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Contemporary perspectives in adolescent mental health

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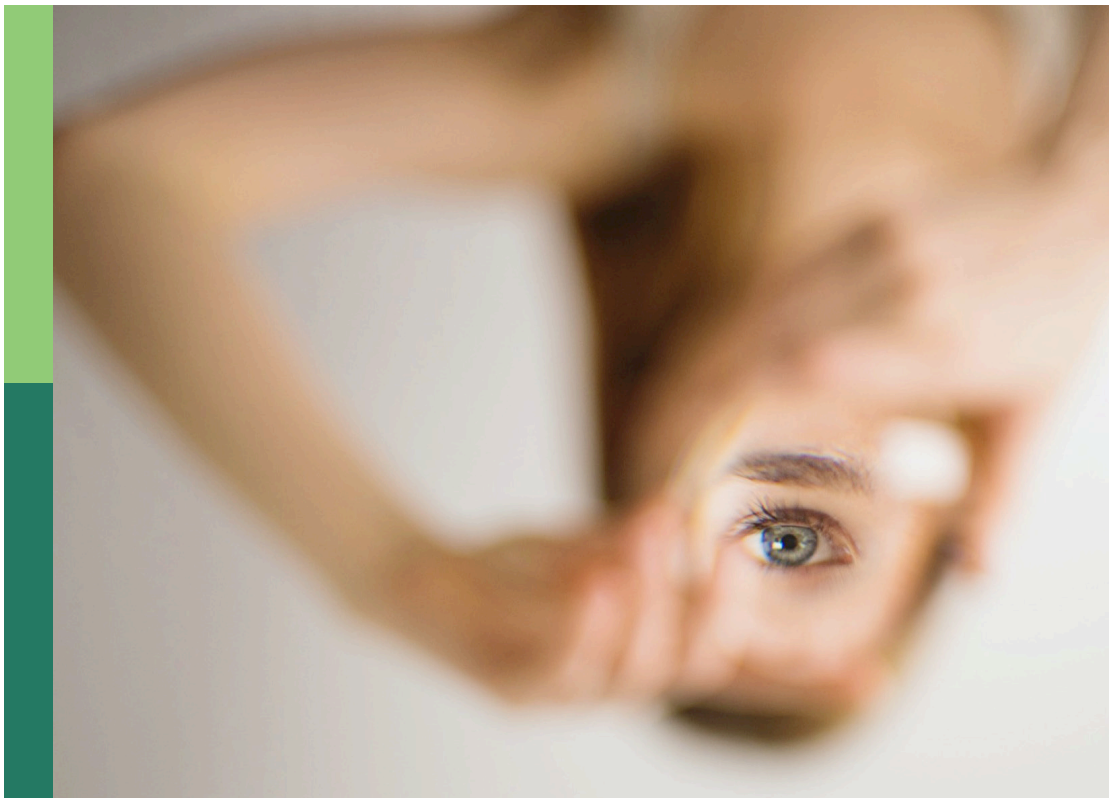

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Contemporary perspectives in adolescent mental health

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Editorial: Contemporary perspectives in adolescent mental health

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Editorial on the Research Topic
Contemporary perspectives in adolescent mental health

The adolescent years mark a critical phase in human development, shaping the foundation for mental health throughout one's life (Patton et al., 2016). As we delve into the complex landscape of adolescent mental health, it becomes evident that understanding and addressing the unique contemporary challenges faced by this age group are imperative for creating and supporting environments in which adolescents can develop resilience and thrive mentally as well as physically.

Mental health is a cornerstone of young peoples' functioning and increasingly a topic of concern (Cosma et al., 2023). The foundation of mental health begins in childhood but is largely laid in adolescence, and more than half of adult mental health disorders have their onset before the age of 14 (Kessler et al., 2007). Mental health problems are becoming a leading cause of disease burden amongst adolescents globally, affecting their achievement of developmental tasks, socially, personally and academically. Poor adolescent mental health has been linked with poor long-term adult health morbidity and mortality (Patton et al., 2016). Optimal mental health requires a positive sense of wellbeing in addition to the absence of clinically significant, active mental illness. Monitoring systems are key to understanding whether efforts to improve young people's mental health at a national and international level are successful (Viner et al., 2012).

To advance our knowledge, the special topic "*Contemporary perspectives in adolescent mental health*" in *Frontiers in Psychology* provides a platform for cutting-edge research and insights. Taking a contemporary perspective to adolescent mental health means that we recognize that adolescents today are experiencing life in a different context than the generations before; therefore, it is important to continue to update our knowledge of adolescent mental health with this in mind. The last decades have seen great changes in young peoples' lives, including technological advancement, global conflict, environmental change, social polarization, and the COVID-19 pandemic, all which may impact on adolescent mental health (e.g., Martin et al., 2022, 2023; Boer et al., 2023). Accordingly, this collection of papers brings together diverse

perspectives including different cultural contexts and research methodologies, shedding light on various facets of adolescent mental health (e.g., time trends, COVID-19 impacts, mechanisms) and offering valuable contributions to this evolving field.

Previous research has outlined the increase in mental health problems in contemporary generations of adolescents (Bor et al., 2014), with increases over time in the age and gender gaps (Cosma et al., 2020; Boer et al., 2023). Our Research Topic includes three papers that advanced knowledge in this area. Eriksson and Stattin used a person-centered approach to identify secular trends in the mental health profiles among 15-year-olds in Sweden. Their findings suggest that the turning point toward decline was 2010, with profiles of psychosomatic complaints registering the highest increase over time. Similarly, in a Scottish sample, covering the same time period and using the same methodology, Inchley et al. reported worsening trends of psychosomatic complaints. However, a widening of the social inequality gap was found, especially for girls. Finally, Li et al. in their focus on sexual minorities showed that the distress is also not shared equally across all adolescent groups, but that we need to be understanding how today's reality may be affecting subgroups of adolescents in unique ways. These studies emphasize a need for nuanced research which acknowledges that the mental health burden is not shared equally across all adolescents and that deeper understanding of causal mechanisms which may explain why certain groups are affected more is needed. For example, Peleg et al. explored the role of emotional distress as a mediator between differentiation of self and the risk of eating disorders among adolescents. Their findings provide valuable insights into the gendered character of these mechanisms.

How adolescent mental health is conceptualized is an important area of inquiry, and is foundational to how this phenomena is understood and studied. In this Research Topic, King et al. explored a continuous measure of adolescent mental health inspired by a dual-factor model of mental health which suggests that mental illness and positive mental health reflect distinct continua, rather than the extreme ends of a single spectrum (Iasiello et al., 2020). This is a novel approach that uses the full range of data available and may be a useful approach for smaller studies with limited statistical power (King et al.). McMahon et al. examined if a measure of COVID-19 anxiety was associated with psychological distress. Their findings indicate that a positive association exists between worries about the indirect consequences of COVID-19 (consequence anxiety) and psychological distress, and that this is moderated by parent-child closeness. Together, these studies provide valuable insights into how we conceptualize adolescent mental health, and both bring insights that can inform future research.

As part of this search for understanding mechanisms explaining adolescent mental health, this Research Topic brings some advancements in understanding contemporary risk factors for developing mental health problems during adolescent years by exploring individual or parent related mechanisms. As such, Yang et al. explored the role of parent-child attachment and emotional insecurity in the association between exposure to interparental conflict and emotional and behavioral problems. Ding et al.'s work investigated the associations between parental phubbing (i.e., parents' concentrating on using cell phones while neglecting their children in parent–child interaction) and adolescent sleep problems and the mediating role of negative emotions and self-control.

In addition, this Research Topic examined how we can reduce the experience of stress among adolescents. In their qualitative investigation, Persson et al. explored school nurses' experiences of health-promoting work to prevent stress in Swedish adolescents. Their results showcase that healthy living habits are seen as a prerequisite for preventing stress. Conversely, in order to maximize the impact of the work it is important for the school nurse to be visible and accessible to create good relationships with the students but also foster collaboration with stakeholders outside the school. Finally, using national longitudinal data, Srivastava et al. examined time-sequential associations between identity management stress and depression over time by sexual identity fluidity. Their results indicate that sexual identity development and fluidity processes differ between cisgender females and males.

The papers featured in this special topic collectively contribute to a nuanced and comprehensive understanding of contemporary perspectives in adolescent mental health. They stress that the mental health burden is not shared equally by all adolescents and that future research needs to focus on an understanding of which adolescents are affected the most and why that may be. More emphasis on causal mechanisms, as well as resilience factors are needed if we are to fully address the decline in adolescent mental health. As we navigate the challenges and opportunities of this critical developmental stage, it is imperative to integrate these insights into policies, practices, and interventions that support the wellbeing of adolescents. By fostering a holistic approach that considers the digital landscape, social inequalities, individual-level mechanisms and cross-cultural differences, we can pave the way for a healthier and more resilient generation.

Author contributions

AC: Writing – original draft, Writing – review & editing. GM: Writing – original draft, Writing – review & editing. SW: Writing – original draft, Writing – review & editing. YC: Writing – original draft, Writing – review & editing. CC: Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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School nurses' experiences of health-promoting work to prevent stress in Swedish adolescents

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Aim: To investigate school nurses' experiences of health-promoting work to prevent stress in Swedish adolescents

Materials and methods: Swedish school nurses (*n* = 225) responded to a web survey with open-ended questions. The results were subjected to a qualitative content analysis.

Results: Six categories were identified from the analysis: (1) Knowledge of body and soul, (2) Identifying stress and ill health, (3) Collaborative working within/outside school, (4) Make yourself (i.e., school nurses) visible to the students, (5) Support students' learning, and (6) Tools for stress management. One of the most important themes in preventing and counteracting stress in school-aged children and adolescents was promoting healthy living habits. That school nurses were easily accessible and visible were important for them to identify stress as early as possible. The close collaboration with the school health care team and building relationships with the students were emphasized. The stress in adolescents was largely linked to schoolwork and performance anxiety. To counteract this, the dialogue with the teachers was important to increase their knowledge of mental health problems and stress and influence the scheduling of school exams.

Conclusion: The study contributes to increased knowledge in the field and provides concrete strategies for how school nurses can work to counteract stress in students.

KEYWORDS

adolescents, school nurses, health promotion, stress, experience

Introduction

Mental health problems among adolescents are increasing (Bor et al., 2014), and the prevalence of recurring psychosomatic symptoms has doubled since the 1980s (Högberg et al., 2020). Without recovery and rest, the risk of depression and fatigue syndrome increases with prolonged stress (Åsberg et al., 2010). According to Selye (1965), stress

is a reaction to a stimulus that can have a positive or negative effect, depending on the context. Stress is present throughout the period that an individual is exposed to various unspecified stressors. Furthermore, there is also a difference between acute and persistent stress (Tan and Yip, 2018). When people are exposed to stress, they go through several stages. The first stage is the alarm stage, where the body is put on standby and prepares for any danger; the second stage is the resistance stage, where the individual tries to achieve balance by avoiding the change and adapting to the situation. The last stage is the stage of exhaustion, which occurs when the resistance to counteract the stressors becomes too great (Tan and Yip, 2018). Stress can have positive and negative effects, where positive stress is necessary for certain situations for the individual to survive. On the other hand, negative stress can affect several of the body's organs. The brain can be affected when exposed to long-term stress, for example, problems with memory and learning. The heart is also affected by acute and prolonged stress, leading to increased heart rate and sympathetic nervous system activation. Stress also affects the immune system, appetite, gastrointestinal functions, and endocrine system (Yaribeygi et al., 2017). Everyone can be exposed to stress and experience depression or severe fatigue. The balance between what is considered common and disease is difficult to discern. There are no obvious limits. Stress is linked to mental illness in several different ways. If it is long-lasting and the possibility of rest is limited, it can give rise to symptoms of irritation, fatigue, depression, and anxiety (Åsberg et al., 2010).

Stress in adolescents

Adolescents show different symptoms and signs of stress depending on age. Common symptoms are difficulty concentrating, changes in sleep and eating habits, and changes in mood and behavior. Headaches, abdominal pain, and general pain are also common symptoms. Other symptoms include difficulty falling asleep, concentrating, depression, procrastination, and melancholy (Warghoff et al., 2020: Hörbo et al., 2021; McKegney, 2021). McKegney (2021) reports that isolation, increased anxiety, and avoidance of leisure activities are warning signs. According to Jakobsson et al. (2019), stress is the most common cause of adolescent sleep problems. The concept of stress includes school stress, everyday stress, and fear of missing out. School stress can manifest as anxiety, constant agitation, stress over schoolwork, and not keeping up (Jakobsson et al., 2019). According to Kyoung (2019), adolescents who perform worse in school are also those who, to a greater extent, show signs of depression or suicidal thoughts.

Other stressors may be conflicts in close relationships and new environments, such as changing schools or classes (Kyoung, 2019; Warghoff et al., 2020). Jakobsson et al. (2019) and Warghoff et al. (2020) report that young people set demands and expectations on themselves that they cannot always live up to. Parents and teachers also have some expectations of adolescents that can contribute to stress. According to Mörelius (2015), the school nurse should be aware of when adolescents seek contact for "simple" problems as this may be a sign that they want contact with an adult who can listen and provide support.

The role of the school nurse

School nurses are employed at every school in Sweden, however, schools with few students (approximately less than 300–400 students) might not have access to the school nurse every day of the week. In average, each school nurse is responsible for 484 students (Ellertsson et al., 2017). According to Swedish law (Education Act, 2010), school health care must primarily focus on prevention and health promotion. Students have the right to medical, psychosocial, psychological, and special educational interventions. The National Board of Health and Welfare (2017) states that good collaboration between school health care and teachers at the school creates good conditions for the work. School health care aims to create as good conditions as possible for a good learning situation. According to the Education Act (2010), students must be offered at least three health talks in compulsory school and one in upper secondary school. Hilli and Pedersen (2021) report that these health conversations are a tool where school nurses can identify ill-health and young people's specific needs by implementing appropriate measures. The school nurses have an important task in supporting and giving young people the opportunity to trust their abilities. To improve health and well-being, it is important to listen to adolescents' expressed feelings and needs, both the expressed and the unspoken (Hilli and Pedersen, 2021). School nurses must be visible to give their students good support and know who they can turn to. Accessibility can be challenging; therefore, school nurses must reflect on their role to be "enough" (Sherwin, 2016). School nurses must be flexible and open to implementing measures early and collaborate with the school health care team and guardians (Hilli and Pedersen, 2021). Many school nurses consider their work with adolescents with mental health problems meaningful and important (Jönsson et al., 2019). School nurses experienced a transition to a more digital way of working during the COVID-19 pandemic (Martinsson et al., 2021). The current study aimed to investigate school nurses' health-promoting work to prevent stress in Swedish adolescents.

Materials and methods

The current study was conducted among school nurses in Sweden in 2021 during the coronavirus 2019 (COVID-19) pandemic. In Sweden, schools for 6–15-year-old children were

mainly open during the pandemic. However, schooling for 16–19-year-old adolescents was partly by distance learning. The study was conducted as an anonymous cross-sectional study with a qualitative approach in the form of an online survey with open-ended questions. Before data collection started, the study was approved by the Swedish Ethical Review Authority (2021-00946).

Sample

Purposeful sampling was applied (Polit and Beck, 2017). The online survey was distributed to school nurses in Sweden who worked in school health care, regardless of whether the school was private or public. The inclusion criteria for participating in the study were to work as a school nurse in Sweden. The school nurses who participated worked in primary and secondary schools with varying ages for the students, between 6 and 19 years old.

Procedure and data collection

Initially, a short request to school nurses to participate in the study through a post in the Facebook group "School nurses in Sweden," with 2,600 members. The second approach meant that an information letter was sent to the school health care administration of schools in southern Sweden, who then forwarded the information letter with the link to the web-based survey to the school nurses in their schools. A reminder was sent out on one occasion after 2 months. The survey consisted of four open-ended questions aimed at the school nurse's health-promoting work, see **Appendix**. The questionnaire was available to answer from May to December 2021.

Analysis

The open-ended questions were analyzed with inductive, qualitative content analysis. According to Graneheim and Lundman (2004), qualitative content analysis focuses on distinguishing variations in the data material. Furthermore, they describe that similarities and differences can be formulated in categories and themes. The current study analyzed the texts on the open-ended questions by establishing an analysis schedule. The analysis scheme created columns with sentence units, codes, subcategories, and categories (**Table 1**). The questionnaire responses were placed in numerical order in the sentence units column. The meaning units were read several times, and codes were worked out. These can be likened to labels, where one or more words summarize the text. Graneheim and Lundman (2004) describe the codes as tools to help the authors reflect on the text. Once the codes were entered into the schedule, mind maps were used to distinguish subcategories and categories for the different answers. Graneheim and Lundman (2004) describe that the categories consist of several codes with similar meanings. After further analysis and sorting of similarities and differences, these were further changed before subcategories emerged that became a latent interpretation of the content of the text. The analysis was discussed between the four authors until a consensus was obtained.

Results

Six categories were identified from the analysis: (1) Knowledge of body and soul, (2) Identifying stress and ill health, (3) Collaborative working within/outside school, (4) Make yourself (i.e., school nurses) visible to the students, (5) Support students' learning, and (6) Tools for stress management.

Knowledge of body and soul

The school nurses expressed that an important part of their work was preventing stress and talking to the students about healthy living habits. The students' screen time and its connection to poor sleep were highlighted in the health conversations and the importance of a regular circadian rhythm. Conversations about physical activity and good eating habits promote students' stress tolerance. For students to balance school and leisure, it was considered important that they were allowed to rest and recover, even though it was also important to do fun things in their free time. The school nurses gave the students advice on how they could affect their health independently. While some school nurses mainly talked about healthy habits during the individual health conversations, others went out to the classes alone or with the school social worker. The lectures in class could, for example, be about stressful lifestyles and alcohol, drugs, and sex education. Topics discussed depended largely on the students' age, and the information was adapted to the students' maturity. To make it easier to catch the students' attention, some of the school nurses divided the class into small groups instead of informing everyone at the same time. To give students an increased understanding of what happens in the body during stress, the school nurses informed them about the difference between positive and negative stress and its effect on the body.

> *"I talk a lot about sleep, activity and diet with the adolescents to counteract the negative stress at school. With the right conditions, you can deal with stress better, in my opinion."*

The school nurses also expressed that students' mental health problems have increased in recent years. When they talked about mental health, the school nurses also tried to

TABLE 1 Overview of the sentence units, codes, subcategories, and categories.

Sentence units	Codes	Subcategories	Categories
Shares knowledge about stress, how it works, how it affects the body and what can affect stress	Informs about stress and how it can affect the body	Sharing knowledge about stress and body	Knowledge of body and soul
Trying to create relations with the students to enable them to visit me for various reasons, not only bodily complaints.	Creating relations enables the students to visit the school nurse when needed.	Building relationships	Make yourself (i.e., school nurses) visible to the students
Collaboration between the school health care and the teaching teams about how to discuss stress and mental health in the classroom.	Working together with the teachers, school administration and the school health professionals	Collaboration with the school health team and teachers	Collaborative working within/outside school

convey that the mood varies over time, that all bad mood is not anxiety and depression, and that everyone can have bad days without a diagnosis. Many school nurses consider it important to talk about the students' thoughts about the future, prepare them for adulthood, and strengthen their self-esteem. Some school nurses tried to have a salutogenic perspective and encourage health factors when discussing mental illness.

> *"The whole school health care team (not just the school nurse) should focus on normalizing that the mood varies over time. All bad mood is not anxiety and depression."*

Identifying stress and ill-health

The health conversation and spontaneous visits were good opportunities to capture abnormalities and identify mental and physical health problems. During these conversations, the school nurse tried to work with the underlying cause of the student, for example, having a headache and what stressors there were. During the health visit, the school nurse detected early signs of stress and mental illness and implemented the necessary measures. They also followed up on any deviations and thus worked preventively to counteract ill health. Length, weight, vision, and hearing were checked during the health visit, and vaccinations according to the basic program were also performed.

> *"Trying to capture them in the health conversation and talk about stress, what stress is, and that stress is part of life."*

School attendance could be improved by detecting health problems early, such as relationship problems with friends. Capturing those students who already had high school absenteeism was also a way of identifying mental illness.

> *"Capturing students who are not feeling well mentally at an early age."*

Collaborative working within/outside school

Collaborating with other professionals was one of the most important tasks to prevent ill health and stress. It was important for the school nurses to collaborate with the school health care team and the teachers at the school. The stress in adolescents was largely linked to schoolwork and performance anxiety. To counteract this, the dialogue with the teachers was important to increase their knowledge of mental health problems and stress and influence the scheduling of the number of tests per week. The school nurses often mentioned the school social worker as the closest partner in the school health care team. At the school health care meetings, the school nurse also had the chance to highlight important information from the health surveys and share it with the team members. In this way, they could together map students who needed, for example, a special education need coordinator or school social worker. When there was a risk of stress and ill health, the relationship with the child's parents was greatly important to the entire school health care team. The school health care team was present at many school parent meetings. This was considered a good opportunity to explain all professional functions' tasks.

To provide the right care and support to those students with illness, harmful stress, or disability, collaboration with other health services agencies (such as child and adolescent psychiatric services) was important. It also emerged that collaboration with the student council was an excellent opportunity to hear the students' voices.

> *"Collaboration between school health care team and the teachers on how the group can talk about stress and mental health in the classrooms."*

> *"Follow up if needed, call home to parents, or refer to the school social worker, child and adolescent psychiatric service or other instance if relevant."*

Make yourself (i.e., school nurses) visible to the students

Accessibility and always having the door open were an important part of the school nurses' work in health promotion. Students always felt welcome when the need arose, and the "drop-in" visits helped build relationships. Being visible at school, for example, being outside in the school yard during breaks and inside in the school canteen during lunchtime to identify problems and to establish a connectedness with the students, was also an important task. Trusting relationships with the students was valuable because detecting deviations and identifying mental and physical illnesses were easier. Trust made the students dare to open up and talk about difficulties. The duty of confidentiality was also mentioned that strengthen the relationship and contribute to security. The school nurse and others in the school health care team confirmed the students, put them in the center and captured them by listening and giving support.

> *"Always keep the door open so they can come and talk."*

> *"Listening in and being there as support. Be able to advise on health without judging. Health visits and be available for spontaneous visits."*

Support students' learning

According to the school nurses, it was important to influence the students' work environment to give them the right conditions to complete their studies, as many students felt stressed and had performance anxiety over schoolwork. Many stated that there were shortcomings in the scheduling at school and that it was not unusual to have two or three tests the same week. This meant a lot of stress, and the close collaboration with the teachers was important to develop a good study plan for exams and assignments. The school nurse expressed an increased understanding of mental illness and how it could affect school performance in school health care. Therefore, close collaboration was extremely important for the students to assimilate their studies well and achieve a reasonable workload and a good work environment. It also became easier to identify the students who needed to be supported with resources to achieve their goals in school.

> *"Trying to influence via the school health care team at school management level so that teachers can assess the students' abilities in other ways than through tests and that teachers communicate better in their work teams when planning their subjects. It is not uncommon for students to sometimes have 2 tests on the same day or 3 tests in the same week."*

Tools for stress management

The school nurse gave the students tools to identify stress and how stress can affect them. Some schools worked with coaching and structure in everyday life. In other schools, the school nurses and school social workers had relaxation exercises in groups in the form of yoga, mindfulness, or other breathing exercises, which was much appreciated. The school nurses could also help the student by sketching out a mind map to visualize what a day looked like.

> *"I work with mindfulness, yoga, and relaxation in small groups (when it's not corona)."*

> *"Counteract stress with painting and other activities during class time. Get to know how I study best. Study - pause- study -pause. Get on the so-called "the sleep train," stop using the phone before bedtime, use of weight blanket, foot massage. breathe, have a positive mindset, to be good as you are."*

Discussion

The study revealed several aspects of the Swedish school nurse's health promotion work to prevent stress in adolescents. Three main findings will be highlighted. First, the school nurses describe healthy living habits as a prerequisite for preventing stress. Second, it is important for the school nurse to be visible and accessible to create good relationships with the students. The third finding addresses collaboration with other actors in and outside the school.

