisms. Given the attachment theory (36, 67), a high-quality family support system may foster the development of

TABLE 1 | Descriptive statistics and correlations among study variables ($N = 621$).

	M (SD)	1	2	3	4	5	6	7	8	9	10
1. Sex	-	-									
2. Age	15 (1.65)	−0.12**	-								
3. Self-esteem	22.86 (6.92)	−0.07	0.17***	-							
4. Psychological distress	36.32 (7.46)	0.12**	−0.07	−0.55***	-						
5. Family structure	-	0.02	0.07	0.09*	−0.06	-					
6. Family income	-	−0.11**	0.01	0.07	−0.03	0.07	-				
7. Family support	14.84 (5.60)	−0.01	0.23***	0.32***	−0.21**	0.07	0.0004	-			
8. Living environment	-	0.06	0.08*	−0.08	0.04	−0.16***	−0.25***	−0.05	-		
9. Peer support	15.93 (6.19)	−0.02	0.13**	0.26***	−0.16**	−0.04	0.09*	0.22***	0.01	-	
10. Teacher support	12.21 (5.70)	−0.05	0.02	0.25***	−0.17**	0.01	0.01	0.26***	−0.04	0.27***	-
11.NSSI behavior	-	0.11**	−0.09*	−0.40***	0.44***	−0.09*	−0.02	−0.25***	0.04	−0.14***	−0.16***

*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

children's emotion regulation skills. For instance, parents provide the fundamental exemplary model, and their children learn how to express rather than repress their negative feelings and regulate emotions by adaptive strategies from their parents (68, 69), for example, crying or asking for help (70).

Another possible explanation is that those adolescents may engage in NSSI to "get a reaction from parents" (1, 62). In a large sample of Chinese high school students, You et al. subsequently found that "social influence," including "get parents to understand or notice me" and "to get others' attention," were rated as secondary reasons for NSSI among (71). A helpful and friendly family appears to be a key defense against NSSI; according to all prior research, the result was consistent with previous studies of western adolescents (34).

Social Level

The adolescent is considered to be easily influenced by the social environment, including peer and teacher, and living environment. Interestingly, we found no significant association between social environments and NSSI among those Chinese adolescents with mood disorders. This finding is inconsistent with previous Western findings (72, 73). A possible explanation was that the poor living environment, including relationships with family, peers, and teachers might influence those adolescents' problematic behaviors *via* individual capacities, such as self-esteem. In line with the Multi-System Model of Resilience (74), the external resources would contribute to individuals' internal resources, thereby promoting their adaptive outcomes. For example, Thompson et al. found that self-esteem was a significant mediator between peer relationships and adolescents' internalizing, externalizing, and delinquent behaviors (75). Additionally, it has also been found that adolescents who feel supported by their teacher may increase their sense of self-worth, predicting more emotional adjustment and less psychological maladjustment (76).

To further test this hypothesis, we used the mediation model. Interestingly, self-esteem was revealed to have a significant mediating effect between family, peer, teacher support, and NSSI behavior frequency. Further research should employ a longitudinal design to understand better how social environments affect the frequency of those Chinese adolescents' NSSI behavior.

Limitations and Implications

The study has several limitations. First, it should be acknowledged that all the measures in this study are self-reported, which may be an artifact of shared method variance. Future research using physiological measures, such as stress hormones, pain tolerance, may provide a more comprehensive perspective on NSSI. Second, the intersection of NSSI and sex has been limited by using small samples of boys drawn primarily from clinical populations. Future research designs should be more deliberate in selecting samples. Third, correlational and cross-sectional would limit us from drawing any causal conclusion, further producing biased estimates. Thus, a prospective, longitudinal design is required to tases the temporal order between variables overtimes. Fourth, clinical samples were obtained from different China regions, which helps represent the nation. However, there exist different cultural norms, social-economic levels, and other social characteristics. Thus, a region-level residual in multilevel analyses should be further considered (77). Fifth, individuals with suicidal ideation may employ different functions than individuals without suicidal ideation, which should be further explored. Finally, the underlying mechanism from social support to NSSI behaviors *via* self-esteem could be further examined in future studies. Despite these limitations, this study has examined the related psychosocial determinates (individual, family, and environmental factors) among a clinical sample of Chinese adolescents, which provides a starting point for further intervention studies.

TABLE 2 | Hierarchical regression analyses of associator factors of NSSI behaviors ($N = 621$).

	Model 1					Model 2					Model 3					
	B	**SE**	***β***	***T***	***p***	**B**	**SE**	***β***	***t***	***p***	**B**	**SE**	***β***	***t***	***p***	**Adjusted *p***
Individual level																
(Constant)	8.98	4.08		2.20	0.03	9.18	4.11		2.23	0.03	9.77	4.27		2.29	0.02	0.06
Sex	1.28	0.93	0.05	1.37	0.17	1.46	0.93	0.06	1.56	0.12	1.43	0.94	0.06	1.53	0.13	0.29
Age	−0.13	0.20	−0.02	−0.63	0.53	0.02	0.21	0.00	0.09	0.93	0.01	0.21	0.00	0.06	0.95	0.95
Self-esteem	−0.30	0.06	−0.22	−5.15	<0.001	−0.25	0.06	−0.19	−4.25	<0.001	−0.24	0.06	−0.18	−3.94	<0.001	<0.001
Psychological distress	0.39	0.05	0.31	7.34	<0.001	0.38	0.05	0.30	7.16	<0.001	0.37	0.05	0.30	7.12	<0.001	<0.001
Family level																
Family structure						−0.94	0.72	−0.05	−1.31	0.19	−0.98	0.73	−0.05	−1.34	0.18	0.33
Family income						0.08	0.38	0.01	0.20	0.84	0.10	0.39	0.01	0.26	0.80	0.95
Family support						−0.20	0.06	−0.01	−3.26	0.01	−0.19	0.06	−0.11	−2.94	0.003	0.01
Social level																
Living environment											0.05	0.74	0.00	0.07	0.95	0.95
Peer support											−0.03	0.06	−0.02	−0.53	0.59	0.81
Teacher support											−0.05	0.06	−0.03	−0.77	0.44	0.69
R^2	0.23					0.25					0.25					
Adjusted R^2	0.23					0.24					0.24					
F for R^2 change	46.23					4.21					0.36					
p-value	<0.001					0.01					0.78					

Sex (0 = boys; 1 = girls), Age, family structure (0 = have siblings, 1 = do not have siblings); Family support, perceived social support from family; Environment, living environment (1 = living in rural areas, 2 = living in cities); Peer support, perceived social support from peer; Teacher support, perceived social support from teacher.

Our findings can help health professionals design the prevention and intervention programs among adolescents engaging in NSSI with the comorbid mental disorder under the Chinese context. Integrated interventions targeting low self-esteem and high psychological distress, such as the compassion-focused treatment (including self-compassion and emotional regulation), may help achieve more with less effort (78). Treating those adolescents with respect and dignity was also necessary. Second, the NSSI prevention and intervention program should provide parents with better tools to help their children. Specifically, helping educated parents improve communication, parenting skills, and knowledge of NSSI might be a promising direction for minimizing the possibility of adolescents engaging in NSSI. Thirds, the school-based intervention programs may significantly improve children's poor maladaptive strategies *via* strengthening their self-esteem (79).

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Human Research Ethics Committee of Shenzhen Kanning Hospital [2020-K021-01]. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

YZ developed the study concept. LM collected the data, oversaw the data collection, and organized the database. DQ developed the study design, performed the data analysis and interpretation, and drafted the manuscripts with support from all authors. HB performed the data analysis and interpretation. LM, HB, LH, YW, and YZ provided critical revisions and provided logical suggestions. LQ contributed to the data analysis and study design. JY organized the database. JY, TZ, XD, and KH collected the data. All authors contributed to the article, read, and approved the submitted version.

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Health Status and Association With Interpersonal Relationships Among Chinese Children From Urban Migrant to Rural Left-Behind

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Background: To date, numerous studies have examined the health status of Chinese left-behind children and migrant children. However, the impact of children's diverse migration/left-behind experiences on their health is still unclear.

Methods: A cross-sectional survey was conducted in 2020 in Nanling country (Anhui province) and Kaihua country (Zhejiang province) in China. School children from grade 5 to 8 reported their socio-demographic, interpersonal relationships, self-rated health, suicidal ideation, and depression. Participants were divided into four groups based on their migrant patterns, namely rural left-behind children with previous migration experience (ME-LBC), rural children with previous migration experience (ME-NLBC), rural left-behind children without migration experience (LBC), and rural children without migration experience (NLBC).

Results: Among 2,323 participants included in the present study, there were 336 ME-LBC (14.5%), 283 ME-NLBC (12.2%), 561 LBC (24.1%) and 1,143 NLBC (49.2%). Compared with NLBC, ME-LBC reported significantly poorer self-rated health (OR = 0.72, 95% CI [0.53–0.97], $p < 0.05$), higher risk of depression ($\beta = 0.90$, 95% CI [0.02–1.77], $p < 0.05$) with adjustment of socio-demographic and interpersonal relationships. There was no significant difference in suicidal ideation among different groups of children. The better interpersonal relationship was associated with a better self-rated health, and lower prevalence of depression and suicidal intention.

Conclusions: Compared to ordinary rural children, ME-LBC tended to experience higher levels of depression and poorer self-rated health. These research findings imply developing intervention programs about psychological adjustment tailored to different migrant patterns of Chinese rural children. The keys might be to strengthen the relationships with peer and teacher in school and improve the quality of parent-child communication in family for LBC.

Keywords: migrant children, left-behind children, interpersonal relationship, health status, China

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INTRODUCTION

With the rapid social and economic development, there has been continued growth of rural-to-urban migration in China over the past 30 years (1). This phenomenon has been considered as the largest migration in human history (2), where more than 172 million rural people have migrated from their hometowns to cities for better employment opportunities (3). As a result, a great number of Chinese rural children have experienced parental migration during their childhood. Children of these migrant parents can benefit from their migrant parents' increased income and subsequently improved family economic status. It is a dilemma for those children to decide to move with their migrant parents or to stay. Moving can put those children under an unfamiliar and unstable environment, while staying can leave those children living in a circumstance lacking parental supervision and support due to parental absence. In either case, children's mental health and future development can be negatively affected.

Mental Health of Migrant and Left-Behind Children

There is an increasing number of migrant parents choosing to raise their children in cities, resulting in the "migrant children" (MC) (4). Migrant children are migrant population under the age of 18 years who have left their hukou registration place for 6 months or longer with parents from rural areas to cities (5). There are 34.26 million MC, accounting for approximately 12.8% of Chinese children (6). There is also a tremendous number of migrant parents who can't afford to raise their children in cities but to leave their children in the rural hometown, resulting in the "left-behind children" (LBC). Left-behind children are defined as population under the age of 18 years who stay at their hukou registration place while both of their parents or one parent migrate to urban areas to work for at least 6 months (7). There are approximately 41 million rural LBC, accounting for 29% of rural children and 15% of Chinese children (8). LBC are usually taken care of by their grandparents or their families.

The mental health of LBC in rural areas and MC in urban areas have drawn great attention from researchers across many disciplines (e.g., public health, sociology, psychology, anthropology). A number of previous studies has showed the mental health outcomes in LBC and MC, although the results were inconsistent, most findings have documented the adverse effects on child's mental health due to the long-term lack of parental care. One meta-analysis which included 91 Chinese studies demonstrated that LBC were 52% more likely to report depression, 70% more likely to report suicidal ideation, and 85% more likely to report anxiety due to parental absence and the subsequent insufficient parent-child communication compared with rural children (9). Previous studies also showed that compared with urban children, MC experienced more mental health problems such as depression and loneliness (10, 11), which can be explained by stressful events such as peer rejection, academic challenges, family conflicts and social isolation due to their migrant experiences (12, 13).

Diverse Migrant Experience and Child Mental Health

Migration is a fluid process. Different from attributes such as gender and ethnicity, being "left-behind" or "migrant" is a temporary status of some children in their growth process, rather than a specific attribute accompanying them throughout their lives. Some children even have mixed experiences of being left-behind and being migrants at different times. Literature has focused on the fluidity and heterogeneity of children's migrant experiences (3). Because of the *Hukou*, the Chinese Household Registration System determining the distribution of social welfare resources including employment opportunities, medical care, and education resources (14, 15), many school-aged MC are limited to access public schools or social welfare. Thus, many MC may return to their hometowns by school-age and become *returning migrant children* (16). Quite a few rural children even have mixed experiences of being left-behind and being migrant at different times. According to a rough estimation by the All-China Women's Federation, there were nearly 3.5 million migrant children who returned to their hometowns in 2009 (16).

Migrant children returning to their hometowns without the presence of both parents were classified as rural left-behind children with previous migration experience (ME-LBC) in the present study. ME-LBC are different from LBC because they necessitate a re-adaptation to a no-longer-familiar educational and social environment in rural areas (16). They are also different from MC because they move from urban areas back to rural areas and have to rebuild new interpersonal relationships without the presence of both parents and may also have to build attachment with their new caregivers if they move back alone. Koo et al. described this group as "a doubly disadvantaged child population" because they suffered from damaged social ties with interpersonal relationships in the school and the larger community due to residential relocation as well as separation from parents if they returned alone (17). To our knowledge, few researchers have measured the mental health of ME-LBC. Liu and Zhu's qualitative study reported that over a third of returning migrant children experienced difficulties in re-adapting to rural life (16). Previous migration experiences significantly contributed to the increased risks of depression and impairments of self-esteem and resilience of rural Chinese children (18). So far, literature on this topic remains relatively limited.

Child Mental Health and Interpersonal Relationships

The close interpersonal relationship has long been recognized as a significant context contributing to child mental health and development (19). Family functioning theory (20) articulates the way where stress within a family system negatively impacts parental involvement, family cohesion, and family adaptability, and impairs children's internalizing and externalizing psycho-social wellbeing (21). Parent-child communication is emphasized as an important indicator of the family functioning (2), and is also widely considered as a dynamic procedure, where family members can exchange their emotions with joy and confidence.

The beneficial effects of parent-child communication on LBC's mental health have been well-established in previous studies (2, 22). Healthy parent-child communication is also associated with better psychological resilience (23) and a higher level of school satisfaction of children (24), and a strong predictive factor of children's self-rated health (25).

In addition to parents' level, the school's interpersonal relationships also play an important role in children's development (26). As noted, teachers' support can reduce LBC's anxiety (27), loneliness (28) and also enhance LBC's psychological resilience and autonomous motivation (29). Peers' support can have a similar effect (30). With friends' companionship, children acquire opportunities for emotional expressions and display lower levels of depressive symptoms (31). Indeed, the care from peers has been found to help children avoid lonely and depressed feelings in contexts of social isolation. Generally speaking, children spend more time at school than at home. Therefore, teachers' and peers' care and supports are important resources for LBC's development and health (29). While the effects of parent-child communication, teacher-child/peer-child relationships have been well addressed among LBC and MC, little has been done among children with diverse migration experiences.

The Current Study

To better understand the Chinese rural children's mental health, especially those with diverse migrant experiences, this study hypothesized that: (1) Compared to children without any migrant and left-behind experience, LBC with previous migrant experiences would exhibit more depressive symptoms, poorer self-reported health, and a higher prevalence of suicidal ideation; (2) Good interpersonal relationships can offset the negative effects of migrant experiences on LBC's self-rated health, suicidal ideation and depressive symptoms.

METHODS

Participants and Procedure

This cross-sectional study was conducted in Anhui and Zhejiang province in China between November to December 2020. Anhui, a relatively underdeveloped southeastern province, has 16 million migrant workers and 4.5 million LBC (2); Zhejiang is a developed coastal province but its western mountainous area is relatively underdeveloped and has numerous LBC. We purposely chose one underdeveloped county in each province (Kaihua in Zhejiang, Nanling in Anhui) and randomly selected three towns from each county, and then selected two schools (one primary school and one junior high school) from each town randomly. In each school, all classes in the targeted grades (grade 5–6 in primary school and grade 7–8 in junior high school) were selected. All students in the selected classes were invited to participate. Across the twelve schools, 2,931 out of 3,025 eligible students completed the questionnaire, representing a response rate of 96.9%. We discarded 122 questionnaires due to the lack of information about parental migration trajectories and migrant experience about him/herself. We then excluded 486 children from incomplete families (e.g., parents have divorced, passed away, etc.). The final sample of the present study was consisted of 2,323 participants.

Ethical approval for this study was obtained from the Ethics Committee of the School of Public Health at Zhejiang University (NO. ZGL201804-2) and the consent and permission were obtained from the local government and presidents of the sample schools. Mandarin was used in the survey to collect data as precise (reliable) as possible. Before the survey, an informed consent form enclosing a detailed description of this study was provided to both the eligible students and their guardians. On the day of the survey, two research assistants were present and conducted the survey during the lunch break in classrooms. In the beginning, the contents of the survey were introduced by research assistants. Participants were informed that their participation was confidential and anonymous, that they could quit at any time even after consent was obtained. Then, one research assistant gave instructions for filling the questionnaire and the other maintained the classroom order. Participants answered the questions by themselves and were informed that they were not allowed to discuss with each other. Considering the that the survey covered the student's privacy information, the questionnaire were completed by children without teachers' presence during the whole process to ensure the true and distraction-free responses. Anonymity and confidentiality were assured. The questionnaire took the participants about 30 minutes (32).

Measures

Socio-Demographic Variables

Socio-demographic information included: province, age, sex, grade, household wealth level, and parental highest education level. Household wealth level was defined as the economic level of the family and then was coded as "top/upper-middle," "middle" and "lower-middle/low." Parental highest education level referred to the higher education level of their two parents and was characterized as "primary school or below," "middle school," and "high school or above."

Previous Migration Experience and Current Left-Behind Status

Previous migration experience and current left-behind status were identified by asking the following two questions: "Since you were born, have you ever studied or lived in the place where your parent (s) work for at least 6 months, except winter or summer vacation or other holidays?" and "Has your parent (s) migrated into other places for work and been absent for over 6 months?" Children were classified as ME-LBC if they respond "Yes." to both questions. Children were classified as ME-NLBC if they respond "Yes." to the first question and "No." to the second question. Children were classified as LBC if they respond "No." to the first question and "Yes." to the second question. Children were classified as NLBC if they respond "No." to both questions.

Interpersonal Relationships

Peer's Level

According to the recent study conducted in China (33), the peer's relationship was measured by the following question: "In

general, how much do you feel your friend's care about you?" The response options were "Very much / affirmative," "Neutral" and "Seldom/none."

Teacher's Level

Children were asked by the following question: "In general, how much do you feel your teacher's care about you?" In the analyses, responses were divided into three types, similar to the peer's level.

Parents' Level

The communication between parent and child was assessed by the Chinese version of the Parent-Adolescent Communication Scale (PACS) (34, 35). This 20-item scale is composed of two sub-scales: one that measures the communication openness with parents, and the other that assesses the degree of communication problem with parents. Each sub-scale has 10 items. Each item is scored on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). A higher score of the openness and a lower score of the problem indicate better parent-adolescent communication. In the current study, the Cronbach's alpha of father-adolescent and mother-adolescent communication scales was 0.903 and 0.919, respectively.

Health Outcomes

Self-Rated Health (SRH)

SRH was measured by one question from the SF-36. The SF-36 questionnaire is a brief self-administered questionnaire, which is widely used by many countries in the world, and also translated and validated to Chinese version (36). Children were asked to assess their general health with the question "How do you rate your current health status?" Response options were "excellent," "very good," "good," "fair" or "poor" (37). Responses with "good," "fair" and "poor" were coded 0 and "excellent" and "very good" were coded 1 in the current study.

Depression

The Chinese version of the Children's Depression Inventory (CDI) was used to measure depressive symptoms of children in the present study. The CDI is one of the most widely used instruments in gauging children's depressive symptoms across the world (38). It is a self-rated symptom-oriented 27-item scale and each item is scored on a three-point Likert scale. Depression was analyzed as both continuous and categorical variables. The CDI score is used as continuous variable with the mean taken as a measure of depressive tendency in rural children, the total score ranges from 0 to 54, with higher scores corresponding to more severe depressive symptoms (39). While the categorical variable quantifies the prevalence of depression, a score of or above 19 is identified as depression (38, 40). The Chinese version of CDI demonstrates high internal consistency and construct validity in the Chinese context (41), and the Cronbach's alpha in the present study was 0.894.

Suicidal Ideation

The Beck Depression Inventory (BDI) is one of the most widely used self-report instruments for the assessment of depression. Children's suicidal ideation was assessed by one item selected from the BDI: "Which of the following options best fits your real situation during the past year?" Previous studies showed that using a single suicide item derived from the Beck's depression scale might be a valid approach to assess suicidal ideation (42). Of the four options, the following three options were identified as a "Yes." for suicidal ideation: "I had thoughts of killing myself, but I wouldn't carry them out.", "I had thoughts of killing myself." and " I will kill myself when I get a chance."

Data Analysis

Firstly, chi-square tests and one-way analysis of variance (ANOVA) were conducted to examine differences of demographic characteristics, interpersonal relationships and health outcomes among four different groups of children. Secondly, binary logistic regressions and linear regressions were performed to examine the association between groups of children and health outcomes (self-rated health, suicidal ideation, and depression), and the association between interpersonal relationships and health outcomes after controlling for the province, age, sex, grade, household wealth level, and parental highest education level. All statistical analyses were performed using SPSS version 20.0 and assumed a statistical significance level of $p < 0.05$.

RESULTS

The present study included 2,323 children, including 336 ME-LBC, 283 ME-NLBC, 561 LBC, and 1,143 NLBC. **Table 1** presents the socio-demographic characteristics of children stratified by groups. Overall, there was no statistically significant difference in the province, age, grade, household wealth level, and parental highest education level among four groups of children. ME-LBC has the highest proportion of boys, followed by LBC, ME-NLBC, and ME-LBC.

Table 2 shows the interpersonal relationships of children stratified by groups. There were significant differences between different children's groups with respect to care from friends ($p = 0.003$), care from teachers ($p = 0.009$), and problem subscale ($p = 0.006$) of mother-adolescent communication. ME-NLBC reported significantly higher scores in mother-adolescent communication problem than LBC (27.31 ± 7.91 vs. 26.13 ± 7.80), and also than NLBC (27.31 ± 7.91 vs. 25.50 ± 7.70).

Table 3 shows the health outcomes of children stratified by groups. ME-LBC reported a significantly lower prevalence of being excellent/ very good in self-rated health than NLBC (63.0 vs. 70.8%). ME-LBC reported a significantly higher prevalence of depression than NLBC (28.9 vs. 21.2%). ME-LBC reported significantly higher scores of depression than NLBC (14.42 ± 8.51 vs.12.71 ± 8.22).

Tables 4, **5** show the regression analysis results for health outcomes, interpersonal relationships, and groups with adjustments for the province, age, sex, grade, household wealth level, and parental highest education level. In **Table 4**, compared with NLBC, ME-LBC (OR = 0.69, 95% CI [0.53, 0.91], $p < 0.01$) reported significantly poorer self-rated health. In **Table 5**, when adjustments for interpersonal relationships were introduced, ME-LBC (OR = 0.72, 95% CI [0.53, 0.97], $p < 0.05$) reported significantly poorer self-rated health.

TABLE 1 | Socio-demographic characteristics of children stratified by groups.

	ME-LBC[a] *N* (%)	ME-NLBC[b] *N* (%)	LBC[c] *N* (%)	NLBC[d] *N* (%)	F or $\chi 2$	*p*
Province					0.941	0.816
Anhui	164 (48.8)	142 (50.2)	272 (48.5)	580 (50.7)		
Zhejiang	172 (51.2)	141 (49.8)	289 (51.5)	563 (49.3)		
Age (Mean, SD)	11.96 (1.20)	11.91 (1.17)	11.90 (1.20)	11.90 (1.21)	0.247	0.863
Sex					7.943	0.047
Male	181 (55.0)	150 (54.9)	286 (52.2)	539 (48.1)		
Female	148 (45.0)	123 (45.1)	262 (47.8)	582 (51.9)		
Grade					1.522	0.677
Grade 5 Grade 6	153 (45.7)	132 (46.6)	278 (49.6)	546 (47.8)		
Grade 7 Grade 8	182 (54.3)	151 (53.4)	282 (50.4)	597 (52.2)		
Household wealth level					9.861	0.131
Top/upper-middle	84 (25.1)	74 (26.2)	125 (22.3)	320 (28.0)		
Middle	221 (66.2)	183 (64.9)	386 (68.9)	748 (65.6)		
Lower-middle/ low	29 (8.7)	25 (8.9)	49 (8.8)	73 (6.4)		
Parental highest education level					9.349	0.155
Primary school or below	36 (10.8)	34 (12.1)	55 (9.9)	116 (10.2)		
Middle school	197 (59.2)	158 (56.0)	354 (63.6)	647 (56.9)		
High school or above	100 (30.0)	90 (31.9)	148 (26.6)	375 (33.0)		

[a]*Left-behind children with previous migration experiences.*
[b]*Non-left-behind children with previous migration experiences.*
[c]*Left-behind children.*
[d]*Non-left-behind children.*

TABLE 2 | Interpersonal relationships of children stratified by groups.

	ME-LBC[a] (1)	ME-NLBC[b] (2)	LBC[c] (3)	NLBC[d] (4)	F or $\chi 2$	*p*	PC[&]
Care from friends *N* (%)					20.146	0.003	(3,4)
Very much/affirmative	242 (72.0)	208 (73.8)	372 (66.5)	863 (75.6)			
Neutral	83 (24.7)	63 (22.3)	168 (30.1)	259 (22.7)			
Seldom/none	11 (3.3)	11 (3.9)	19 (3.4)	20 (1.8)			
Care from teachers N (%)					17.057	0.009	(3,4)
Very much/affirmative	246 (73.7)	212 (76.0)	407 (73.1)	895 (78.7)			
Neutral	82 (24.6)	56 (20.1)	142 (25.5)	225 (19.8)			
Seldom/none	6 (1.8)	11 (3.9)	8 (1.4)	17 (1.5)			
Mother-adolescent communication (Mean, SD)							
Openness subscale	35.48 (9.94)	35.04 (9.82)	35.33 (9.87)	36.02 (9.77)	1.126	0.337	
Problem subscale	26.10 (7.78)	27.31 (7.91)	26.13 (7.80)	25.50 (7.70)	4.200	0.006	(2,3) (2,4)
Father-adolescent communication (Mean, SD)							
Openness subscale	36.12 (10.08)	35.42 (10.59)	36.14 (10.01)	36.22 (10.04)	0.482	0.695	
Problem subscale	24.62 (8.18)	24.91 (8.13)	23.91 (7.93)	24.26 (8.00)	1.158	0.324	

[a]*Left-behind children with previous migration experiences.*
[b]*Non-left-behind children with previous migration experiences.*
[c]*Left-behind children.*
[d]*Non-left-behind children.*
[&]*PC indicates the significance of pairwise comparisons in the post hoc analysis.*

In **Table 4**, compared with NLBC, ME-LBC (OR = 1.44, 95% CI [1.06, 1.96], $p < 0.01$) reported significantly higher prevalence of depression. In **Table 5**, when adjustments for interpersonal relationships were introduced, results were no longer significant.

In **Table 4**, compared with NLBC, ME-LBC ($\beta = 1.49$, 95% CI [0.42, 2.55], $p < 0.05$) reported significantly higher scores of depression. In **Table 5**, when adjustments for interpersonal relationships were introduced, ME-LBC ($\beta = 0.90$, 95% CI [0.02, 1.77], $p < 0.05$) reported significantly higher scores and the difference between NLBC and LBC was no longer significant.

Table 5 also presents the association between interpersonal relationship with children's health outcome. In family level,

TABLE 3 | Health outcomes of children stratified by groups.

	ME-LBC[a] (1)	ME-NLBC[b] (2)	LBC[c] (3)	NLBC[d] (4)	F or $\chi 2$	*p*	PC[&]
Self-rated Health *N* (%)					10.593	0.014	(1, 4)
Excellent/very good	211 (63.0)	197 (69.6)	365 (65.1)	808 (70.8)			
good/fair/poor	124 (37.0)	86 (30.4)	196 (34.9)	333 (29.2)			
Suicidal intention *N* (%)					2.241	0.524	
Yes	94 (28.1)	87 (31.0)	164 (29.3)	308 (27.0)			
No	241 (71.9)	194 (69.0)	396 (70.7)	834 (73.0)			
Depression (Categorical) *N* (%)				10.302	0.016	(1, 4)	
Yes	85 (28.9)	56 (22.5)	135 (26.5)	216 (21.2)			
No	209 (71.1)	193 (77.5)	374 (73.5)	802 (78.8)			
Depression (Continuous) (Mean, SD)							
CDI score	14.42 (8.51)	13.92 (8.26)	13.70 (8.43)	12.71 (8.22)	4.308	0.005	(1, 4)

[a]*Left-behind children with previous migration experiences.*
[b]*Non-left-behind children with previous migration experiences.*
[c]*Left-behind children.*
[d]*Non-left-behind children.*
[&]*PC indicates the significance of pairwise comparisons in the post hoc analysis.*

TABLE 4 | Regression coefficients for health outcomes and groups with adjustments for social-demographic characteristics.

	Self-rated health	Suicidal intention	Depression (Categorical)	Depression (Continuous)
	OR (95%CI)	OR (95%CI)	OR (95%CI)	β (95%CI)
Group (Ref: NLBC[d])				
ME-LBC[a]	0.69 (0.53, 0.91)**	1.09 (0.82, 1.45)	1.44 (1.06, 1.96)*	1.49 (0.42, 2.55)*
ME-NLBC[b]	0.92 (0.68, 1.25)	1.31 (0.97, 1.77)	1.01 (0.71, 1.44)	1.08 (−0.06, 2.21)
LBC[c]	0.77 (0.62, 0.97)*	1.15 (0.91, 1.46)	1.40 (1.08, 1.80)*	0.95 (0.08, 1.82)**

With adjustments for province, age, sex, grade, household wealth level, and parental highest education level.
[a]*Left-behind children with previous migration experiences.*
[b]*Non-left-behind children with previous migration experiences.*
[c]*Left-behind children.*
[d]*Non-left-behind children.*
*$p < 0.05$, **$p < 0.01$.

the mother-adolescent communication's problem was associated with worse self-rated health, higher level of suicidal intention and depression. In contrast, the openness of father-adolescent communication associated with better health status. In school level, the better peer and teacher's relationship was associated with lower level of depression among all the groups of children.

DISCUSSION

To the best of our knowledge, there was very limited evidence that focused on the health status of Chinese rural children with both migrant and left-behind experiences. Based on a sample collected from two Chinese provinces with widely differing socioeconomic development levels, our original hypotheses were partially confirmed. Firstly, left-behind children with previous migrant experiences exhibited poorer self-rated health and more depression compared with children without any left-behind or migrant experiences. Secondly, better interpersonal relationships including peers' supports, teachers' supports, and parent-adolescent communication can partially offset the negative effects of previous migrant experiences on ME-LBC's self-rated health and fully offset the negative effects of left-behind status on LBC's self-rated health. Thirdly, better interpersonal relationships including peers' supports, teachers' supports, and parent-adolescent communication were associated with better self-rated health, less depressive symptoms and suicidal intention.

Children with mixed experiences of being migrant and left-behind were vulnerable. One study conducted in Guizhou province with 701 participants (43) also indicated that children with mixed experiences of being previously migrant and being presently left-behind might had poor mental health than ones with only being left-behind or being migrant. Using Bourdieu's Field Theory as a guiding framework, the social capital that migrant families accumulate while working in cities can not easily be transferred to the context of rural places. When migrant children are "forced" to return to their hometowns, they carry a different set of dispositions (habitus) into the rural education system (field) (17) including different curriculum content, teaching practices, and performance standards (17). Thus, ME-LBC can face huge challenges in adapting to rural life without parents' presence. Previous studies demonstrated that ME-NLBC adapted better to their new schools and communities in rural areas than ME-LBC did (16, 17). In this regard, LBC with migration experiences might be vulnerable (43).

Furman and Buhrmester's (44) social provisional theory highlights that interpersonal relationships (i.e., parental relationship and friendship) are important determinants of the wellbeing and development of children. Positive family communication has been identified as an important protective factor in the mental health and wellbeing of young people (45). One study conducted in Chongqing province (China)

TABLE 5 | Regression coefficients for health outcomes, interpersonal relationships and groups with adjustments for social-demographic characteristics.

	Self-rated health	Suicidal intention	Depression (Categorical)	Depression (Continuous)
	OR (95%CI)	OR (95%CI)	OR (95%CI)	β (95%CI)
Group (Ref: NLBC[d])				
ME-LBC[a]	0.72 (0.53, 0.97)*	1.05 (0.76, 1.46)	1.26 (0.86, 1.84)	0.90 (0.02, 1.77)*
ME-NLBC[b]	0.96 (0.70, 1.33)	1.25 (0.90, 1.75)	0.83 (0.55, 1.25)	0.10 (−0.83, 1.03)
LBC[c]	0.85 (0.66, 1.08)	1.10 (0.84, 1.44)	1.25 (0.92, 1.70)	0.20 (−0.52, 0.91)
Care from friends (Ref: Seldom/ none)				
Very much/affirmative	1.97 (1.07, 3.64)*	0.74 (0.39, 1.42)	0.14 (0.06, 0.31)***	−7.19 (−9.12, −5.25)***
Neutral	1.12 (0.60, 2.07)	0.80 (0.41, 1.54)	0.25 (0.11, 0.58)*	−4.37 (−6.32, −2.41)***
Care from teachers (Ref: Seldom/ none)				
Very much/affirmative	1.02 (0.49, 2.14)	0.35 (0.16, 0.77)**	0.35 (0.15, 0.82)*	−4.85 (−7.06, −2.64)***
Neutral	0.74 (0.35, 1.55)	0.48 (0.22, 1.06)	0.60 (0.25, 1.44)	−3.60 (−5.84, −1.37)**
Mother-adolescent communication				
Openness subscale	1.01 (1.00, 1.03)	0.98 (0.96, 0.99)	0.95 (0.94, 0.97)***	−0.17 (−0.21, −0.12)***
Problem subscale	0.96 (0.94, 0.98)***	1.08 (1.06, 1.11)**	1.09 (1.06, 1.11)***	0.28 (0.23, 0.34)***
Father-adolescent communication				
Openness subscale	1.03 (1.01, 1.04)***	0.97 (0.96, 0.99)***	0.97 (0.96, 0.99)***	−0.11 (−0.15, −0.07)***
Problem subscale	1.02 (1.00, 1.04)*	0.99 (0.98, 1.01)	1.01 (0.99, 1.03)	0.04 (−0.01, 0.09)

With adjustments for province, age, sex, grade, household wealth level, and parental highest education level.

[a]*Left-behind children with previous migration experiences.*

[b]*Non-left-behind children with previous migration experiences.*

[c]*left-behind children.*

[d]*Non-left-behind children.*

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

showed that a lower frequency of parent–child communication was a risk factor for depression symptoms among LBC (22) In addition to the family environment, the relationship with friends also constitutes an important developmental context for children. Given the huge importance of friend companionship in children's lives, the research by Zhao et al. has shown the significance of friends' support in decreasing the LBC's depression and loneliness in rural China, confirming the validity of the associations between friendship quality and children's emotional outcomes (22). Teacher support can also reduce LBC's anxiety levels in the school setting (27).

Self-rated Health is considered as a subjective indicator that is used to reflect the result of general health (46). Previous studies have shown that SRH is a stable health outcome measured from adolescence to early adulthood (47, 48). Correspondingly, the SRH tool has been applied to LBC in Ghana and Nigeria (49). Our results also suggested that, in general, the ME-LBC have persistently worse self-reported health than NLBC. During the process of adaptation to new situations, ME-LBC who migrated from urban to rural areas are more likely to face challenges from the school setting and the family structure different from their residence before (46).

Given the significant effects of parental-child communication on children's health status, intervention and training programs can be provided for parents and guardians to enhance their skills in caregiving and communicating with children as a way to foster the growth of the family function. It is important to help children maintain positive and regular communication with their migrant parents and present caregivers. Next, considering the significant effects of peers' care and companionship on children's mental health, special attention must be paid to help children with migration experiences have more connections with their friends and classmates in the school. It is important to help them acquire social skills for reciprocal friendships to gain more social support. It is also important to provide training programs for teachers so that they can provide more care and spend more time on ME-LBC, not only on the academic performance but also on their emotional care and support. Schools may be the suitable settings for mental health programs in rural areas with ever more unpredictable home environments (50).

Several limitations of this study should be noted. Firstly, the present study was student self-administrated which may lead to underestimates of the suicidal ideation incidence and depression incidence out of social desirability. Future studies might better collect data from multiple informants (e.g., parents or caregivers) to achieve a more sophisticated data set (51). For example, to understand the situation of suicidal ideation of rural children, more factors should be taken into consideration, including domestic violence and parents' history of mental illness. Secondly, the generalizability of our results can be limited since we only included students from two provinces in China. Thirdly, we did not include the return time or migration time point and duration of migration and return, nor did we include details of parental absence in our studies, which might further enrich the present study.

Despite these potential limitations, our findings have some important contributions to the current research literature. Firstly, the present study expands the knowledge that Chinese rural children are not a homogeneous population (43). And we found that ME-LBC were the more depressed group. It is necessary to distinguish the diverse migration status and to explore the differentiated protective mechanisms of their health status, especially of the current LBC who had previous migration experiences. As mentioned above, this group of children was described as "a doubly disadvantaged group" due to the separation from parents if they returned alone and also the need for re-adoption to new community lifestyles and rebuilding the interpersonal connection (17). Second, the government needs to create greater opportunities for children to unite with their parents in urban areas. Third, considering that LBC, especially

those LBC with previous migrant experiences, are the most vulnerable to emotional difficulties, special attention must be paid to these children to help them overcome the challenges induced by the parental absence and re-adaptation to the new environment.

Finally, the issue of health status and wellbeing of rural children might receive more extensive attention from the whole society. At the international level, the United Nations *Transforming our world the 2030 agenda for sustainable development* (14) through its sustainable development goals (particularly SDG 17) encourage all the countries to implement research practice and policies to assure the rights, health and wellbeing of migrant workers and their children. At the national level, China has initiated key programs in recent years aiming at providing better health services to the LBC. The National Mental Health Work Plan (2015–2020) aims to establish psychological counseling rooms in all schools and to increase awareness of psychological wellbeing (14). In 2019, the "Child Welfare Officer" project was promoted nationwide by the Ministry of Civil Affairs of the People's Republic of China (52) in order to improve the better growth and development of children, especially vulnerable Chinese rural children. It is important that we need to face the heterogeneity of rural children and their health status. Given growing evidence of the influence of sex and gender on children's mental health (53, 54), it will be important in future studies of Chinese rural children's mental health to consider both sex and gender-related influences. Seeking effective intervention strategies also should be considered by the government, society, and social welfare organizations. More studies should verify the effectiveness of evidence-based intervention's effect in the future.

CONCLUSION

The present study showed that previous migration experiences significantly increase the risk of depression and poorer self-rated health among rural children in China. And the good interpersonal relationships was associated with a lower level of depression and better self-rated health. Interventions aiming at improving relationships of parents, peers and teacher can exert great benefits on left-behind children with previous migration experiences.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of the School of Public Health at Zhejiang University (China). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

FW conceptualized the study conception and design. FW, GZ, MW, JX, JL, and HA collected the data. GZ and FW conceived data interpretation and performed all statistical analyses. GZ drafted manuscript while MW, JX, JL, and HA critically revised the manuscript for important substantial revisions. All authors gave their final approval and agree to be responsible for all aspects of the work. All authors contributed to the article and approved the submitted version.

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Profiles of Stress and Coping Associated With Mental, Behavioral, and Internet Use Problems Among Adolescents During the COVID-19 Pandemic: A Stratified Random Sampling and Cluster Analysis

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Background: Adolescents are vulnerable to behavioral and mental health problems, which might be further exacerbated during the COVID-19 pandemic. This study explored how participants with different profiles of stressful life events, coping resources (i.e., self-esteem and perceived social support) and coping strategies (i.e., maladaptive and adaptive coping) varied in the prevalence of mental, behavioral, and Internet use problems.

Methods: Data were collected from a large and representative sample of Chinese secondary school students in Hong Kong (n = 3,136) from September to November 2020 (48.1% males; mean age = 13.6 years old). Cluster analysis and logistic regression models were used for analysis.