Healthy living habits are a prerequisite to counteracting stress. A key finding is the school nurses' conversations about healthy living habits to prevent adolescent stress. Schultchen et al. (2019) described that those who were more physically active often had a lower level of stress and vice versa, that higher stress levels were often linked to low physical activity. Furthermore, Schultchen et al. (2019) found that a similar connection could not be made between a healthy diet and stress, as what was considered a healthy diet was individual and, in many cases, emotionally driven. Some ate when they were stressed, while others could not eat when they experienced stress. In the current study, the school nurses believe that reduced screen time is a prerequisite for good sleep as poor sleep habits increase sensitivity to stress. Åsberg et al. (2010)

confirmed this and argued that rest and recovery were important to avoid the negative effects of stress. In their study, Hale and Guan (2015) described that social media affected adolescents' sleep, partly because they fall asleep later but also decreased their sleep quality. Woo et al. (2021) were of a different opinion and emphasized in their study that screen use had positive effects, for example, on mental health. Internet functions could strengthen social support and the feeling of belonging, which, according to Antonovsky (1987), is important for preventing and managing stress. However, one consequence of using social media may be that physical encounters are avoided, leading to reduced physical activity and reduced stress tolerance.

The school nurses emphasize the importance of being accessible and visible to create good student relationships. Our study shows that school nurses believe that the possibility of students accessing the school nurse on "drop-in" visits allows them to identify stress and ill health in adolescents. Hilli and Pedersen (2021) described that it was important for the students to feel confident in the school nurse and feel they could talk about everything. It was also important as a school nurse to listen to what the students said and interpret what was not said. Sherwin (2016) confirmed this, which helped the students know who to turn to, but also emphasized that it was important that the school nurse during the "drop-in" visits reflected on her role as accessibility could sometimes be a challenge (Sherwin, 2016). The school nurse is obliged to follow the national program with regular health conversations and health check-ups and vaccinations. However, being visible and accessible to the students is also important. To balance these two important areas, which identify stress and ill health in adolescents, the school nurse must be given the time and space needed.

Collaboration between different actors is important for the school nurse in promoting work against stress. Typical collaborations within schools are with the school social worker and the teachers, and outside schools with the adolescent health care facilities and the child psychiatric clinic (Jönsson et al., 2019; Martinsson et al., 2021). Hilli and Pedersen (2021) described the importance of a good collaboration with the school health care team and guardians to implement measures in the event of ill health at an early stage. The collaboration with the guardians and their commitment was also important to the health workers to promote the students' health. Furthermore, they considered that the school nurse and the teachers complimented each other and that the school nurse's competence was required when teaching specific health subjects, which the students appreciated (Hilli and Pedersen, 2021).

School nurses believe that students often experience stress and performance anxiety related to schoolwork. Many of the school nurses express in the study that it is not unusual to have several tests in the same week, which increases student stress. The results also show that it is important to coordinate the study plan with the teachers, which gives the teachers an increased understanding of the students' situation. Jakobsson et al. (2019) confirmed this in their study and reported that many students experienced stress in connection with school work and that it took a lot of time to prepare for tests and school assignments. Students sometimes had to sit late into the night, which affected sleep (Jakobsson et al., 2019). Against this background, a coordinated study plan must be highlighted at the school management level to reduce students' stress and performance anxiety and get all actors to work toward the same goal.

Strengths and limitations

The study's strengths are the relatively high number of participants and the wide variety of data. But there are approximately 3,000 school nurses in Sweden, and less than 10% of this population has responded to the survey. Due to the anonymous and voluntary data collection, we do not know if the included respondents are representative of the whole school nurse population in Sweden. School nurses' work situation differs worldwide, so the generalization of the results may be limited. However, other professionals also work with health promotion to prevent stress in adolescents, and the experiences of Swedish school nurses could provide guidance and inspire other settings.

Implications for practice and suggestions for future research

The Swedish school nurses and health care team actively counteract and prevent stress. The results also showed that collaboration was important to the school nurse's work, both within school with other school staff, and also outside school with other health agencies. The study also shows that it is important for school nurses to be visible and accessible to identify ill health and stress more easily. One suggestion may be for the school nurse to set aside days in their calendar that the students are aware of, specifically dedicated to "drop-in" visits. Suggestions for future research are evaluations of school nurses' health promotive work to prevent stress in adolescents. It would also be valuable to investigate school nurses' experiences of health promoting work in other countries and regions.

Conclusion

According to the Swedish school nurses, healthy living habits were central to preventing and counteracting stress. School nurses felt that being easily accessible and visible were important to identify stress as early as possible. The close collaboration with the school health care team and building relationships with the students were emphasized. The stress in

adolescents was largely linked to schoolwork and performance anxiety. To counteract this, the dialogue with the teachers was important to increase their knowledge of mental health problems and stress and influence the scheduling of the number of tests per week. The study contributes to increased knowledge in the field and provides concrete strategies for how school nurses can work to counteract stress in students.

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 Swedish Ethical Review Authority (2021-00946). The patients/participants provided their written informed consent to participate in this study.

Author contributions

PG and E-LE: conceptualization, funding acquisition, project administration, resources, and supervision. LP and CR: writing–original draft. All authors: data curation, formal analysis, investigation, methodology, writing–review and editing, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix

1. What main task do you think you have to promote the health of school children in your role as a school nurse?
2. What health promotion efforts should school health care focus on?
3. At what age do you think stress is most common?
4. How do you preventively work as a school nurse to counteract stress?

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Development of a novel continuous measure of adolescent mental health inspired by the dual-factor model

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Background: According to the Dual-factor Model, mental health is comprised of two related constructs: subjective well-being and psychopathology. Combining these constructs can provide a more accurate and comprehensive assessment of adolescent mental health than considering either on its own. The model suggests the need to group mental health into four distinct categories, which does not recognize its potential continuum and adds statistical complexity. In this study, we developed a continuous measure inspired by, and as a complement to, the Dual-factor Model. Our goal was to demonstrate a novel approach to developing a valid measure for use in public health research that captures varying mental health states more accurately than traditional approaches and has advantages over the categorical version.

Methods: Self-report data are from the 2014 Canadian Health Behavior in School-aged Children study (n = 21,993). Subjective well-being was measured by combining indicators of life satisfaction, positive affect, and negative affect. Internalized and externalized symptoms scales were combined to measure psychopathology. The continuous dual-factor measure was created by subtracting standardized psychopathology scores from standardized subjective well-being scores. Construct validity was assessed using multivariable linear regression by examining associations between factors known to be associated with adolescent mental health status (demographic characteristics, social and academic functioning, and specific indicators of mental health) and average mental health scores.

Results: The average age was 14.0 (SD = 1.41) years. The continuous mental health score ranged from 5 to 67 [Mean (SD): 50.1 (9.8)], with higher scores indicating better overall mental health. The nature and direction of the associations examined supported construct validity. Being from a more affluent family, and having more supportive relationships with family, peers, teachers, and classmates was associated with greater mental health (Cohen's d: 0.65 to 1.63). Higher average marks were also associated with better mental

health. Average mental health scores were much lower if students reported feeling hopeless or rated their health as fair or poor.

Conclusion: A continuous measure of mental health based on the Dual-factor Model appears to be a comprehensive and valid measure with applications for research aimed at increasing our understanding of adolescent mental health.

KEYWORDS

adolescent, mental health, measurement, Dual-factor Model of mental health, psychopathology, subjective well-being

Introduction

According to the World Health Organization, optimal mental health involves the successful performance of mental functioning, resulting in productive activities, fulfilling relationships, and the ability to cope with adversity (World Health Organization, 2004). Traditionally, symptoms of mental illness (e.g., anxiety and depression) have been used to infer the presence or absence of optimal mental health. Asymptomatic youth are considered mentally healthy by this approach, despite having varying levels of mental functioning (Greenspoon and Saklofske, 2001). According to the field of positive psychology the presence of subjective well-being (SWB) (e.g., life satisfaction and positive emotions) is also important to optimal mental health and functioning (Seligman and Csikszentmihalyi, 2000; Keyes, 2017).

A Dual-factor Model of mental health [also referred to as the Two Continua Model of Mental Health and Illness, the Complete State Model, and the Dual-continua Model (Wang et al., 2011)] was proposed by Greenspoon and Saklofske (2001), as one approach to the assessment of mental health but in composite. The Dual-factor Model states that mental health can be assessed by combining ratings on two dimensions: SWB and psychopathology (Greenspoon and Saklofske, 2001; Wang et al., 2011). SWB is defined according to the hedonic tradition as feeling good about one's life, and psychopathology refers to the presence of internalized or externalized symptoms and behaviors associated with mental illness. The resultant two-factor measure depicts four mental health groups with unique mental functioning and treatment needs: (1) "Mentally Healthy" (high well-being and low psychopathology), (2) "Symptomatic yet Content" (high well-being, but high psychopathology), (3) "Asymptomatic yet Discontent" (low well-being despite low psychopathology), and (4) "Mentally Unhealthy" (low well-being and high psychopathology) (**Figure 1**; Wang et al., 2011). Measures based on the Dual-factor Model are felt to provide more accurate and comprehensive assessments of mental health status than traditional unidimensional measures that focus on specific indicators of well-being or psychopathology. Each group reports unique levels of functioning in domains related to mental health (social, physical, behavioral, and academic), with the highest functioning group (mentally healthy) reporting both low psychopathology and high well-being (Lyons et al., 2012; Suldo et al., 2016). "Asymptomatic yet Discontent" youth who would be identified as mentally healthy using traditional disease-based approaches display reduced functioning compared to the "Mentally Healthy" group (Lyons et al., 2012; Suldo et al., 2016) and similar academic struggles as those with high psychopathology (Smith, 2018). "Symptomatic yet Content" youth who would be categorized as mentally unhealthy based on their psychopathology score display better social functioning and academic engagement (Antaramian et al., 2010), and higher self-worth than the "Mentally Unhealthy" group (Suldo and Shaffer, 2008; Suldo et al., 2011). In other words, being symptom free and feeling good (happy and satisfied with life) equates to optimal mental health and functioning.

While evidence supports the application of a dual-factor measure over traditional approaches, there are disadvantages to grouping mental health into four broad categories. In studies that have operationalized a dual-factor measure, over half to two-thirds of adolescents were labeled mentally healthy (Suldo et al., 2016), ignoring within-group variation, and potentially masking important within-group differences. Compared to a continuous variable, a four-category, nominal outcome also adds statistical and interpretive complexity to common regression approaches, is less easily adopted to advanced statistical applications (e.g., structural equation modeling), and requires a greater sample size to detect meaningful effects (Altman and Royston, 2006).

The purpose of this study was therefore to develop and test a novel measure of adolescent mental health for use in public health research, based on our adaptation of the Dual-factor Model (King et al., 2021) and in a continuous form (**Figure 2**). Such a continuous measure could potentially comprehensively and more accurately capture varying mental health states than traditional approaches. It would also possess various statistical advantages over a categorical dual-factor measure.

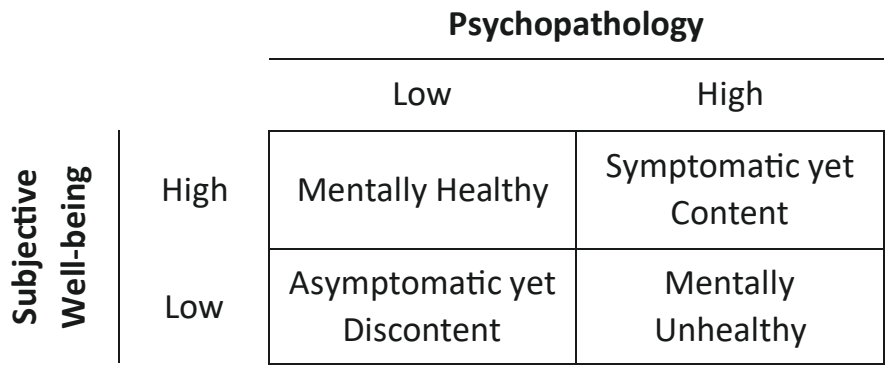

FIGURE 1
Mental health status groups based on the Dual-factor Model of mental health (Greenspoon and Saklofske, 2001; Wang et al., 2011). The labels used in this study for the mental health groups come from Renshaw and Cohen (2014).

Given the novelty of this measure, we assessed construct validity in its testing.

Materials and methods

Overview of research design

The steps involved in this research were: (1) development of the continuous measure of mental health based on the Dual-factor Model (Greenspoon and Saklofske, 2001; Wang et al., 2011), combining measures of SWB and psychopathology, and (2) testing of its construct validity (Westen and Rosenthal, 2003), *via* examining measures of association with indicators known to be associated with adolescent mental health (Freeman et al., 2016; McAdam et al., 2018). The latter step included specific indicators of mental health, demographic factors, reports of academic performance, and social support variables. *A priori*, higher mental health scores on our measure were expected to be linearly associated with greater social support, better health, greater academic performance, and greater self-reported family affluence (**Figure 3**).

Data source

Data for this study come from the 2014 Canadian Health Behavior in School-aged Children (HBSC) study (Freeman et al., 2016). The sample covers all provinces and territories, with notable exclusions including private and on-reserve schools, home schooled students, and incarcerated students (collectively, < 7% of the eligible student population) (Van Pelt et al., 2015). A self-report general health questionnaire was administered in the classroom, in hardcopy or online formats, that compiled data on health and health-related behaviors from grade 6 to 10 students (typically ages 11 to 15 years old) (Freeman et al., 2016). Participation in the survey required student assent and parental consent (either active and/or passive). Sample weights were developed to ensure national representativeness by grade within province/territory. Ethics approval for the HBSC study was obtained from the Public Health Agency of Canada (REB 2013-0022), and the Queen's University Ethics Board (GREB TRAQ #: 6010236).

Variables contributing to the dual-factor inspired measure

The mental health measure was created by combining measures of SWB and psychopathology into a composite score (**Figure 2**).

Subjective well-being

Following precedent (Greenspoon and Saklofske, 2001; Suldo and Shaffer, 2008; Lyons et al., 2012), SWB was measured by combining with equal weighting three separate but related constructs: life satisfaction, positive affect, and negative affect (Diener et al., 1999). Life satisfaction was rated from 0 "*Worst possible life*" to 10 "*Best possible life*" using the Cantril Ladder (Cantril, 1965; Mazur et al., 2018). Positive and negative affect were measured using available HBSC items. A single item ("*I am full of energy*") from the Positive and Negative Affect Schedule for Children (PANAS-C) (Laurent et al., 2005) was used to measure positive affect. Negative affect was measured using the items "*I often feel lonely*" and "*I often feel helpless*" (five response options: "*Strongly Agree*" to "*Strongly Disagree*") from the PANAS-C (Laurent et al., 2005) and the Implicit Positive and Negative Affect Test (IPANAT) (Quirin et al., 2009). To achieve equal weighting, life satisfaction, positive affect, and negative affect were standardized to have a mean of 50 and standard

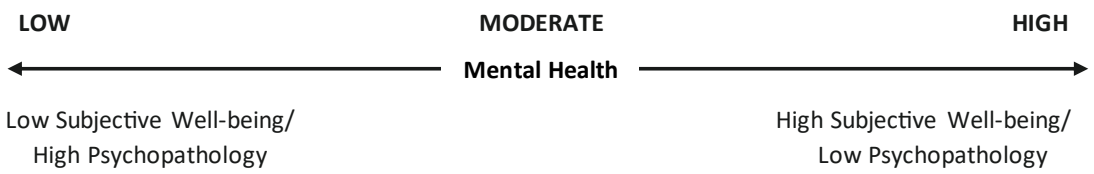

FIGURE 2
Composite continuous measure of mental health inspired by the Dual-factor Model (Greenspoon and Saklofske, 2001; Wang et al., 2011). Psychopathology = sum of standardized internalized and externalized symptom scores; subjective well-being (SWB) = standardized negative affect score subtracted from sum of standardized life satisfaction and positive affect scores. Each score was then standardized to have a mean of 50 and standard deviation of 10.

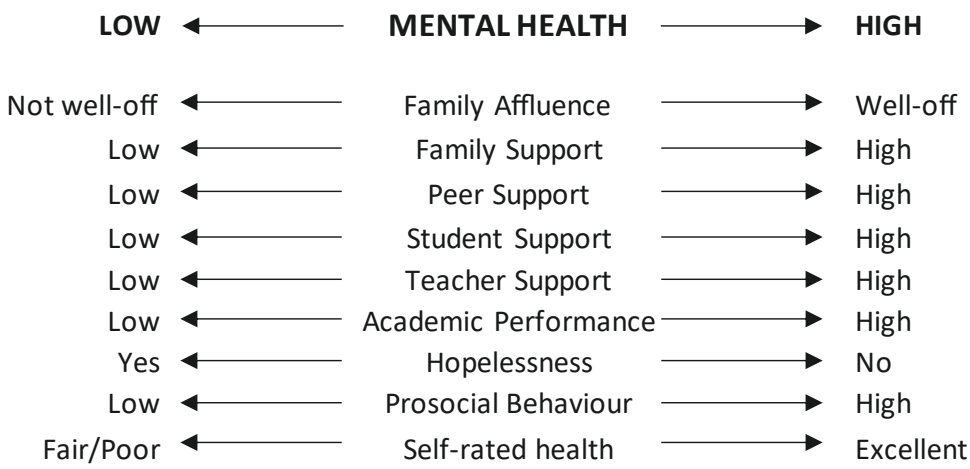

FIGURE 3
Expected relationships between family affluence, social support, academic functioning, and indicators of mental health, and the composite mental health score.

deviation of 10. A *SWB score* was calculated by summing standardized life satisfaction and positive affect scores, and then subtracting the standardized negative affect score [SWB = (life satisfaction + positive affect) – negative affect] (Diener et al., 1999; Suldo and Shaffer, 2008).

Psychopathology

Internalized symptoms were assessed *via* the four-item psychological symptoms subscale of the subjective health complaints scale (range = 0 to 16; α = 0.79) (Hetland et al., 2002; Freeman et al., 2016). Students reported how often they had the following in the past 6 months: "*Feeling low (depressed),*" "*Irritability or bad temper,*" "*Feeling nervous,*" "*Difficulties in getting sleep*" (five response options: "*Rarely or never*" to "*About every day*"). Externalized symptoms were measured using an overt risk-taking scale, that combined the frequency of engagement ("*None,*" "*Infrequent,*" "*Frequent*") in the following behaviors: alcohol consumption, lifetime drunkenness history, smoking history, use of alternative tobacco products, physical fighting, caffeinated energy drink consumption, and non-helmet use on a bicycle (α = 0.75) (Kwong et al., 2018). Internalized and externalized symptom scores were also standardized to have a mean of 50 and standard deviation of 10. The *psychopathology (PTH) score* used in the composite mental health measure was calculated by summing the adolescent's internalized and externalized symptoms scores. Both internalized and externalized symptoms were included because some adolescents are more likely to internalize their distress, while others are more likely to act out and externalize their behaviors (Herpertz-Dahlmann et al., 2013).

Variables used in the validation test

Construct validity was assessed by examining whether mental health scores differed in the expected direction on variables describing academic functioning, social support, demographic characteristics, and specific indicators of mental health, as illustrated in **Figure 3** (Desocio and Hootman, 2004; Freeman et al., 2011; McAdam et al., 2018).

The measures described below have been scrutinized for face validity and shown to have strong construct validity and internal consistency reliability where applicable (Currie et al., 2014).

Demographic characteristics

Age was categorized as ≤ 11, 12, 13, 14, or ≥ 15 years old, and youth identified as either "*Male*" or "*Female.*" Relative family affluence was measured using the item: "*How well off do you think your family is?*" ("*Well-off,*" "*Average,*" "*Not well-off*").

Social support

Family and peer support were measured using the Multidimensional Scale of Perceived Social Support (MPSS) (Zimet et al., 1988). Family support was assessed using four items describing whether students believe their family is available and willing to help them in times of need (five response options: "*Strongly disagree*" to "*Strongly agree*") (range = 0 to 16; α = 0.91) (Freeman et al., 2016). Peer support was measured using a four-item scale (range = 0 to 16; α = 0.92), describing beliefs they have friends they can count on and confide in (five response options: "*Strongly disagree*" to "*Strongly agree*") (Freeman et al., 2016).

Academic functioning

Student support was measured using a 3-item HBSC scale (range = 0 to 12; α = 0.80), capturing students' perceptions of their peers within the school environment (five response options: "*Strongly disagree*" to "*Strongly agree*") (Ravens-Sieberer et al., 2009; Freeman et al., 2016). Teacher support was assessed using nine items (range = 0 to 36; α = 0.90) related to students perceptions of their teachers feelings toward them, and how they felt about their teachers (five response options: "*Strongly disagree*" to "*Strongly agree*") (Freeman et al., 2016). Academic performance was measured using five categories describing average marks in the past year (1 = "*Mostly letter grades below C/below 50%/or level 1,*" 2 = "*Mostly Cs/between 50 and 59%/or level 2,*" 3 = "*Mostly Bs and Cs/between 60 and 69%/or level 3,*" 4 = "*Mostly As and Bs/between 70 and 84%/or level 3 and 4,*" 5 = "*Mostly As/above 85%/or level 4*").

Mental health indicators

Hopelessness (*Yes* or *No*) was assessed with the item: "*During the past 12 months, did you ever feel so sad or hopeless almost every day for 2 weeks or more in a row that you stopped doing some usual activities.*" This item is the first of five in the Youth Risk Behavior Survey (YRBS) suicidality scale, and a strong predictor of clinical depression (Harter and Whitesell, 1996). Prosocial behavior was measured using a 5-item scale (range = 0 to 25) capturing how often youth engage in behaviors that put others before themselves (α = 0.87) (Freeman et al., 2016). Finally, self-rated health status was measured with the item: "*Would you say your health is. . .?*" ("*Excellent,*" "*Good,*" "*Fair,*" or "*Poor*").

Analysis

All analyses were conducted using SAS Version 9.4 (SAS Institute, Cary, NC, United States, 2016).

Developing the measure

The adolescent's psychopathology and SWB scores were each standardized to have a mean of 50 and standard deviation of 10. The composite mental health score was then calculated by subtracting the psychopathology score (higher score = higher psychopathology) from the SWB score (higher score = higher well-being). The resulting score was similarly standardized, with higher scores corresponding to better mental health (**Figure 2**).

Testing the measure

Sample weights were applied to all analyses. Average mental health scores were described by available covariates (**Figure 3**). Continuous covariates were modeled using approximate quartiles based on the sample distribution. Mixed-effects linear regression was used to test for group differences adjusting for age and sex, and clustering by school using random effects. Cohen's d was calculated as a standardized measure of effect size (values ≥ 0.8 are considered large, and ≥ 1.2 very large) (Sawilowsky, 2009). Assuming a standard deviation of 10 the analysis was 80% powered to detect differences between means of 0.5 to 2.5, two-sided alpha = 0.05. The above analysis was repeated in the "Mentally Healthy" group as defined according to the four-category Dual-factor Model (King et al., 2021), to examine within group variation in average mental health scores.

Results

The sample used to create the measure (n = 21,993) was 53% female with an average age of 14.0 (SD = 1.41) years. Approximately two-thirds of the sample identified as White, one-fifth were born outside of Canada, and over 80% lived in a home with two adults. The composite mental health score ranged from 5 to 67 [weighted Mean (SD) = 50.1 (9.8)], with higher scores indicating better mental health. The distribution was moderately skewed toward poor mental health (skewness = −0.72). Based on the intraclass correlation coefficient of 0.038, 3.8% of the variability in mental health scores could be attributed to school-level factors.

For the analyses examining the mental health score by selected covariates, the sample was restricted to students with complete data [n = 18,720 (weighted n = 18,867)]. Adolescents that were excluded because of missing

data were comparable to those included by age, gender, relative family affluence, and self-rated health status ($p > 0.05$).

Average mental health scores were significantly different by the covariates examined ($p < 0.001$), in the expected direction (p-trend < 0.001) (**Table 1**). Mental health scores were lower in girls and decreased with increasing age. Being in a more supportive and affluent family, and having more supportive relationships with peers, teachers, and other students were associated with greater mental health. Higher marks in school were also associated with better mental health. Average mental health scores were significantly lower if students reported having felt hopeless or rated their health as fair or poor. Differences were most pronounced (Cohen's d > 1.2) for family support, academic achievement, feelings of hopelessness, and self-rated health.