Results: The prevalence of suicidal ideation and sleep disturbance was 29.8 and 55.4%, respectively. Behavioral problems were most frequently reported in excessive social media use (53.5%), followed by excessive Internet gaming (43.6%), obesity (34.1%), damaging properties (14.6%), and alcohol or substance abuse (5.1%). The results of cluster analysis yielded three distinctive stress and coping profiles: severe profile (High Risk/Low Protective; 17.0%), moderate profile (Moderate Risk/Moderate Protective; 35.8%), and mild profile (Low Risk/High Protective; 47.2%). Participants with severe and moderate profiles displayed significantly higher levels of mental (range for AOR: 2.08–15.06; all $p < 0.001$) and behavioral health problems (range for AOR: 1.22–11.22; all $p < 0.05$) compared to the mild profile cluster.

Conclusions: Adolescents' mental and behavioral health may be shaped by a combination of stressful life events and variations in coping resources as well as strategies. Transdiagnostic and multimodal interventions on these factors are warranted to reduce mental, behavioral, and Internet use problems among adolescents.

Keywords: stress-coping theory, mental health, behavioral problems, Internet use, youth, cluster analysis

INTRODUCTION

Adolescence is a period of stressful challenges, during which individuals undergo extensive physical, psychological, emotional, and personality development. The high prevalence and co-occurrence of behavioral and mental health problems in adolescence have emerged as a paramount public health concern. For instance, mental disorders affect 10–20% of youth worldwide; and suicide is the third leading cause of death in 15–19 year-old youth (1). A national survey in the U.S. reported that 7.4% of children aged 3–17 years had a current behavioral problem (2). More importantly, the coronavirus 2019 (COVID-19) pandemic poses a grim challenge to youths' normal life, including lockdowns and schooling disruptions (3). Adolescents are particularly vulnerable to mental distress and behavioral difficulties in pandemics (4). A systematic review reported that 41.7, 42.3, 30.8, and 21.3% of children and adolescents suffered from depression, irritability, inattention, and sleep disturbance during the COVID-19 pandemic, respectively (4). Internet-related behaviors (e.g., Internet gaming) also had increased during the pandemic among Chinese adolescents due to social distancing and motivation of escapism coping (5, 6). Therefore, it is critical to raise the awareness of monitoring various behavioral and mental health problems among adolescents during this unusual period.

Adolescents are commonly exposed to various risks and stressors related to interpersonal relationships, academic stress, violence, and health threats (7). The high levels of stressful experiences often lead to disruptions in adolescents' physical, mental, and behavioral health (8, 9). However, individuals who experience negative life stress do not necessarily develop adverse health consequences. In light of this, researchers have proposed the concept of coping, which represents the cognitive and behavioral efforts of an individual to manage the internal and external demands encountered during a specific stressful situation (10). According to the stress-coping theory, coping responses in face of adversity will greatly affect one's health outcomes. Coping strategies can be adaptive (e.g., positive reframing and acceptance) or maladaptive (e.g., rumination and self-blame). Generally, adaptive coping (in which the stressor is managed cognitively or through action) is thought to mitigate the debilitating stress effects and prevent the development of depression and risky behaviors in face of stressors (11, 12), whereas maladaptive coping (in which the stressor is ignored or repressed) has a positive association with depression, suicidal ideation, and problematic behaviors (e.g., Internet-related behaviors) (13–15). On the other hand, coping resources can aid in the coping process by facilitating coping flexibility and increasing the efficacy of adopted coping strategies (10, 16). These resources can be stable characteristics of a person's disposition (e.g., self-esteem) and social environment (e.g., social support). Social support and self-esteem may have stress-buffering effects by preventing a situation from being appraised as stressful or by providing a solution to a stressful problem, which are associated with lower risks of depression and problematic behaviors (e.g., smoking and alcohol use) among adolescents (9, 17).

Despite these specific associations between stress, coping and health outcomes, there is very limited research defining the collective relationships between stressful life events, coping resources and strategies, as well as mental and behavioral health problems among adolescents. Given that adolescents tend to use multiple coping resources and strategies to deal with stress, studies examining behavioral and psychological responses to stressors should incorporate both of these constructs and capture the multidimensionality of stress-coping processes (9). Cluster analysis is a promising method for identifying and describing subgroups of individuals along multiple dimensions of interest (e.g., stressors, coping resources, and coping strategies). Such an approach may assist health professionals to identify distinct stress-coping profiles to which individuals might belong and, subsequently, shape intervention designs to the unique dispositions and risks of the targeted group.

In the present study, we aimed (1) to investigate the prevalence of behavioral (e.g., smoking, substance abuse, damaging properties, and Internet gaming) and mental health problems (e.g., suicidal ideation and sleep disturbance) in a large-scale and representative population of adolescents during the COVID-19 pandemic; (2) to identify profiles of adolescents based on their exposures to stressful life events, coping resources (i.e., self-esteem and perceived support) and individual coping strategies; and (3) to investigate whether the subgroups of adolescents created by the cluster analysis differed in levels of behavioral and mental health problems.

METHODS

Study Design and Participants

A school-based survey was conducted among secondary school students in Hong Kong from September to November 2020 when the spread of the virus in local clusters had been controlled and the schools were re-opened after a long time of face-to-face classes suspension since January 2020. A stratified random sampling of schools was implemented with one secondary school randomly selected and invited for each of the 18 districts in Hong Kong. As a result, 13 of the 18 schools accepted the invitation to participate in this study. All secondary 1–4 (7th−10th year of formal education) students who lived in Hong Kong and attended face-to-face classes at the investigation time of the schools were invited. Shenzhen-Hong Kong cross-boundary students who lived in Shenzhen, mainland China, and attended online courses were not invited. Secondary 5 and 6 students were not invited due to schools' concerns about their academic stress and exam pressure. In total, 4,323 students from the 13 schools were invited, and 3,147 (72.8%) returned their questionnaires.

Procedures

Students and parents were invited and informed about the survey and its purpose with school teachers' assistance. Participants were explained that the participation was voluntary and anonymous, and rejection would not affect any right or service they would receive from the school. They were also guaranteed that only the research team can access their data. Two research assistants

with a training background in psychology and at least 6 months of interviewing experience implemented the survey in classroom settings in the absence of teachers. The survey questionnaire had about 100 items which took about 15 min to complete. No incentive was given to the participants. Ethics approval was obtained from the corresponding author's affiliation (Ref No. SBRE-18-433). The written informed consent was obtained from both parents and children.

Measures

Problematic Behaviors

Self-reported engagement in problematic behaviors was measured using the Problem Behavior Scale, which has been commonly used among adolescents (18, 19). The frequency of behavioral health problems, including alcohol or substance addiction, tobacco use, damaging properties, running away from home, and skipping school/absenteeism, during the past 6 months were asked. As sedentary lifestyle and obesity are significant challenges during the COVID-19 pandemic for children and adolescents (20), we assessed obesity problem using the item from the Pediatric Behavior Scale to examine whether the adolescents had been overweight or gained too much weight in the past 6 months (21). Response categories were dichotomized into having problematic behaviors (sometimes/very often) or not (none).

Internet Use

Two items were used to ask participants about the average time per week they spent on social media and Internet gaming during the past 6 months. As recommended by the American Academy of Pediatrics that time allotted to Internet gaming should be within 1 h per day and the total screen time should not exceed 2 h for children and teenagers (22), participants who spent >1 h on social media and Internet gaming per day were classified as excessive social media and Internet gaming users, respectively.

Mental Health Problems

The presence of suicidal ideation was measured using item 9 of the Patient Health Questionnaire, which asked "Over the past two weeks, how often have you thought that you would be better off dead, or of hurting yourself" (23). Responses rated on a 4-point Likert-type were dichotomized into 0 (not at all) and 1 (several days/more than half of the days/nearly every day). Such measurement has been widely used in previous studies (24). The frequency of sleep disturbance in the past 6 months was measured using a single item, with responses categorized into 1 (sometimes/very often) and 0 (none).

Stressful Life Events

The Adolescent Self-Rating Life Events Checklist (ASLEC) was used to measure the severity of life stress experienced during the past year (8). It lists 26 negative life events on six social-stress domains: interpersonal relationship (e.g., I argued with my classmates), academic pressure (e.g., I failed in the examination), being punished (e.g., I was criticized and punished), bereavement (e.g., A family member/close friend died), the pressure of health and adaptation, and others, which were chosen on the basis of having occurred most frequently to Chinese adolescents. Participants were first asked whether the particular event happened to them. Then they were asked to rate the perceived stressfulness of each experienced event (i.e., the extent to which the event affected the respondent's life) on a five-point Likert scale ranging from 0 (not at all) to 4 (extremely severe). If a particular event did not happen, the event was scored 0, as it did not affect the respondent's life at all. Summing scores for all events in each subscale generates a total stress intensity score for the specific domain. A higher score indicates a greater perception of stress. The Cronbach's alpha of the scale was 0.94 in the present study.

Perceived Social Support

Four items were used to assess perceived social support, including two items about parental support and two items for peer support (25). The items were "How much support had you received from your parents/friends when you needed to talk with someone or needed emotional support?" and "How much support had you received from your family/friends when you needed instrumental support (e.g., financial support)?" The items were rated on a 10-point scale, ranging from 0 (none) to 10 (tremendous). Higher scores denote higher levels of perceived social support. The Cronbach's alpha was 0.79 in the present study.

Self-Esteem

Self-esteem was measured using the abbreviated version of the Rosenberg Self-esteem Scale (RSE). The original RSE is a 10-item assessment with a four-point Likert scale format ranging from strongly disagree to strongly agree. Previous studies have used different abbreviated versions of RSE, which has shown reliability and validity across age and gender groups (26). The five positive-worded items of RSE were used in the current study. It had a Cronbach's alpha of 0.90.

Maladaptive and Adaptive Cognitive Coping

The short version of Cognitive Emotion Regulation Questionnaire (CERQ-short) was used to assess the set of cognitive emotion regulation strategies that individuals apply in response to stressful life events (27). The original CERQ has been well-validated in Chinese studies (28, 29), which demonstrated acceptable psychometric properties (e.g., Cronbach's alphas = 0.83–0.90 and test-retest coefficients = 0.64–0.68). The CERQ-short also showed satisfactory validity, reliability, and measurement invariance (e.g., Cronbach's alpha = 0.80 and test-retest coefficients = 0.69) among adolescents across different countries (30, 31) and had been applied in Hong Kong Chinese people (32). The CERQ-short consists of nine dimensions: (i) self-blame, (ii) other-blame, (iii) rumination, (iv) catastrophizing, (v) putting into perspective, (vi) positive refocusing, (vii) positive reappraisal, (viii) acceptance, and (ix) planning. Theoretically, the nine strategies can be grouped into adaptive coping strategies (putting into perspective, positive refocusing, positive reappraisal, acceptance, and planning) or maladaptive coping strategies (self-blame, other-blame, rumination, and catastrophizing). Items were measured on a 5-point Likert scale ranging from 1 (never) to 5 (always). The Cronbach's alphas for the maladaptive coping subscale and

adaptive coping subscale were relatively low but acceptable (0.57 and 0.59) (33).

Background Factors

Background information, including sex, age, whether being born in Hong Kong, living arrangements, and parental education levels, were collected.

Statistical Analysis

The SPSS 23.0 Statistics for Windows (IBM Corp. Released 2015, Armonk, NY: IBM Corp) were used for all statistical analyses. The two-step cluster analysis procedure, an exploratory method to identify natural latent groupings within a dataset of continuous (standardized) and categorical features, based on the agglomerative hierarchical clustering method and assuming a joint multinomial-normal distribution was used. Such a technique presents several advantages compared to more traditional techniques, like automatically determining the optimal number of clusters by comparing the values of a model-choice criterion across different clustering solutions [i.e., log-likelihood distance and the Schwarz Bayesian Information Criterion (BIC)] rather than on an arbitrary choice, using categorical and continuous variables simultaneously, analyzing atypical values, and being able to handle large datasets (34). Comparative studies regarded two-step cluster analysis as one of the most reliable in terms of the number of subgroups detected, classification probability of individuals to subgroups, and reproducibility of findings (35). The set of indicator variables for the clustering procedure carried out included the six subscales of stressful life events, self-esteem, family support, friend support, maladaptive coping, and adaptive coping. The clustering quality for the final model was estimated with the Silhouette index, which constitutes a global consistency measure of the cohesion/separation. The Silhouette index is a commonly used indicator to measure how tightly grouped all the data in the cluster (36). Silhouette values fall within the range of −1 to 1 and higher values denote better matching in one's own cluster (similarity within the cluster) and poor matching in other clusters (different compared to the other clusters). Values lower than 0.30 are interpreted as having a poor fit, between 0.30 and 0.50 as fair, and higher than 0.50 as good (37).

Chi-square tests and analysis of variance (ANOVA) with Fisher's least significant difference (LSD) *post-hoc* test were used to confirm whether individuals of clusters differed significantly in sociodemographic characteristics and indicators included in the cluster analysis; effect sizes of cluster differences were represented by Cohen's d and odds ratio. In addition, multivariate logistic regression models were performed to test the associations between cluster membership and mental/behavioral health outcomes, adjusted for all sociodemographic variables. The adjusted odds ratios (AOR) and corresponding 95% confidence intervals (CI) were reported. *P*-values lower than 0.05 are considered statistically significant.

RESULTS

Descriptive Characteristics

The mean age of the participants was 13.6 years and 51.9% were females. Of all the participants, 73.0% lived with both parents while 21.4% lived in a single-parent family; 15.8% of the participants' mothers and 13.4% of their fathers had obtained an educational level of college or above (**Table 1**). The mean values and standardized deviations for the cluster indicators, including stressful life events across six domains, self-esteem, family and friend support, maladaptive coping, and adaptive coping, are also presented in **Table 1**.

Clustering Outcomes

The solution selected as the optimal in the two-step cluster procedure was for three latent empirical groups. As shown in **Supplementary Table 1**, this solution gave the highest value for the ratio of distance measures and lower value of BIC. The 3-cluster solution achieved the highest ratio distance measure (2.78) and a cohesion/ separation index into the fair range (silhouette = 0.3). **Figure 1** displays the ordered bar chart with the relative relevance for each indicator used in the clustering. These weights ranged from 0 to 1, and greater values indicate a lower likelihood that changes between clusters are attributable to chance. The measures with the greatest discriminative relevance were the six subscales of stressful life events, followed by self-esteem, family support, maladaptive coping, and friend support.

Comparison Between Clusters

Descriptive data for sociodemographic characteristics, stressful life events, self-esteem, family support, friend support, maladaptive coping, and adaptive coping are reported by cluster in **Table 1** and showed graphically in **Figures 2**, **3**. The largest cluster (47.2%) was characterized by low levels of stressful life events and maladaptive and adaptive coping as well as high levels of self-esteem, family support, and friend support, compared to the remaining two clusters. Cluster 2 comprised 35.8% of the sample, characterized by moderate levels of stressful life events, coping strategies, self-esteem, and perceived support. The final cluster 3 was marked by high values on all six domains of stressful life events, high levels of maladaptive and adaptive coping, and low levels of self-esteem, family support, and friend support. The three clusters differed significantly in the levels of these indicators and the majority showed a large effect size of between-group differences (Cohen's $d > 0.8$; **Table 1**). Based on the set of results in this study, cluster 1 was labeled as "low-risk profile (Low Risk/Low Protective)", cluster 2 as "moderate-risk profile (Moderate Risk/Moderate Protective)", and cluster 3 as "severe-risk profile (High Risk/Low Protective)".

With respect to sociodemographic variables, the three clusters significantly differed in gender, age, whether or not born in Hong Kong, and living arrangement. Participants who were born in Hong Kong and lived with both parents were more likely to be classified into the low profile group (cluster 1). Males and younger adolescents were over-represented in cluster 1 relative to cluster 2 (**Table 1**).

TABLE 1 | Comparison between the clusters in sociodemographic and psychosocial variables.

Independent variables	Total (n = 3,087)	Cluster 1 (n = 1,457)	Cluster 2 (n = 1,106)	Cluster 3 (n = 524)	*P*-value	Cluster 1 vs. 2		Cluster 1 vs. 3		Cluster 2 vs. 3	
	N (%)	*N* (%)	*N* (%)	*N* (%)		*p*-value	Odds Ratio	*p*-value	Odds Ratio	*p*-value	Odds Ratio
Sociodemographic variables											
Gender					**0.012**	**0.003**		0.242		0.272	
Male	1,507 (48.1%)	736 (50.6%)	492 (44.7%)	248 (47.6%)			Ref		Ref		Ref
Female	1,629 (51.9%)	719 (49.4%)	609 (55.3%)	273 (52.4%)			1.25		1.12		0.89
Born in Hong Kong					**0.008**	**0.009**		**0.014**		0.691	
No	533 (17.0%)	216 (14.9%)	207 (18.8%)	102 (19.6%)			Ref		Ref		Ref
Yes	2,602 (83.0%)	1,236 (85.1%)	895 (81.2%)	419 (80.4%)			0.81		0.81		0.99
Living with parents					**<0.001**	**<0.001**		**<0.001**		**0.047**	
Both	2,227 (73.0%)	1,135 (78.7%)	767 (69.7%)	329 (63.8%)			Ref		Ref		Ref
Mother	504 (16.2%)	192 (13.3%)	193 (17.5%)	112 (21.7%)			1.46		1.82		1.28
Father	166 (5.3%)	58 (4.0%)	69 (6.3%)	37 (7.2%)			1.65		2.31		1.40
Neither	171 (5.3%)	58 (4.0%)	71 (6.5%)	38 (7.4%)			1.72		2.31		1.33
Mother's educational level					0.825	0.574		0.958		0.635	
Primary school or below	226 (7.3%)	87 (6.1%)	85 (7.8%)	51 (9.9%)			Ref		Ref		Ref
Middle school	1,396 (45.3%)	650 (45.7%)	490 (45.1%)	228 (44.3%)			0.87		0.74		0.83
College or undergraduate	408 (13.2%)	217 (15.3%)	128 (11.8%)	52 (10.1%)			0.73		0.58		0.78
Master or above	78 (2.5%)	41 (2.9%)	20 (1.8%)	15 (2.9%)			0.52		0.81		1.61
NA (e.g., don't know)	972 (30.9%)	426 (30.0%)	364 (33.5%)	169 (32.8%)			0.94		1.06		0.98
Father's educational level					0.110	0.903		0.054		0.052	
Primary school or below	314 (10.2%)	112 (7.8%)	124 (11.4%)	73 (14.1%)			Ref		Ref		Ref
Middle school	1,449 (46.8%)	685 (47.9%)	488 (44.8%)	243 (47.0%)			0.72		0.64		0.91
College or undergraduate	370 (11.8%)	198 (13.8%)	117 (10.7%)	49 (9.5%)			0.66		0.52		0.78
Master or above	47 (1.5%)	17 (1.2%)	19 (1.7%)	9 (1.7%)			1.53		0.93		0.65
NA (e.g., don't know)	913 (29.5%)	418 (29.2%)	341 (31.3%)	143 (27.7%)			0.72		0.44		0.67
	Mean (SD)	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**	***P*-value**	***p*-value**	**Cohen's d**	***p*-value**	**Cohen's d**	***p*-value**	**Cohen's d**
Age	13.6 (1.3)	13.6 (1.3)	13.7 (1.3)	13.6 (1.4)	**0.007**	**0.007**	−0.08	0.562	0.00	**0.010**	0.07
Psychological variables											
Self-esteem	14.2 (3.0)	15.5 (2.4)	13.2 (2.8)	12.4 (3.2)	**<0.001**	**<0.001**	0.88	**<0.001**	1.10	**<0.001**	0.27
Family support	11.1 (5.1)	13.3 (4.5)	9.4 (4.8)	8.5 (5.0)	**<0.001**	**<0.001**	0.84	**<0.001**	1.01	**<0.001**	0.18
Friend support	10.6 (5.0)	12.1 (4.6)	9.3 (4.7)	9.1 (5.2)	**<0.001**	**<0.001**	0.60	**<0.001**	0.60	0.448	0.04
Adaptive coping	16.3 (3.2)	16.0 (3.3)	16.3 (2.9)	17.2 (3.4)	**<0.001**	**0.022**	−0.10	**<0.001**	−0.36	**<0.001**	−0.29
Maladaptive coping	12.9 (2.6)	12.0 (2.5)	13.3 (2.4)	14.4 (2.7)	**<0.001**	**<0.001**	−0.53	**<0.001**	−0.92	**<0.001**	−0.43
SLE-relationship	4.7 (4.3)	1.7 (1.8)	5.6 (3.0)	11.3 (3.6)	**<0.001**	**<0.001**	−1.58	**<0.001**	−3.37	**<0.001**	−1.72
SLE-academic pressure	4.4 (4.0)	1.8 (1.8)	5.1 (2.8)	10.4 (3.7)	**<0.001**	**<0.001**	−1.40	**<0.001**	−2.96	**<0.001**	−1.62
SLE-punishment	3.4 (4.8)	0.6 (1.1)	3.3 (2.7)	11.5 (5.3)	**<0.001**	**<0.001**	−1.31	**<0.001**	−2.85	**<0.001**	−1.95
SLE-bereavement	1.5 (2.6)	0.3 (0.9)	1.6 (2.1)	4.8 (3.6)	**<0.001**	**<0.001**	−0.81	**<0.001**	−1.72	**<0.001**	−1.09
SLE-health and adaption	1.5 (2.0)	0.5 (0.8)	1.6 (1.5)	4.2 (2.5)	**<0.001**	**<0.001**	−0.92	**<0.001**	−1.99	**<0.001**	−1.26
SLE-others	2.2 (2.7)	0.6 (1.0)	2.4 (1.8)	6.5 (2.9)	**<0.001**	**<0.001**	−1.24	**<0.001**	−2.72	**<0.001**	−1.70

Post-hoc LSD significant comparison (0.05). SLE, stressful life events. P-values <0.05 are presented in bold.

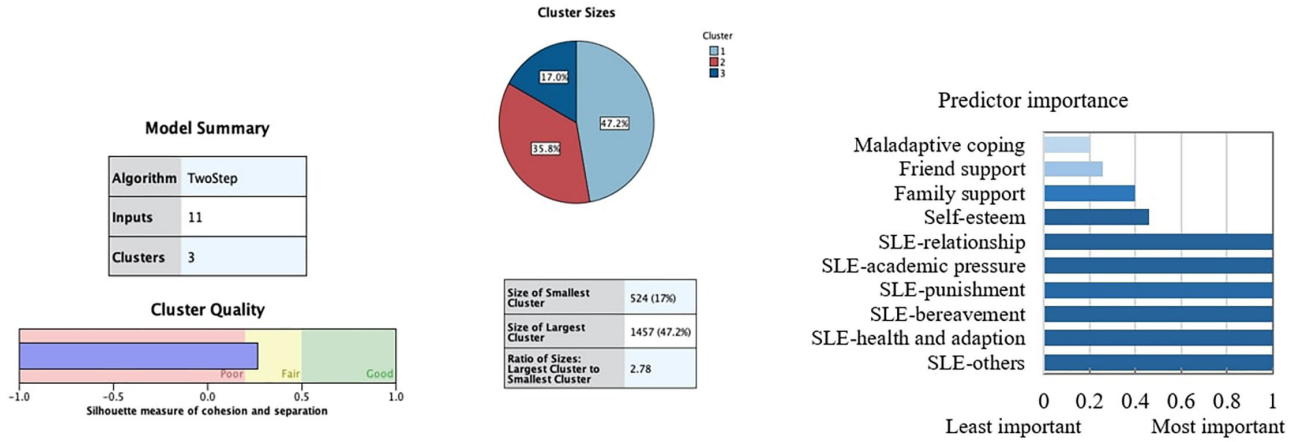

FIGURE 1 | Summary of clustering results. SLE, stressful life events.

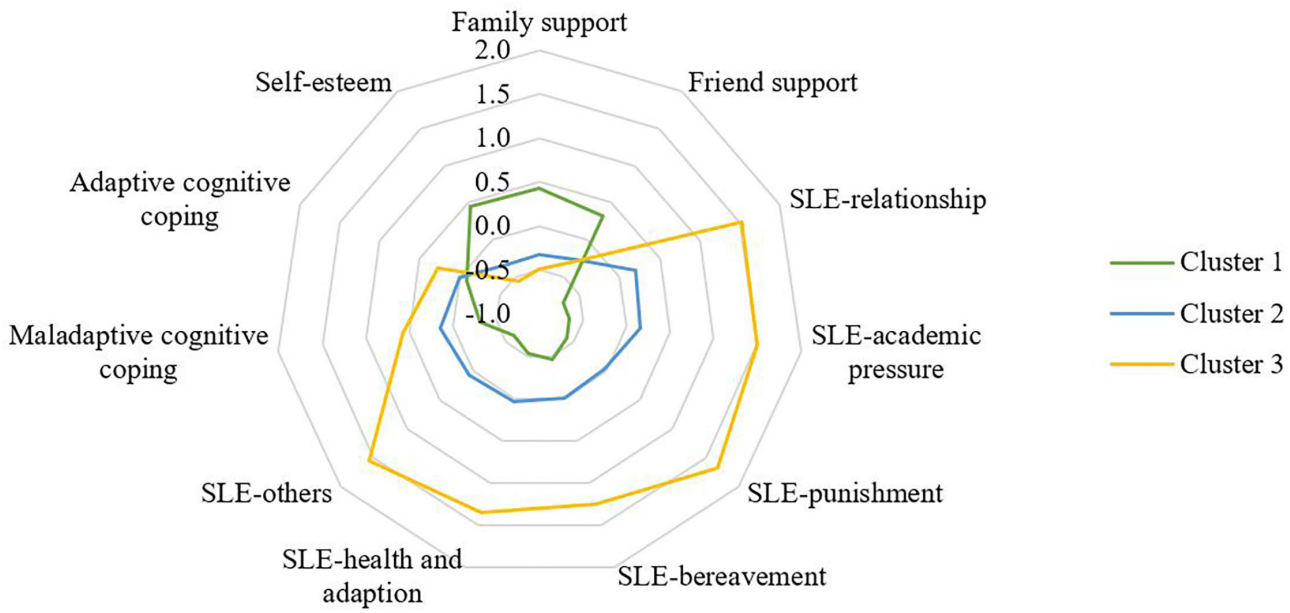

FIGURE 2 | Radar-chart displaying the differences between the three clusters. SLE, stressful life events. Standardized scale scores were presented.

Associations Between Cluster Membership and Mental, Behavioral, and Internet Use Problems

Figure 4 illustrates the prevalence of mental, behavioral, and Internet use problems in the total sample and by clusters. 5.1, 2.3, 2.6, and 2.8% of the participants reported that they had alcohol or substance abuse, tobacco use, running away from home, and skipping school/absenteeism in the previous 6 months, respectively. While about half of the participants reported that they had excessive social media and Internet gaming use and 34.1% had obesity problems. Concerning mental health, 29.8% of them reported suicidal ideation in the past 2 weeks and half of them had sleep disturbance in the past 6 months (55.4%). The detailed frequency distribution of mental, behavioral, and Internet use problems is presented in **Supplementary Table 2**.

Adjusted for all sociodemographic variables, the multivariate logistic regression models indicated that compared to the low profile cluster, individuals in the moderate and severe profile groups consistently reported significantly higher prevalence of behavioral (range for AOR: 1.22–11.22; all $p < 0.05$) and mental health problems (range for AOR: 2.08–15.06; all $p < 0.001$) (**Table 2**). We also conducted multinominal logistic regression analysis to assess the associations between cluster membership and behavioral/mental health outcomes using the original response categories of dependent variables, which showed similar significant results (**Supplementary Table 3**).

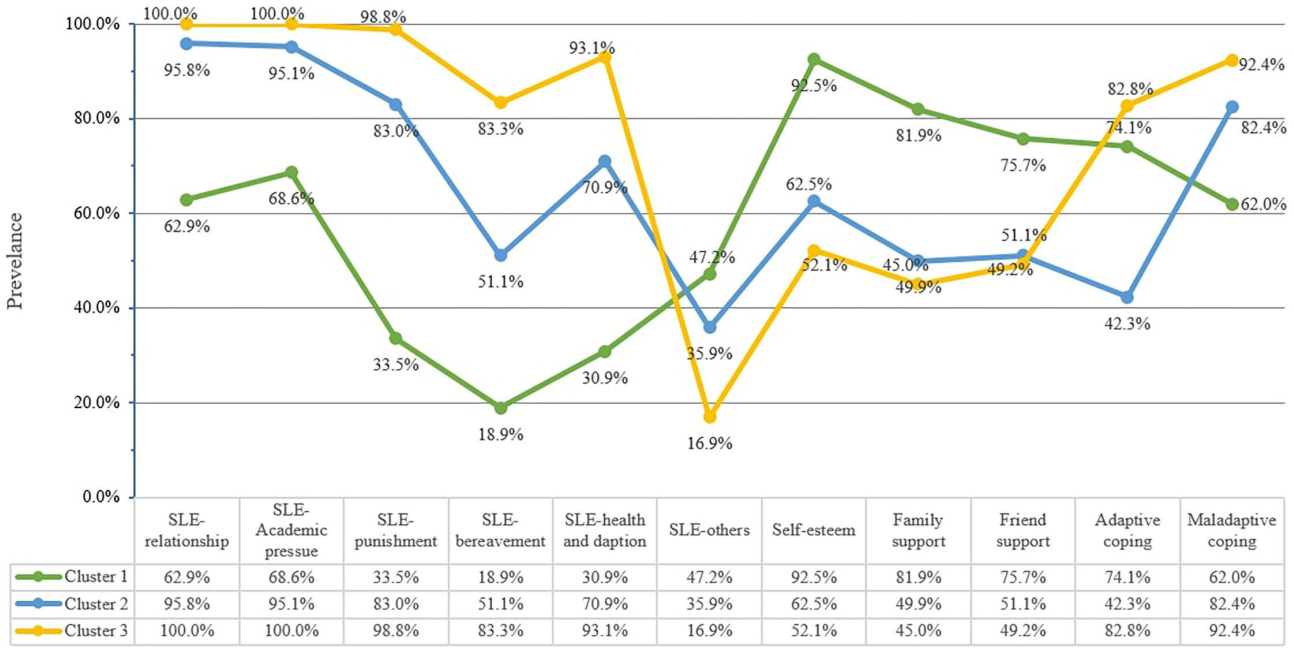

FIGURE 3 | Line-chart displaying the levels of participants' risk and protective profiles. SLE: stressful life events. The percentage of SLE variables represented the proportion of individuals who had at least one type of stressful life events in the specified domain. The percentage of self-esteem, family support, friend support, adaptive coping and maladaptive coping variables represented the proportion of individuals who scored above the median of the specified scale.

DISCUSSION

Principal Results

The present study investigated the prevalence of various mental, behavioral, and Internet use problems in a large-scale adolescent population in Hong Kong, China, during the COVID-19 pandemic. We further explored whether adolescents could be differentiated based on stress and coping profiles, and assessed whether their levels of health-related behaviors and mental health problems varied as a function of these profiles. The results provided empirical evidence that adolescents' behavioral and mental health may be shaped by the combined profiles of their stressful experiences, coping resources, and adopted coping strategies. These findings highlight the potential for multimodal stress and coping interventions that may help adolescents to prevent and reduce their various psychological and behavioral risks.

We found that about 30% of the adolescents expressed suicidal ideation and half of them had sleep disturbance, which was higher than the prevalence of suicidal ideation reported in a pre-COVID-19 study among a representative sample of secondary school students in Hong Kong (13.7%) (38). Other studies also reported significant increases in mental health problems among adolescents due to the COVID-19 pandemic (39, 40). The prevalence of problematic behaviors in the present study is comparable to or lower than the findings of a pre-COVID-19 study among 7,975 Hong Kong secondary school students, including smoking (5.1 vs. 7.8%), substance use (2.3 vs. 2.5%), running away from home (2.6 vs. 6.7%), truancy (2.8 vs. 6.2%), and damaging properties (11.4 vs. 14.5%) (41). This pattern corroborates a prior national survey in Iceland, showing that COVID-19 has significantly increased the mental distress of adolescents while the decrease in risky behaviors (e.g., substance use) was observed (42). It is plausible that the COVID-19 preventive measures (e.g., social isolation) have reduced adolescents' access to substances or risky behaviors. This is also consistent with social developmental theories that adolescents' behaviors are socially influenced, and preventive measures might have reduced negative peer influence on and rewards of exploring problematic behaviors (43). In addition, parental supervision over children's behaviors may have enhanced due to school closure and increased time spent at home. Notably, of the various problematic behaviors, adolescents reported the highest prevalence in excessive Internet gaming and social media use, and obesity (all >30%). Similarly, a previous study also suggested that adolescents' Internet gaming increased during the pandemic and school closures (44). These findings underline the need for interventions of adolescents' sedentary lifestyles especially Internet use during the pandemic to prevent the potential long-term adverse health impact. Continued parental surveillance of Internet use behaviors at different stages of the pandemic and after schools are resumed is greatly warranted.

Based on the multivariate stressful experiences, coping resources, and coping responses, participants were categorized into three groups: High Risk/Low Protective, Moderate Risk/Moderate Protective, and Low Risk/High Protective. The two-step cluster analysis indicated that a three-cluster solution was the best model for a fair cluster quality, evidenced by

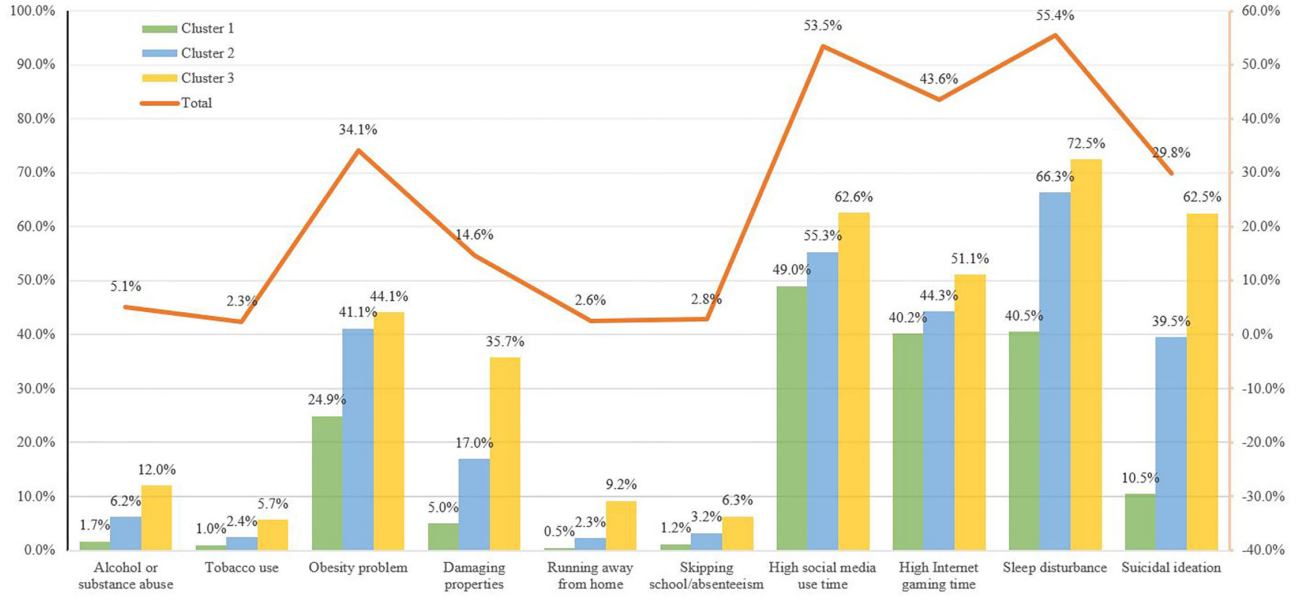

FIGURE 4 | Frequency of behavioral, Internet use, and mental health problems by clusters.

the lower value of BIC and the maximum ratio of distance measures (45). Future studies are warranted to confirm whether this clustering pattern exists among adolescents in different regions. We found that adolescents who were not born in Hong Kong and in single-family were more likely to have moderate/severe profiles, supporting the migration morbidity hypothesis that immigration leads to psychosocial problems in migrant populations (46). Such at-risk subpopulations warrant further investigation. While low-risk group reported the highest levels of self-esteem, family support, and friend support, which might be protective factors of adolescents' mental and behavioral health (9, 17). Furthermore, clustering results supported that adolescents with high levels of stressful life events had relatively low self-esteem, social support as well as more maladaptive and adaptive coping. This pattern corroborates previous studies that stressful experiences may lead to feelings of powerlessness, helplessness, and loss of self-control, which thus result in a predisposition toward more maladaptive coping (47). The availability of coping resources may also inhibit stress proliferation indirectly through its effect on the choice of coping strategy (e.g., less maladaptive coping). Unexpectedly, maladaptive coping showed a similar pattern with adaptive coping across clusters. This may suggest that maladaptive and adaptive coping are relatively two distinct constructs instead of the opposite ends of a single dimension (48). It is plausible that people use more than one strategy, including both maladaptive and adaptive styles, to manage a stressful situation. In addition, adaptive coping showed a relatively weaker discriminative relevance in identifying at-risk groups compared to maladaptive coping, corroborating previous studies that maladaptive coping has stronger associations with health outcomes than adaptive coping (48). Relevant stakeholders including educators, gatekeepers, and parents should be made aware of adolescents' coping characteristics and skill training about the reduction of maladaptive coping and promotion of adaptive coping may be considered as an important agenda in health policy and health education in advancing adolescents' mental and behavioral health.

Beyond identifying stress-coping profiles using cluster analysis, the present study found consistent and robust associations between cluster membership and a wide range of mental and behavioral health problems. Compared to the low-risk cluster, individuals with high and moderate profiles reported a significantly higher prevalence of problematic behaviors and mental health issues. Notably, the dose-response relationship was observed that the severe cluster had larger odds ratios than the moderate cluster across all health outcomes when using the low-risk cluster as the reference group. These findings provide empirical support for the stress-coping theory that stressful experiences and coping strategies play significant roles in determining individuals' mental and behavioral health (11, 13, 14, 17). This study further demonstrated a deeper understanding that adolescents' behaviors and psychological health may be shaped by their combined profiles of stressful experiences, available coping resources, and coping styles. Relevant health promotions may incorporate and target different perspectives of stress and coping to achieve greater intervention efficacy.

Limitations

The study has limitations. First, the cross-sectional design cannot determine causal inferences. Adolescents with mental distress might further isolate themselves, resulting in reduced social support and increased maladaptive coping. Future prospective

TABLE 2 | Associations between cluster membership and behavioral, Internet use, and mental health problems.

Dependent outcomes		AOR (95% CI)	*P*-value
Alcohol or substance abuse	Cluster 1 (ref)	1.00	
	Cluster 2	3.26 (2.03, 5.25)***	<0.001
	Cluster 3	6.92 (4.23, 11.32)***	<0.001
Tobacco use	Cluster 1 (ref)	1.00	
	Cluster 2	2.05 (1.07, 3.93)*	0.032
	Cluster 3	5.14 (2.69, 9.84)***	<0.001
Obesity	Cluster 1 (ref)	1.00	
	Cluster 2	2.08 (1.74, 2.49)***	<0.001
	Cluster 3	2.42 (1.93, 3.02)***	<0.001
Damaging properties	Cluster 1 (ref)	1.00	
	Cluster 2	4.17 (3.08, 5.63)***	<0.001
	Cluster 3	11.22 (8.17, 15.39)***	<0.001
Running away from home	Cluster 1 (ref)	1.00	
	Cluster 2	4.47 (1.91, 10.46)***	<0.001
	Cluster 3	17.95 (7.95, 40.51)***	<0.001
Skipping school/absenteeism	Cluster 1 (ref)	1.00	
	Cluster 2	2.82 (1.52, 5.24)**	0.001
	Cluster 3	4.92 (2.57, 9.40)***	<0.001
Excessive social media use	Cluster 1 (ref)	1.00	
	Cluster 2	1.19 (1.01, 1.41)*	0.041
	Cluster 3	1.75 (1.40, 2.19)***	<0.001
Excessive Internet gaming use	Cluster 1 (ref)	1.00	
	Cluster 2	1.22 (1.02, 1.45)*	0.026
	Cluster 3	1.65 (1.32, 2.06)***	<0.001
Suicidal ideation	Cluster 1 (ref)	1.00	
	Cluster 2	5.80 (4.66, 7.23)***	<0.001
	Cluster 3	15.06 (11.59, 19.56)***	<0.001
Sleep disturbance	Cluster 1 (ref)	1.00	
	Cluster 2	2.66 (2.24, 3.16)***	<0.001
	Cluster 3	3.82 (3.03, 4.82)***	<0.001

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

studies are warranted. Second, self-reported measures might be subject to recall bias and social desirability bias (e.g., disclosing substance use may be sensitive for students). In order to increase response rate and guarantee response quality, short measures of coping and self-esteem were used. Maladaptive and adaptive coping subscales showed low internal reliability. Future studies should be replicated with the full CERQ scale and further test the appropriateness of two-factor structure (i.e., adaptive and maladaptive dimensions) using confirmatory factor analysis. Third, as data for this study were gathered from young adolescents from participating secondary schools in Hong Kong, there might be selection bias. Findings cannot be generalized to out-of-school adolescents, e.g., institutionalized adolescents, home-schooled adolescents, or adolescents who cannot attend school in-person due to/during the pandemic. The generalization of the findings should be cautious and future study may consider stratified random sampling based on the number of schools in each district to improve the representativeness of the sampling. However, the sex and age distribution in the current sample was comparable to the latest census data of secondary grade 1–4 students in Hong Kong (49). Fourth, we assessed obesity problem solely using previous behavioral scale item. The measurement of physical activity, sedentary behavior, and body mass index may be considered in future studies to have a more comprehensive investigation of adolescents' physical health and health behaviors. Fifth, the silhouette coefficient of clustering result indicated a fair model fit. Robust clustering methodology with better fit and taking into account outliers should be explored. Lastly, future studies should include other important mental health problems (e.g., depression and anxiety) and problematic behaviors (e.g., stealing and bullying), and explore the interplay between mental and behavioral risks among adolescents.