Average mental health scores are described in students categorized as mentally healthy according to the categorical Dual-factor Model in **Table 2**. Within this group average mental health scores consistently differed by the covariates examined ($p < 0.001$), and in the expected direction ($p < 0.001$) (**Table 2**). The differences in means for each covariate reached moderate to very large in size according to Cohen's d (0.63 to 1.38) (Sawilowsky, 2009).

Discussion

Inspired by the Dual-factor Model (Greenspoon and Saklofske, 2001; Suldo and Shaffer, 2008; Wang et al., 2011), a novel continuous measure of mental health was developed in a representative sample of Canadian adolescents by combining measures of SWB and psychopathology. In tests of this measure, large and significant differences in mental health scores were identified in the expected direction for all covariates examined, including indicators of social support, academic functioning, global health status, and feelings of hopelessness. This provides evidence in support of the construct validity of this continuous measure. We believe it can be used as a summary indicator of mental health status.

The development of our measure was guided and supported by a contemporary theory of mental health (Greenspoon and Saklofske, 2001; Suldo and Shaffer, 2008). According to the Dual-factor Model, which argues that mental health is comprised of two separate but related constructs, this measure has greater content validity than measures that consider one dimension (Greenspoon and Saklofske, 2001; Suldo and Shaffer, 2008; Wang et al., 2011). By combining the positive and negative dimensions of mental health a more accurate and comprehensive assessment of overall mental health status can be made than if they are considered separately (Wang et al., 2011). By including more information, it may also be a more stable and reliable measure of mental health than relying on a single dimension, potentially reducing random measurement error.

In studies that have operationalized a categorical dual-factor measure, adolescents who scored positively on measures of psychopathology and well-being reported better functioning (e.g., higher grade point average and more social support) than those who scored positively on one dimension only (Suldo and Shaffer, 2008; Antaramian et al., 2010; Kelly et al., 2012). The presence of well-being in addition to the absence of psychopathology is essential to optimal or complete mental health (Wang et al., 2011). On the opposite end of the spectrum, low well-being in the presence of active mental illness is associated with the worst mental health and functioning (Wang et al., 2011). This is consistent with the two ends of the mental health continuum defined by our measure (**Figure 2**), and our finding of a linear increase in average mental health scores with increasing support and academic functioning.

A potential limitation of the continuous measure is that it cannot distinguish whether suboptimal mental health is related to deficits in well-being or the presence of psychopathology. These two groups might have different etiological factors at work, interventional needs, and risk trajectories. The categorical dual-factor measure may be better suited for identifying the source of adolescents current or future mental health-related difficulties, and the appropriate strategy for intervention (i.e., treating symptoms, or promoting well-being). The continuous measure, however, is well suited for population health research aimed at examining associations between risk and protective factors and levels of adolescent mental health. In this study we consistently identified significant differences in the expected direction between the continuous measure of mental health and various indicators of mental functioning, suggesting that different levels of mental health are accurately captured across the full continuum of possible scores. Further, the two groups that cannot be differentiated with the continuous measure (symptomatic yet content, and asymptomatic yet discontent) report similar academic functioning (Suldo and Shaffer, 2008; Antaramian et al., 2010) and physical health (Suldo and Shaffer, 2008). However, symptomatic yet content youth often report more supportive relationships with family and peers (Antaramian et al., 2010; Kelly et al., 2012), and greater emotional and cognitive engagement at school (Antaramian et al., 2010).

Unlike the categorical dual-factor measure (Greenspoon and Saklofske, 2001; Wang et al., 2011), the continuous version takes advantage of the full range of data. Categorizing mental health ignores within group heterogeneity, potentially leading to an underestimate of effects, and the concealing of non-linearity in the relationships of interest (Altman and Royston, 2006). In studies operationalizing a categorical measure the majority of adolescents are grouped as mentally healthy (as high as 67%) (Antaramian et al., 2010). This means that the majority of

TABLE 1 Description of the 2014 HBSC sample by average mental health score.

Sex	*n*	(%)	Mean	(SD)	*p**	*p*-trend*	Cohen's d
Male	8,774	(46.5)	51.6	(8.8)	ref	/	0.30
Female	10,093	(53.5)	48.7	(10.5)	<0.001		
Age							
≤11	1,645	(8.7)	54.8	(7.6)	ref	<0.001	ref
12	3,102	(16.4)	53.4	(8.5)	<0.001		0.17
13	3,550	(18.8)	51.6	(9.2)	<0.001		0.38
14	4,303	(22.8)	49.3	(9.7)	<0.001		0.63
≥15	6,266	(33.2)	46.8	(10.2)	<0.001		0.89
Relative family affluence							
Well-off	10,701	(56.7)	52.4	(9.0)	ref	<0.001	ref
Average	6,484	(34.4)	48.0	(9.2)	<0.001		0.48
Not well-off	1,682	(8.9)	43.5	(12.1)	<0.001		0.83
Family support							
High	5,242	(27.8)	56.0	(7.6)	ref	<0.001	ref
Q2	5,744	(30.4)	52.2	(7.4)	<0.001		0.51
Q3	3,977	(21.1)	47.6	(8.5)	<0.001		1.04
Low	3,904	(20.7)	41.5	(10.0)	<0.001		1.63
Peer support							
High	4,830	(25.6)	53.0	(9.6)	ref	<0.001	ref
Q2	3,190	(16.9)	51.2	(9.5)	<0.001		0.19
Q3	6,112	(32.4)	49.8	(9.2)	<0.001		0.34
Low	4,734	(25.1)	46.6	(10.0)	<0.001		0.65
Student support							
High	4,762	(25.2)	54.8	(8.1)	ref	<0.001	ref
Q2	4,708	(25.0)	51.9	(8.2)	<0.001		0.36
Q3	5,007	(26.5)	49.0	(9.2)	<0.001		0.67
Low	4,389	(23.3)	44.1	(10.4)	<0.001		1.15
Teacher support							
High	4,761	(25.2)	55.9	(7.3)	ref	<0.001	ref
Q2	4,893	(25.9)	52.0	(7.8)	<0.001		0.52
Q3	4,537	(24.1)	48.7	(8.8)	<0.001		0.89
Low	4,675	(24.8)	43.4	(10.7)	<0.001		1.36
Academic performance							
A's/>84%/level 4	6,036	(32.0)	52.4	(8.1)	ref	<0.001	ref
A's & B's/70–84%	9,156	(48.5)	50.2	(10.0)	<0.001		0.24
B's & C's/60–69%	2,994	(15.9)	46.7	(11.0)	<0.001		0.59
C's/50–59%	556	(3.0)	43.4	(10.2)	<0.001		0.98
<C's/<50%/level 1	124	(0.7)	38.7	(10.4)	<0.001		1.47
Self-rated health status							
Excellent	5,626	(29.8)	54.9	(8.0)	ref	<0.001	ref
Good	10,160	(53.9)	49.8	(8.9)	<0.001		0.60
Fair/poor	3,081	(16.3)	42.2	(10.3)	<0.001		1.38
Feelings of hopelessness							
No	13,889	(73.6)	53.4	(7.4)	ref	/	1.43
Yes	4,978	(26.4)	40.9	(9.9)	<0.001		
Prosocial behavior							
High	4,979	(26.4)	52.1	(10.2)	ref	<0.001	ref
Q2	4,530	(24.0)	50.6	(9.5)	<0.001		0.15
Q3	5,353	(28.4)	49.3	(9.5)	<0.001		0.28
Low	4,005	(21.2)	47.8	(9.6)	<0.001		0.43

(1) Values are weighted, (2)*All *p*-values obtained from mixed effects multivariable linear regression models that adjusted for age and sex, and clustering by school.

the distribution of the continuous measure, and a potentially wide range of mental health is collapsed into this one group. In a secondary analysis we examined whether average mental health scores differed by indicators of academic and social functioning, and self-rated health in the mentally health group defined by the categorical dual-factor model (King et al., 2021). Results showed significant variability in functioning within this group. These findings suggest that significant variability

in mental health status is masked by the categorical measure, and the continuous measure is able to differentiate levels of mental health within "mentally healthy" adolescents, and across the full range of the distribution. This appears to be a distinct advantage of the continuous dual-factor measure over its categorical counterpart.

The continuous measure also provides a more viable option for smaller studies with limited power. In studies categorizing mental health, one or more of the mental health groups is represented by a small percentage of the sample (<12% is common) (Suldo and Shaffer, 2008; Antaramian et al., 2010; Kelly et al., 2012). In smaller samples it becomes difficult to impossible to run a statistical analysis and/or generate meaningful results on a category with such small numbers. Finally, irrespective of sample size a continuous measure is more easily modeled in advanced statistical applications than a four-category nominal variable. In standard path analysis for example there is an assumption that variables are measured on an interval scale (O'Rourke and Hatcher, 2013). Fitting a model with a nominal categorical variable adds complexity in all stages of the analysis from conceptualization to interpretation of the output.

Future studies combining the two dimensions of mental health into a continuous measure might consider different weighting, based on findings that symptomatic yet content youth on average appear to report slightly greater mental functioning than asymptomatic yet discontent youth (i.e., giving more weight to SWB) (Suldo and Shaffer, 2008; Antaramian et al., 2010; Kelly et al., 2012). Future studies might also consider whether internalized and externalized symptoms should be treated equally, as they were in this study. Internalized symptoms (e.g., anxiety

TABLE 2 Description of the average mental health score by indicators of social support, academic functioning, and self-rated health in "mentally healthy" adolescents according to the categorical dual-factor measure† [weighted *n* = 14,994 (67.6% of the full sample)].

	n	(col%)	Mean	(SD)	*p**	*p*-trend*	Cohen's d
Family support							
High	4,993	(33.7)	58.0	(5.5)	ref	<0.001	ref
Q2	5,173	(34.9)	54.7	(5.2)	<0.001		0.62
Q3	2,903	(19.6)	52.2	(5.3)	<0.001		1.07
Low	1,744	(11.8)	50.2	(5.8)	<0.001		1.38
Peer support							
High	4,196	(28.3)	56.8	(6.3)	ref	<0.001	ref
Q2	2,575	(17.3)	55.6	(5.7)	<0.001		0.20
Q3	4,948	(33.3)	53.9	(5.7)	<0.001		0.48
Low	3,128	(21.1)	53.0	(5.8)	<0.001		0.63
Student support							
High	4,363	(29.5)	57.6	(5.5)	ref	<0.001	ref
Q2	4,024	(27.2)	55.0	(5.6)	<0.001		0.47
Q3	3,830	(25.9)	53.5	(5.6)	<0.001		0.75
Low	2,554	(17.3)	51.7	(6.2)	<0.001		1.01
Teacher support							
High	4,532	(31.4)	57.9	(5.2)	ref	<0.001	ref
Q2	4,175	(28.9)	54.9	(5.4)	<0.001		0.53
Q3	3,323	(23.0)	52.8	(5.7)	<0.001		0.93
Low	2,404	(16.7)	51.4	(6.3)	<0.001		1.13
Academic performance							
A's/>84%/level 4	5,245	(35.6)	55.4	(5.6)	ref	<0.001	ref
A's & B's/70–84%	7,157	(48.6)	54.9	(6.1)	<0.001		0.09
B's & C's/60–69%	2,014	(13.7)	53.4	(6.6)	<0.001		0.33
C's/50–59%	277	(1.9)	52.9	(6.2)	<0.001		0.42
<C's/<50%/level 1	42	(0.3)	51.0	(5.0)	<0.001		0.83
Self-rated health status							
Excellent	5,210	(35.0)	57.4	(5.6)	ref	<0.001	ref
Good	8,155	(54.8)	53.9	(5.8)	<0.001		0.61
Fair/poor	1,507	(10.1)	50.8	(5.5)	<0.001		1.19

(1) Values are weighted, (2)*All *p*-values obtained from mixed effects multivariable linear regression models that adjusted for age and sex, and clustering by school, and (3) †A description of the categorical dual-factor measure is described elsewhere (King et al., 2021).

and depression) may have a stronger correlation with overall mental health status than externalized symptoms for example, which could be accounted for in the development of the measure.

Strengths of this study included the use of a large, representative sample of Canadian adolescents to develop and test a novel measure of adolescent mental health, making the results generalizable to a wide population. Well-validated scales were used to measure life satisfaction, psychopathology and the covariates included in the tests of construct validity (Currie et al., 2014). This study provides a practical approach to developing a valid, contemporary measure of mental health status that can be applied in future research studies. Several limitations also warrant comment. Because this was a secondary analysis, limited data were available for measuring well-being and psychopathology. The use of validated scales rather than individual items to measure the indicators of well-being, particularly positive and negative affect, could further strengthen the measure. Similarly, the inclusion of other measures of externalized symptoms (e.g., aggression, impulsivity, and hyperactivity) could also strengthen the measure. The use of self-report data likely resulted in some social desirability bias, especially for externalized symptoms.

Conclusion

In this study we demonstrated a novel approach to developing a valid measure of adolescent mental health status that is more accurate and comprehensive than traditional unidimensional measures and has advantages over the categorical version. A continuous measure of adolescent mental health based on the Dual-factor Model appears to be construct valid and has applications for public health research aimed at increasing our understanding of the factors and circumstances that influence adolescent mental health.

Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: Data cannot be shared publicly due to Health Behavior in School-aged Children (HBSC) restrictions. However, data are available for researchers who meet the criteria for access to confidential data. Requests to access these datasets should be directed to dmc@hbsc.org.

Ethics statement

Ethics approval for the HBSC study was obtained from the Public Health Agency of Canada (REB 2013-0022), and the Queen's University Ethics Board (GREB TRAQ #: 6010236). Participation was voluntary, and written informed consent (explicit or implicit depending on local protocol) was obtained from school administrators, parents, and participating students.

Author contributions

NK, CD, and WP contributed to the design and conception of the study. NK performed the statistical analysis and wrote the first draft of the manuscript. All authors revised the manuscript and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Destructive interparental conflict affects Chinese children's emotional and behavioral problems: Indirect pathways *via* parent–child attachment and emotional insecurity

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Background: Previous studies have demonstrated that destructive interparental conflict (IPC) is closely related to the emergence of emotional and behavioral problems in adolescents. In addition, in the family system, such conflict also affects the patent–child attachment relationship and emotional insecurity of adolescents.

Objectives: This study mainly explores the relationship between destructive interparental conflict and adolescents' emotional and behavioral problems, focuses on the role of parent–child attachment and emotional insecurity, and analyzes whether this relationality plays multiple mediating roles in the influence of destructive interparental conflict on emotional and behavioral problems.

Methods: Data for the study were obtained through a questionnaire survey conducted on 524 Chinese adolescents from primary and junior high school.

Results: Structural equation modeling was conducted to test direct and indirect pathways between destructive interparental conflict and Chinese adolescents' emotional and behavioral problems. Destructive IPC negatively predicted parent–child attachment and parent–child attachment negatively predicted emotional and behavioral problems. Destructive Interparental conflict positively predicted emotional insecurity and emotional insecurity positively predicted emotional and behavioral problems.

Discussion: The results show that: (1) Parent–child attachment negatively predicted emotional and behavioral problems, and emotional insecurity positively predicted the same. (2) Parent–child attachment and emotional insecurity act in a multiple mediating role between destructive IPC and adolescents' emotional and behavioral problems. (3) Parent–child attachment and emotional insecurity constitute two indirect pathways between destructive IPC and adolescents' emotional and behavioral problems, respectively.

Conclusion: Destructive IPC can adversely affect emotional and behavioral problems among adolescents; destructive IPC plays a damaging role in their emotional security and parent–child attachment, consequently effecting emotional and behavioral problems.

KEYWORDS

destructive interparental conflict, parent–child attachment, emotional insecurity, Chinese children, emotional and behavioral problems

Introduction

Adolescents' emotional and behavioral problems

Early adolescence is a critical developmental period for emotional and behavioral problems (Yang et al., 2019), with the emotional and behavioral problems that commonly emerge during this time ascending the risk of life-long impairment (Patton et al., 2016). Adolescents with such emotional and behavioral problems often tend to be asocial and show poor peer interaction, emotional instability (Weymouth et al., 2019), depression, and anxiety (Ran et al., 2021). There is evidence that children with moderate to severe emotional and behavioral problems in the preschool period are difficult to change in the adolescents and develop dysfunction, negatively impacting their peer relationships, self-development, academic, and family function over the long-term (Liu et al., 2022). Whether it is for individuals, families, or society as a whole, adolescents' emotional and behavioral problems should attract sufficient attention. In this regard, then, studying the influence factors of adolescents' emotional and behavioral problems is significant for the development of intervention measures that reduce such behavior and improve adolescents' mental health.

Destructive interparental conflict and adolescents' emotional and behavioral problems

Destructive interparental conflict refers to verbal or physical attacks or disputes between husband and wife, due to disagreement or other reasons (Chi, 2003). Moreover, the parental relationship has a general influence on adolescents' self-awareness, personality characteristics, mental health, and behavior (Lucas-Thompson et al., 2015). Research shows that children from divorced but conflict-free homes have fewer emotional and behavioral problem than children whose parents remain in an unhappy marriage (Borrine et al., 1991), adolescents who grow up in a family with a harmonious parental relationship and warm atmosphere have a higher level of self-awareness than those who grow up in families with a tense parental relationship; the latter tend to become confident and full of happiness and hope for the future.

The quality of the parental relationship is considered a key factor in the psychopathology of adolescents and adolescents (Harold and Sellers, 2018). In the early development of infants, parents' neglect and abuse affect adolescents' neurodevelopment (Davies et al., 2017). Emotional neglect of adolescents, caused by destructive Interparental Conflict (IPC), will continue to affect the emergence of adolescents' emotional and behavioral problems, especially leading to depression and low ability in emotional adjustment and social adaptation (Davies et al., 2017), Most such problems are connected to growing up in disharmonious and unhappy families. Compared with those who have experienced constructive IPC, adolescents with destructive IPC will have more emotional and behavioral problems (Adare et al., 2021). Since witnessing destructive IPC, or experiencing parents' divorce, is the primary adverse event in adolescents' growth period, it is closely related to their emotional and behavioral problems. Therefore, this study intends to investigate the relationship and possible pathways between destructive IPC and adolescents' emotional and behavioral problems among Chinese adolescents.

An indirect pathway through child–parent attachment

Based on *Attachment Theory*, parents form the source for adolescents' initial emotions (Tracy, 2001). Parent–child attachment formed under a harmonious parent–child relationship can promote adolescents' healthy emotional development. Attachment is a primary side of the parent–child relationship that makes adolescents feel secure and unthreatened in the family environment (Ali et al., 2021). Research revealed that insecure attachment was negatively correlated with both social adjustment and mental health (Brumariu and Kerns, 2010). In the view of life history (LH) theory, the attachment styles in childhood interact with other behavioral developments (Hawley et al., 2009), at the same time, fast LH strategies, i.e., less investment in adolescents' growth and less attention to adolescents' learning, cognitive development, and parenting are often associated with unsafe and unpredictable adolescents' environments, negative environmental influences can be up-regulated or exacerbated with insecure

attachment (Lu and Chang, 2019; Lu et al., 2022). Unpredictability experienced by children before the age of 10, such as family dislocation, unstable family relationships, positively predicts aggressive behaviors in adolescent and young adulthood (Ellis et al., 2021). Children in insecure attachment families will tend to adopt coercive strategies to compete with their peers in the face of adverse social realities (Chen and Chang, 2012). In the family environment parents' marital relationship and quality will also affect the parent–child relationship, and the level and quality of parent–child attachment to a certain extent. Therefore, parents' neglect of adolescents' emotions caused by destructive IPC has indirect and inverse effects in predicting safe child–father attachment (Schudlich et al., 2019).

Parents' participation reduces adolescents' anxiety and attachment (Barone et al., 2021). Attachment plays an important role in the development of adolescents' emotional skills. Adolescents in secure attachment recognize emotional expressions of others faster than in insecure attachment (Mirbagheri et al., 2020).

A good parent–child attachment relationship can positively predict behaviors and habits among Chinese adolescents (Mo et al., 2021). Frequent parental conflicts can cause parents to ignore adolescents' feelings and tend to invest little and do not interact with adolescents. This can lead to lower levels of parent–child attachment, which, in turn, can increase the risk of adolescents' emotional and behavioral problems. Therefore, in this study, we regard parent–child attachment as one of the important predictors of adolescents' emotional and behavioral problems.

An indirect pathway through emotional insecurity

Emotional security is a sense of security, stability, and happiness that adolescents obtain in a safe family environment and stable parental relationship. Emotional Security Theory (EST; Davies et al., 2016) explains that a high degree of emotional insecurity among adolescents is caused by their involvement in frequent and intense exposure to destructive IPC. This mainly includes two aspects: negative emotional response, stress behavior response. Existing studies have indicated that the adjustment of husband and wife is an important factor in forming the family emotional atmosphere, which helps to increase resiliency in the face of stressful life events, and is of great significance to family health. Therefore, when negative interparental behaviors, which also comprise destructive IPC, are buffered by positive interactions, they will pose a lesser threat to the child's sense of security (Zemp et al., 2019). Furthermore, when a child feels that the stable family structure is threatened under destructive IPC, they become emotionally disturbed, and even use a negative or avoidant posture to protect themselves, connecting with school problems (Martin et al., 2017). In short, emotional insecurity is a lack of security caused by unexpected life events during childhood.

Furthermore, such adolescents with emotional insecurity also show poor sleep quality, which, in turn, leads to poor academic performance and poor interaction with friends; the latter also leads to poor social skills (Davies et al., 2017), bad peer relationship, and other behaviors problem, for instance, internet addiction (Zhou et al., 2017). Previous studies have concluded that the quality of the mother's emotion and emotional attachment relationship will be carried over to the child across generations (Cooke et al., 2019). When the mother is in conflict with her spouse, adolescents will also experience similar negative emotional reactions in the family environment, and this can lead to a decreasing quality of the attachment relationship. Furthermore, this insecurity and emotional and behavioral problems will continue to remain for some time (Carlone and Milan, 2021). Insecurities in emotional experience are reinforced by frequent family conflicts. Studies have also found that emotional insecurity can predict the relationship between parents' marital conflict and adolescents' emotional and behavioral problems (Davies et al., 2017), Therefore, we regard emotional insecurity as one of the important predictors of emotional and behavioral problems among Chinese adolescents.

Destructive IPC will have immediate and long-term negative effects on adolescents' emotional and behavioral problems. Its immediate influence will make adolescents exhibit low and nervous psychological reactions when faced with conflict. Its long-term influence refers to a series of emotional and behavioral problems, such as unstable peer interaction, caused by destructive IPC, which eventually influences adolescents' social interaction mechanism.

In summary, based on the aforementioned theories and previous research, this study aimed to investigate the impact of destructive IPC on emotional and behavioral problems among Chinese adolescents and their internal mechanism, and proposed four hypotheses (as shown in Figure 1). (1) Destructive IPC is positively correlated with emotional and behavioral problems among Chinese adolescents; (2) Parent–child attachment can negatively predict emotional and behavioral problems and emotional insecurity can positively predict emotional and behavioral problems; (3) Parent–child attachment and emotional insecurity play an intermediary role between destructive IPC and Chinese adolescents' emotional and behavioral problems respectively; and (4) Parent–child attachment and emotional insecurity play multiple intermediary roles between destructive IPC and adolescents' emotional and behavioral problems.

Materials and methods

Participants and procedure

This study used convenient sampling, 524 participants from primary school and junior high school volunteered to participate in our research, 252 girls (accounting for 48.1%), 272 boys (accounting for 51.9%), M_{age} = 13.69 years, SD = 1.37 years (min = 12, max = 17). The data were collected with the prior consent of the school teacher, and obtained the

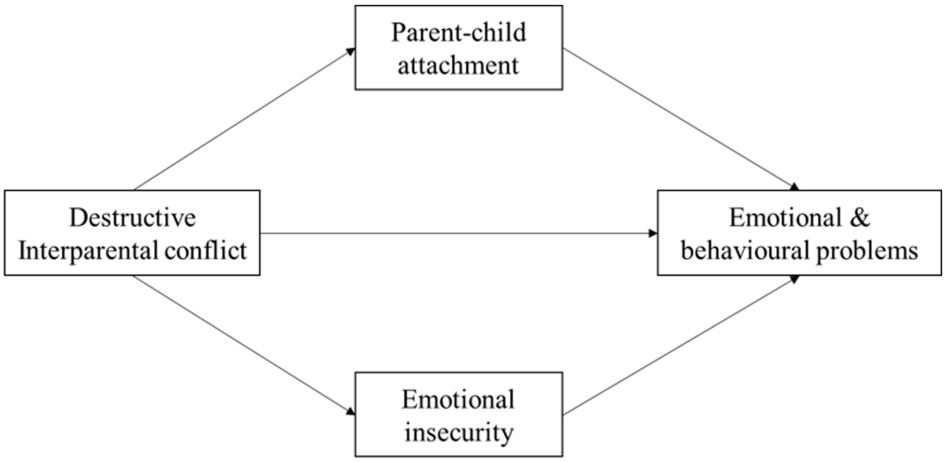

FIGURE 1
Hypothetical indirect pathways between destructive interparental conflict and adolescents' emotional and behavioural problems.

consent of the parents of the participants through the head teacher of the participants in 2018. Communicated with the head teacher to explain the purpose and requirements of this research, the head teacher and graduate students majoring in psychology were the testers, the questionnaire was distributed by class. Schools, parents, and adolescents are actively involved in data collection. In terms of the family structure, 467 participants were reported from nuclear family, 38 from single-parent family, and 19 from stepfamily. This study was approved by the Ethics Committee of North China University of Science and Technology.

Before the questionnaire completion, trained research assistants introduced the purpose of data collection, and provided guidance on how to fill out the survey. Participants were ensured that their responses will be anonymous and confidential.

Demographic variables

Participants reported their sex (1 = boy, 0 = girl), age, family structure (1 = nuclear family, 2 = single-parent family, and 3 = stepfamily), and subjective socio-economic status (SES). Subjective SES was assessed by self-reported.

Measures

Children's perception of interparental conflict scale

The Children's Perception of Interparental Conflict Scale (CPIC) compiled by Grych et al. (1992) and revised by (Chi and Xin, 2003) was selected. The scale has ideal psychometric indexes and suitable for Chinese participants (Chi and Xin, 2003). The scale has 40 items, which are divided into two factors: conflict characteristics and conflict evaluation. The conflict characteristics include three conflict dimensions of frequency, intensity, and resolution, such as 'My parents rarely quarrel.' Participants rated each item on a 4-point Likert-type scale from 1 (*absolutely true*) to 4 (*not at all true*). This study only uses conflict characteristic factors to measure parental marital conflict. Scores were averaged across items, so that higher scores indicate the higher frequencies of conflict, higher intensity of conflict, and lower levels of resolution. Latent variable of destructive interparental conflict was constructed using the dimension scores of frequency, intensity, and resolution. The Cronbach'α coefficient of the scale was 0.910.

The inventory of parent and peer attachment

The Inventory of Parent and Peer Attachment (IPPA Scale; Armsden and Greenberg, 1987) was selected, the scale has ideal psychometric indexes and suitable for Chinese participants (Ju et al., 2011), which was divided into two subscales: child–parent attachment and peer attachment. Each subscale groups into three dimensions: trust, communication, and alienation. As the research direction of this paper is the mediating role of parent–child attachment, we choose the subscale of parent–child attachment, which consists of 28 questions, including 10 questions of trust, 10 questions of communication, and 8 questions of alienation, adapting 5-point Likert's scoring method, with scores ranging from 1 to 5. The response format was 1 (*never*) to 5 (*always*). Latent variable of parent–child attachment was constructed using the dimension scores of trust, communication, and alienation. The higher the latent variable score of participants, the better the attachment quality. The Cronbach' α coefficient of the scale was 0.826.

Security in the interparental subsystem scale

Security in the Interparental Subsystem Scale (SIS Scale; Davies et al., 2002) was used to assess how adolescents balance emotional security when facing the interparental conflict between parents in the natural environment. The scale consists of 37 items, including emotional reactivity, behavioral disorders, avoidance, involvement, constructive family representations, destructive family representations, conflict spillover representations, etc. Due to the lack of factor validity of the three factors of behavioral disorder, avoidance, and involvement in the original scale, then only three factors of emotional reactivity, destructive family representations, and conflict spillover representations were used as SIS scales for Chinese adolescents groups to measure the emotional insecurity of adolescents facing interparental conflict, which is revised by Wang et al. (2014). Latent variable of emotional insecurity was constructed using three factors in this study. The scale has ideal psychometric indexes and suitable for Chinese participants. The revised questionnaire combines destructive family representations and conflict spillover representations into the dimension of negative representation, which reflects the destructiveness of interparental conflict perceived by children to their own family happiness, and possesses good reliability and validity. The revised questionnaire consists of 17 questions (the dimension of emotional reactivity includes 9 questions, the dimension of destructive family representations includes 4 questions, and the dimension of conflict spillover representations includes 4 questions), adapting Likert's 4-point scoring method. The response format was 1 (*not at all true*) to 4 (*absolutely true*). The Cronbach' α coefficient of the scale was 0.922.

Strengths and difficulties questionnaire

Difficulty and Strengths Questionnaire (SDQ Questionnaire) was adopted by Goodman (1997). The questionnaire was divided into parent version, teacher version, and student version, which was suitable for children and adolescents aged 4–16 years. In the study, the student version of SDQ was used for measurement, which is the simplified Chinese version published by SDQ official website.[1] The research shows that the Chinese version of SDQ possesses good reliability and validity, and can be used to evaluate the mental health status of Chinese children and adolescents (Xu et al., 2019). Student version of SDQ questionnaire has 25 items, which are divided into five dimensions: conduct problems, emotional symptoms, hyperactivity-inattention, peer problems, and prosocial behaviors. Among them, 10 items are advantages, 14 items are difficulties, and 1 item is neutral. Each item is graded according to level 3, with 0 score for '*not at all true,*' 1 score for '*somewhat true*' and 2 points for '*absolutely true.*' Among them, the 7th, 11th, 14th, 21st, and 25th items are entitled reverse scoring items, with 2 points for '*not at all true*' 1 point for '*somewhat true*' and 0 point for '*absolutely true.*' We use these five dimensions to construct the latent variable to evaluate adolescents' emotional and behavioral problems. The Cronbach'α coefficient of the scale was 0.710.

Analytical procedure

First, Harman's single-factor test was used to check for common method variance. Then, SPSS 25.0 was used to conduct descriptive statistics and zero-order correlation analyses controlling for age, gender, SES, and family structure. Finally, basing on latent variables constructing by the dimensions of each scale, the structural equation model was constructed by AMOS 24.0, with destructive IPC as the independent variable, adolescents' emotional and behavioral problems as the dependent variable, and parent–child attachment and emotional insecurity as mediating variables. The model was assessed using a combination of indices and criteria, such as $\times 2/df < 5$, CFI > 0.90, TLI > 0.90, RMSEA < 0.08, and SRMR < 0.05. The mediating effect was measured by bootstrapping with 5,000 resamples drawn to derive the 95% confidence intervals (CIs).

Results

Common method biases

Since interparental conflict, parent–child attachment, emotional insecurity, and emotional and behavioral problems are measured by self-report, there may be common method bias in this study, Harman's single-factor test was used to verify common method bias (Podsakoff et al., 2003). Exploratory factor analysis was conducted on all variables, and the results of factor analysis extracted 20 factors with characteristic roots greater than 1. The first factor explained 22.21% of the total variation, lower than the critical point of 40%. Therefore, it was considered that there was no obvious common method bias in this study.

Descriptive statistics of every variable

Means, SDs, and zero-order correlations among variables are shown in Table 1. The results showed that the dimensions of inappropriate resolution, frequency of destructive IPC, and intensity of destructive IPC are significantly negatively correlated with the dimensions of communication, trust, and alienation of parent–child attachment ($r = -0.55 \sim -0.41$, $ps < 0.01$), indicating that the higher the score of destructive IPC, the lower the score of parent–child attachment, the more serious destructive IPC and the worse the parent–child attachment. The dimensions of inappropriate resolution, frequency of destructive IPC, and intensity of destructive IPC are positively correlated with the dimensions of conflict spillover representations, destructive family

1 http://www.sdqinfo.com

TABLE 1 Zero-order correlations and descriptive for study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Gender (0 = girls, 1 = boys)	–															
2 Age	0.05	–														
3 Inappropriate resolution	−0.03	0.12**	–													
4 Frequency of destructive IPC	−0.07	0.10*	0.67**	–												
5 Intensity of destructive IPC	0.03	0.12**	0.66**	0.74**	–											
6 Communication	−0.02	−0.20**	−0.49**	−0.50**	−0.49**	–										
7 Trust	−0.03	−0.18**	−0.55**	−0.54**	−0.55**	0.81**	–									
8 Alienation	−0.01	−0.18**	−0.42**	−0.43**	−0.41**	0.60**	0.66**	–								
9 Conflict spillover representations	0.00	−0.07	0.272**	0.33**	0.29**	−0.22**	−0.33**	−0.45**	–							
10 Destructive family representations	−0.05	−0.16**	0.35**	0.37**	0.34**	−0.18**	−0.23**	−0.34**	0.61**	–						
11 Emotional reactivity	−0.11*	−0.08	0.21**	0.27**	0.26**	−0.10*	−0.14**	−0.30**	0.70**	0.70**	–					
12 Hyperactivity-inattention	0.11*	0.12**	0.32**	0.33**	0.31**	−0.42**	−0.47**	−0.42**	0.31*	0.22**	0.25**	–				
13 Conduct problems	0.09*	−0.04	0.26**	0.27**	0.26**	−0.33**	−0.40**	−0.44**	0.31**	0.16**	0.19**	0.45**	–			
14 Prosocial behaviors	0.18**	0.01	0.23**	0.23**	0.27**	−0.36**	−0.31**	−0.22**	0.00	0.05	−0.03	0.20**	0.17**	–		
15 Emotional symptom	−0.17**	0.08	0.26**	0.35**	0.26**	−0.38**	−0.39**	−0.51**	0.46**	0.38**	0.43**	0.43**	0.45**	0.08	–	
16 Peer problems	0.07	−0.03	0.10*	0.10*	0.09*	−0.24**	−0.21**	−0.25**	0.16**	0.14**	0.19**	0.24**	0.26**	0.14**	0.30**	–
M	–	–	10.50	13.06	14.87	28.09	35.28	17.34	7.03	7.60	17.79	3.55	2.41	2.59	3.08	2.81
SD	–	–	4.09	4.07	4.61	8.98	9.05	4.72	2.77	3.44	6.86	2.31	1.62	2.23	2.52	1.61

M = mean; SD = Standard deviation. *$p < 0.05$; **$p < 0.01$.

representations, and emotional reactivity of emotional insecurity, respectively ($r = 0.21 \sim 0.37$, $ps < 0.01$), at the same time, the three dimensions of destructive IPC are positively correlated with the dimensions of hyperactivity-inattention, conduct problems, prosocial behaviors, emotional symptom, and peer problems of emotional and behavioral problems ($r = 0.09 \sim 0.33$, $ps < 0.05$), indicating that the higher the score of destructive IPC, the more serious the emotional insecurity and emotional and behavioral problems of Chinese adolescents. The dimensions of communication, trust, and alienation of parent–child attachment are negatively correlated with the dimensions of hyperactivity-inattention, conduct problems, prosocial behaviors, emotional symptom, and peer problems of emotional and behavioral problems ($r = -0.51 \sim -0.20$, $ps < 0.01$), indicating that the better the parent–child attachment, the less the adolescents' emotional and behavioral problems. Apart from prosocial behaviors, the dimensions of conflict spillover representations, destructive family representations, and emotional reactivity of emotional insecurity are significantly positively correlated with hyperactivity-inattention, conduct problems, prosocial behaviors, emotional symptom, and peer problems of emotional and behavioral problems, respectively, ($r = 0.14 \sim 0.45$, $ps < 0.01$), indicating that the higher the emotional insecurity of Chinese adolescents, the more serious their emotional and behavioral problems.

Direct way and indirect way between destructive IPC and emotional and behavioral problems

Because destructive IPC, parent–child attachment, emotional insecurity, and emotional and behavioral problems are multidimensional, latent variable analysis is used in this study. As presented in Figure 2, SEM was conducted to test direct and indirect pathways between destructive IPC and Chinese adolescents' emotional and behavioral problems. The model yielded good fit to the data, $\chi^2/df = 3.35$, RMSEA = 0.07, SRMR = 0.05, CFI = 0.93, TLI = 0.90. Destructive IPC negatively predicted parent–child attachment ($\beta = -0.69$, $p < 0.01$), and parent–child attachment negatively predicted emotional and behavioral problems ($\beta = -0.71$, $p < 0.01$). Destructive IPC positively predicted emotional insecurity ($\beta = 0.42$, $p < 0.01$), and emotional insecurity positively predicted emotional and behavioral problems ($\beta = 0.38$, $p < 0.01$).

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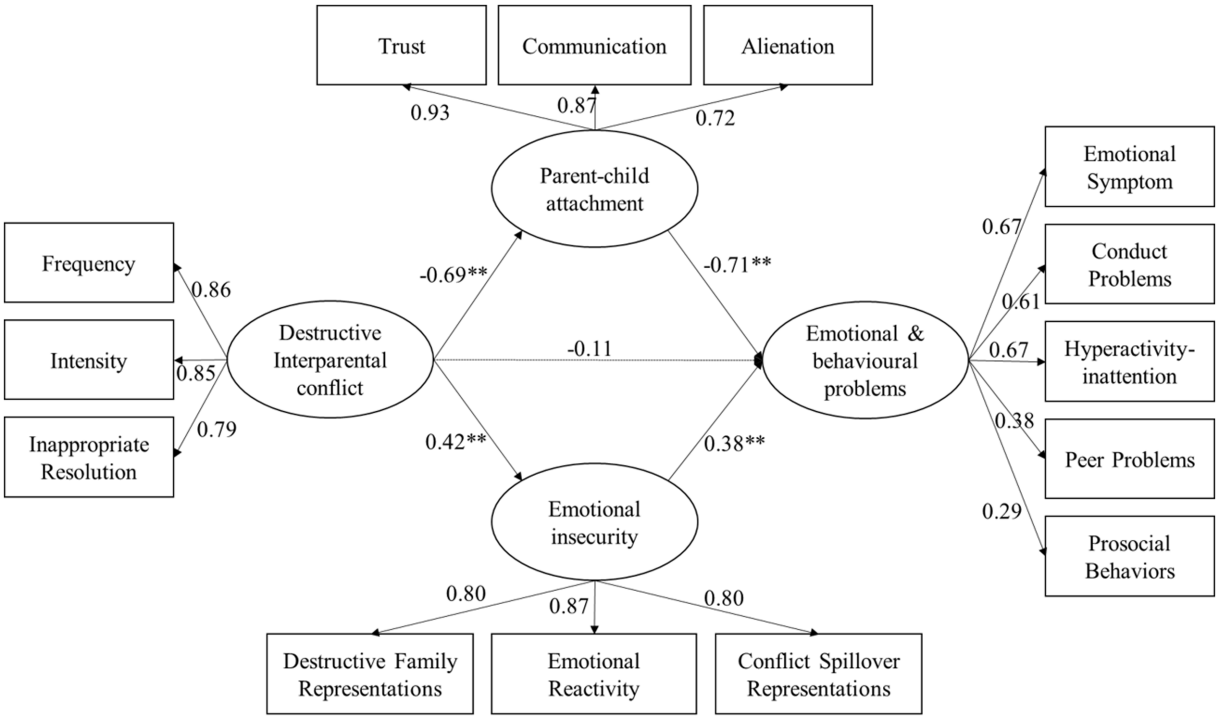

FIGURE 2
Estimates from SEM testing the direct and indirect pathways between destructive IPC and Emotional and behavioural problems. Estimates are standardized coefficients. The dashed line is the nonsignificant path. *p<0.05; **p<0.01. SEM=structural equation modeling.

TABLE 2 Standardized direct and indirect paths between IPC and child's emotional and behavioral problems.

Paths	β	SE	p	LLCI	ULCI
Total effect	0.539	0.055	<0.001	0.422	0.639
Direct effect					
IPC → emotional and behavioral problems	−0.111	0.091	0.208	−0.297	0.060
Total indirect effect	0.650	0.064	<0.001	0.532	0.785
IPC → parent–child attachment → emotional and behavioral problems	0.490	0.055	<0.001	0.392	0.611
IPC → emotional insecurity → emotional and behavioral problems	0.160	0.038	<0.001	0.096	0.244

Bootstrapping analyses: Further testing the mediating roles of parent–child attachment and emotional insecurity

The mediating effect was measured by using the deviation correction percentile Bootstrap (repeated sampling 5,000 times). As represented in Table 2, the indirect effect of destructive IPC on emotional and behavioral problems through parent–child attachment is significant (β = 0.49, p < 0.01, 95%CI = [0.39,0.61]), and the indirect effect of destructive IPC on emotional and behavioral problems through emotional insecurity is significant (β = 0.16, p < 0.01, 95% CI = [0.10, 0.24]), indicating that parent–child attachment and emotional insecurity mediate the relation of destructive IPC and emotional and behavioral problems, respectively.

Discussion

This study investigated the relationship between destructive IPC and emotional and behavioral problems among Chinese adolescents, the pathways of indirect influence, and its influence on emotional and behavioral problems. Based on attachment theory, emotional security theory (EST), and fast history (FH) theory, this study indicated two indirect pathways between destructive IPC and emotional and behavioral problems among Chinese adolescents. The study indicated two mechanisms of influence between destructive IPC and emotional and behavioral problems among Chinese adolescents. Our results showed that destructive IPC does affect emotional and behavioral problems among Chinese adolescents through parent–child attachment and emotional insecurity.

Derived from the overall impact of destructive IPC on Chinese adolescents' emotional and behavioral problems, the results showed that there is not a significant direct path effect is not between IPC and Chinese adolescents' emotion–behaviors. In other words, parent–child attachment mediated the mechanism of destructive IPC on Chinese adolescents' emotional and behavioral problems. Because of the frequent destructive IPC, the interparental relationship grows more tense, which reduces parents' attention and participation with adolescents. By reducing the level of parent–child attachment, the risk of adolescents' emotional and behavioral problems is shown to have increased. Therefore, in this study, the direct influence of IPC on Chinese adolescents' emotional and behavioral problems is not significant, because the influence pathway of IPC and adolescents' emotional and behavioral problems is mediated by parent–child attachment and emotional insecurity.

This result shows that among Chinese adolescents from primary school and junior high school, the influence of IPC on their emotional and behavioral problems is both immediate and long-terms. Adolescents constantly receive and release negative emotions and even formed aggressive psychology when faced with IPC. Negative emotion, the early stage of aggressive psychology, influences emotional insecurity; however, over time, it will also increase the risk of emotional and behavioral problems affected by the development of parent–child attachment. Therefore, emotional insecurity and parent–child attachment are shown to have played a mediating role in this effecting mechanism. Thus, research hypothesis 1 is not supported, while the other two are supported.

An indirect pathway through parent–child attachment

Our data showed that there is an indirect pathway in destructive IPC affecting emotional and behavioral problems among Chinese adolescents. In other words, destructive IPC is shown to be positively correlated with emotional and behavioral problems among Chinese adolescents by negatively predicting parent–child attachment. This indirect path has a long-term impact on adolescents. Destructive IPC, as an unfavorable family environment factor, will have a severely destructive impact on parent–child attachment by reducing adolescents' emotional dependence on parents and parents' participation (Adare et al., 2021). Secure parent–child attachment can buffer the negative impact of family conflict on adolescents.

This result shows that a series of negative psychological trends brought about by IPC will affect the emotional connection between parents and adolescents, leading to a situation where both do not feel warmth and support each other at home. This will then lead to peer problems or a series of misconduct problems in the process of interpersonal communication. Moreover, frequent interparental conflict increases adolescents' aggressive behavior and conflict toward their parents. They become irascible, obtain low emotional adjustment ability, and turn incapable to reasonably solve various problems in interpersonal communication. This can then predict the quality of peer relationships and friendships in adolescence (Gasser-Haas et al., 2021), and academic achievement in late childhood and early adolescence. Undoubtedly, this path that influences adolescents' emotional and behavioral problems through parent–child attachment also tends to be durable and stable over a period of time.

Based on attachment theory, safe attachment relationships formed in early childhood have a huge impact on interpersonal communication, emotional stability, and personal development during adolescence and adulthood. Growing up with favorable rather than unfavorable parent–child attachment enables adolescents to cope better and reduce psychological pressure when faced with adverse life events (Bannink et al., 2013). A study has shown that secure attachment relationship is related to emotional regulation. Adolescents who grow up in a secure and good attachment relationships with either of their parent show better emotional regulation and peer relationship, capable to handle themselves better in peer groups, and indulge in less conduct-related problems (Vu et al., 2016). In a study based on resting-state functional magnetic resonance imaging, it has been emphasized that adolescents with secure parent–child attachment build stronger connections in the limbic system, especially the hippocampus and other nerve tissues, since the hippocampus plays an important role in learning, memory, and emotion. A cross-cultural study pointed out that compared with the United States and Poland, parent–child attachment, especially mother attachment, plays a core role in adolescents' self-control and social adaptation, and is also considered to have played a greater role in adolescents' mental health in China and Spain (Mancinelli et al., 2021). Adolescents with secure parent–child attachment have fewer emotional and behavioral problems than those with insecure parent–child attachment. Based on this, our study concluded that parent–child attachment does play a necessary mediating role between destructive IPC and emotional and behavioral problems among Chinese adolescents. Furthermore, based on attachment theory, the emotional distress caused by the perceiving family conflict will spread to the attachment relationship between parents and adolescents. Moreover, it triggers other emotional and behavioral problems in the developing stage of adolescents. Consistent with this specific study's hypothesis, our study has found an indirect pathway through which destructive IPC is linked to emotional and behavioral problems among Chinese adolescents by influencing parent–child attachment.

An indirect pathway through emotional insecurity

Our study's results have found another indirect pathway that states that destructive IPC has a significant positive correlation with adolescents' emotional and behavioral problems by positively predicting emotional insecurity. This study supports our hypothesis that emotional insecurity does play a mediating role in the relationship between destructive IPC and emotional and behavioral problems.

Emotional security theory (EST) indicated that adolescents who are faced with frequent conflicts in the family have more negative

emotional responses (e.g., avoidance and depression) and stress behavior responses (e.g., peer interaction abnormalities, poor academic performance). Stress-induced emotional health and emotional regulation ability are the core parameters of emotional security. Adolescents who are insecure in emotional situations tend to be readily impulsive when dealing with external things that result in emotional and behavioral problems. Adolescents who have witnessed excessive IPC are faced with the risk of structural fragmentation, and collapse of the family system, which produces emotional insecurity, which, in turn, leads to emotional problems, such as sensitivity, depression, avoidance, and failure in forming healthy peer relationships, as well as reduced prosocial behavior and a series of misconduct problems. High stress from destructive IPC can predict negative emotions (Cummings et al., 2006). A study found that the influence of early experiences will be constantly replaced by recent development experience. In other words, it means that in longitudinal studies, as time goes by, the influence of conflict between parents on adolescents' anxiety level gradually decreases and eventually disappears (Van Eldik et al., 2020)—since adolescents are more susceptible to it than adolescents. Therefore, during the stage of adolescents' development, those who have witnessed their parents' conflict are more affected by anxiety than teenagers and adults. This study also provides more support for EST by concluding that emotional insecurity plays a very important role between destructive IPC and Chinese adolescents' emotional and behavioral problems. Consistent with our research hypothesis, this study has described an indirect pathway through which destructive IPC is linked to adolescents' emotional and behavioral problems by affecting emotional insecurity.