CONCLUSIONS AND PUBLIC MENTAL HEALTH IMPLICATIONS

This study is a timely investigation of mental and behavioral health problems among Chinese adolescents in Hong Kong during the COVID-19 pandemic, and efforts should be made to mitigate adolescents' mental and behavioral health problems. The findings offer important public health and clinical implications in the assessment and potential management of at-risk adolescents. First, high levels of stressful life events were reported by adolescents, especially in the domain of relationships, academics, or being punished. Pre-COVID studies also suggested that adolescents' stressful life events mainly came from academic domain and interpersonal relationships with family, teachers, and friends (8, 50). School social workers and counselors should be aware of these common stressors of adolescents. Second, students at risk of suffering from mental distress and engaging in unhealthy behaviors could be systematically screened primarily based on their profiles of negative life events as these indicators provided the greatest discriminative power to identify different clusters. However, coping resources and strategies may provide additional precision to identify groups that might best benefit from interventions in a cost-effective manner (12). Health promotions to reduce adolescents' mental and behavioral risks should thus incorporate and target both stress and coping to achieve greater intervention efficacy, such as alleviating stressful perceptions, increasing coping resources (e.g., enhancing social support and self-efficacy), and reducing maladaptive coping. Therefore, interventions based on transdiagnostic approaches, such as cognitive-behavioral therapy and problem-solving therapy, and the formation of supportive networks for adolescents, may be particularly beneficial and efficient to prevent and reduce multiple mental and behavioral risks in a cost-effective manner (37).

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

Ethics approval was obtained from the Survey and Behavioral Ethics Committee of the corresponding author's affiliated institution (Ref No. SBRE-18-433). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

RS: conceptualization, methodology, and writing—original draft. KW, JL, and YZ: data curation. RS and JL: formal analysis. XY: funding acquisition and writing—review and editing. KW: investigation. All authors commented on previous versions of the manuscript and approved the final manuscript.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpubh.2022.826911/full#supplementary-material

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REVIEW
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Threats and Interventions on Wellbeing in Asylum Seekers in the Netherlands: A Scoping Review

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Background: Most asylum seekers experience stress, not only due to the reason for fleeing and their travel but also due to their compulsory stay in the asylum seeker center in the Netherlands and the asylum procedure. This often leads to self-medication and addiction which causes lower self-esteem and lower quality of life. Adverse life events, forced migration, and prolonged asylum procedures, in addition to the complexity of the acculturation process, can all contribute to higher levels of psychopathology.

Objective: What are the threats to wellbeing in terms of mental health, psychosocial, and addiction problems, and what are the effective interventions for wellbeing for asylum seekers in asylum seeker centers in the Netherlands, reported in the literature?

Method: Following the descriptive nature of the research question and the need for identifying knowledge gaps, an overview of existing knowledge was created by executing a scoping review on influencing factors on the mental health of asylum seekers. The Neuman system model was used as a guiding framework to understand the complexity of the issues this population experience and to identify the stressors and the factors which cause the imbalance and also the disease.

Results: The literature review resulted in 26 articles that met the criteria for inclusion. The threats included the influence of staying in the environment of an asylum seekers center, drug abuse among asylum seekers, health-care professionals and employees who do not detect or underestimate the underlying suffering of asylum seekers, and frequent relocations of asylum seekers. The two assessment instruments used were the Rapid-Assessment-Response method (RAR method) and the Health Information Assessment Tool Asylum Seeker tool (HIATUS tool). Finally, the five interventions were identified: therapy for asylum seekers diagnosed with post-traumatic stress disorder (PSTD), art therapy, education focused on prevention as intervention, cultural interview, and mindspring.

Conclusion: The knowledge on identifying and reducing threats, assessment, and treatment interventions for asylum seekers living in an asylum seekers center found in the literature provided perspectives on improving their wellbeing. The great diversity of cultural aspects and continuous changes in the number and origin of refugees in the Dutch asylum seekers centers disrupted the continuity of care.

Keywords: asylum seeker, mental health, psychotrauma, interventions, stressors

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HIGHLIGHTS

- Treatment possibilities on mental health conditions in asylum seekers.
- The vulnerability of asylum seekers.
- Poor mental health leads to lower outcomes on well-being.

INTRODUCTION

Currently, in Europe, the asylum seeker centers get overcrowded due to increased refugee flows (1). In recent years and nowadays in the Netherlands, the majority of asylum seekers come from Syria. On top of that, Dutch asylum seeker centers are now faced with a sudden rise in refugees from Afghanistan due to the recent change in the political situation in Afghanistan (2).

In September 2021 in the Netherlands, 30% of first-time asylum seekers came from Afghanistan, 29% Syria, 8% Turkey, 5% Somalia, 5% Yemen, 3% Algeria, and 2% unknown nationality (1). In the year prior, 30% of first-time asylum seekers came from Syria, 12% Turkey, 11% Afghanistan, and 6% Algeria (1).

Asylum seekers in Dutch asylum seekers centers are often heavily burdened with mental health problems (3). Mental health problems and self-medication were triggered by war, political instability, poor economy, and worsened during travel to the Netherlands (4). Self-medication often led to addiction, lower quality of life, and generalized displeasure (4). How asylum seekers perceived and coped with illness in terms of their culture of origin was often unknown by professionals providing mental health care in refugee camps in the Netherlands (3).

Numerous reasons were identified why asylum seekers initially leave their home country, including by war, religion, beliefs, sexual orientation, the economic situation, and political situation in the home country (5, 6). Despite these extraordinarily stressful circumstances, it was still a difficult decision to leave. Often, an opportunity to flee was unplanned, and thus, the decision and the subsequent flee had to be made without adequate preparation (7). The opportunity for fleeing was frequently solicited by human traffickers. They were required to pay large sums of money or may be kidnapped and were required to pay a ransom to be able to leave their home country (7). Refugees are forced to travel with only a few personal belongings that they must carry (8). The journey can be very dangerous due to high risks of exploitation, rape, physical illness, and death by drowning or other injuries (9).

An asylum seeker is defined as a person who sought safety or prosperity by fleeing to another country and when arrived, officially asked for asylum which is mainly done at a refugee camp (5). When a person gets a temporary or permanent permit in the Netherlands, this person was identified as a "status holder" or "a person with a migration background" (10). In the Netherlands, refugee camps also known as asylum seeker centers are diverse. These centers provided only the very basic support, such as, "bed, bath, and bread." Some asylum seekers required a more restricted environment due to the previous crime history. Unaccompanied minors were signed to small living facilities (10).

Asylum seekers in the Netherlands were considered a high-risk group for mental health problems. Adverse life events, forced migration, prolonged asylum procedures, and the complexity of the acculturation process can all contribute to higher levels of psychopathology (11). A study by Gerritsen et al. (12) revealed large variations in the prevalence of mental health problems. The prevalence of post-traumatic stress disorder (PTSD), depression, and anxiety vary from a few percent to more than 70% (12). In 2006, 28.1% of the asylum seekers from Afghanistan, Iran, and Somalia in Dutch asylum seekers centers suffered from PTSD and 68.1% suffered from depression or anxiety (13). Psychological issues are sometimes presented as physical symptoms which have a potential to mislead the health-care professional (14). Two research questions evolved: What are the threats to wellbeing in terms of mental health, psychosocial, and addiction problems, and what are the effective interventions for wellbeing for asylum seekers in asylum seeker centers in the Netherlands, reported in the literature?

METHODS

Due to the descriptive nature of this research, a scoping review was executed to identify influencing factors on the mental health of asylum seekers and to identify knowledge gaps in the literature (15). With a scoping review in a transparent and rigorous way, areas of research can be mapped (16). The Preferred Reporting Items For Systematic Reviews and Meta-analyses Extension for Scoping Reviews statement (PRISMA ScR) included recommendations in the design, literature search, analysis, and reporting of the scoping review (17). This descriptive study was registered in the open science framework registries (Registration DOI https://doi.org/10.17605/OSF.IO/YBR7F).

Information Sources and Search

The search was conducted in the period before December 15, 2019 in the following databases: PsycINFO, Psychology & Behavioral Sciences Collection, Academic Search Premier, CINAHL MEDLINE, PubMed, Embase, and the Cochrane database. Additional articles were found using the snowballing process by searching through the reference list of previously identified articles.

Using the Problem Intervention Control Outcome (PICO) method, a search rule was constructed and an initial search was performed (18). From this search, initially, a few vital relevant articles were identified. The search rule was validated and improved by comparing the search terms with terms used in titles in the literature lists of vital articles. This resulted in new search terms which were added to the search rule. With this validated rule, the selected databases were searched again. All studies that met the inclusion criteria were uploaded into Rayyan R (19), a web application for systematic reviews.

Search Items and Eligibility Criteria

The data were sought on the following variables "asylum seekers" OR refugees OR Exiles AND Netherlands OR Dutch, "effective measures" OR "real measures" OR "actual measures"

OR "effective actions" OR "effective procedures" OR "effective methods" OR "effective processes" OR therapy OR Care OR prevention OR treatment OR "social support" AND "mental health" OR addiction OR "psychosocial problems," wellbeing OR comfort OR welfare OR health OR safety (**Appendix 1**).

Included articles that met inclusion criteria reported threats on wellbeing in terms of mental health, psychosocial, addiction problems. Articles also included the effective interventions for wellbeing for asylum seekers in Dutch asylum seeker centers. English and Dutch publications were included. The following exclusion criteria were used: duplicate, newborn children, study protocol, abstract author, wrong population, diagnostic instrument, index, Switzerland, experience in Sweden, study design.

All studies that met the inclusion criteria were uploaded into Rayyan R and were ranked individually by FP and RE, blinded for each other. Afterward, studies that were not immediately agreed upon were discussed by FP and RE for a final decision.

Critical Appraisal

To measure the quality of the identified articles, a critical appraisal for qualitative research from Treloar et al. (20) was used. For seven of the 10 key issues, the extent each selected study met the criteria set by Treloar et al. (20) (**Appendix 2**).

Synthesis of Results

For identifying threats on wellbeing and interventions in the selected articles, we used the Neuman system model as its supports approaching the individual as an open system (21). This model is based on the combination of the stress coping, systems, and prevention theory, which helps in defining stressors and interventions. In this theoretical framework, wellbeing is defined as a continuum with wellbeing and illness at opposite ends of the continuum. Wellbeing for a person is associated with optimal system stability, which is the best possible state of wellbeing at any time (21). Threats for wellbeing are defined as barriers in dealing with stressors by insufficient possession of coping strategies and insufficient access to resources. Interventions are defined as support for dealing with stressors, support for increasing coping strategies, and access to resources. The data in the identified articles were categorized in the three means for self-efficacy stressors, coping strategies, and resources.

Neuman system model

In this framework, the client is seen as an open system illustrated by a series of concentric circles which Neuman has named the flexible line of defense, normal line of defense, and lines of resistance (refer to **Figure 1**). Each of these lines protect the client's basic structure, or central core from stressors in the environment. The circles and the core are composed of five related variables: physiological, psychological, sociocultural, developmental, and spiritual. The primary focus of the Neuman system model is the possibility for negative outcomes. This occurs when the person is not able to cope effectively with stressors from the environment (22). Each related variable provides a perspective on a person, how he or she grew up, the social economic situation and mental and physical condition. Furthermore, it provides insight on the view of the person in the present and the future. As such using these insights, severe illness and lower quality of life can be prevented.

Stressors

A tendency exists within any system to maintain a steady state or balance among the various disruptive forces operating within or upon it (23). The Neuman system model identifies these disruptive forces as stressors. Neuman system model environmental stressors are classified as intrapersonal between persons, interpersonal within the person, and extrapersonal outside the person in nature. They are present within as well as outside the client system. Intrapersonal stressors are internal environmental forces that occur within the boundary of the client system. Interpersonal stressors are external environmental interaction forces that occur outside the boundaries of the client system at a proximal range. Extrapersonal stressors are external environmental interaction forces that occur outside the boundaries of the client system at the distal range (21). In this study, the stressors were extracted to identify the threats to the wellbeing of the asylum seeker (**Appendix 3**).

Coping Strategies

According to Folkman and Lazarus, there is a specific role for care providers to mobilize client systems coping strategies: those refer to the specific efforts, behavioral and psychological, that asylum seekers use to master, tolerate, reduce, or minimize stressful events (24). Two general coping strategies are distinguished: problem-solving strategies and emotional-focused coping strategies. Problem-solving strategies are efforts to do something active to alleviate stressful circumstances, whereas emotion-focused coping strategies involve efforts to regulate the emotional consequences of stressful or potentially stressful events. Some coping strategies are active, and others are considered avoidant. Active coping strategies are either behavioral or psychological responses designed to change the nature of the stressor itself or how one thinks about the stressor. Avoidant coping strategies lead people into activities, such as alcohol use or mental states, such as withdrawal that keep them from directly addressing stressful events (21). In this study, skills were extracted that asylum seekers naturally have and that they have developed in their life to deal with stressful situations (**Appendix 3**).

Resources

The five dimensions of the client system function harmoniously in interactions with intrapersonal, interpersonal, and extrapersonal stressors. The extent of interactions between and among the five variables determines how much resistance a client system has to environmental stressors. Resources can be deployed on different variables. Physiological refers to the bodily structure and internal function. Psychological refers to mental processes and interactive environmental effects, both internally and externally. Sociocultural refers to the combined effects of sociocultural conditions and activities. Developmental refers to age-related development processes and activities. Spiritual refers to spiritual beliefs and influences. The resources are divided into the five variables that indicate in which the asylum seeker experiences support. This also provides insight into where resources are lacking among asylum seekers staying at asylum

seeker centers, based on the data retrieved from the articles included in this scoping review (**Appendix 3**).

What influence intrapersonal, interpersonal, and extrapersonal stressors have on the wellbeing of the asylum seeker was extracted from the content of the included articles and subsequently described. Which coping strategies they already have or have learned from themselves or from others. We also describe which resources asylum seekers have or have access to during their stay at asylum seeker centers and these are subdivided into the five variables to provide insight into which threats there are and which interventions work well for this target group. Following the Neuman system model (**Figure 1** and **Appendix 3**) concerning stressors, coping strategies, resources, and subthemes of these, we summarize the extracted data.

RESULTS

In screening on domain and inclusion criteria in the databases and the additional snowball search, 94 records remained. After removing the duplicates, the database searches resulted in 45 citations. A total of 19 articles were excluded after reading the full text for the following exclusion reasons: diagnostic instrument, wrong country, young children, study protocol, wrong population, conference abstract only, wrong study design, index magazine, index symposium, and research group, which resulted in 26 articles included in this scoping review (**Figure 2**).

Following the Neuman system model, the retrieved data were reported on the topics: intrapersonal stressors, interpersonal stressors, extrapersonal stressors, coping strategies, and five types of resources.

Stressors

More than one stressor may be imposed on the client system at any time (21).

Intrapersonal Stressors

The fact that asylum seekers were in an asylum procedure and therefore almost always are in a long-term stay in an asylum seeker center leads to the asylum seekers experience a lot of stress. This was also caused by uncertainty about the future and anxiety about being sent back to their country of origin or where they have previously reported in Europe (13, 25–31). Severely traumatized asylum seekers with long-lasting high levels of psychological burden often gave inconsistent interviews during the hearings of immigration services (25). Some asylum seekers said that the post-migration stressors, such as prolonged periods of uncertainty, fear, and boredom, cause more stress than pre-migration stressors (32). The access to medical and psychological care was generally difficult for asylum seekers with physical and psychological problems (25). As a consequence, there was a higher risk of suicide, especially in male asylum seekers, due to a lower use of mental health services and negative outcomes of their asylum procedure (27). Also, relationship issues, loss of family members, and other stressful life events were related to a higher rate of suicide in comparison with the Dutch population (27). In asylum seekers' children, the burden of frequent relocations was associated with an increase in mental health problems (33). Many asylum seekers who are mostly men report incidents of torture or other forms of torture (28). The prevalence rates of mental health and substance abuse disorders under undocumented asylum seekers were high (34). Unaccompanied adolescent asylum seekers who were staying in a special reception for first asylum registration in the Netherlands report more emotional problems and symptoms of anxiety (35). Also, the high number of incidents in the asylum seekers centers caused more emotional problems and symptoms of anxiety by minors (35). Asylum seekers experienced increasing post-traumatic stress due to their response to multiple post-traumatic experiences and ongoing post-migration difficulties. In summary, the major intrapersonal stressor "substance and drug abuse" of some asylum seekers triggers mental problems, gave physical complaints, and led to disruptive behavior among these asylum seekers inside and outside the asylum seekers center.

Interpersonal Stressors

The degree of burden by the experienced stress depends on various factors. The trauma experienced in the country of origin, during the trip, and living in an asylum seekers center in the Netherlands causes a major imbalance in daily life (13, 25, 26, 34, 36). Low health literacy of asylum seekers and their caretakers and cultural differences led to impaired communication between health professionals and asylum seekers (37). Loneliness, boredom, and shortage of money were major problems in asylum seekers living in asylum seekers centers. Some of them had started a distributive trade of beer, cannabis, khat, and opium to provide themselves with money and drugs to cope with these problems (26). Drug use is an underestimated problem in asylum seekers, and general practitioners should refer them to addiction care, which often does not occur (13, 30, 34). When asylum seekers were undocumented, they experienced often multiple adverse events or traumas, and the current life being undocumented was extra challenging (34). In summary, the major interpersonal stressors have been the influence of staying in the environment of an asylum seekers center with its tight regime, and scanty living conditions and involuntary living together with other asylum seekers from multiple countries with subsequent differences in cultural backgrounds, and speaking other languages, were very burdening for an individual living in such a center. Furthermore, the frequent relocations of asylum seekers interrupted the continuity of care and exposed the person to diverse suppressing environments in the different centers. They also lost social support which they had inside or outside the former center.