Research limitations and prospects

Nonetheless, this study has certain limitations. First, the participants belong to high-grade primary and junior high schools, who are still passing through the development stage in terms of personality, emotion, and mental health level. Although this study is innovative in focusing on the indirect pathways (parent–child attachment and emotional insecurity) of IPC on Chinese adolescents' emotional and behavioral problems, considering the limitations of cross-sectional studies, the perspective of longitudinal research can allow further opportunities to study the impact of behaviors on adolescents' future growth, and understand how individual differences and developmental dissimilarity are developed in the healing of conflicts experienced during childhood. Therefore, as an extension to this study, a longitudinal study could be considered to explore other indirect pathways of destructive IPC on emotional and behavioral problems during the child's adolescence and adulthood. Since this study was conducted in China where citizens tend to pay more attention to the concept of family, the impact of destructive IPC on family structure and its stability, and more importantly, how it manifests among young adolescents, would be greater and more obvious than it is in the West. Therefore, in this study, it is imperative to consider the cultural differences between China and the West.

In addition, during childhood, the factors affecting adolescents' emotional and behavioral problems are diverse. Under the condition of high-level family instability, parents with low education level will show a higher level of family insecurity (Coe et al., 2017). Therefore, for future research, we aim to more comprehensively consider factors that include family economic level, characteristics of dependents, and so on. An existing study has classified the trajectories of IPC in early childhood into three types: low stability, high-decreasing, and high-increasing marital conflict (Madigan et al., 2016). Therefore, in the future, we would like to classify the trajectory of IPC during childhood, and explore their mechanism of action on adolescents' emotional and behavioral problems. Some researchers have also indicated that physiological structures are not yet completely mature during infancy and childhood. Exposure to adverse experiences, including destructive IPC and intimate partner violence, will have an impact on adolescents' brain structure development, such as the Hypothalamus-Pituitary–Adrenal (HPA) axis (Mueller and Tronick, 2019). The relationship between experiencing intimate partner violence (IPV) and adolescents' emotional and behavioral problems will become stronger over time (Vu et al., 2016). In other words, adverse events in the family environment will have a "sleeper effect" on adolescents' development. Moreover, destructive IPC will be related to the problematic parenting practices at a higher level each year. Therefore, we aim to focus on the intertemporal impact of destructive IPC on adolescents in the longitudinal study.

Despite these limitations, this study has significantly contributed to the academic study of the influence of IPC on adolescents' emotional and behavioral problems against the backdrop of Chinese culture. To this end, it opens up two indirect pathways between destructive IPC and adolescents' emotional and behavioral problems; lays a foundation for more detailed and in-depth research to be conducted in the future; and has significance for Chinese parents to deal with family conflict, stabilize family relations, and cultivate a positive atmosphere for adolescents. In the family environment, it is recognized that conflict between parents will have a huge impact on the mental health and external development of young adolescents. Those growing up in safe, healthy, and happy families will perform well in interpersonal communication, emotional control, psychological resilience, and academic performance.

Since conflicts cannot be avoided in family environments in the future, it is important to apply appropriate and effective solutions during adolescents' younger years. This indicated that establishment of a stable parent–child relationship and keeping secure emotion can appropriately reduce the impact and pressure caused by destructive IPC. Coping with and changing frequent IPC are the most important aspects in a family environment. Therefore, the important role of adjustment between husband and wife should be considered as a solution to destructive IPC, which reduces its impact on adolescents. The results of our study stress the necessity for continuous and deep concern regarding the link between the family system and Chinese children's developmental outcomes.

Conclusion

First, destructive IPC can adversely affect emotional and behavioral problems among adolescents, experiencing more destructive IPC rise the risk of emotional and behavioral problems. Second, destructive IPC plays a damaging role in their emotional security and parent–child attachment, consequently effecting emotional and behavioral problems, Therefore, those Chinese adolescents who experience destructive IPC will experience lower emotional security and parent–child attachment quality, resulting in more emotional and behavioral problems.

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.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of North China University of Science and Technology (Approval No. 2021068). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Relationships among inferiority feelings, fear of negative evaluation, and social anxiety in Chinese junior high school students

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Introduction: This study aimed to explore the relationship between feelings of inferiority and social anxiety in Chinese junior high school students. In addition, it examined the potential mediating effect of fear of negative evaluation in this relationship.

Methods: A survey was administered to a sample of 734 Chinese junior high school students. The Feelings of Inadequacy Scale, Brief Fear of Negative Evaluation Scale, and Social Avoidance Distress Scale were used.

Results: First, there were significant positive correlations between all subscales for the inferiority feelings, social anxiety, and fear of negative evaluation. Furthermore, fear of negative evaluation mediated the predictive effects of four inferiority subscales (i.e., self-esteem, academic ability, appearance, and physical ability) for social anxiety. However, the total score for the sense of inferiority and social confidence subscale lacked this mediating effect.

Conclusion: The inferiority feelings of self-esteem, academic ability, appearance, and physical ability may directly and indirectly predict social anxiety through fear of negative evaluation.

KEYWORDS

junior high school students, inferiority feelings, social anxiety, fear of negative evaluation, mediating effect

1. Introduction

Junior high school students are in an important developmental transition period to maturity. During adolescence, the students facing psychophysical changes are vulnerable to psychological problems (Li et al., 2020). Although they are growing quickly, mental health services in China still have a lot of issues. Due to widespread stigma, a lack of human

resources, and disjointed service delivery models, mental health services are underutilized in China (Liu et al., 2018b). Therefore, Chinese adolescents still face various psychological crisis and behavioral problems (Zhou et al., 2020), such as anxiety (Wu et al., 2021), depression (Wu et al., 2021), internet addiction (Chi et al., 2020), suicide (Li et al., 2021). In addition, students are under tremendous pressure from study and competition in China's education system (Sun et al., 2012). A competitive education system in traditional Chinese culture has been linked with the high incidence of anxiety among adolescents (Liu et al., 2018a). In sociocultural situations with closely knit social networks, worries about being rejected and losing vital social resources may be stoked (e.g., East Asian cultures; Schunk et al., 2022). Chinese people may be higher in rejection avoidance than western. In this case, Chinese adolescents are probably more likely to be fearful of negative evaluations from peers or teachers. Some studies have shown that the East Asian prefer to avoid accrual of negative reputation (Yamagishi et al., 2008). In other words, Chinese adolescents tend to avoid social when they are concerned about negative perceptions of themselves. Therefore, it is very meaningful to study the psychological characteristics of junior high school students' inferiority feelings, fear of negative evaluation and social anxiety.

Social anxiety is a common adolescent anxiety characterized by an unreasonable fear of negative appraisal in social situations (Morrison and Heimberg, 2013). Social anxiety is diagnosed when this concern begins to impair interpersonal communication. Compared with students in other age groups, junior high school students have higher levels of social anxiety. Furthermore, the incidence of social anxiety disorder in adolescence exceeds 50% (Aderka et al., 2012). Moreover, social anxiety increases risk for other clinical disorders such as depression (Kalin, 2020). Although social anxiety may be relieved with school closure during the COVID-19 outbreak, such improvement is likely to be short-lived (Morrissette, 2021). Children and youths with the high social anxiety traits will face significant challenges when schools reopen. Therefore, sustained and effective interventions are needed based on a full understanding of the causes of adolescent social anxiety during a pandemic.

Feelings of inferiority involves feelings of weakness and inability to help oneself (Ergun-Basak and Aydin, 2019). People with low self-esteem tend to despise themselves and believe that they are less valuable than others (Adler, 1927). Negative emotional experiences stem from underestimation of self in social comparisons. Severe feelings of inferiority are psychological defect (Adler, 1927). There are two core concepts for inferiority feelings: poor self-evaluation and negative emotional experience (Tang, 2012). The psychological development stage of junior high school students occurs during the adolescent period. Their self-awareness develops rapidly but inconsistently (Agbaria et al., 2012). They are very sensitive to the evaluations of others, especially negative ones. Thus, they cannot accurately perceive themselves, which may lead to low self-concept and even a sense of inferiority. People with high inferiority feelings are afraid to interact with others for fear of rejection and tend to adopt an avoidant approach, which may exacerbate social anxiety (Shim et al., 2013). Numerous researchers have also found that lower self-evaluation influences the development of social anxiety, and that lower self-evaluation is a major cause of inferiority feelings (Lin and Fan, 2022). According to the conceptual study of inferiority complex and social anxiety, inferiority complex is an individual's negative evaluation of self, and the negative feedback from the external environment can lead to social anxiety. Studies have shown that the feelings of inferiority influenced social interactions and social relationships with peers (Collins, 1996; Wilkinson, 1999; Liu et al., 2022). In addition, inferiority feelings still explain a significant amount of variation in interpersonal rumination (Cimsir, 2019), and self-esteem is an important negative predictor of social anxiety (Yücens and Üzer, 2018; You et al., 2019). The current researches on inferiority have focused on the definition, cause, and solution (Lyu, 2022). However, individuals are often unique, and there is little discussion on commonality. Current limitations are that little research has focused on inferiority at specific levels, such as the inferiority of academics, appearance, social interaction, and physical ability. As a result, we proposed Hypothesis 1.

> *Hypothesis 1 (H1)*: All subscales for the inferiority feelings are correlated with social anxiety.

Watson and Friend (1969) defined fear of negative evaluation as apprehension about others' appraisal, distress about the possibility of unfavorable judgment, avoidance of situations involving evaluations, and anticipation one would be unfavorably evaluated. The essence of inferiority feelings is the low self-esteem, and the individuals are unable to face their strengths and weaknesses in a rational and objective manner. Junior high school students in the sensitive period are still in the immature stage of self-awareness, which are prone to poor self-perception bias (Portillo and Fernández-Baena, 2019). "Biased self-perception" refers to the tendency to perceive one's social performance as more negative than that of the observer, which is a characteristic of high fear of negatively evaluating individuals (Nordahl et al., 2017). Previous research has shown that individuals with lower self-esteem were more prone to have a higher level of fear of negative evaluation (Ahadzadeh et al., 2018). Due to poor self-representation and negative schemas, unpleasant experiences often accompany fear of evaluation. Inferiority feelings are therefore likely to contribute to the fear of negative evaluation. At the same time, fear of negative evaluation is considered as a cognitive and emotional risk factor for social anxiety (Haikal and Hong, 2010). It is closely related to trait anxiety and social avoidance (Stein et al., 2002). Throughout the literature, it has been found that fear of negative evaluations is associated with social anxiety (Zhong and Zhang, 2011; Cheng and Binrong, 2016). Some cognitive models suggest that social anxiety stems in part from fear of negative evaluations and excessive self-focus (Clark and Wells, 1995; Rapee and Heimberg, 1997). Excessive self-focus has some

similarities with the characteristic egocentricity of inferiority feelings. Therefore, we proposed Hypothesis 2 and hypothesized research model (see Figure 1).

> *Hypothesis 2 (H2)*: Fear of negative evaluation plays a mediating role between the subscales of inferiority and social anxiety.

Previous research has revealed a significant relationship between junior high school students' inferiority feelings and social anxiety. However, few studies have explored the relationship between a specific level of inferiority and social anxiety, and the role of fear of negative evaluations in this relationship. Therefore, this study used a questionnaire method to investigate the relationship among these variables and aimed to provide a better theoretical basis to guide early prevention and treatment.

2. Materials and methods

2.1. Participants

The data were collected for over 20 days between 1 January 2019 and 20 January 2019. This research adopted convenience sampling to recruit 900 students from four public junior high school in Shaoguan, China as participants. Before investigation, we obtained informed consent from students and parents, and the investigators introduced the aims and procedures of this study to the students and assured confidentiality upon receipt of the questionnaire. The participants were given paper-based anonymous questionnaires in the classroom. The students of Grade 7 and Grade 8 were each selected from 7 classes for testing. Since the students of Grade 9 were facing the entrance examination, only 4 classes were selected. A total of 850 questionnaires were collected using group testing with immediate return. After discarding the invalid questionnaires (missing data >5%), 734 valid questionnaires were retained, and the effective rate was 86.4%. The students signed a written informed consent form before participating in this survey, and all their legal guardians agreed. This study was approved by the Ethics Committee of Minnan Normal University.

2.2. Measures

2.2.1. Feelings of inferiority

This study used the Feeling of Inadequacy Scale (FIS; Fleming and Courtney, 1984) to assess the inferiority feelings. The FIS has a total of 36 items, including five dimensions. It measures the individual's feelings of inferiority in terms of self-esteem, social confidence, academic ability, appearance, and physical ability. In the FIS, items 3, 6, 25, and 31 are scored in reverse. A 5-point Likert scale (1 = *never*, 5 = *always*) is used. The higher the score, the stronger the individual's feelings of inferiority. In the present study, Cronbach's α for the total FIS scale was 0.92.

2.2.2. Social anxiety

The Chinese version of Social Avoidance and Distress Scale (SAD) was used in the current study (Wang et al., 1999). The SAD includes two factors: social avoidance and social distress. The former factor refers to the behavioral tendency to avoid social interaction. The latter represents feelings elicited in the situation. There are 14-item for each subscale. In the SAD, items 1, 3, 4, 6, 7, 9, 12, 15, 17, 19, 22, 25, 27, and 28 are scored in reverse. The scoring method uses *yes/no* responses. People with higher scores on the SAD scale are more anxious in actual interactions, and vice versa. In the present study, Cronbach's α for the SAD was 0.86.

2.2.3. Fear of negative evaluation

The study also used the Chinese version of Brief Fear Negative Evaluation Scale (BFNE; Leary, 1983; Chen, 2002). It consists of 12 items, using a 5-point Likert scale (1 = *completely inconsistent* and 5 = *extremely consistent*). In the BFNE, items 2, 4, 7, and 10 are scored in reverse. Cronbach's α for the BFNE was 0.80 in the present study.

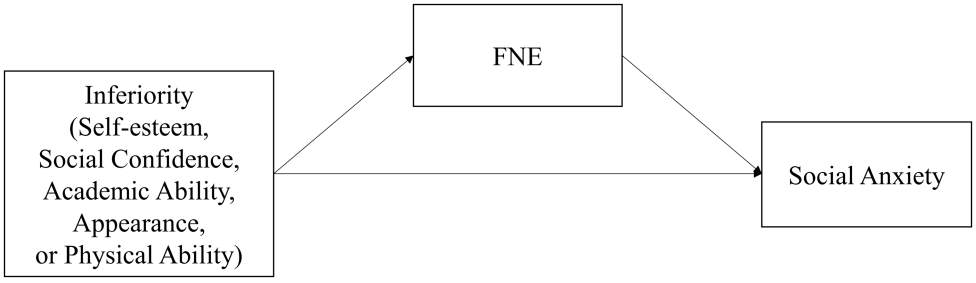

FIGURE 1
Hypothesized research model. FNE = fear of negative evaluation.

2.3. Data analysis

SPSS Version 22.0 (IBM, NY, United States) was used to conduct reliability analysis, the common method bias test, and Pearson correlation analysis. Finally, mediation analysis was conducted using the SPSS plugin PROCESS (Hayes, 2017). Bootstrapping was performed with 5,000 resamples and a confidence interval of 95%. The mediation analysis was considered significant when zero did not appear in the 95% confidence interval.

3. Results

3.1. Common method bias test

In order to reduce the common method bias brought by the self-reported questionnaire method, this study carried out procedural control by emphasizing anonymity and confidentiality during the data collection process. For checking the effectiveness of program control, we conducted a common method bias test (Podsakoff et al., 2003; Tang and Wen, 2020). The unrotated Harman's single factor test result showed that there were 16 factors having the eigenvalue higher than 1. The explained variance of the first factor was 19.74%. This value was far below the critical level of 40%. Thus, the problem of common method bias in this study was not serious.

3.2. Descriptive statistics and correlations

This study finally selected 734 students as samples comprising 343 males (46.73%) and 391 females (53.27%), all aged 12–16 years old. The sample was made up of 260 Grade 7 students (35.42%), 307 Grade 8 students (41.83%) and 167 Grade 9 students (22.75%). In terms of family residence, 474 students (64.58%) lived in urban areas, while the remaining 35.42% resided in rural areas (n = 260). Regarding the issue of being an only child, 207 students (28.10%) were only children, while the remaining 527 students (71.80%) were not. As for parenting style, it was reported harsh and tough (23.85%) for 175 students, democratic and respectful (71.25%) for 523 students, and negligent and permissive (4.90%) for 36 students. Finally, self-assessment of students' academic performance was based on five categories, such as excellent (9.95%), good (21.66%), average (36.37%), fair (23.98%), and poor (8.04%). The sample characteristics are shown in Table 1.

Table 2 shows the mean, standard deviation, range, and correlation values for all variables that include inferiority, fear of negative evaluation, social anxiety, and their factors. There were significant positive correlations between all factors and variables ($r \geq 0.21$, $p \leq 0.001$).

TABLE 1 Sample characteristics.

Characteristics	Options	Frequency	Percentage (%)
Age	12	70	9.54
	13	267	36.38
	14	249	33.92
	15	119	16.21
	16	29	3.95
Gender	Male	343	46.73
	Female	391	53.27
Grade	7	260	35.42
	8	307	41.83
	9	167	22.75
Family residence	Rural	474	64.58
	Urban	260	35.42
Only child or not	Yes	207	28.20
	No	527	71.80
Academic performance	Excellent	73	9.95
	Good	159	21.66
	Average	267	36.37
	Fair	176	23.98
	Poor	59	8.04
Parenting style	Harsh and tough	175	23.85
	Democratic and respectful	523	71.25
	Negligent and permissive	36	4.90

3.3. Examination of the mediation model

This study used inferiority feelings as the independent variable, fear of negative evaluation as the mediating variable, and social anxiety as the dependent variable. The possible effect was tested by mediation analysis after controlling for demographic variables (age, gender, grade, family residence, only child situation, academic performance, and parenting style; see Figure 2; Tables 3, 4). The results of the mediation test showed that, in Model A, feelings of inferiority significantly and positively predicted fear of negative evaluation ($\beta = 0.54$, $p < 0.001$) and social anxiety ($\beta = 0.48$, $p < 0.001$). However, fear of negative evaluation's prediction on social anxiety was not significant ($\beta = 0.02$, $p > 0.05$). Additionally, the bootstrap results for the mediating effect showed that the 95% confidence interval was [−0.03, 0.05] including 0, which indicates that the total score of fear of negative evaluation is not mediator in the predictive effect of total feelings of inferiority on social anxiety.

In current study, we took the five dimensions of inferiority (i.e., self-esteem, social confidence, academic ability, appearance, and physical ability) as independent variables, fear of unfavourable evaluation as mediating variables, and social anxiety as dependent

TABLE 2 Correlation matrix among variables (n=734).

	1	2	3	4	5	6	7	8	9	10
1. Self-esteem	1									
2. Social confidence	0.60***	1								
3. Academic ability	0.57***	0.64***	1							
4. Appearance	0.51***	0.57***	0.46***	1						
5. Physical ability	0.43***	0.56***	0.53***	0.57***	1					
6. Inferiority	0.77***	0.90***	0.79***	0.74***	0.76***	1				
7. Social avoidance	0.44***	0.40***	0.32***	0.23***	0.28***	0.43***	1			
8. Social distress	0.38***	0.52***	0.36***	0.31***	0.35***	0.50***	0.67***	1		
9. Social anxiety	0.45***	0.50***	0.37***	0.30***	0.34***	0.51***	0.91***	0.92***	1	
10. FNE	0.41***	0.54***	0.38***	0.47***	0.38***	0.55***	0.21***	0.31***	0.29***	1
M	2.51	2.49	2.71	2.58	2.40	2.54	0.43	0.48	0.46	3.09
SD	0.74	0.79	0.65	0.74	1.04	0.63	0.23	0.25	0.22	0.73
Range	1.0–5.0	1.0–4.9	1.0–5.0	1.0–5.0	1.0–5.0	1.0–4.7	0–1.0	0–1.0	0–1.0	1.0–5.0

Note: FNE = fear of negative evaluation. ***$p < 0.001$.

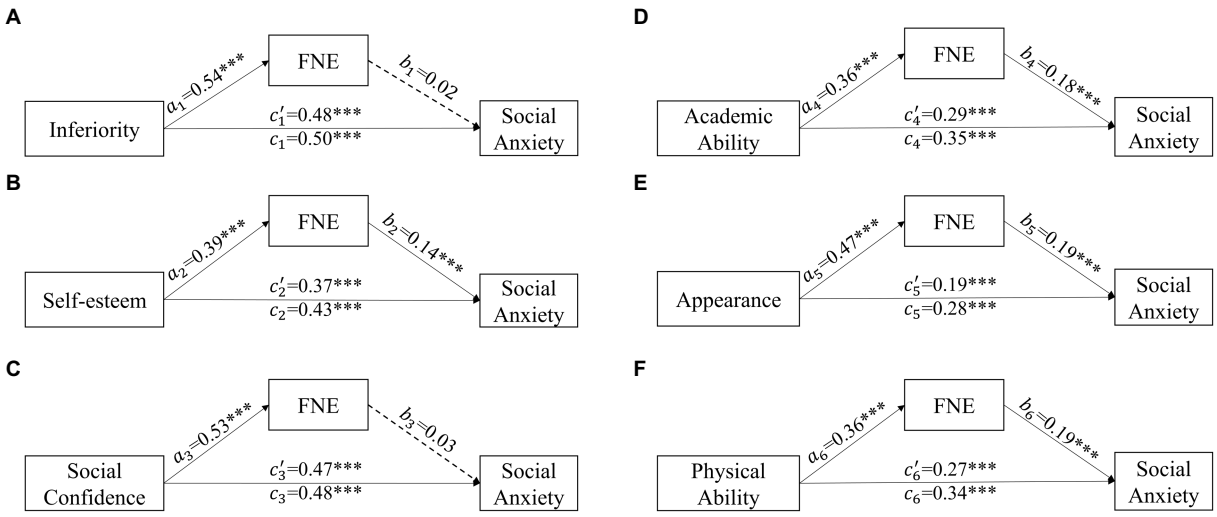

FIGURE 2
The mediation model of fear of negative evaluation on the relationship between inferiority and social anxiety.

variables. The results of the mediation test for the five models are described below (see Figure 2; Tables 3, 4).

In Model B, self-esteem significantly and positively predicted fear of negative evaluation (β = 0.39, $p < 0.001$) and social anxiety (β = 0.37, $p < 0.001$), and fear of negative evaluation significantly and positively predicted social anxiety (β = 0.14, $p < 0.001$). The bootstrapping test for indirect effect results showed that the mediating effect was 0.06, and the 95% confidence interval was [0.03, 0.09] excluding 0. These results indicate that fear of negative evaluation plays a partial mediating role in the relationship between self-esteem and social anxiety.

In Model C, social confidence significantly and positively predicted fear of negative evaluation (β = 0.53, $p < 0.001$) and social anxiety (β = 0.47, $p < 0.001$). However, the prediction of fear of unfavourable evaluation on social anxiety was not significant (β = 0.03, $p > 0.05$), and the bootstrap test results of the mediating

TABLE 3 Mediation effect of FNE on the relationship between inferiority and social anxiety.

Model	Outcome variable	Predictors	*R*	R^2	*SE*	*F*	*β*	*t*
Model A	Social anxiety	Inferiority	0.54	0.29	0.04	36.39***	0.50	15.53***
	FNE	Inferiority	0.57	0.33	0.36	44.09***	0.54	17.48***
	Social anxiety	Inferiority	0.54	0.29	0.04	32.35***	0.48	12.73***
		FNE					0.02	0.25
Model B	Social anxiety	Self-esteem	0.47	0.22	0.04	25.93***	0.43	12.71***
	FNE	Self-esteem	0.39	0.19	0.44	21.21***	0.39	11.42***
	Social anxiety	Self-esteem	0.49	0.24	0.04	25.21***	0.37	10.29***
		FNE					0.14	3.92***
Model C	Social anxiety	Social confidence	0.53	0.28	0.04	35.50***	0.48	15.31***
	FNE	Social confidence	0.56	0.32	0.37	41.80***	0.53	16.97***
	Social anxiety	Social confidence	0.53	0.28	0.04	31.62***	0.47	12.50***
		FNE					0.03	0.84
Model D	Social anxiety	Academic ability	0.41	0.17	0.04	18.47***	0.35	10.24***
	FNE	Academic ability	0.41	0.17	0.45	18.65***	0.36	10.53***
	Social anxiety	Academic ability	0.44	0.20	0.04	19.66***	0.29	7.89***
		FNE					0.18	4.94***
Model E	Social anxiety	Appearance	0.36	0.13	0.04	13.28***	0.28	8.09***
	FNE	Appearance	0.51	0.26	0.40	31.57***	0.47	14.48***
	Social anxiety	Appearance	0.39	0.16	0.04	14.81***	0.19	4.92***
		FNE					0.19	4.87***
Model F	Social anxiety	Physical ability	0.40	0.16	0.04	17.54***	0.34	9.89***
	FNE	Physical ability	0.41	0.17	0.45	18.63***	0.36	10.53***
	Social anxiety	Physical ability	0.44	0.19	0.04	18.94***	0.27	7.53***
		FNE					0.19	5.04***

Note: FNE = fear of negative evaluation. ***$p < 0.001$.

TABLE 4 Bootstrap test for indirect effects.

Path	Effect	*SE*	LLCI	ULCI
Inferiority → FNE → social anxiety	0.01	0.02	−0.03	0.05
Self-esteem → FNE → social anxiety	0.06	0.02	0.03	0.09
Social confidence → FNE → social anxiety	0.02	0.02	−0.02	0.06
Academic ability → FNE → social anxiety	0.07	0.02	0.03	0.10
Appearance → FNE → social anxiety	0.09	0.02	0.05	0.13
Physical ability → FNE → social anxiety	0.07	0.02	0.04	0.10

Note: FNE = fear of negative evaluation; LLCI, low limit of confidence interval; ULCI, upper limit of confidence interval.

effect showed that the 95% confidence interval was [−0.02, 0.06] including 0, which indicates that fear of negative evaluation does not play a mediating role in the relationship between social confidence and social anxiety.

In Model D, academic ability significantly and positively predicted fear of negative evaluation (β = 0.36, $p < 0.001$) and social anxiety (β = 0.29, $p < 0.001$), and fear of negative evaluation significantly and positively predicted social anxiety (β = 0.18, $p < 0.001$). The indirect effect bootstrapping test results showed that the mediating effect was 0.07. The 95% confidence interval was [0.03, 0.10] excluding 0, which indicates that fear of negative evaluation plays a partial mediating role in the relationship between academic ability and social anxiety.

In Model E, appearance significantly and positively predicted fear of negative evaluation (β = 0.47, $p < 0.001$) and social anxiety (β = 0.19, $p < 0.001$), and fear of negative evaluation significantly and positively predicted social anxiety (β = 0.19, $p < 0.001$). The indirect effect bootstrapping test results showed that the mediating effect was 0.09. The 95% confidence interval was [0.05, 0.13] excluding 0. These results indicate that fear of negative evaluation

plays a partial mediating role in the relationship between appearance and social anxiety.

In Model F, physical ability significantly and positively predicted fear of negative evaluation ($\beta = 0.36$, $p < 0.001$) and social anxiety ($\beta = 0.27$, $p < 0.001$). Fear of unfavourable evaluation significantly and positively predicted social anxiety ($\beta = 0.19$, $p < 0.001$). The indirect effect bootstrapping test results showed that the mediating effect was 0.07. The 95% confidence interval was [0.04, 0.10] excluding 0, which indicates that fear of negative evaluation plays a partial mediating role in the relationship between physical ability and social anxiety.

4. Discussion

The present study investigated the relationship among feelings of inferiority, fear of negative evaluation, and social anxiety. We found that the subscales of these three variables were all significantly positively correlated. In the mediation analysis, fear of negative evaluation was a predictive mediator of the inferiority feelings of self-esteem, academic ability, appearance, and physical ability on social anxiety, but not the overall inferiority score and that of its subscale, social confidence.

The total score and each inferiority dimension of junior high school students had a significant positive correlation with social anxiety. These findings confirmed our Hypothesis 1 and were consistent with several studies (Payam and Agdasi, 2017), which suggested that the stronger the sense of inferiority, the greater the level of social anxiety. Students who feel inferior perform poorly in many aspects of everyday and academic life. They are afraid of being rejected and are afraid to interact with others. At the same time, they often use avoidance methods, which will exacerbate social anxiety (Yu and Liu, 2020).

The total score and each dimension of the inferiority feelings of junior high school students showed significant positive correlations with fear of negative evaluation. The higher the score of FIS, the stronger the fear of negative evaluation. These findings concur with previous studies (Geukens et al., 2020), indicating that adolescents with low self-esteem have greater fear of unfavorable evaluation by others. Fear of negative evaluation is a form of social anxiety. Adolescent junior high school students have strong egocentric characteristics. Often, they feel as if they are being observed by some imaginary audiences (Neff, 2003). Another study found that individuals with low self-esteem and low self-assessment are more afraid of negative evaluations (Borecka-Biernat, 2020). Therefore, students with higher inferiority feelings are not only characterized by low self-evaluation, but are also very afraid of negative evaluations by others.

There was a significant positive correlation between social anxiety and fear of negative evaluation of junior high school students, that is, the higher the score of the students' social anxiety questionnaire, the stronger the performance of fear of negative evaluation, and vice versa. This result is consistent with that reported by Ajmal and Iqbal (Ajmal and Iqbal, 2019), revealing a positive correlation between social anxiety and fear of negative evaluation. The study concludes that fear of negative evaluation produces social anxiety in university students. Their research results align with those obtained in our study's sample involving middle school students (Pan et al., 2018).

Further analysis showed that the mediating effect of fear of negative evaluation between the total inferiority score and social anxiety was not significant. In contrast, fear of unfavorable evaluation had a significant mediating effect between self-esteem, academic ability, appearance and physical ability and social anxiety. These findings partly support our Hypothesis 2. The exception to this mediating effect was social confidence. The reason is probably that the predictive effect of social confidence on social anxiety was higher than other four dimensions and fear of negative evaluation. In addition, confidence and anxiety are two opposite emotional experience in social interaction (O'Toole et al., 2013). Building confidence can effectively reduce social anxiety (Damer et al., 2010). Social confidence's predictive effect on social anxiety may be less affected by fear of negative evaluation. Consequently, the mediating effect of fear of negative evaluation between the total inferiority score and social anxiety may be also significantly affected. However, a partial mediation existed in this study. Our results showed that the feelings of inferiority affecting junior high school students in self-esteem (Jiang and Ngien, 2020), academic ability (Strahan, 2003), appearance (Titchener and Wong, 2015), and physical ability (Dimech and Seiler, 2010) could directly predict their level of social anxiety status. In addition, it predicts their social anxiety status, which is mediated by fear of unfavorable evaluation. These results can be explained as follows. Some researchers indicate that fear of negative evaluation is the most common among young people, because negative evaluation can bring about comprehensive discomfort including embarrassment, anxiety, lack of ability, and feelings of inferiority (Ajmal and Iqbal, 2019). Students with inferiority in different dimensions are characterized by low self-concept and involuntarily accept the unfavorable evaluation of others (Murad, 2020). Hence, the students are not good at letting go from the emotional level and rationalizing from the cognitive level, which eventually generates anxiety and manifests higher levels of social anxiety.

Cognitive behavioral therapy promotes rational analysis and logical thinking to change the irrational beliefs of patients, and help them solve emotional and behavioral problems (Amin et al., 2020). Some studies have found that individuals with high levels of cognitive emotion regulation, fear of negative evaluation has a stronger predictive effect on social anxiety (Hong and Hong, 2011). It is a good intervention direction of CBT to know whether students with the feelings of inferiority in academic performance, appearance, physical condition and low self-esteem will have social anxiety, which can effectively reduce the degree of social anxiety. Therefore, junior high school students can reduce the degree of fear of negative evaluation by regulating cognitive emotion and reduce the effect of Inferiority in different dimensions on social anxiety.

The findings of this study may offer a reference value to prevent and reduce social anxiety among junior high school

students in China. This study focuses on the prediction of social anxiety by specific and explicit inferiority feelings, such as self-esteem, academic ability, appearance, and physical ability. Chinese junior high schools and parents can base on the present findings to identify the initial underlying mind and behavior of students who suffer from social anxiety as a result. Schools can also reduce students' social anxiety by teaching reasonable cognitive models and rectifying irrational beliefs about the fear of evaluation through the work of mental health education.

There are two limitations in this study. First, this study used a cross-sectional research design, and future studies can further explore a longitudinal design and cross-lagged analysis. In addition, the participants in this study were from the same region. Future studies are necessary to conduct across regions or across urban and rural areas.

5. Conclusion

The inferiority of self-esteem, academic ability, appearance, and physical ability may directly and indirectly predict social anxiety through the fear of negative evaluation. This study provides an important direction for social anxiety intervention in individuals with high scores of the inferiority in self-esteem, academic ability, appearance, and physical ability.

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 Minnan Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

JL and SC: conceptualization. JL and LW: methodology and writing—original draft. JL, SJ, MZ, and SC: validation and writing—review and editing. JL, SJ, and MZ: formal analysis and visualization. JL: investigation. JL and MZ: data curation. MZ and SC: supervision. SC: project administration and funding acquisition. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Sexual identity fluidity, identity management stress, and depression among sexual minority adolescents

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Introduction: Sexual identity is mutable and evolving, particularly during adolescence. Sexual identity fluidity could be stressful for some adolescents and may differ by birth-sex. Evidence suggests chronic stress can lead to negative mental health outcomes. However, it is unknown if these two processes (stress and depression) differ by sexual identity fluidity.

Methods: This paper studied time-sequential associations between identity management stress and depression over time by sexual identity fluidity, in a national longitudinal data from sexual minority adolescents (SMA) aged 14–17 years using a multigroup autoregressive cross-lagged model (n = 1077).

Results: In the sample, 40% of SMA reported at least one change in sexual identity over 18-month period. Greater number of cisgender females reported sexual identity fluidity compared to their male counterparts (46.9% vs. 26.6%). A temporal cross-lagged effect was reported between depression and identity management stress among cisgender females who reported fluidity in sexual identity; and no cross-lagged effect was reported among those females who did not report fluidity. However, among cisgender male sample depression predicted subsequent identity management stress, irrespective of their change sexual identity fluidity status.

Conclusion: Public health programs and practice must be responsive to the sexual identity fluidity processes among adolescents, with particular attention to minority stress and depression. In addition, our results indicate that sexual identity development and fluidity processes differ between cisgender females and males; and the nuances associated with these processes of change need further investigation.

KEYWORDS

sexual minority adolescents, sexual identity fluidity, LGBTQ, mental health, identity management stress

Introduction

Adolescence is a time characterized by a greater reliance on peers, the onset of romantic relationships, and a strengthening sense of sexuality (Nickerson and Nagle, 2005; Brown and Bakken, 2011; Tolman and McClelland, 2011; Connolly et al., 2014). Adolescence is also a period when sexual identity begins to develop; though, experiences and processes of sexual identity development often differ among adolescents (Perrin, 2002; Savin-Williams and Cohen, 2004). For example, some adolescents may have a consistent sexual identity over time, whereas others may report shift in their sexual identity, referred as sexual identity fluidity (Ott et al., 2011; Katz-Wise and Hyde, 2015; Diamond et al., 2017). Sexual identity fluidity is more common among sexual minority adolescents (e.g., gay, lesbian, bisexual, queer), with recent estimates noting sexual identity changes among sexual minority youth ranging from 28% to 67% (Diamond, 2008; Morgan et al., 2018; Silva, 2018; Cohen et al., 2020; Srivastava et al., 2022).

Sexual identification can be stressful for youth, stemming from: social norms to maintain a consistent sexual identity over time; pressure to choose identity labels that may approximate heterosexuality (e.g., mostly heterosexual, bisexual, pansexual) due to the privileging of heterosexuality; and expectations to choose a label that may not fit with one's dynamic experiences of sexual/romantic attractions, behaviors, and relationships (Hall, 2019). Some research suggests that sexual identity fluidity is associated with worse mental health, including depression (Everett, 2015; Feinstein et al., 2019).

There are several theories that may help explain the association between sexual identity fluidity and worsening mental health, including identity control theory and minority stress theory. Identity control theory posits that one's identity must align with their internal assessment on how the identity and associated behaviors within the context of social structures where the identities are embedded (Burke, 2006). With respect to sexual identities, it would mean that different aspects of sexuality (i.e., attraction, behavior and identity) must have coherence and concordance and one is able to manage these within their social environments (Igartua et al., 2009; Rosario et al., 2011). However, discordance among these aspects of sexuality may result in one or more shift in sexual identity over time (Rosario et al., 2011). Applying the minority stress framework, the internal process of understanding, internalizing, and confusion in regard to one's sexual identity may represent an additional sexual minority stressor, referred to as identity management stress (Goldbach et al., 2017). For example, discordance among aspects of sexuality or developing identity in a homonegative climate could lead to identity dissatisfaction, and stress (Igartua et al., 2009; Ott et al., 2011; Page et al., 2013; Horley and Clarke, 2016).

Decades of theoretical and empirical evidence have shown that chronic stress can lead to negative mental health outcomes, such as depression (Pearlin, 1999; Marin et al., 2011). Meyer (2003) argues that sexual minority adolescents are exposed to heightened stress related to a variety of stigma and discrimination-related experiences based on their non-heterosexual status, often referred to as sexual minority stress (Meyer, 2003; Marshal et al., 2011; Goldbach et al., 2014). Research suggests that adolescents experiencing stress associated with identity management (e.g., addressing disagreements between sexual behavior or attraction and sexual identification) may report more symptoms of depression (Clark et al., 2015; Everett, 2015; Caplan, 2017). Among sexual minority youth, depression occurs at a greater rate during adolescence, compared to their cisgender heterosexual peers (Cole et al., 2002). Unfortunately, both identity-related stressors and depression are also known to have harmful effects on multiple developmental outcomes (e.g., later mental health, educational and economic outcomes) through their late adolescence and early adulthood (Dekker et al., 2007; Fergusson et al., 2007; Bulhões et al., 2020).

In addition, these processes of sexual identity development may differ by sex assigned at birth. Some evidence suggests that cisgender males typically describe their sexuality often as unchanging; however, cisgender females often describe it as more fluid, evolving, and contextual, leading to different pathways of identity development (Kinnish et al., 2005; Diamond, 2008; Radtke, 2013). This difference in identity development by sex assigned at birth could be extended to differential rates of fluidity in sexuality identity between cisgender males and females. For example, research suggests that cisgender females may be more likely to report sexual identity fluidity compared to males over time (e.g., Oi and Wilkinson, 2018 [19.3 vs. 13.3%]; Fricke and Sironi, 2020 [18.0 vs. 6.2%], Savin-Williams et al., 2012 [17.8 vs. 6.2%], and Stewart et al., 2019 [26.0 vs. 11.0%]).

Present study

Evidence suggests the importance of examining stressful experiences associated with identity management and depressive symptomology among sexual minority adolescents. However, these associations have not been studied longitudinally. In addition, it is unknown if these dynamic processes (identity management stress and depression) vary between those who report sexual identity fluidity versus those who did not. Moreover, given empirical evidence that sexual identity fluidity rates differ by sex assigned at birth, it is also important to understand if the association between identity management stress, depression, and sexual identity fluidity differs by sex assigned at birth.

The present study utilizes a large (N = 1,077) longitudinal sample of sexual minority adolescents. The goals of the present study are to assess time-sequential associations between two

processes (identity management stress and depression) over time. In line with identity control theory, the present study sought to understand longitudinal associations between identity management stress and depression and how these processes may differ for those who report sexual identity fluidity versus those who do not.

Methods

Participants and procedures

A national community sample of sexual minority adolescents was recruited for a longitudinal investigation via targeted social media advertising (Facebook, Instagram, YouTube) based on geography and urbanicity/rurality to purposefully recruit adolescents from across the United States and in both urban and rural areas (2018-2022). A brief screener determined study eligibility (aged 14–17, identified as cisgender, provided a U.S.-based ZIP code, and reported a sexual attraction other than heterosexual or straight). Data come from a parent study (Schrager et al., 2022) of sexual minority adolescents aimed at understanding experiences of sexual minority stress and behavioral health during adolescence. To ensure data integrity, several checks for fraud (e.g., duplicate email address or contact information, screening out on first attempt and re-entering with false responses to get through the screener) and data quality (e.g., unrealistic survey completion times, low validation scores based on attention check measures, or decline to answer numerous questions) were completed before respondents were included in the finalized baseline data. Participants considered to be non-fraudulent were given the opportunity to refer up to three other adolescents into the study. All participants provided online assent prior to completing the survey. A total of 1,077 participants completed the baseline of the longitudinal investigation, and they were contacted for follow-up surveys every 6-months. The current analyses use 4 time-points (baseline, 6-months, 12-months, and 18-months follow-up). Participants received $15 for completing the baseline survey and could earn another $10 for each of the three people they referred to the study. Participants were paid incrementally for their participation in follow-up surveys. All study methods were approved by the authors' University Institutional Review Board (masked for review).

Measures

Demographics

Demographic characteristics (age, race/ethnicity, sex at birth, sexual orientation, and socioeconomic status) were assessed with items created by the authors. The race/ethnicity item had six response options (Native American, American Indian, or Alaska Native; Asian or Pacific Islander; Black or African American; White; Latino or Hispanic; and race and ethnicity not listed); respondents could choose all categories with which they identified. Participants who chose multiple racial/ethnic categories were coded as multiracial. For analytic purposes, this variable was collapsed into six categories (White; Latino or Hispanic; multiracial or multiethnic; Black or African American; Asian or Pacific Islander; and Native American, American Indian, or Alaska Native). To assess sex, participants were asked "What was your sex assigned at birth?" Response options were "male" and "female."

Sexual orientation/identity was assessed by asking an open-ended question, "What would you say is your sexual orientation or identity?" The research team used existing literature, prior work with sexual identity variables, and a range of responses on this question to design a qualitative coding scheme. The responses were coded as gay, lesbian, bisexual, pansexual, bisexual or pansexual, complex or multiple identities (e.g., gay pansexual, bisexual lesbian), queer, straight or mostly straight, asexual, and another identity (e.g., demisexual, agrosexual).

Sexual identity fluidity was measured as a reported change in sexual identity between waves. For the purpose of analysis, fluidity in identity was coded as 1 for reporting any change in sexual identity over 4 time-points and 0 for consistently reporting the same sexual identity across time-points.

Identity management stress

To assess sexual identity-specific stress, we used the Identity Management subscale ($\alpha = 0.79$; test–retest $r = 0.90$) from the 54-item Sexual Minority Adolescent Stress Inventory (Schrager et al., 2018). The subscale included 3 items ("I am questioning how to label my sexual orientation"; "I am having trouble accepting that I am LGBTQ."; "I feel pressured to label myself as gay or lesbian."); and responses to items were scored in a binary fashion: "Yes" responses are coded as 1, "No" responses are coded as 0. The subscale was administered for endorsement on items in the past 30 days at each time-point (baseline to 18-month follow up). The 30-day subscale scores are created as percentages of endorsed statements (i.e., 0, 33.3, 66.7, and 100.0%) (Goldbach et al., 2017).

Depressive symptoms

Symptoms of depression were measured using the Center for Epidemiologic Studies Depression Scale Short Form (CES-D-4), which contains four items assessing the frequency of depression symptoms during the past week ("I felt depressed"; "I felt lonely"; "I had crying spells; "I felt sad"). Participants responded on a Likert scale with response options ranging from

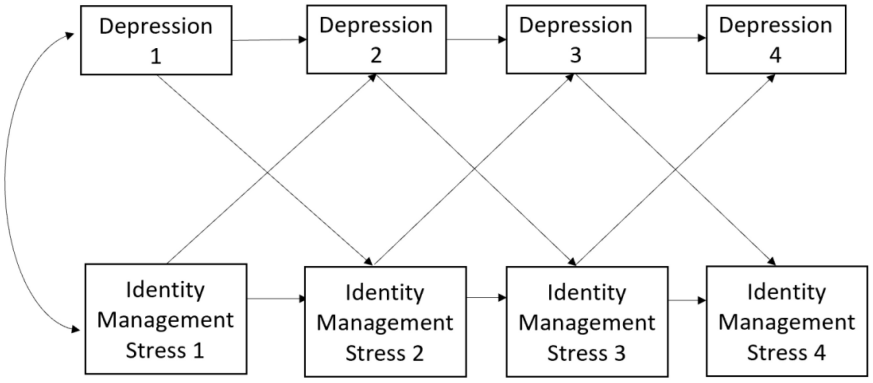

FIGURE 1
Time-sequential associations between depression symptoms and identity management.

0 (*rarely or none of the time [less than 1 day]*) to 3 (*most or all of the time [5–7 days]*); scores were summed (0–12; Melchior et al., 1993). Depressive symptoms were measured at every time-point, and internal consistency was high across time-points (Cronbach $\alpha = 0.83–0.85$).

Analytic plan

Bivariate analyses were used to examine the differences in reported sexual identity fluidity (ever versus no change) by demographic variables at baseline. T-test for difference in sample means were conducted for the continuous variable (age), while chi-square tests were conducted for categorical variables (sex assigned at birth, race/ethnicity and sexual identity).

We examined if there were differences in time-sequential associations between depression and identity management stress, by sexual identity change status (no change versus change) using a multigroup autoregressive cross-lagged (ARCL) model. The cross-lagged design comprises two or more variables at two or more time points. It yields three types of effects: synchronous associations (correlations between different variables measured at the same time), stability effects (correlations between the same variable measured at different times), and cross-lagged effects. The cross-lagged effects refer to the prediction of one or more variables by other (temporarily preceding) variables, controlling for the baseline level of the predicted variable. A multi-step process was employed to time-sequential associations between depression and identity management stress, by identity change status (**Figure 1**).

In our first model, each variable was allowed to predict subsequent follow-up assessment of itself, measuring the stability of individual differences in the construct from one occasion to the next. Cross-lagged effects were estimated, controlling for the previous level of the construct being predicted. Thus, when depression at 6-month follow-up was predicted by identity management stress at baseline, depression at baseline was controlled to rule out the possibility that the cross-lagged effect is simply due to correlations between depression and stress at baseline (Anyan et al., 2020). In our second model, we used a multiple group analysis framework where sexual identity change and sex assigned at birth variables were used to permit direct comparisons of the association between change in depressive symptoms and stress between groups. Model fit was determined using the following indices: $\chi 2$ goodness-of-fit statistic, the comparative fit index (CFI $\geq$ 0.90), the root-mean-square error of approximation (RMSEA $\leq$ 0.08), and the standardized root-mean-square residual (SRMR $\leq$ 0.08) (Browne and Cudeck, 1993; Hu and Bentler, 1999). Analyses were carried out in the structural equation modeling (SEM) framework using Mplus 8.0; We used the full information maximum likelihood estimator for all analyses, which assumes data are missing at random and uses all data available for each participant (Muthén and Muthén, 2009).