Extrapersonal Stressors

Frequent relocations between asylum seekers centers caused a lot of stress to asylum seekers due to the loss of all the familiar things at and around the asylum seekers center. Also, they cannot take all their personal belongings, so they had to buy these things again (31, 33, 37). It also caused a disruption of continuity of health care. In many cases, the loss or absence of medical records led to potentially life-threatening complications (37). Asylum seekers with physical complaints got more often asylum than asylum seekers with psychological symptoms (25). The

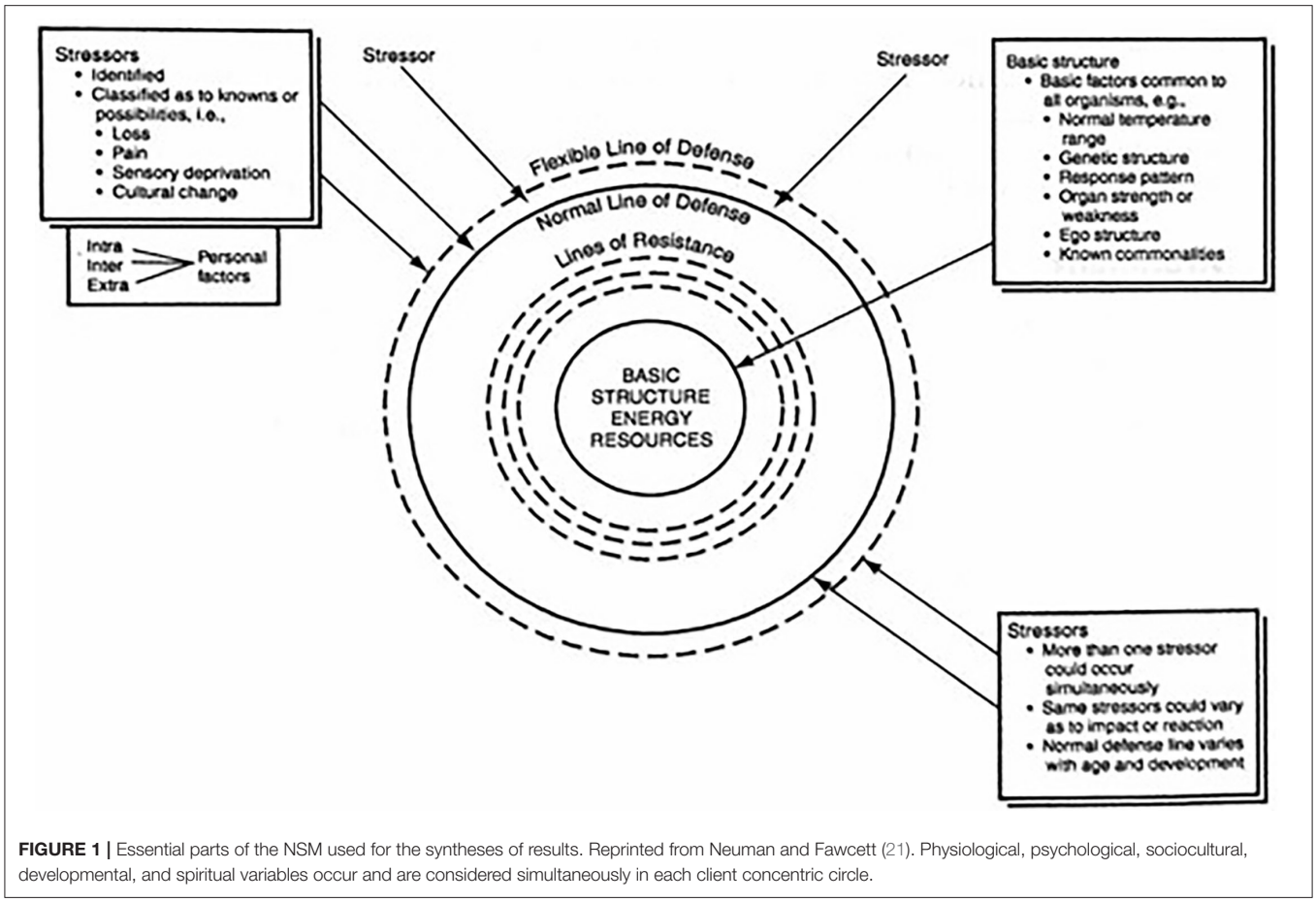

FIGURE 1 | Essential parts of the NSM used for the syntheses of results. Reprinted from Neuman and Fawcett (21). Physiological, psychological, sociocultural, developmental, and spiritual variables occur and are considered simultaneously in each client concentric circle.

migration of women from low-income to high-income countries increased the amount of maternal mortality and severe morbidity compared to host countries (38). Also, the increased level of popularity of anti-immigrant political parties in the Netherlands contributed to the vulnerability of women who were pregnant. The consequences of those political parties that were against immigrants had already resulted in lower reimbursement of interpretation services and significant cuts in health care (13, 32, 38). Asylum seekers suffered from uncertainty about their legal status and other resettlement stressors (31, 39). Asylum seekers did not have direct access to general practitioners but must be assessed and subsequently referred by a vocational trained nurse of the medical health center (13). Adequate and appropriate care should always be the main goal for healthcare professionals who worked with asylum seekers. However, there could be an ethical dilemma within those professionals in thinking that asylum seekers need to be treated differently (29). Because of the lack of money, undocumented asylum seekers had difficulties in accessing health care, and the expectation of limited treatment success discouraged the provision of mental health services (34). In summary, the major extrapersonal stressor had been health-care professionals and employees who did not detect or underestimate the underlying suffering of asylum seekers led to undertreatment and subsequent extra burdening.

Coping Strategies

There was less to be found in the literature about what skills asylum seekers naturally have to cope with stress. Only two of the included articles provide intrinsic resources on how to deal with stress. The first article is specific about the use of substance abuse, some asylum seekers used substances to cope with loneliness others for boredom, but the majority used it to self-medicate for better sleep, less stress, and to deal with uncertainty and cope with mental health symptoms (26). The second article included learned skills that helped asylum seekers to cope with stress during this period. This concerns having self-confidence, a positive self-image, and having meaningful daytime activities, which creates perspective and ensures a feasible balance in their lives (29). Many organizations have tried to develop and gave preventive training for asylum seekers. This helped asylum seekers to develop active coping skills (40). Asking the asylum seekers what they needed to keep their mental health in balance in the uncertain state during the procedure could help to keep or reestablish a positive self-image (29). Healthcare providers can challenge patterns of coping by helping asylum seekers to see when their chosen coping styles are inadequate and when other strategies might work better (29).

Gaining refugee status in the Netherlands gave them restored feelings of safety and control over their life (31). Besides training

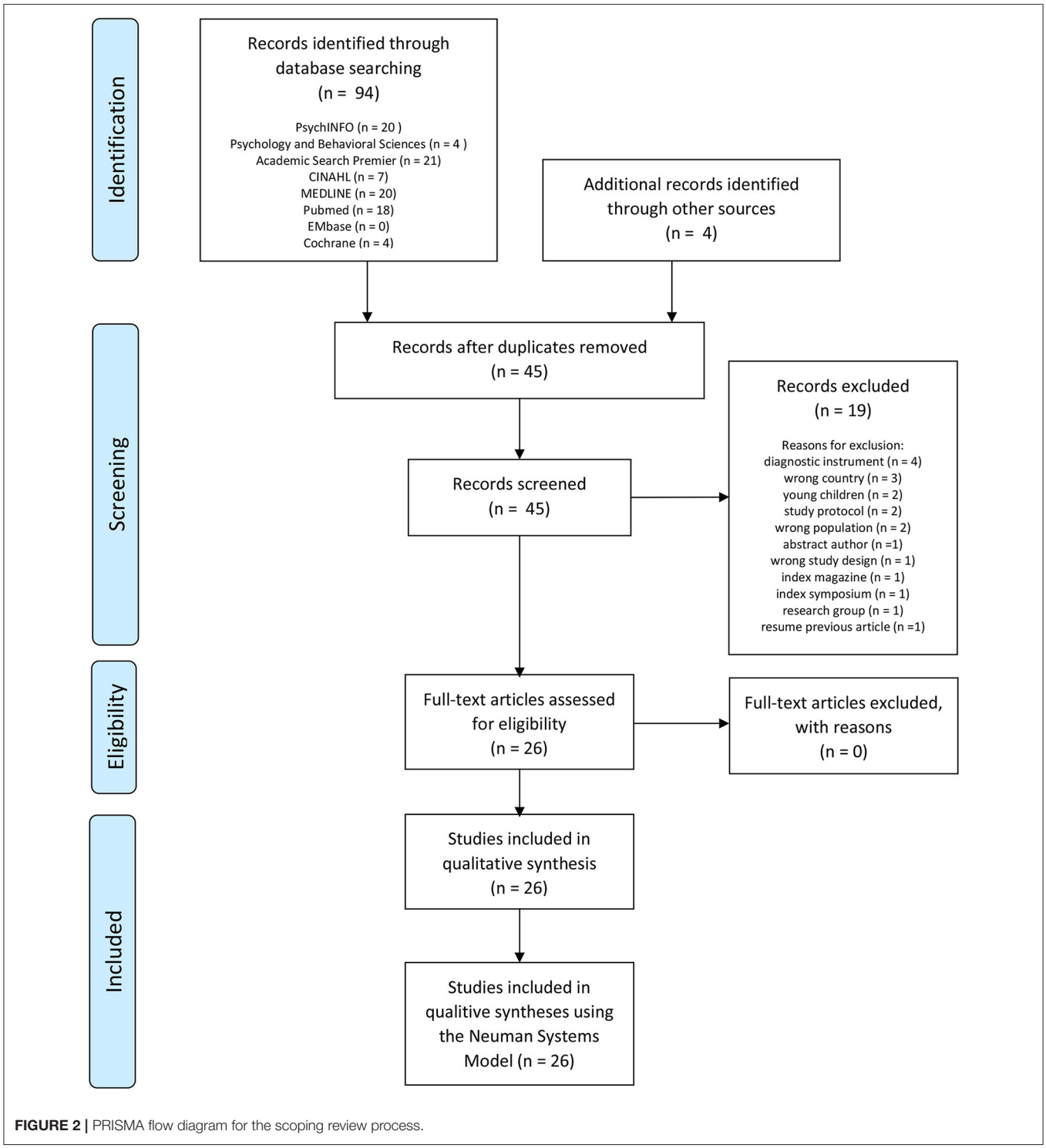

FIGURE 2 | PRISMA flow diagram for the scoping review process.

of asylum seekers, there were several initiatives to improve the expertise of both medical and teaching staff on the asylum seekers centers (26).

Resources

Resources were available for every asylum seeker if they know how to find these or had people who guide them to these resources. The first resources asylum seekers go to were usually located on the premises of the asylum seeker centers or near the asylum seeker centers and the people from the Central Agency for the Reception of Asylum Seekers, health center asylum seekers, or teachers in case of minors under the age of eighteen. The major assignment these professionals had is the prevention and treatment if necessary (13, 27, 38, 40). Available resources were

instruments for assessing substance and drug abuse and health status. The RAR method is for assessing substance and drug abuse and the amount of drug usage in a population (26). The HIATUS tool provided for a standardized assessment in different dimensions, such as self-reported health and mental health status (41). Other resources included five interventions for treatment, therapy for PTSD, art therapy, education, cultural interview, and mindspring.

1. Therapy for asylum seekers diagnosed with PTSD in different mental health-care settings (31, 34, 36, 42)
2. Art therapy to help people to speak through art about their traumas if expressing themselves when words are limited (43)
3. Education focused on prevention as an intervention to learn about stressors, coping, and explain how to make use of help and healthcare sources (27, 44)
4. Cultural interview which supports gaining trust and recognizes the cultural background of the asylum seekers (45)
5. Mindspring: a community-based program in which trained asylum seekers give other asylum seekers in the asylum seeker centers group sessions on psychoeducation, psychosocial support, and empowerment (44).

Physiological

The physiological variable refers to the bodily structure and internal functioning (46). The general practitioner should proactively discuss the need for contraception (38). Many asylum seekers express their complaints as physical problems which in half of the cases cannot be physically diagnosed, and these complaints are sometimes associated with heightened stress (28). The general practitioner needed to be consulted and be informed by mental health professionals about how psychological problems could be missed when people present physiological problems (30). Healthcare workers needed to be aware of the effects on mental health by a strict reception policy on a reception center and provide this info to policymakers (35).

Psychological

The psychological variable refers to mental processes and interactive environmental effects both internally and externally (46). For more severe mental health problems, people were often referred to specialized care which was the institutions who are often not specialized in intercultural care and had no experience in care providing to people who speak other languages (13, 30, 32, 36, 47). Professionals should have considered culture as a key resource area in psychosocial wellbeing (32). Professionals used culturally informed interventions to understand the causes of psychological problems and interpretation by the asylum seeker crises are less severe (32). Better assessment to reveal common gaps in health information systems in Europe should formulate joint strategies and improve better access to health care for asylum seekers (41). Therapy in a group setting provided asylum seekers with holding, safety, and enlarged coping skills, and they could manage resettlement stressors in a more adequate way (31). Training professionals to recognize depression and suicidal behavior had shown massive effects on reducing suicide deaths in general populations and as well had resulted in asylums seekers population (27). In undocumented asylum seekers, it was helpful to offer a treatment program for those with psychiatric and addiction problems which gave them supportive and helpful contrast with the insecurities of daily life (34). Received treatment for PTSD after arriving in the Netherlands reduced the symptoms of PTSD. Consequently, it was important that general practitioners follow existing guidelines on quick referral to mental health care for asylum seekers who show PTSD symptoms (42). Psychoeducation and psychosocial support programs for asylum seekers who are trained by health-care professionals could have helped to raise awareness, give support, and could better understand the problems asylum seekers experience (44).

Sociocultural

The sociocultural variable refers to combined effects of sociocultural conditions and influences (46). Unaccompanied children received foster care from sometimes foster parents or the Nidos Foundation (40, 48). Groen (45) says that the cultural interview helps gaining trust and building an interrelationship by recognizing cultural roots. There was a need for cultural acceptable methods for family planning, especially under teenage girls as well as abortion (38). Some asylum seekers expressed their wish that a mental health professional should have helped them solve practical aspects, such as finding a job and arranging a residency permit (32). Language obstacles should have been recognized and solved using appropriate interpreter services (38). Access to medical health care was dependent on the interface of the characteristics of asylum seekers and their households, social and physical environments, and the characteristics of health systems, organizations, and providers (37). When asylum seekers were offered help in keeping and making meaningful contacts, they become engaged in activities (29). Besides the importance of the use of mental health care, it was important to improve contextual factors, such as employment, social, or family networks, becoming familiar with the new culture and social position during treatment (39, 42). To connect non-verbal with asylum seekers who suffered from severe problems, art therapy was a helpful way and showed what cannot be said (43).

Developmental

The developmental variable referred to age-related developmental processes and activities (46). School-based psychoeducation programs should have helped asylum seekers to develop active scoping skills to empower young asylum seekers and to help them cope with their trauma and stress problems. It was therefore extremely important that professionals gave asylum seekers training in psychological tools to have better active coping skills (40).

Spiritual

The spiritual variable refers to spiritual beliefs and influences (46). When some Islamic asylum seekers struggled to find help from mental health professionals, they often asked help from exorcist doctors because some are convinced that they suffer from the Jinn (49). Recognition of the legal status of asylum seekers gave them restored hope for the future (31). Some groups of asylum seekers, for example, Somali people, did not have much faith in Dutch health care (13). Asylum seekers should therefore be encouraged to find new identities by becoming caring parents,

trustworthy friends, or members of a religious group which could have improved the quality of life (29). A major benefit from art therapy was that it creates space for unconscious processes (43).

DISCUSSION

Triggered by the reason for fleeing and the circumstances during their travel to the Netherlands, asylum seekers in Dutch asylum seekers centers experienced serious threats to their mental wellbeing. In 26 articles, the following threats were identified: the influence of staying in the environment of an asylum seekers center with its tight regime, scanty living conditions, and involuntary living together with other asylum seekers from multiple countries with subsequent differences in cultural backgrounds, and speaking other languages, substance and drug abuse among asylum seekers, health-care professionals and employees who do not detect or underestimate the underlying suffering of asylum seekers leading to undertreatment, and frequent relocations of asylum seekers. Two assessment instruments were identified: the RAR method and the HIATUS tool. Additionally, five interventions were identified: therapy for asylum seekers diagnosed with PTSD, art therapy, education focused on prevention as intervention, cultural interview, and mindspring.

The threats revealed that the care provided in the Dutch asylum seekers centers did not match the demand of asylum seekers sufficiently. This was also already reported in 2005 by Gerritsen et al. On the one hand, cultural aspects caused asylum seekers to not trust the health-care system in the Netherlands. On the other hand, the accessibility of health care was a problem for asylum seekers (13). For instance, asylum seekers did not have direct access to the general practitioner because health problems were usually assessed by a vocational trained nurse in the health center at the asylum seekers center. The provided care, which was frequently not matching the demand of the asylum seeker, started from the very beginning an asylum seeker enters the asylum seekers center (50).

Although this population was both characterized by a diverse cultural background and similarities in problems and care demand (51), there were, however, hardly any specific care programs available for these people (52). Despite all available mental health-care services, addiction care services, and the services from the health center at the asylum seekers centers, many health care workers did not have the specific required knowledge to work with this population. Although the RAR method is available, they were unaware of this method and they were also unaware of knowledge about the problem of drug abuse among asylum seekers (26). Due to the changes in refugee flow to the Netherlands, asylum seeker centers were closed and reopened (10). Subsequently, also, staff members change quickly which caused fewer opportunities for specialization and frequent loss of specialized knowledge had put pressure on adequate care and continuity of care. As a consequence, staff was not aware of available assessment instruments and interventions.

Some interventions were found in the literature, which are not applied in daily practice or in every asylum seekers center. Furthermore, there were also no actual protocols or guidelines in mental health care on the treatment of substance and drug abuse and addiction in this specific population (53). Yet in the literature, there were specific helpful assessment instruments and treatment interventions presented, as listed above. These were, however, often specific for a region or organization in the Netherlands and not widely integrated with care (52).

The frequent relocation from one to another asylum seekers center caused frequent interruption of continuity of care. The employees of the Central Agency for the Reception of Asylum Seekers do not always know an asylum seeker receives the care and if they do, they often do not inform the health-care professionals, both the former and new asylum seekers center (Personal communication, Operational manager Dutch health center for asylum seekers, 15-09-2020).

To appreciate these results, the issue of the limitation to the Dutch situation needs to be discussed. This scoping review was specifically aimed at the Dutch situation, so we may not have found stressors or interventions that were used in comparable situations in other countries in the literature. The political situation in the Netherlands and in the rest of Europe caused a negative influence on asylum policy. For example, there were cutbacks in (care) costs and there is a lot of resistance to the reception of asylum seekers in society. This caused a lower quality of life and more stressors for all asylum seekers.

CONCLUSION

The knowledge on identifying and reducing threats, assessment, and treatment interventions for asylum seekers living in an asylum seekers center found in the literature provided perspectives on improving their wellbeing. The great diversity of cultural aspects and continuous changes in the number and origin of refugees in the Dutch asylum seekers centers disrupted the continuity of care. The absence of guidelines and required knowledge of professionals working with these asylum seekers led the question of what professionals need for providing effective health care to asylum seekers. Also, there is a need for insight into the amount of drug use and the accompanying number of drug problems in asylum seekers and the subsequent negative influence on their quality of life, health status, influence on disease, and interventions. The Netherlands was divided when it comes to the reception of asylum seekers. This was clearly visible in politics, media, and society. The result was a cost reduction in care for asylum seekers, which resulted in fragmentation in care, lower quality of care, and a higher burden of disease. The shortage of well-trained and intercultural expert healthcare personnel also caused loss of knowledge and the cessation of local or non-local interventions.

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FP, RE, and EV contributed to the conception and design of the study. FP and RE reviewed the identified literature double-blind. FP wrote the first

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Self-Reported Anxiety in Spain: A Gendered Approach One Year After the Start of COVID-19 Pandemic

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The COVID-19 pandemic has an impact on mental health. However, there is little evidence on how different axes of social inequity influence mental health from a gender perspective and over time. Our aim is to analyze anxiety according to gender identity and other axes of social inequities (migration status, sexual orientation, age, and employment conditions) one year after the start of the COVID-19 pandemic in Spain. We conducted a cross-sectional study among adults living in Spain with an online survey from April 8 to May 28, 2021. The main variable was anxiety measured by Generalized Anxiety Disorder Scale (GAD-7). Sex-stratified multivariate logistic regression models were constructed to assess the association between axes of inequities and anxiety. Our findings ($N = 2{,}053$) suggest that women have greater anxiety risk than men (35.2 vs. 28.2%, respectively). We observe in both genders that there is a clear age gradient, with anxiety decreasing as age increases; and that there is an association between worsening employment status and anxiety risk, although there is a difference between women by education level. Additionally, not having Spanish nationality is also associated with greater anxiety risk in women. In men, identifying as non-heterosexual is associated with a higher risk of anxiety. The axes of inequities have different effects according to gender identity. These differences in anxiety risk by population subgroup must be taken into account in order to sensibly and equitably treat the surge in mental health disorders brought on by the COVID-19 pandemic.