Results

Sample description

Table 1 contains demographic information. At baseline, the average age of the participants was 15.9 years (*SD* = 1.0); most reported sex assigned at birth as female (66.8%; n = 720). In terms of sexual identity, 38.8% (n = 418) identified as gay or lesbian, followed by bisexual (33.5%; n = 361), pansexual (12.4%; n = 133), bisexual or pansexual (4.0%; n = 43), complex or multiple identities (3.1%; n = 33), queer (2.7%; n = 29), questioning (1.7%; n = 18), asexual (1.6%; n = 16), mostly straight (1.3%; n = 14) and another identity (1.0%; *n* = 11). In the sample, 58.2% (n = 626) identified as White/Caucasian, followed by Latino/Hispanic (13.7%; n = 147), Multiracial (10.3%; n = 111), Black/African American (8.4%; n = 90), Asian/Pacific

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TABLE 1 Participant characteristics (N = 1077; at baseline).

	n (%) or M (SD)	At least one change in sexual identity	No change in sexual identity	χ^2 (df)
Age[#]	15.86 (0.98)	15.89 (0.97)	15.81 (0.98)	1.3634 (990)
Sex assigned at birth[#]				
Male	357 (33.2%)	84 (26.6%)	232 (73.4%)	
Female	720 (66.8%)	317 (46.9%)	359 (53.1%)	36.89 (1)*
Race/Ethnicity[#]				
White/Caucasian	626 (58.1%)	243 (42.1%)	334 (57.9%)	
Latino/Hispanic	147 (13.7%)	37 (28.2%)	94 (71.8%)	
Black or African American	90 (9.4%)	36 (44.4%)	45 (55.6%)	
Asian or Pacific Islander	72 (6.7%)	28 (40.0%)	42 (60.0%)	
Native American or American Indian	31 (2.9%)	15 (51.7%)	14 (48.3%)	
Multi-racial or multi-ethnic	111 (10.3%)	42 (40.4%)	62 (59.6%)	10.84 (5)
Sexual identity[#]				
Gay	239 (22.2%)	30 (14.0%)	184 (86.0%)	
Lesbian	179 (16.6%)	60 (36.8%)	103 (63.2%)	
Bisexual	361 (33.5%)	123 (35.9)	220 (64.1%)	
Pansexual	133 (12.4%)	64 (53.3%)	56 (46.7%)	
Bisexual or Pansexual	43 (4.0%)	37 (92.5%)	3 (7.5%)	
Multiple identities	33 (3.1%)	28 (87.5%)	4 (12.5%)	
Mostly straight	14 (1.3%)	9 (81.8%)	2 (18.2%)	
Queer	29 (2.7%)	17 (63.0%)	10 (37.0%)	
Questioning	18 (1.7%)	16 (100.0%)	0 (0.0%)	
Asexual	17 (1.6%)	9 (56.3%)	7 (43.7%)	
Another identity	11 (1.0%)	8 (80.0%)	2 (20.0%)	193.87 (10)*
Change in sexual identity				
At least one change	401 (40.4%)			
Number of changes				
0 times	591 (59.6%)			
1 time	228 (23.0%)			
2 or more times	173 (17.4%)			
Identity management stress				
Time 1	30.21 (32.24)	38.61 (32.9)	25.07 (30.5)	−6.65 (990)*
Time 2	26.69 (31.47)			
Time 3	26.87 (31.18)			
Time 4	26.95 (30.07)			
Depression				
Time 1	6.49 (3.40)	6.86 (3.32)	6.22 (3.43)	−2.93 (987)*
Time 2	6.27 (3.46)			
Time 3	5.90 (3.43)			
Time 4	6.02 (3.39)			

Age ranged from 14-17 years; Depressive symptoms ranged from 0 to 12; [#]indicates values at Time 1; χ^2 (df) = chi-square (degrees of freedom); χ^2 (df) were provided for sex assigned at birth, race/ethnicity, and sexual identity; while t-test (degrees of freedom) values were provided for age, depression and identity management stress at baseline. * = significance at p value < 0.05.

Islander (6.7%; n = 72), and Native American/America Indian (2.9%; n = 31).

Sexual identity fluidity

In terms of sexual identity fluidity, around 40% of the sample (n = 401) reported at least one change in sexual identity over 4 time-points (18 months). In terms of number of changes, 23.0% (n = 228) reported one change, followed by two or more changes (17.4%; n = 173). In the sample, participants significantly differed in reported sexual identity fluidity (ever versus no change) by sex assigned at birth (26.6% cisgender males versus 49.6% cisgender females reported fluidity; χ^2 (df) = 36.89 (1); $p < 0.05$) over the 18-month period. Similarly, participants also differed in reported sexual identity fluidity by sexual identity at baseline (χ^2 (df) = 193.87 (10); $p < 0.05$). For example, 14% of those identified as gay at baseline reported a change in sexual identity over the 18-month period, compared to 36.8% lesbian, and 35.9% bisexual identified participants. These rates were found higher among those identified as pansexual (53.3%), bisexual or pansexual (92.5%), multiple identities (87.5%), mostly straight (81.8%), queer (63%), questioning (100%), and those identified with another identity (80.0%) at baseline. However, no significant differences were found in reported sexual identity fluidity by age and race/ethnicity (Table 1).

In addition, those who reported at least one change in sexual identity over 18-months, had significantly higher scores on identity management stress (38.61 vs. 25.07; *t*-test value = −6.65; $p < 0.05$) and depression (6.86 vs. 6.22; *t*-test value = −2.93; $p < 0.05$) at the baseline compared to those who did not report any change in sexual identity.

Depression and identity management stress

Results of our model fitting process indicated a model where effect of autoregressive components and cross-lagged were constrained to be equal over time in our multi-group ARCL models. Both our models resulted in adequate model fit (Model 1: grouping by sexual identity change status; CFI = 0.85, SRMR = 0.06, RMSEA = 0.08) (Model 2: grouping by sexual identity change status and sex assigned at birth; CFI = 0.84, SRMR = 0.07, RMSEA = 0.08) (Table 2). Although the comparative fit index (CFI) indicates minimally acceptable fit, the RMSEA and SRMR indicated that the models adequately fit the data (Browne and Cudeck, 1993; Hu and Bentler, 1999). Moreover, Lai and Green (2016) caution against strict cutoffs for data interpretation, stating that these two types of fit indices may diverge in the conclusions they suggest.

Cross-lagged effects

Model 1 examined the temporal association between identity management stress and depression by sexual identity fluidity status (Table 3). Results indicate depression predicted greater, subsequent, identity management stress for both groups, those who reported fluidity in sexual identity (β = 0.828; SE = 0.25; $p < 0.001$) and those who did not (β = 0.657; SE = 0.18; $p = 0.001$). However, identity management stress did not predict subsequent depression.

TABLE 2 Goodness of fit statistics for the mental health and minority stress ARCL models.

	df	χ^2	*p*	CFI	SRMR	RMSEA
Model 1	124	474.14	$p < 0.0001$	0.85	0.06	0.075
Model 2	224	551.85	$p < 0.0001$	0.84	0.07	0.077

df, degrees of freedom; χ^2, chi-square values; *p*, probability values; CFI, comparative fit index; SRMR, standardized root-mean-square residual; RMSEA, root mean square error approximation.

TABLE 3 Unstandardized estimates and standard errors for the ARCL Model 1 (grouping by sexual identity change).

	Model 1	
	No change	Change
	EST. (SE)	EST. (SE)
DEP (T2) ON STRESS (T1)	0.002 (0.002)	0.005 (0.003)
DEP (T3) ON STRESS (T2)	0.002 (0.002)	0.005 (0.003)
DEP (T4) ON STRESS (T3)	0.002 (0.002)	0.005 (0.003)
STRESS (T2) ON DEP (T1)	0.657 (0.18)*	0.828 (0.25)*
STRESS (T3) ON DEP (T2)	0.657 (0.18)*	0.828 (0.25)*
STRESS (T4) ON DEP (T3)	0.657 (0.18)*	0.828 (0.25)*
DEP (T2) ON DEP (T1)	0.582 (0.02)*	0.563 (0.03)*
DEP (T3) ON DEP (T2)	0.582 (0.02)*	0.563 (0.03)*
DEP (T4) ON DEP (T3)	0.582 (0.02)*	0.563 (0.03)*
STRESS (T2) ON STRESS (T1)	0.462 (0.02)*	0.432 (0.03)*
STRESS (T3) ON STRESS (T2)	0.462 (0.02)*	0.432 (0.03)*
STRESS (T4) ON STRESS (T3)	0.462 (0.02)*	0.432 (0.03)*

Models controlled for age, birth sex (reference: male) and race/ethnicity (reference: white). No Change, no change in sexual identity; Change, at least one change in sexual identity across 4 time points. DEP, depressive symptoms; STRESS, Identity Management Stress; T1-T4, time point 1- time point 4; EST, unstandardized estimates; SE, standard error; *= significance at *p* value < 0.05.

Difference by sex assigned at birth

Our final model examined the temporal association between identity management stress and depression by sexual identity fluidity status and sex assigned at birth (Table 4). Among cisgender females, those who reported fluidity in sexual identity, results indicated reciprocal associations between identity management stress and depression over time. Depression predicted greater, subsequent, identity management stress (β = 0.433; SE = 0.25; $p < 0.05$), and identity management stress predicted greater, subsequent, depression (β = 0.006; SE = 0.003; $p < 0.05$). However, among those cisgender females who did

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TABLE 4 Unstandardized estimates and standard errors for the ARCL Model 2 (grouping by sexual identity change status and sex assigned at birth).

	Model 2			
	Females		Males	
	No change	Change	No change	Change
	EST. (SE)	EST. (SE)	EST. (SE)	EST. (SE)
DEP (T2) ON STRESS (T1)	0.002 (0.003)	0.006 (0.003)*	−0.005 (0.004)	−0.002 (0.005)
DEP (T3) ON STRESS (T2)	0.002 (0.003)	0.006 (0.003)*	−0.005 (0.004)	−0.002 (0.005)
DEP (T4) ON STRESS (T3)	0.002 (0.003)	0.006 (0.003)*	−0.005 (0.004)	−0.002 (0.005)
STRESS (T2) ON DEP (T1)	0.433 (0.25)	0.638 (0.30)*	0.678 (0.27)*	1.173 (0.50)*
STRESS (T3) ON DEP (T2)	0.433 (0.25)	0.638 (0.30)*	0.678 (0.27)*	1.173 (0.50)*
STRESS (T4) ON DEP (T3)	0.433 (0.25)	0.638 (0.30)*	0.678 (0.27)*	1.173 (0.50)*
DEP (T2) ON DEP (T1)	0.571 (0.03)*	0.540 (0.03)*	0.509 (0.03)*	0.629 (0.05)*
DEP (T3) ON DEP (T2)	0.571 (0.03)*	0.540 (0.03)*	0.509 (0.03)*	0.629 (0.05)*
DEP (T4) ON DEP (T3)	0.571 (0.03)*	0.540 (0.03)*	0.509 (0.03)*	0.629 (0.05)*
STRESS (T2) ON STRESS (T1)	0.460 (0.03)*	0.436 (0.03)*	0.449 (0.03)*	0.411 (0.05)*
STRESS (T3) ON STRESS (T2)	0.460 (0.03)*	0.436 (0.03)*	0.449 (0.03)*	0.411 (0.05)*
STRESS (T4) ON STRESS (T3)	0.460 (0.03)*	0.436 (0.03)*	0.449 (0.03)*	0.411 (0.05)*

All the models controlled for age and race/ethnicity (reference: white). No Change, no change in sexual identity; Change, at least one change in sexual identity across 4 time points. DEP, depressive symptoms; STRESS, identity management stress; T1-T4, time point 1- time point 4; EST, unstandardized estimates; SE, standard error; *= significance at p value < 0.05.

not report fluidity in sexual identity, we did not find any cross-lagged effects.

Among cisgender males, results indicated that depression predicted greater, subsequent, identity management stress for both groups, those who reported fluidity in sexual identity ($\beta = 1.173$; SE = 0.50; $p < 0.05$) and those who did not ($\beta = 0.678$; SE = 0.27; $p < 0.05$). While, identity management stress did not predict subsequent depression in both cisgender male groups.

Discussion

The current study advances our understanding of sexual identity fluidity, and its association with depression and identity management stress over time. The study examined difference in time-sequential associations between depression and identity management stress, by fluidity status using a multigroup autoregressive cross-lagged model. In the sample, 40% of sexual minority adolescents reported at least one change in sexual identity over 4 time-points over 18-month period. This finding is consistent with the literature, where 28-67% of sexual minority adolescents and youth have reported fluidity in sexual identity orientation over time (Diamond, 2008; Morgan et al., 2018; Silva, 2018; Cohen et al., 2020).

With regard to our research question (i.e., if temporal relationship between identity management stress and depression over time differs by sexual identity fluidity status), results show that depression predicted greater identity management stress, irrespective of sexual identity fluidity status. However, in our second model (grouping by fluidity in sexual identity and birth sex), results indicated that the association between depression and identity management stress over time differed by sexual identity fluidity for cisgender females, but not for cisgender males. Among cisgender females who reported fluidity in sexual identity, we found a reciprocal effect of identity management stress and depression over time (depression predicted subsequent identity management stress, and identity management stress predicted subsequent depression). However, among those females who did not report fluidity in sexual identity, we did not find any cross-lagged effects. Among males, we found that depression predicted subsequent identity management stress, irrespective of sexual identity fluidity status. This result draws support from limited evidence where adolescents with discordant or fluid sexual identity labels are more likely to report higher rates of depression (Everett, 2015; Caplan, 2017). For example, Caplan (2017) reported that in their school sample, those with a concordant sexual orientation (agreement between sexual behavior or attraction, and sexual identification) report significantly lower depressive symptoms scores than do those with a discordant sexual orientation. Our results suggest that among female adolescents, sexual identity fluidity is associated with cognitive and emotional disruptions as they reconfigure their identities and navigate social support networks, leading to heightened stress and depressive symptomology. Additionally, prior research examining impact of sexual identity fluidity on mental health risks have looked at change from the point of directionality (a change towards same-sex identities or a change towards heterosexual identities (e.g., Everett, 2015). However,

in our study, we examined fluidity in sexual identity labels, and not in sexual orientation on a Likert scale. Hence, we are not able to assess directionality of change, as the understanding of authentic sexual identity and a shift toward or away from it would differ from individual to individual.

Our results indicate that sexual identity fluidity process differs between cisgender females and males. Among males, the association between these two processes (identity management stress and depression) did not differ by sexual identity fluidity status. The suggested difference in that sexual identity change process between cisgender females and males, could be attributed to difference in sexual identity development and related experiences by birth sex (Kinnish et al., 2005; Diamond, 2008; Radtke, 2013). A recent systematic review of changes in sexual identities by Srivastava et al. (2022) found that sexual identity fluidity was more common among cisgender female compared to their male counterparts (often by more than 10 percentage points); however, it remains difficult to draw reliable conclusions about the extent and cause of these differences by sex assigned at birth. We believe one of the reasons for higher rates of fluidity among females in our sample compared to males could be attributed to sexual identification at baseline. For example, in our sample, those who identified with less common sexual identities (ex., pansexual, asexual, queer, and questioning) at baseline were more likely to report a change in sexual identity over 18-month period, compared to those who identified as gay, lesbian, and bisexual. *Post hoc* analyses suggests that 85% of cisgender males identified with more common sexual identities (gay or bisexual) at baseline, compared to only 66% of cisgender females. Further, those identifying as more common identities (gay, lesbian, bisexual) were least likely to report a change at the subsequent time point (14.1% vs. 49.3%; $\chi^2 = 132.1$, $p < 0.001$) compared to participants identifying with less common identities (ex., pansexual, asexual, queer, and questioning). Given the variations in reported changes and reasons for the change, more research is needed to understand the causes of such differences by assigned sex at birth. Our finding also finds some support in the extant literature, for example, Glover et al. (2009) reported that in their study males used more traditional label (e.g., gay), whereas females presented greater variability in attraction and self-labels of sexual orientation, and were more likely to experience non-exclusive attractions, thus making sexual orientation and identification a much more fluid process compared to males. Some of these differences can be explained by dominant notions of masculinity for males and more acceptability of fluidity in sexuality for females (Kilianski, 2003; Breen and Karpinski, 2013; Diamond, 2016); however, the nuances associated with sexual identity development and processes of change as they differ between cisgender females and males need further investigation.

Current research and practice with sexual minority adolescents has suggested role of enabling environment in healthy identity development among sexual minority adolescents (Perrin, 2002; Savin-Williams and Cohen, 2004; Legate et al., 2019). Studies suggest that adolescents with unsupportive or homophobic familial environment, delay their coming out processes or even try to meet the heterosexual expectations of their predominately heterosexual families (Waldner and Magrader, 1999; Cox et al., 2010; Legate et al., 2019). For example, a study with 502 adolescents reported less acceptance and greater difficulty with disclosure were associated with higher scores on internalized homophobia (negative self-perceptions and self-devaluation for being non-heterosexual) (Cox et al., 2010). Additionally, confusion about one's sexual identity can also delay endorsement and integration of sexual identity label (Igartua et al., 2009; Rosario et al., 2011). In short, lack of enabling environment may result in delaying of identity integration, resulting in development of less-authentic identities likely to change later. We believe some adolescents are more likely to report sexual identity fluidity than others, which may be because of underlying factors like access to community and support, relationship status, presence of a role model, etc. Moreover, these processes of fluidity could also be an additional stressor among sexual minority adolescents. The results add to the limited knowledge on the complex relationship between minority stress and depression as it relates to sexual identity fluidity.

Limitations and conclusion

This study had several limitations. This study focused on cisgender youth, it does not discuss the disparities experienced by transgender and gender non-binary adolescents (Price-Feeney et al., 2020; Srivastava et al., 2020). Sexual identity fluidity were measured as a difference in response to sexual identity question between two time-points, however, this may not be a conscious change on adolescent's part. Internet survey research has distinct advantages, especially for reaching marginalized, geographically dispersed minority populations (Stern et al., 2020). We recruited a large sample of diverse sexual minority adolescents from both urban and rural areas of United States. However, internet-based recruitment and data collection also have limitations and challenges. In terms of generalizability, our findings are limited to adolescents who have access to the internet and online spaces. Although there is now significant evidence that the demographic and behavioral characteristics of those recruited online are similar to those recruited through more traditional, in-person venues. Additionally, internet survey research also has validity concerns (e.g., duplicate participations). However, our study protocols addressed these concerns through rigorous validity checks. All data were self-reported; however, anonymity was ensured by not collecting any identifying information, which minimized response bias.

Despite these limitations, to our knowledge, this paper is the first to examine the difference in relationship between depression and identity management stress by sexual identity fluidity status in a nationwide sample of sexual minority adolescents. Given pervasive homonegative social and political climates in many areas, sexual minority adolescents will continue to experience sexual identity development in less supportive environments, adding to the minority stress experiences. Among females, the evidence of relationship between identity management stress and depression as it associates with sexual identity fluidity is important to support female adolescents through their healthy identity development processes. However, the underlying and understudied variations by sex and gender need further examination.

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 University of Southern California Institutional Review Board. Written informed consent for participation was not provided by the participants' legal guardians/next of kin because: All participants provided assent to participate, and longitudinal participants provided informed consent at the first follow-up survey after reaching age 18. All study procedures were reviewed and approved by the University of Southern California Social–Behavioral Institutional Review Board, including a waiver of parental permission given the potential for harm due to unintentional "outing" to a parent during the consent process.

Author contributions

AS contributed to the conceptualization, formal analysis, and writing, reviewing, and editing the manuscript. WJH and EAK contributed to the interpretation of results and editing the manuscript. JTG is the PI on the grant, and contributed to the conceptualization, and interpretation of results. All authors contributed to the manuscript revision, read, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Adolescents at risk of eating disorders: The mediating role of emotional distress in the relationship between differentiation of self and eating disorders

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Introduction: Adolescents may feel dissatisfied with their bodies, which may lead to a risk of eating disorders (EDs) due to several factors, with emotional distress being one of the most important. Evidence suggests that family might be one of the most significant factors that may increase or decrease emotional distress. An important family pattern found to contribute to mental and physical health is the differentiation of self (DoS). The primary purpose of the current study was to map the complex relationships between DoS, emotional distress, and EDs among adolescents. We hypothesized that emotional distress would mediate the relationship between DoS and the risk of EDs among adolescents. Moreover, based on findings indicating a higher risk of EDs among females, we expected sex differences in the research indices and the mediation model.

Methods: The sample included 194 non-clinical adolescents (mean age 15.15; mean BMI 21.66). Preliminary analyses examined differences between males and females using *t*-tests. In addition, Pearson correlations were run to assess the association between background variables and the study metrics among males and females. To examine the mediation effect, we ran SEM.

Results: Due to a sex moderation effect, two mediation models were run (SEM), one for females and one for males. Results indicated that emotional distress partially mediated the relationships between DoS and the risk of EDs. In addition, sex differences were found in the mediated indices, showing that among female adolescents, perfectionism is the only dimension of EDs that was associated with DoS through the mediation of emotional distress. While the relationship between emotional distress and the risk of EDs is well documented.

Conclusions: It is concluded that high DoS may reduce emotional distress, which may, in turn, decrease the risk of EDs. In addition, the results enable an in-depth understanding of specific risk factors of EDs that characterize each sex.

KEYWORDS

eating disorders, adolescents, emotional distress, stress, anxiety, depression, differentiation of self

1. Introduction

Adolescence is characterized by accelerated changes occurring in various areas (Sawyer et al., 2018). For example, in the family, teenagers take more responsibility and go through a process of individuation and separation from the family unit. Similarly, at school, academic demands increase, and in the wider society, they explore new experiences with peers and engage in new adult activities (Helsen et al., 2000; Steinberg, 2007). Physically, adolescents experience changes that shape their perceptions of themselves and their attitudes toward their appearance and may lead to dissatisfaction with their body image (Markey, 2010; Chulani and Gordon, 2014; Voelker et al., 2015).

Negative body perception was found to predict weight control behavior that may be manifested in harmful actions, such as fasting, purging, extreme diets, or intense exercise (Knowles et al., 2009). In addition, body dissatisfaction and preoccupation with weight were found to be related to eating disorders (EDs; Voelker et al., 2015). EDs are well-defined by the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders* 5th Edition (DSM-V) as diseases characterized by severe disturbances in eating behaviors. According to the DSM-V, the following EDs are recognized: anorexia nervosa (AN), atypical anorexia nervosa (AAN), bulimia nervosa (BN), binge eating disorder (BED), and avoidant/restrictive food intake disorder (ARFID; the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition, DSM-5, American Psychiatric Association, 2013).

A significant limitation in the current knowledge is that most studies that examined the detection, treatment, and course of EDs have focused on females, leading to sex bias (Silén et al., 2021). Thus, it was found that body image disorder was more common among girls (15%) than boys (6.8%; Quiles-Marcos et al., 2011). Recently community studies found the prevalence of EDs ranged from 3.1 to 17.9% among females and 0.6 to 2.4% among males (Silén et al., 2020). In addition, according to Silén et al. (2021), the rate of people suffering from EDs diagnosed according to the DSM-5 criteria is 1:10 male/females, respectively, in clinical samples and 1:4 in non-clinical samples. Yet it should be noted that recent studies show that the prevalence of EDs among men is increasing. Therefore it is recommended to further examine this issue among male adolescents for identification, detection, and tailored treatment (Nagata et al., 2020).

Previous studies yielded positive associations between EDs and stress (e.g., Aoun et al., 2013; Solmi et al., 2020), anxiety, and depression (e.g., Drieberg et al., 2019) among adolescents. Teenagers' coping with these pressures alongside the many changes that occur during adolescence is challenging and requires strength and personal qualities that will enable them to successfully deal with the various difficulties and stresses (Orkibi and Ronen, 2015).

There is evidence that family might be one of the most significant factors in increasing or decreasing emotional distress. Indeed, it was observed that family patterns both contributed to mental and physical health and increased the risk of EDs (Erriu et al., 2020). According to Bowen's (1978) Family Systems Theory, the emotional, physiological, and behavioral patterns in the family system are passed from generation to generation. Bowen argued that childhood and adolescence are critical periods for achieving developmental tasks and regulating emotions. This is a time when their personality is in a process of formation and it is still possible to help prevent critical difficulties (Kerr and Bowen, 1988). During this period, adolescents learn to be less dependent on their parents and develop symmetrical relationships with them, thus increasing their tendency to make decisions independently (Bowen, 1978; Kerr and Bowen, 1988).

One of the most important family patterns that has been derived from this theory is differentiation of self (DoS). DoS is a pattern passed down through the generation. It describes, on an interpersonal level, the ability to balance intimacy and autonomy in relationships with significant others, and on the intrapersonal level, the ability to balance cognition and emotion. For adolescents, DoS includes six components: own emotional reactivity, maintaining a clear identity, hypersensitivity to others, seeking emotional distance, emotional dependence on others, and reactive distancing from a close friend (Knauth and Skowron, 2004). DoS takes shape during childhood and adolescence and is influenced by the parents' level of DoS. High DoS allows an individual to adhere to his feelings, thoughts, and needs and to deal more effectively with stressful situations and social pressures, while low DoS increases the difficulty of behaving authentically, regulating emotions, and coping with stress and crises.