Keywords: anxiety, gender, COVID-19, health inequities, mental health, immigrants, sexual orientation, pandemic

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INTRODUCTION

Evidence shows that people of a low socioeconomic status have a disproportionately high risk of COVID-19 infection and that vulnerable communities have higher exposure to the rapid spread of the virus and a higher mortality (1–5). Moreover, the pandemic has worsened the financial situation of those with precarious employment conditions, whose financial margins were already at risk (6). Taking a gender perspective into account, women are more affected by this pandemic, as they are overrepresented in sectors that are most affected by the current crisis (e.g., retail, hospitality, care, and domestic work) (7). In addition, the burden of unpaid caregiving and work-life balance has fallen largely on women during periods of lockdown. Studies carried out in Europe show that women spent on average 62 h per week caring for children (compared to 36 h for men) and 23 h per

week doing housework (15 h for men) (7). Findings suggest that these social inequities are related to worse mental health outcomes among women (8–10). Also, these gender-based inequities has been associated with increases in gender-based violence, impacts on the different phases of reproductive and maternal health, fear of infection and infecting others, as well as taking on caregiving tasks in complex contexts and being conscientious about the negative impact their own discomfort can have on their children (8, 11–13). However, there is a significant under-representation of women and gender diverse people in COVID-19 decision-making bodies, which may hinder the effective management of COVID-19 for these subgroups and act as a multiplier of pre-existing gender-based inequities (14, 15).

On the other hand, migration is a complex process which affects people differently. Migration often results in traumatic events, barriers and challenges which lead to increased prevalence of psycho-social and other health issues among migrant populations when compared to the local population (16). Studies that consider the mental health of migrant populations during the COVID-19 pandemic report that migrant populations faced an increased risk of COVID-19 infection due to crowded living conditions and employment type, both public-facing and informal (e.g., house cleaning). In fact, in our previous study conducted in Spain at the start of lockdown (between April and May 2020), the migrant population was more concerned (85.6%) about economic problems than people who were born in Spain (79.4%) (17). Furthermore, the suspension of public administration has led to delayed appointments for legal procedures, affecting numerous immigration and asylum procedures (18). In addition, migrant populations reported barriers to accessing COVID-19-related health services, such as language interpretation and fear of deportation due to legal status (19, 20). To this date, there are few studies in Spain that consider migration status in relation to gender and health during this period.

The COVID-19 pandemic has additionally impacted other social identities which have remained at the margins, as is the case for people who do not identify within the heteropatriarchal model (21–23). Previous evidence shows that adults and adolescents who identified as a sexual and/or gender minority reported elevated anxiety levels (24). Poorer mental health outcomes in these subgroups can be explained with a psychological framework, due to stigmatization and greater social and interpersonal problems compared to heterosexual individuals (25). Studies conducted during the pandemic show that adults identifying as sexual minorities are more likely to report living in households with food and economic insecurity than heterosexual respondents (26). In addition, over 52% non-heterosexual individuals experienced depression in the last year and a similar proportion had self-harmed or considered taking their own life (27). Thus, the COVID-19 pandemic could have mental health effects both in previously healthy people as well as in people with pre-existing mental health disorders (28).

The contributions of this study are as follows. Our interest is to study how the Spanish resident population is dealing with pandemic one year later, by the first quarter of 2021 taking into account a gender approach (29, 30). During this period, the country was still experiencing a series of mobility restrictions and shop closures. Using a gender perspective implies including different axes of inequality to highlight social disparities. According to previous studies, sexism, racism, homophobia, classism, and aging represent axes of oppression that manifest in different ways and worsen population health (31–33). According to the evidence these measures affect societies in three manners: (1) exposing existing vulnerabilities, (2) reinforcing current inequalities, and (3) amplifying social differences in the future because of scarring effects (34). Thus, the COVID-19 pandemic reveals disproportionate risk and impact based on structured inequality at intersections of ethnic minority status, gender and class, as well as occupation (ethnic minorities, women, and undocumented workers) (35).

As public health and primary care researchers, we strive to look at specific subgroups to identify mental health outcomes related to possible experiences of discrimination and inequality. We will focus on anxiety, given that it is a symptom that manifests itself in uncertain situations (36). Therefore, our research question is: *How are anxiety levels in Spanish residents one year after the first wave of COVID-19 pandemic? Which population subgroups are most affected psychologically, considering various axes of social inequality?* Our aim is to analyze anxiety levels according to gender identity and other axes of social inequality (migration status, sexual orientation, age, and employment conditions) one year after the start of the COVID-19 pandemic in Spain.

METHODS

The present study is part of a larger project in Spain, for which we conducted an online survey during the start of the COVID-19 pandemic and carried out other qualitative studies. We are also conducting this same study in several Latin American countries. This paper is a cross-sectional study among adults living in Spain using data collected from a second online survey. Data were obtained and maintained between April 8 and May 28, 2021 using REDCap (Research Electronic Data Capture), an electronic data capture tool hosted at Fundació Institut Universitari per a la recerca a l'Atenció Primària de Salut Jordi Gol i Gurina (IDIAPJGol). REDCap is a secure, web-based software platform designed to collect data for research studies, providing (1) an intuitive interface for validated data capture; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages, and (4) procedures for data integration and interoperability with external sources (37, 38).

Recruitment was done through online platforms, social media and contact with community-based organization around Spain using convenience sampling techniques. The survey was piloted with people with different sociodemographic characteristics. Both the research team and participants contributed to the recruitment and dissemination of the on-line survey, using snowball strategies. The average time to answer the survey

TABLE 1 | Socio-demographic characteristics and social variables by gender identity ($n = 2,053$).

	Women	Men	Total	*P*-value[a]
GAD-7				
Normal/Mild	976 (64.8%)	392 (71.8%)	1,368 (66.6%)	0.003
Mod/Severe	531 (35.2%)	154 (28.2%)	685 (33.4%)	
Age				
18–30 years	259 (17.2%)	100 (18.3%)	359 (17.5%)	<0.001
31–50 years	724 (48.0%)	208 (38.1%)	932 (45.4%)	
51–64 years	445 (29.5%)	183 (33.5%)	628 (30.6%)	
≥65 years	79 (5.2%)	55 (10.1%)	134 (6.5%)	
Median (p25–p75)	45 (35–54)	48 (35–56)	46 (35–55)	0.010[b]
Mean (SD)	44.8 (12.5)	46.5 (14.0)	45.2 (12.9)	0.007[c]
Nationality				
Spain	1,419 (94.2%)	509 (93.2%)	1,928 (93.9%)	0.433
Other countries	88 (5.8%)	37 (6.8%)	125 (6.1%)	
Place of birth				
Spain	1,339 (88.9%)	498 (91.2%)	1,837 (89.5%)	0.124
Other countries	168 (11.1%)	48 (8.8%)	216 (10.5%)	
Sexual orientation				
Heterosexual	1,344 (89.2%)	447 (81.9%)	1,791 (87.2%)	<0.001
Non-hetero	163 (10.8%)	99 (18.1%)	262 (12.8%)	
Education level				
University	1,245 (82.7%)	425 (78.0%)	1,670 (81.4%)	0.016
Non-university	261 (17.3%)	120 (22.0%)	381 (18.6%)	
Work				
Working/Retired	1,226 (81.4%)	427 (78.2%)	1,653 (80.5%)	0.112
Other	281 (18.6%)	119 (21.8%)	400 (19.5%)	
Employment status				
Not worsened	1,176 (78.0%)	396 (72.5%)	1,572 (76.6%)	0.009
Worsened	331 (22.0%)	150 (27.5%)	481 (23.4%)	
Living with children				
No	674 (53.2%)	293 (62.5%)	967 (55.7%)	<0.001
Yes	594 (46.8%)	176 (37.5%)	770 (44.3%)	
Concerned school situation of minors				
Little None	107 (20.7%)	44 (28.6%)	151 (22.5%)	0.040
Mod-quite-a lot	410 (79.3%)	110 (71.4%)	520 (77.5%)	
Housework				
Equitable	616 (50.7%)	315 (69.4%)	931 (55.7%)	<0.001
Mostly me	472 (38.8%)	44 (9.7%)	516 (30.9%)	
Another person	128 (10.5%)	95 (20.9%)	223 (13.4%)	
Housing m^2				
Less 50 m^2	77 (5.1%)	30 (5.5%)	107 (5.2%)	0.726
50–100 m^2	471 (31.3%)	161 (29.5%)	632 (30.8%)	
>100 m^2	959 (63.6%)	355 (65.0%)	1,314 (64.0%)	
Concerns co-existence				
Little None	979 (77.2%)	358 (76.3%)	1,337 (77.0%)	0.700
Mod-quite-a lot	289 (22.8%)	111 (23.7%)	400 (23.0%)	
Self-perceived health				
Excellent/Good	1,224 (81.2%)	464 (85.0%)	1,688 (82.2%)	0.049
Regular/Bad	283 (18.8%)	82 (15.0%)	365 (17.8%)	
Social support				
None/Little	102 (6.8%)	38 (7.1%)	140 (6.9%)	0.847
Moderate/Much	1,397 (93.2%)	501 (92.9%)	1,898 (93.1%)	

SD, Standard Deviation. [a]Unless otherwise stated, p-value derived from Chi-Square test. [b]Mann-Whitney U test. [c]T-test.

was 10 min, which was specified on the front page of the survey. Data collection was finalized when the borders of the cities were opened and greater mobility for displacement was given within the autonomous communities in Spain. This study has been informed by gender perspective and the social determinants of health (39–41). All members of the research team are highly sensitive of the different axes of social inequities, and the multiple power structures that differentially impact the population unequally.

Our final study population was comprised only of people who identified with the gender binary, identifying either as a man or woman with regards to gender identity. We understand gender identity as a person's understanding and experience of their own gender (42). Participants were allowed to select one of the following options for gender identity: female, male, non-binary and other. People who selected the "non-binary" or "other" were excluded from the present analyzes, as they will be included in a future study that is exclusive to the LGBTQI+ community. The final study population included cisgender participants: people whose gender identity matched their sex at birth. All data were stratified by gender identity (women vs. men) for final analysis.

The main outcome was anxiety, which we measured using the Generalized Anxiety Disorder 7-item (GAD-7). The GAD-7 has several advantages: it is easy to use, it is a validated instrument, has clear psychometric properties, and consists of only seven items (43). Moreover, it is an instrument adapted to the Spanish population (44). Anxiety was defined as excessive worry and persistent restlessness related to different elements such as personal health, employment, social interactions and everyday life situations (36). The anxiety variable was categorized as normal, mild, moderate and severe. We considered an individual to have anxiety if they reported moderate or severe levels. Sociodemographic variables, including age, having Spanish nationality, education level, being an essential worker, employment and socioeconomic status, housing and living conditions, care work, concern for cohabitant, domestic violence, and perceived social support were considered as independent variables. We calculated absolute and relative frequencies of these sociodemographic variables, stratified by gender identity. Multivariate regression models were constructed to evaluate the association between anxiety variable and socio-demographics and social variables.

Differences between groups were assessed using the chi-square test, the Mann–Whitney *U*-test or the *t*-test. Box plots were used to chart the distribution of GAD-7 values in the different nationality, sexual orientation, age, study level and work condition groups, stratified by gender. Univariate and multivariate logistic regression models were constructed to evaluate the association between nationality, sexual orientation, age and employment conditions with anxiety (GAD-7). Crude and adjusted odds ratios (ORc & ORa) and 95% confidence intervals (95% CI) were calculated. Analyzes were stratified by gender identity. We have carried out four types of models for women and men. Model 0: crude models (one model for every variable); model 1: variables adjusted for nationality and sexual orientation; model 2: variables adjusted for nationality, sexual orientation and age; model 3: variables adjusted for nationality, sexual orientation, age, and employment status. The level of statistical significance was set at 0.05 and all tests were two-tailed. All analyzes were performed in Stata 17.0.

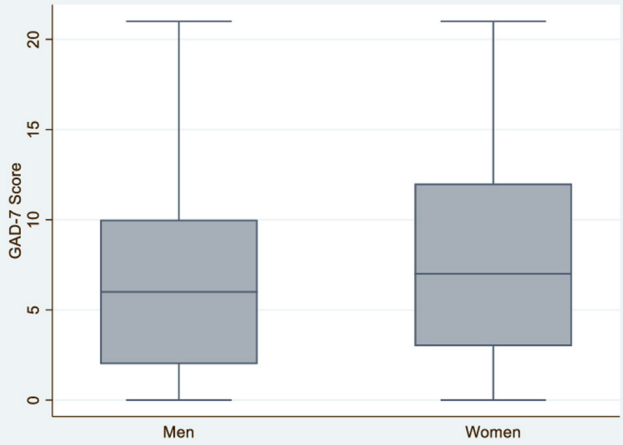

FIGURE 1 | Anxiety according to gender identity in men and women $N =$ 2,053.

RESULTS

A total of 2,053 individuals were selected in the study, of which 73.4% identified as women, 26.6% as men. 5.8% of women and 6.8% of the men did not have Spanish nationality. 10.8% of women and 18.1% of men did not identify as heterosexual. The median age of women was 45 years (IQR: 35–54), vs. 48 years (IQR: 35–56) for men. 22.0% of women's employment conditions worsened since the start of the pandemic, compared to 27.6% of men. Detailed characteristics of the study population by gender identity are available in **Table 1**.

The risk of anxiety was 35.2% in women and 28.2% in men (**Table 1** and **Figure 1**). Women with a worse self-perceived health status reported higher levels of anxiety (**Table 2**). 61.5% of women who reported having poor self-perceived health had risk levels of anxiety, compared to 29.2% of women who reported having excellent health ($P < 0.001$). Women with high levels of social support reported lower levels of anxiety. For example, 33.7% of women with a high level of social support reported risk of anxiety, compared to 52.9% of women with no social support ($P < 0.001$) (**Table 2**). There was no statistically significant difference in anxiety levels among women who lived with minors, though women experienced higher anxiety levels associated with school performance. For instance, 40.7% of women who were very concerned about their child's performance at school reported moderate or severe anxiety levels, compared to 21.5% of women who expressed low concern ($P < 0.001$). Finally, there was no statistically significant difference in anxiety levels in women based on the amount of domestic work they undertook, 38.8% take care of household task alone and 50.7% share it.

TABLE 2 | Association between sociodemographic characteristics, social variable, and anxiety (GAD-7)* among women and men in Spain ($n = 2,053$).

	Women ($N = 1,507$)			Men ($N = 546$)		
	GAD-7			GAD-7		
	Normal/Mild	Mod/Severe	*P*-value[a]	Normal/Mild	Mod/Severe	*P*-value[a]
Age						
18–30 years	155 (59.8%)	104 (40.2%)	<0.001	63 (63.0%)	37 (37.0%)	0.003
31–50 years	443 (61.2%)	281 (38.8%)		140 (67.3%)	68 (32.7%)	
51–64 years	313 (70.3%)	132 (29.7%)		142 (77.6%)	41 (22.4%)	
≥65 years	65 (82.3%)	14 (17.7%)		47 (85.5%)	8 (14.5%)	
Median (p25-p75)	46 (36–56)	43 (33–51)	<0.001	50 (38–58)	44 (31–52)	<0.001[b]
Mean (SD)	45.9 (12.8)	42.6 (11.7)	<0.001	47.9 (13.9)	42.9 (13.5)	<0.001[c]
Nationality						
Spain	929 (65.5%)	490 (34.5%)	0.022	367 (72.1%)	142 (27.9%)	0.554
Other countries	47 (53.4%)	41 (46.6%)		25 (67.6%)	12 (32.4%)	
Place of birth						
Spain	879 (65.6%)	460 (34.4%)	0.043	359 (72.1%)	139 (27.9%)	0.624
Other countries	97 (57.7%)	71 (42.3%)		33 (68.8%)	15 (31.3%)	
Sexual orientation						
Heterosexual	881 (65.6%)	463 (34.4%)	0.067	331 (74.0%)	116 (26.0%)	0.013
Non-hetero	95 (58.3%)	68 (41.7%)		61 (61.6%)	38 (38.4%)	
Education level						
University	826 (66.3%)	419 (33.7%)	0.004	307 (72.2%)	118 (27.8%)	0.631
Non-university	149 (57.1%)	112 (42.9%)		84 (70.0%)	36 (30.0%)	
Work						
Working/Retired	804 (65.6%)	422 (34.4%)	0.167	313 (73.3%)	114 (26.7%)	0.138
Other	172 (61.2%)	109 (38.8%)		79 (66.4%)	40 (33.6%)	
Employment status						
Not worsened	794 (67.5%)	382 (32.5%)	<0.001	306 (77.3%)	90 (22.7%)	<0.001
Worsened	182 (55.0%)	149 (45.0%)		86 (57.3%)	64 (42.7%)	
Living with children						
No	443 (65.7%)	231 (34.3%)	0.227	212 (72.4%)	81 (27.6%)	0.825
Yes	373 (62.8%)	221 (37.2%)		129 (73.3%)	47 (26.7%)	
Concerned school situation of minors						
Little-nothing	84 (78.5%)	23 (21.5%)	<0.001	36 (81.8%)	8 (18.2%)	0.163
Mod-quite-a lot	243 (59.3%)	167 (40.7%)		78 (70.9%)	32 (29.1%)	
Housework						
Equitable	407 (66.1%)	209 (33.9%)	0.560	242 (76.8%)	73 (23.2%)	0.018
Mostly me	297 (62.9%)	175 (37.1%)		28 (63.6%)	16 (36.4%)	
Another person	83 (64.8%)	45 (35.2%)		61 (64.2%)	34 (35.8%)	
Housing m^2						
Less 50 m^2	42 (54.5%)	35 (45.5%)	0.002	13 (43.3%)	17 (56.7%)	0.001
50–100 m^2	283 (60.1%)	188 (39.9%)		114 (70.8%)	47 (29.2%)	
>100 m^2	651 (67.9%)	308 (32.1%)		265 (74.6%)	90 (25.4%)	
Concerns co-existence						
Little-nothing	682 (69.7%)	297 (30.3%)	<0.001	280 (78.2%)	78 (21.8%)	<0.001
Mod-quite-a lot	134 (46.4%)	155 (53.6%)		61 (55.0%)	50 (45.0%)	
Self-perceived health						
Excellent/Good	867 (70.8%)	357 (29.2%)	<0.001	354 (76.3%)	110 (23.7%)	<0.001
Regular/Bad	109 (38.5%)	174 (61.5%)		38 (46.3%)	44 (53.7%)	
Social support						
None/Little	48 (47.1%)	54 (52.9%)	<0.001	19 (50.0%)	19 (50.0%)	0.002
Moderate/Much	926 (66.3%)	471 (33.7%)		366 (73.1%)	135 (26.9%)	

GAD-7 was categorized in Normal, Mild, Moderate and Severe.

SD, Standard Deviation. [a]Unless otherwise stated, p-value derived from Chi-Square test. [b]Mann-Whitney U test. [c]T-test.

TABLE 3A | Association between social axes of inequalities and anxiety (GAD-7) among women in Spain ($N = 1,507$).

	Model 0		Model 1		Model 2		Model 3	
	ORc[A] (95%CI)	*P*-value	ORa[A] (95%CI)	*P*-value	ORa[A] (95%CI)	*P*-value	ORa[A] (95%CI)	*P*-value
Nationality								
Spain	1.00		1.00		1.00		1.00	
Other countries	1.65 (1.07–2.55)	0.023	1.62 (1.05–2.50)	0.030	1.47 (0.95–2.29)	0.085	1.38 (0.89–2.16)	0.152
Sexual orientation								
Hetero	1.00		1.00		1.00		1.00	
Non-hetero	1.36 (0.98–1.89)	0.067	1.33 (0.96–1.86)	0.090	1.29 (0.92–1.81)	0.135	1.27 (0.91–1.78)	0.165
Age		<0.001[a]				<0.001[a]		<0.001[a]
65+	1.00	<0.001[b]			1.00	<0.001[b]	1.00	<0.001[b]
51–65	1.96 (1.06–3.61)	0.031			1.98 (1.07–3.65)	0.029	1.95 (1.05–3.60)	0.034
31–50 years	2.95 (1.62–5.35)	<0.001			2.88 (1.59–5.24)	0.001	2.78 (1.53–5.06)	0.001
18–30	3.12 (1.66–5.84)	<0.001			3.03 (1.62–5.70)	0.001	3.01 (1.60–5.67)	0.001
Employment status								
Not worsened	1.00						1.00	
Worsened	1.70 (1.33–2.18)	<0.001					1.63 (1.27–2.10)	<0.001

ORc[A], crude ordinal odd ratio.
ORa[A], adjusted odds ratio.
[a]Wald test. [b]Trend Test.

During the period of study, women without Spanish nationality experienced higher levels of anxiety than women with Spanish nationality (ORc = 1.65, CI 95%: 1.07–2.55) (**Table 3A** and **Figure 2**). Women without Spanish nationality continue to have a greater risk of anxiety when further adjusting the model for sexual orientation, age, and employment status, nationality, although the associations lose statistical significance (ORa = 1.36, 95% CI: 0.98–1.89). In women, there were no statistically significant differences in anxiety risk by sexual orientation in all models (**Figure 3**). However, anxiety risk decreased as age increased, with women aged 18–30 having the highest risk of anxiety (ORc = 3.12, 95% CI: 1.66–5.84; ORa = 3.01, 95% CI: 1.60–5.67) (**Table 3A** and **Figure 4**). With regards to employment status, women whose employment conditions worsened had a higher risk of anxiety across all models (**Table 3A** and **Figure 5**) than women whose employment status improved or remained the same (ORc = 1.70, 95% CI: 1.33–2.18).

Men with a worse self-perceived health reported higher levels of anxiety (**Table 2**). 53.7% of men with poor self-perceived health reported anxiety, vs. 23.7% of men with good or excellent self-perceived health ($P < 0.001$). Men with less social support experienced higher anxiety levels (53.4% of men with no social support vs. 23.7% of men with lots of social support reported risk of anxiety levels ($P < 0.001$). In contrast to women, there was no statistically significant difference in anxiety levels between men who lived with minors or men who were concerned about their child's academic performance. However, men who reported being primarily responsible for domestic work reported higher anxiety levels compared to men who either shared this work equally with another person or for whom another person took care of the domestic work. For instance, 36.4% of men who reported being primarily responsible for domestic care work reported anxiety, vs. 35.8% of men who did not perform any domestic work or 23.2% of men who shared this responsibility equally with another person ($P = 0.018$).

In men, there was no statistically significant difference in anxiety risk by nationality (**Table 3B** and **Figure 2**). However, non-heterosexual men had a higher risk of anxiety than heterosexual men (ORc = 1.78, 95% CI: 1.13–2.81). Non-heterosexual men have a greater risk of anxiety than heterosexual men across all models, though statistical significance is lost when further adjusting the model for sexual orientation, age, and employment status (ORa = 1.53, 95% CI: 0. 94–2.49) (**Table 3B**). As in women, anxiety risk decreased as age increased (**Table 3B** and **Figure 4**). Men aged 18–30 presented the highest risk of anxiety compared to the older age groups in all models (ORc = 3.45, 95% CI: 1.47–8.09; ORa = 2.34, 95% CI: 0.96–5.66). Finally, with regards to employment status, men whose employment worsened had a higher risk of anxiety compared to men whose conditions remained the same or improved, across all models (ORc = 2.53, 95% CI: 1.70–3.77; ORa = 2.44, 95% CI: 1.62–3.68) (**Table 3B** and **Figure 5**).

DISCUSSION

Our study has described the relationship between anxiety and gender one year after the start of the COVID-19 pandemic in Spain, while also taking into account other axes of social inequity. According to our results, women had a higher risk of anxiety than men during this period (35.2 vs. 28.2%, respectively). These proportions are higher compared to the same study conducted a year earlier in which 31.2% of women and 17.7% of men reported having anxiety (8). We observed four main findings: (1) in both genders there is a clear age gradient, with anxiety decreasing as age increases; (2) an association between worsening

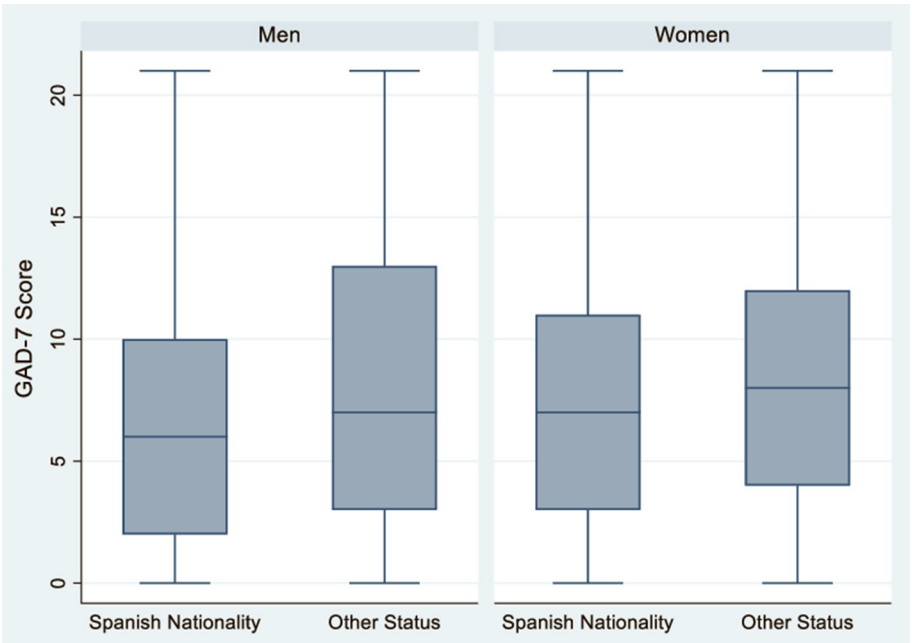

FIGURE 2 | Anxiety according to nationality in men and women $N = 2,053$.

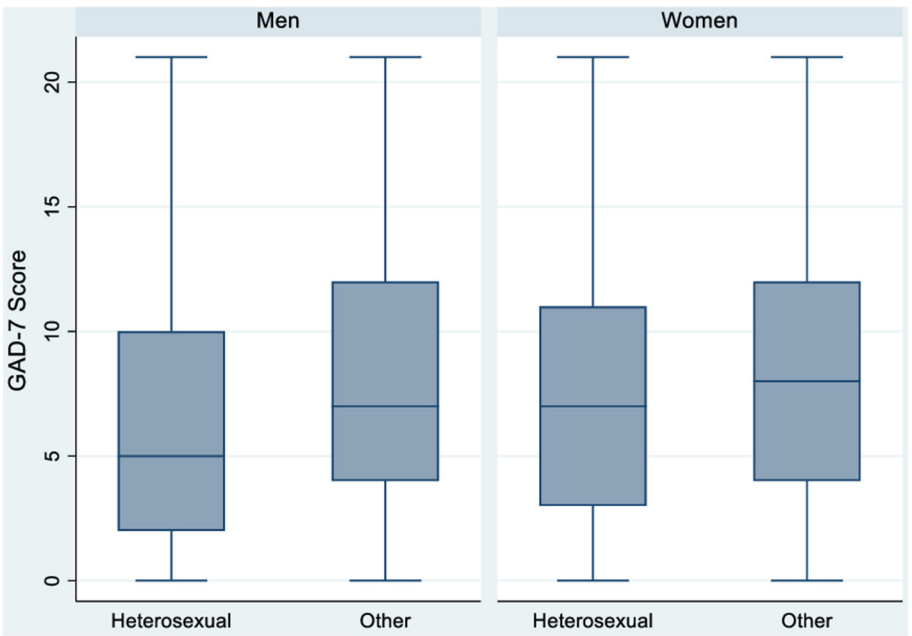

FIGURE 3 | Anxiety according to sexual orientation in men and women $N = 2,053$.

financial situation and anxiety, although there is a difference between women by education level; (3) in women, anxiety is also associated with not having Spanish nationality; and (4) in men, not identifying as heterosexual is associated with a higher risk of suffering from anxiety. We can see that the axes of oppression differ by gender identity.

In addition, anxiety risk is greater in women related to living in smaller spaces, concerns about coexistence with household members, poorer self-perceived health and the perception of not having adequate social support in case of need. Thus, access to safe and stable housing during lockdown is important, as it is a mechanism to ensure security and thermal comfort (45, 46).

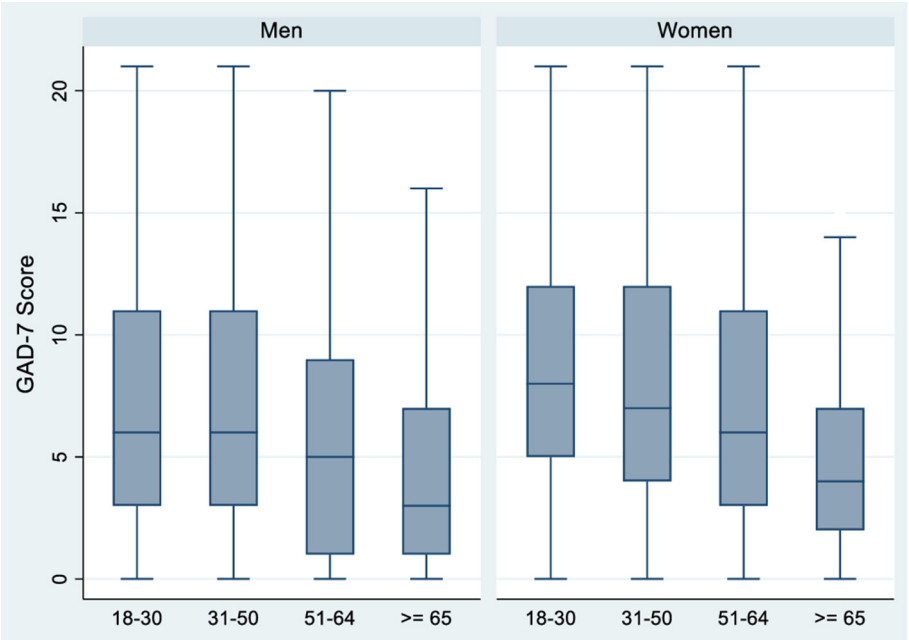

FIGURE 4 | Anxiety according to age in men and women $N = 2,053$.

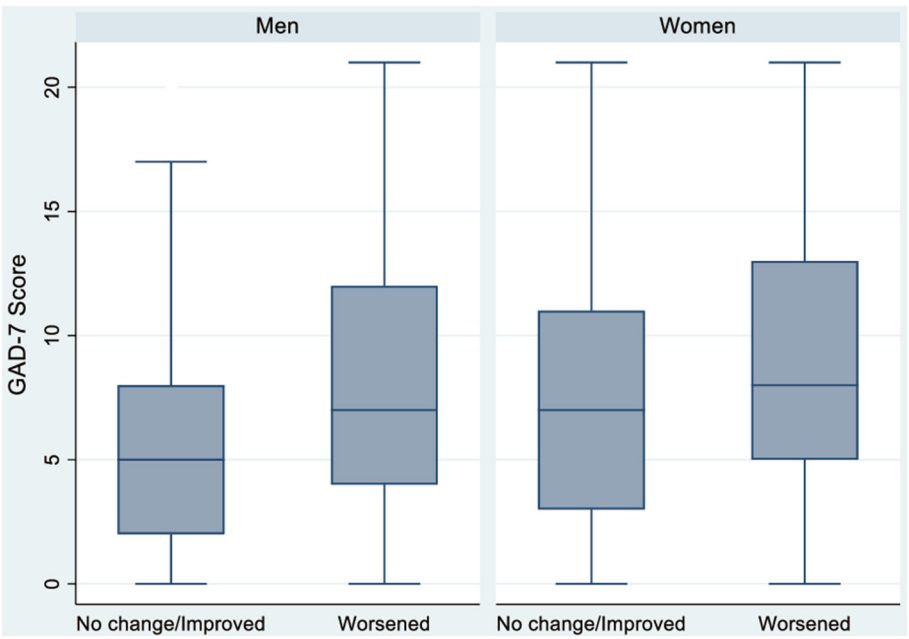

FIGURE 5 | Anxiety according to work condition in men and women $N = 2,053$.

Our findings indicate that physical space and cohabitation have been especially relevant during this period, especially for women, due to the obligation to live together and the possible problems that could emerged in an uncertain social context. In previous studies, it has been found that women experience greater feelings of stress, dissatisfaction and lack of autonomy as they try to reconcile their self-identity with their imposed roles during the initial outbreak period (47). With regard to self-perceived health, previous studies have found an association between social class, psychosocial and physical working conditions and job insecurity and self-perceived health in men (48). Among women, there is an association between self-perceived health and low socioeconomic

TABLE 3B | Association between social axes of inequalities and anxiety (GAD-7) among men in Spain ($N = 546$).

	Model 0		Model 1		Model 2		Model 3	
	ORc[A] (95%CI)	*P*-value	ORa[A] (95%CI)	*P*-value	ORa[A] (95%CI)	*P*-value	ORa[A] (95%CI)	*P*-value
Nationality								
Spain	1.000				1.00		1.00	
Other countries	1.24 (0.61–2.54)	0.555	1.10 (0.53–2.27)	0.804	1.07 (0.51–2.24)	0.852	1.01 (0.48–2.10)	0.988
Sexual orientation								
Hetero	1.00		1.00		1.00		1.00	
Non-hetero	1.78 (1.13–2.81)	0.014	1.76 (1.11–2.80)	0.016	1.48 (0.91–2.38)	0.111	1.53 (0.94–2.49)	0.088
Age		0.004[a]				0.014[a]		
65+	1.00	<0.001[b]			1.00	0.002[b]	1.00	0.005[b]
51–65	1.70 (0.76–3.96)	0.210			1.62 (0.71–3.71)	0.255	1.29 (0.55–2.99)	0.559
31–50 years	2.85 (1.28-−6.37)	0.011			2.64 (1.18–5.94)	0.019	2.20 (0.97–5.00)	0.059
18–30	3.45 (1.47–8.09)	0.004			3.01 (1.26–7.18)	0.013	2.34 (0.96–5.66)	0.060
Employment status								
Not worsened	1.00						1.00	
Worsened	2.53 (1.70–3.77)	<0.001					2.44 (1.62–3.68)	<0.001

ORc[A], crude ordinal odd ratio.
ORa[A], adjusted odds ratio.
[a]Wald test. [b]Trend Test.

status, working conditions, material wellbeing at home and having little or no help with domestic work (48, 49). Likewise, in our study, the perception of having social support (i.e., feeling that friends, family or neighbors care about you) is a protective factor against anxiety. Several studies have shown the importance of the environment in the case of needing help, especially when professionals are not available (50–52).

We observed that the younger population (18–30 years) had higher anxiety levels compared to the older population (65 years or more). These results are consistent with the study we carried out during the lockdown of the first year of the pandemic (8). Although there are few studies on young people and social isolation, it is known that deprivation of social needs in this age group can have lasting effects on social interaction (53). On the other hand, it has been shown that studying online, experiencing tensions with family and increased exposure to social media can contribute to worsened mental health (54, 55). These emotional problems are exacerbated in families of a low socioeconomic status and could have long-lasting effects (56). This suggests that the COVID-19 pandemic should take into account age-specific needs, with a particular focus on the consequences of emotional problems during childhood and adolescence and their future health outcomes. Therefore, intersectoral action between families, primary care and the education system (among those who are in school) must be taken to address this (56).

Another finding is the association between higher levels of anxiety and worsening financial status since the onset of the pandemic, both in men and women. However, our study observed that not having university studies was a risk factor only in women. These results are consistent with studies conducted in Spain prior to the pandemic (57). Despite increased female participation in the workforce, women and men continue to be concentrated in economic activities deemed appropriate for their gender identity, bodies and social roles (31). Because women tend to have less education, this increases their vulnerability and risk of having worsened mental health outcomes as a result of unequal job opportunities (47). On the other hand, we did not observe any difference between being employed with a contract or having a pension and being unemployed or studying in our study population. These results coincide with studies at European level which have found that having a job in and of itself is not a protective factor, but rather depends on the quality and conditions of the job. In other words, having precarious work conditions negatively impacts mental health (58). Therefore, this leads us to conclude that having a job is not a protective factor for mental health, but depends primarily on the quality of working conditions.

In addition, we observed the association between migration status and anxiety. In our study, being in a permanent legal situation (e.g., having Spanish nationality) where one is not actively dealing with immigration paperwork or having to depend on immigration offices or job offers to renew residency permits is a protective factor. On the contrary, women who did not have Spanish nationality, despite being mostly in a legalized administrative situation, were more likely to have symptoms of anxiety. This association was not observed in men. In fact, migrant women, especially young women, have the highest unemployment rate in Spain (18). Consistent with other studies, poor living conditions due to low-income levels may have made it harder to respect curfews or work from home (59). Hegemonic structure such as immigration law affects people, especially in employment systems, as well as through government policies and actions (5, 60). Thus, limited access to the job market, immigration offices and social resources during the pandemic may explain these results in immigrant women.

Another key finding is the association between higher anxiety levels and identifying as non-heterosexual, observed only in men. This can be explained by the fact that in a heteropatriarchal society that assumes and imposes heterosexuality, non-dominant identities experience greater oppression (61). In a misogynistic culture, male homosexuality receives more social punishment, as it is associated with feminine behavior (62). Men are socially expected to subscribe to a model of male hegemony which includes certain behaviors that are not judged in the same way as women, such as being strong, taking risks and having many sexual partners (61, 63–66). From an anthropological approach, homosexuality is considered taboo for men, while being a "whore" is taboo for women, evidenced by the fact that using these attributes as an insult is a mechanism of social control (67). In fact, in a health survey conducted in Barcelona found that gay and bisexual men had a 185% higher likelihood of having anxiety/depression, while no difference was found in women with same-sex attraction (68).

LIMITATION

In our case, the major limitation is the type of sample; we have primarily accessed one population (those who were able to respond to the survey, who we know are not the most vulnerable) to the detriment of other subgroups (69). As a result, our study is not entirely representative of the general population. Furthermore, we recognize our limitation of treating populations without delving into the heterogeneous identities of each of the groups that could explain different axes of oppression. Finally, we believe in the importance of directly involving people who are suffering from a health problem in the research processes and creation of health interventions that directly affect them (70, 71). Lack of comprehensive representation is one symptom of a broken system in which governance is not inclusive of gender identity, geography, sexual orientation, migration status, socioeconomic status or disciplines within and beyond health—ultimately excluding those who offer unique perspectives and expertise (15). Therefore, it is important to understand epidemiology, social science, biomedicine and citizen science as inherently political and as tools that explicitly works toward advancing social justice (50, 71, 72). It is thus important to reflect on the impacts of COVID-19 from a syndemic perspective, meaning that future studies must explore the different effects that the pandemic has on society while considering the intersection with other diseases and with the social conditions and axes of inequities that people experience (73). Intersectionality, a critical theoretical framework, provides a prism through which to examine the differential effects of COVID-19 across axes of social inequity. Intersectionality highlights how power and inequality are structured differently for groups, particularly historically oppressed groups, based on their varied interlocking demographics. Public health officials have told us that "we all" must be socially distant in order to flatten the curve, which has exacerbated social isolation, pain, and suffering. However, already marginalized populations have been forced to largely bear the burden of this suffering (35).

CONCLUSION

After a year of the social and health crisis caused by COVID-19 in Spain, anxiety levels tend to increase in women and men, but with more severe outcomes in women. We believe that these effects on population mental health could last for a long time. Even if incidence and mortality rates were controlled, the experiences that produce suffering at particular points in time are carried throughout the life course. Factors such as age, gender, migration status and sexual orientation have a differential impact on anxiety in the population. Therefore, an interdisciplinary approach must be taken to combat the effects of the COVID-19 pandemic. The inequalities that existed before the appearance of COVID-19 have worsened in Spain, but differentially so according to social identity in women and men. Results that allow the idea of syndemia to be used to study and make visible different health outcomes other than COVID-19 alone. Policy makers at different levels of public administration should open a space for dialogue with citizens and the different sciences to assess which structural and social determinants work as a risk or protective mechanism for mental health.

DATA AVAILABILITY STATEMENT

Data cannot be shared publicly because of ethical restrictions. The Ethics Committee does not allow us to share the data publicly as our data contain sensitive personal information and cannot be fully anonymized. Data are available from the Research Ethics Committee of the Institut de Recerca en Atenció Primària Jordi Gol i Gurina (IDIAPJGol) (contact *via* cei@idiapjgol.info) for researchers who meet the criteria for access to confidential data.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by 20/063-PCV. The submission of the answered questionnaire was considered to be their consent to participate in the study.

AUTHOR CONTRIBUTIONS

CJ-A: conceptualization, methodology, visualization, and writing—original draft. TL-J: conceptualization, methodology, data curation, formal analysis, visualization, and writing—review and editing. MB, LM-P, and BL-G: conceptualization, methodology, visualization, and writing—review and editing. AB: conceptualization, methodology, writing—review and editing, and funding acquisition. All authors contributed to the article and approved the submitted version.

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