Indeed, it was demonstrated that low levels of DoS are associated with high levels of anxiety in adolescents (Peleg et al., 2015), depression (Choi and Murdock, 2017), problematic coping styles, stress, physical health problems (Hooper and Doehler, 2011) and EDs (Peleg et al., 2022). Thus, for example, Doba et al. (2018) found in a sample of adolescents that low DoS may lead to distortions in self-perception, channel emotions into excessive eating or extreme weight gain, and increase pathologies aimed at improving body image.

It has been suggested that emotional distress may increase the risk of EDs, but this depends on certain family indices (e.g., Peleg et al., 2022). Hence, it is essential to examine its mediating role between the two variables of DoS and the risk of EDs. Thus, for example, in a recent study conducted among young adults (Peleg et al., 2022), emotional distress was found to mediate the relationship between DoS and the risk of EDs and specifically, between I-position and the risk of EDs, showing that a low level of I-position indicates a tendency to avoid direct communication in interpersonal relationships. This leads to increased psychological distress, which may, in turn, increase predisposition to EDs. However, the natural course of DoS, emotional distress, and the risk of EDs among adolescents remains poorly understood and thus merits further investigation.

2. The current study

Given the evidence of both associations between emotional distress and EDs and emotional distress and DoS and the mediating role of emotional distress between these variables, the primary purpose of this study was to map the complex relationships between these factors. Despite identifying DoS as a significant developmental phenomenon and its association with psychological and physiological outcomes, investigating how emotional distress mediates the relationships between DoS and the risk of EDs has been negligible. The current study expanded upon the relationships of the variables under study by examining the nature of this critical pathway. In addition, since this issue has not yet been examined among adolescents, we aimed to address this knowledge gap. Hence, we hypothesized that emotional distress (stress, anxiety, depression) would mediate the relationship between DoS (own emotional reactiveness, maintaining a clear identity, hypersensitivity to others, seeking emotional distance, emotional dependence on others, and reactive distancing from a close friend) and the risk of EDs (drive for thinness, bulimic tendencies, body dissatisfaction, and perfectionism) among adolescents. In addition, given that EDs are one of the most gendered mental health disorders (Weber et al., 2019), there is great importance in investigating the differences between male and female adolescents to learn more about the risk factors of EDs. Therefore, our second aim was to examine sex differences in the research indices and the mediation model.

3. Materials and methods

3.1. Participants

The number of participants in the current study was 194 adolescents, of whom 129 were females (66.5%) and 65 males (33.5%; Table 1). Participants' ages ranged from 12 to 20 ($M = 15.14$, SD = 1.71), and their BMI ranged from 15.01 to 33.15 ($M = 21.66$, SD = 3.54). The inclusion criterion was adolescents whose parents were married or living together. This criterion is based on Bowen's (1978) assumption that stressful life events (e.g., divorce) may change DoS levels (e.g., Peleg, 2014). We therefore chose not to include participants whose family status could bias the results.

TABLE 1 Characteristics of study participants (N=194).

	n	%	*M*	SD	Range
Sex					
Females	129	66.5			
Males	65	33.5			
Age			15.14	1.71	12–20
BMI			21.66	3.54	15.01–33.15

3.2. Research instruments

A Personal Information Questionnaire was specifically constructed for the present study. The instrument includes background information, e.g., religion, age, sex, weight, and height.

The Eating Disorder Inventory-2 (EDI-2) (Garner, 1991) is a multidimensional and practical questionnaire for clinical and non-clinical purposes (Lee et al., 1998). The EDI-2 contains 91 items, rated on a six-point scale, and 11 sub-scales. Based on previous studies (Latzer et al., 2018), we used in the current research four significant sub-scales tapping EDs (EDI-2): drive for thinness (DT); bulimic tendencies (B); body dissatisfaction (BD); and perfectionism (P). The EDI-2 was found valid and reliable in a wide range of research studies and has been translated into many languages, including Hebrew (Niv et al., 1998). In the current study, the internal reliability of the questionnaire was good: drive for thinness ($\alpha = 0.80$); bulimic tendencies ($\alpha = 0.83$); body dissatisfaction ($\alpha = 0.87$); and perfectionism ($\alpha = 0.75$).

Differentiation of Self-Inventory for Adolescents (Knauth and Skowron, 2004). The original Questionnaire (DSI-R, Skowron and Schmitt, 2003) was adapted for adolescents and translated into Hebrew (Peleg and Harish, 2022). The questionnaire consists of 25 items that assess relationships in general and in the family of origin. The instrument includes six sub-scales: own emotional reactiveness, maintaining a clear identity, hypersensitivity to others, seeking emotional distance, emotional dependence on others, and reactive distancing from a close friend. A sample item: "Closest friend wants too much from me" (reactive distancing from a close friend). The answers are rated on a Likert scale from 1 (completely incorrect) to 6 (completely true). The calculation is based on means scores. The internal reliabilities of the questionnaire in the current study were: for own emotional reactiveness–0.86, for maintaining a clear identity–0.81, for hypersensitivity to others–0.70, for seeking emotional distance-off–0.86, for emotional dependence on others–0.81, and for reactive distancing from a close friend–0.82.

The Depression Anxiety Stress Scales (DASS-21) (Henry and Crawford, 2005). This questionnaire is a short version (21 items) of a 42-item self-report instrument designed to measure three related negative emotional states: depression, anxiety, and tension/stress. This measure was translated and adapted into Hebrew and was found reliable and valid. The current study's internal consistency (Cronbach's alpha) was good, as the scale was 0.90 (Alon-Tirosh et al., 2021). It includes three sub-scales, depression (7 items), anxiety (7 items), and stress (7 items). Sample item: "I felt that life was meaningless" (depression). Scores are summed such that higher scores indicate more depression, anxiety, or stress. In the present study, we used the total DASS score because there were strong correlations between the three metrics: stress, anxiety, and depression. Factor analysis for the three scales extracted only

one component, Eigenvalues = 2.37. Total Variance Explained = 78.88. Internal consistency in the current study was high; the total score was 0.94, for depression 0.89, for anxiety 0.86, and for stress 0.86.

3.3. Procedure

After receiving approval from the College Institutional Review Board (on 9.12.2019; EMEK YVC 2020-13) and from the Ministry of Education, we approached school principals in northern Israel. The research assistants received approval from two Jewish public high school principals to participate in the study. Participants who gave their parents and their active consent were allowed to participate in the study (10.8%). The research assistants provided participants with the instructions for filling out the questionnaire: they explained that completing the questionnaires was voluntary, participation in the study allowed complete anonymity, there were no right or wrong answers, and withdrawal from the study at any time was possible. All participants signed an informed consent form. Filling out the questionnaire was done in paper and pencil format. Filling out the questionnaires took about 30 min. No compensation was given for participating in the study.

3.4. Data analysis

Preliminary analyses examined differences between males and females using *t*-tests and Chi-square. According to Bonferroni's correction of 11 comparisons, the significance level was $\alpha = 0.00465$. In addition, Pearson correlations testing relationships between age, BMI, and study variables were calculated for males and females separately. Since, in the present study, very high correlations were found between the three scales of DASS-21 (depression, anxiety, and stress), a problem arose in the AMOS model. Therefore, to avoid multicollinearity, we used the total DASS-21 score. To test the mediation hypothesis, path analysis was conducted using IBM AMOS. We used multigroup analysis to examine differences between males and females in the different paths. Multigroup analysis in structural equation modeling (SEM) is another form of moderation analysis using grouping variables (In our study, males and females).

4. Results

4.1. Preliminary analyses

Table 2 presents *t*-tests for examining differences between males and females in the study variables. In addition, a Chi-square test was conducted to examine differences between males and females in the risk of EDs (high risk was determined by a score higher than 14 on the drive for thinness scale). The examination of differences in DoS shows that females are significantly higher in their emotional reactiveness, hypersensitivity to others, and emotional dependence on others but significantly lower in maintaining a clear identity compared to males. No significant differences were found in seeking emotional distance and reactive distancing from a close friend. In addition, females reported significantly higher levels of depression, anxiety, and stress (DASS Score). Finally, females reported significantly higher levels of drive for thinness, body dissatisfaction, and bulimia (EDI-2) than males. In addition, a higher percentage of females than men had a high level of risk of developing EDs. No significant differences were found in perfectionism (EDI-2).

To examine the associations between the study variables, Pearson correlations were run among males and females separately (Table 3). As can be seen in Table 2, own emotional reactiveness, hypersensitivity to others, seeking emotional distance, emotional dependence on others, and reactive distancing from a close friend were positively associated with DASS-21, and maintaining a clear identity was negatively associated with DASS (these are the associations between the independent variables and the mediating variable in the current study). In addition, DASS-21 was positively associated with the four scales of EDI-2 (These are the associations between the mediating variable and the dependent variables).

4.2. Path analysis model

Multigroup path analysis was conducted to explore the potential moderating role of sex in the hypothesized mediation model. According to our hypothesis, the association between DoS and EDs would be mediated by depression, anxiety, and stress (DASS). The results showed a significant decrease in the goodness of fit indices in the constructed model (which constructs the model paths so that they are equal among males and females) compared to the unconstructed model (which separates the path for males and females), χ^2 (15) = 30.27, $p = 0.011$. In other words, these results indicate that the goodness of fit indices of the model that calculates separate paths for males and females are better, χ^2 (38) = 1.39, $p = 0.055$, GFI = 0.96, CFI = 0.98, RMSEA = 0.045, compared to model for males and females together, χ^2 (53) = 1.57, $p = 0.005$, GFI = 0.93, CFI = 0.97, RMSEA = 0.054. Based on the results, separate models will be presented. According to modification indices, we added direct paths between DoS and EDs. In addition, BMI was entered as a covariate. See Table 4 for standardized parameters for the final model.

The results of the model show that own emotional reactiveness and seeking emotional distance were found positively associated with DASS-21, whereas maintaining a clear identity was found negatively associated with DASS-21, with no significant differences between males and females. In addition, only among females, emotional dependence on others was found to be positively associated with DASS-21; and reactive distancing from a close friend was found to be negatively associated with DASS-21 (It should be mentioned that although these paths were significant

TABLE 2 Differences in the study variables by sex (N=194).

	Gender						t (192)	Adj p
	Males (n =65)			Females (n =129)				
	M	SD	R	M	SD	R		
Differentiation of self-inventory (DSI)								
Own emotional reactiveness	2.63	1.24	1.00–5.17	3.52	1.33	1.00–6.00	−4.52	<0.001
Maintaining a clear identity	4.63	1.14	1.00–6.00	4.11	1.06	1.00–6.00	3.10	0.001
Hypersensitivity to others	3.17	1.64	1.00–6.00	4.29	1.35	1.00–6.00	−4.74	<0.001
Seeking emotional distance	2.81	1.70	1.00–6.00	2.87	1.69	1.00–6.00	−0.23	0.407
Emotional dependence on others	2.66	1.30	1.00–6.00	3.02	1.23	1.00–6.00	−1.89	0.030
Reactive distancing from close friend	2.27	1.48	1.00–6.00	2.20	1.29	1.00–6.00	0.37	0.357
DASS scale	0.87	0.70	0.00–2.95	1.05	0.66	0.00–2.81	−1.81	0.036
Eating disorder inventory (EDI)								
Drive for thinness	17.63	9.70	7–42	23.36	10.62	7–42	−3.65	<0.001
≤14	n = 27 (41.5%)			n = 35 (27.1%)			χ^2 (1) = 4.13	p = 0.042
>14	n = 38 (58.5%)			n = 94 (72.9%)				
Body dissatisfaction	22.08	10.88	9–49	28.92	10.51	9–54	−4.23	<0.001
Bulimia	14.17	7.20	7–40	17.02	7.50	7–42	−2.54	0.006
Perfectionism	23.31	6.85	9–36	23.02	6.70	11–36	0.28	0.391

Significant levels shown in the table were corrected using Bonferroni correction (α = 0.00465).

among women only, no significant differences were found between males and females). DASS-21 was found to be positively associated with perfectionism (among both sexes) and positively associated with the drive for thinness, body dissatisfaction and bulimia among males only (with significant differences between males and females). Path analysis summary by gender is presented in Table 4.

An examination of the indirect effects (with DASS-21 as a mediator) shows that the indirect effects of own emotional reactiveness and seeking emotional distance on each of the four EDs scales was found significant among males. Among females, the indirect effects of five of the DoS scales were found significant only on perfectionism (the five scales are: own emotional reactiveness, maintaining a clear identity, seeking emotional distance, emotional dependence on others, reactive distancing from a close friend, see indirect analyses summary by sex in Table 5).

An examination of the direct effects shows a negative direct effect of maintaining a clear identity on body dissatisfaction (for both sexes) and also on the drive for thinness and bulimia (for females only). In addition, the results show a positive direct effect of seeking emotional distance on the drive for thinness and body dissatisfaction (for females only) and on bulimia (for men only). Finally, the direct effect of reactive distancing from a close friend on bulimia was significant for males only (see Figures 1, 2).

5. Discussion

The present study aimed to explore the role of emotional distress as a mediator between DoS and the risk of EDs among adolescents. Due to a sex moderation effect, two mediation models were run for females and males alike. The findings indicate that emotional distress partially mediated the relationship between DoS and EDs. With regard to sex differences, female adolescents reported higher levels of emotional distress and risk of EDs than male adolescents, supporting previous studies (Doba et al., 2018). In addition, females reported higher levels of emotional dependence on others, hypersensitivity to others, and lower levels of maintaining a clear identity than males. As expected, the percentage of females at risk of EDs was higher than males.

The findings indicate that sex differences were found in the mediation model. Thus, among male adolescents, emotional distress mediated the relationships between three metrics of DoS—own emotional reactivity, seeking emotional distance and

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TABLE 3 Correlations between study variables by sex (N=194).

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	-	0.30**	0.14	0.02	0.23*	0.16	0.12	0.18	0.13	0.01	0.09	0.21*	−0.07
2. BMI	0.04	-	0.14	−0.14	0.15	0.07	0.12	0.25*	0.16	0.34**	0.54**	0.35**	−0.10
3. Own emotional reactiveness	−0.01	0.08	-	−0.24*	0.69**	0.38**	0.73**	0.58**	0.77**	0.56**	0.49**	0.57**	0.33**
4. Maintaining a clear identity	0.17*	−0.01	−0.26**	-	−0.07	−0.04	−0.25*	−0.18	−0.29**	−0.21*	−0.45**	−0.26*	0.05
5. Hypersensitivity to others	0.10	0.02	0.65**	−0.19*	-	0.48**	0.72**	0.45**	0.71**	0.55**	0.46**	0.51**	0.38**
6. Seeking emotional distance	−0.01	0.01	0.13	0.09	0.17*	-	0.40**	0.52**	0.61**	0.29**	0.40**	0.60**	0.33**
7. Emotional dependence on others	0.02	0.16*	0.53**	−0.35**	0.49**	0.32**	-	0.53**	0.72**	0.49**	0.40**	0.51**	0.37**
8. Reactive distancing from close friend	0.01	0.18*	0.29**	−0.08	0.20*	0.46**	0.39**	-	0.56**	0.55**	0.54**	0.69**	0.28*
9. DASS	−0.10	0.13	0.54**	−0.34**	0.39**	0.33**	0.54**	0.20*	-	0.55**	0.61**	0.69**	0.33**
10. Drive for thinness	0.00	0.38**	0.38**	−0.38**	0.32**	0.16*	0.38**	0.31**	0.26**	-	0.75**	0.62**	0.34**
11. Body dissatisfaction	−0.07	0.36**	0.30**	−0.43**	0.27**	0.20*	0.43**	0.31**	0.29**	0.63**	-	0.68**	0.06
12. Bulimia	0.02	0.24**	0.26**	−0.35**	0.11	0.12	0.25**	0.24**	0.22**	0.50**	0.32**	-	0.34**
13. Perfectionism	−0.11	0.08	0.28**	−0.12	0.18*	0.11	0.19*	0.13	0.26**	0.32**	0.14	0.30**	-

*$p < 0.05$, **$p < 0.01$.
The correlations appearing above the diagonal were calculated among males ($n = 65$), the correlations appearing below the diagonal were calculated among women ($n = 129$).

maintaining a clear identity—and all indices of the risk of EDs, while in girls, emotional distress mediated the relationships between all indices of DoS except for own hypersensitivity to others and only one measure of Eds—Perfectionism. Namely, in girls, of the four indices of EDs, only perfectionism was found to be mediated by emotional distress. A possible explanation for this result is that girls may have additional factors that increase the risk of EDs (e.g., social pressure, messages in the media regarding the ideal of beauty and thinness, etc.), whereas, for boys, it is likely that mainly emotional distress increases preoccupation with eating behaviors. The importance of this finding among adolescents emerged in light of a recent study conducted among young adults, which revealed that of the indices, perfectionism was the only one that was not found to be related to EDs or DoS (Peleg et al., 2022). Adolescents likely turn to perfectionism because they are in the process of shaping and strengthening self-identity and self-confidence. When they feel distressed or insecure, they are likely to become more perfectionists trying to improve their ego and to feel valuable. Perfectionism usually develops during childhood and adolescence, when parents play a central role (Stoeber and Childs, 2011). According to the Social Learning model (Bandura and Walters, 1977), children and adolescents develop perfectionism by observing and imitating their parents' perfectionism. Throughout their childhood and adolescence, they are exposed to their parents' behaviors trying to be as perfect as they are. Although perfectionism also has positive aspects in increasing motivation and responsibility (e.g., Negru-Subtirica et al., 2021), it has been reported that a high level of perfectionism may increase the risk of EDs (e.g., Peleg et al., 2016; Johnston et al., 2018). This topic is of great importance and merits further investigation.

In addition to the relationships mediated by emotional distress, direct relationships have also been found between DoS and the risk of EDs. Thus, in girls, seeking emotional distance and maintaining a clear identity significantly affected the metrics of risk of EDs (except for perfectionism). Similar results were found among male adolescents: seeking emotional distance, maintaining a clear identity, and reactive distancing from a close friend directly affected all metrics of risk of EDs (apart from perfectionism). The current results support recent studies indicating poor DoS in adolescents with a high risk of EDs (e.g., 10) and adverse relationships between DoS and emotional distress. In addition, the results strengthen the Family Systems Theory (Kerr and Bowen, 1988), which suggests that DoS is rooted in early family experiences and affects the individual's

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TABLE 4 Path analysis summary by sex.

Exogenous variables	Endogenous variables	Direct effect				Differences between paths by sex	
		Female		Male			
		Beta	*p*	Beta	*p*	Chi (1)	*p*
Own emotional Reactiveness	DASS	0.40	<0.001	0.40	<0.001	0.19	0.667
Maintaining a clear identity		−0.20	0.005	−0.14	0.034	0.47	0.493
Hypersensitivity to others		−0.04	0.636	0.17	0.089	2.33	0.127
Seeking emotional distance		0.31	<0.001	0.33	<0.001	0.11	0.744
Emotional dependence on others		0.24	0.007	0.15	0.128	0.41	0.521
Reactive distancing from close friend		−0.17	0.027	−0.03	0.739	1.79	0.181
DASS	Drive for thinness	0.04	0.678	0.56	<0.001	10.12	0.001
	Body dissatisfaction	0.02	0.841	0.39	<0.001	7.65	0.006
	Bulimia	0.04	0.642	0.34	<0.001	4.11	0.043
	Perfectionism	0.26	0.003	0.36	0.002	0.42	0.518
Maintaining a clear identity	Drive for thinness	−0.37	<0.001	−0.05	0.603	7.65	0.006
	Body dissatisfaction	−0.44	<0.001	−0.27	<0.001	2.70	0.100
	Bulimia	−0.33	<0.001	−0.08	0.278	5.29	0.021
Seeking emotional distance	Drive for thinness	0.17	0.025	−0.11	0.345	4.11	0.043
	Body dissatisfaction	0.23	0.003	0.12	0.210	0.67	0.412
	Bulimia	0.08	0.403	0.21	0.029	0.88	0.347
Reactive distancing from close friend	Bulimia	0.10	0.252	0.31	<0.001	1.81	0.179
BMI	DASS	0.09	0.198	0.03	0.664	0.40	0.530
	Drive for thinness	0.38	<0.001	0.24	0.016	1.86	0.172
	Body dissatisfaction	0.34	<0.001	0.43	<0.001	0.68	0.410
	Bulimia	0.21	0.009	0.20	0.010	0.09	0.764
	Perfectionism	0.05	0.577	−0.16	0.171	2.03	0.154

ability to deal with stressful situations. Moreover, this is one of the few studies examining DoS in adolescents. Since DoS can still change at this point, understanding its impact on mental and physical health is critical and allows for preventing the deterioration of emotional difficulties, including the risk of EDs.

To sum up, the present findings partly support the hypothesis that emotional distress mediates the relationship between DoS and EDs. The results suggest that individuals with a high risk of EDs have difficulty dealing with stressful situations and social pressures due to low DoS. It can be speculated that adolescents who find it challenging to maintain their self, identity, and beliefs tend to feel upset and distressed because the responses of significant others may threaten them, and as a result of the heightened emotional distress, they increase perfectionistic behaviors and are at a higher risk of EDs.

6. Limitations

The results should be treated with caution due to several limitations. First, given the correlational nature of the study design, it is not possible to assume causality. Indeed, the option that EDs may lead to low DoS is less likely. Nonetheless,

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TABLE 5 Indirect analysis summary by sex.

Exogenous variables	Endogenous variables	Standardized indirect effects			
		Females		Males	
		Beta	*p*	Beta	*p*
BMI	Drive for thinness	0.00	0.480	0.02	0.663
	Body dissatisfaction	0.00	0.654	0.01	0.663
	Bulimia	0.00	0.661	0.01	0.567
	Perfectionism	0.02	0.094	0.01	0.593
Own emotional reactiveness	Drive for thinness	0.01	0.758	0.23	0.004
	Body dissatisfaction	0.01	0.890	0.16	0.005
	Bulimia	0.02	0.765	0.14	0.001
	Perfectionism	0.10	0.015	0.14	0.002
Maintaining a clear identity	Drive for thinness	−0.01	0.559	−0.08	0.081
	Body dissatisfaction	0.00	0.719	−0.05	0.095
	Bulimia	−0.01	0.643	−0.05	0.071
	Perfectionism	−0.05	0.043	−0.05	0.095
Hypersensitivity to others	Drive for thinness	0.00	0.481	0.10	0.126
	Body dissatisfaction	0.00	0.696	0.07	0.098
	Bulimia	0.00	0.671	0.06	0.058
	Perfectionism	−0.01	0.594	0.06	0.084
Seeking emotional distance	Drive for thinness	0.01	0.628	0.18	0.014
	Body dissatisfaction	0.01	0.831	0.13	0.018
	Bulimia	0.01	0.690	0.11	0.009
	Perfectionism	0.08	0.005	0.12	0.010
Emotional dependence on others	Drive for thinness	0.01	0.708	0.09	0.238
	Body dissatisfaction	0.00	0.921	0.06	0.210
	Bulimia	0.01	0.773	0.05	0.183
	Perfectionism	0.06	0.025	0.06	0.183
Reactive distancing from close friend	Drive for thinness	−0.01	0.567	−0.02	0.804
	Body dissatisfaction	0.00	0.823	−0.01	0.766
	Bulimia	−0.01	0.704	−0.01	0.775
	Perfectionism	−0.04	0.027	−0.01	0.764

longitudinal research is needed to offer more comprehensive information on the suggested relationships between DoS, emotional distress, and EDs. Second, the current study did not examine other aspects of EDs (e.g., social pressure, body image, self-confidence, social network use, etc.). Third, the sample in the current study is not representative. We therefore suggest that further investigations of this issue use a larger representative sample of teenagers from different regions and ethnic groups and include additional variables (e.g., social media use, body image).

7. Conclusion

Notwithstanding the limitations, the present study deepens the understanding of risk factors of EDs and the possibility that family and emotional factors are involved in the etiology of EDs among adolescents. In addition, while the relationship between emotional distress and the risk of EDs is well documented, the present study is novel. It indicates that high DoS may reduce emotional distress, which in turn may reduce the risk of EDs. Another strength of the present study lies in the investigation of two separate models for males and females alike, which enables an in-depth understanding of the risk factors that characterize males and females.

8. Clinical implications

The findings may have significant applied contributions. It is reasonable to assume that promoting the healthy development of children and adolescents will enable adaptive individuation

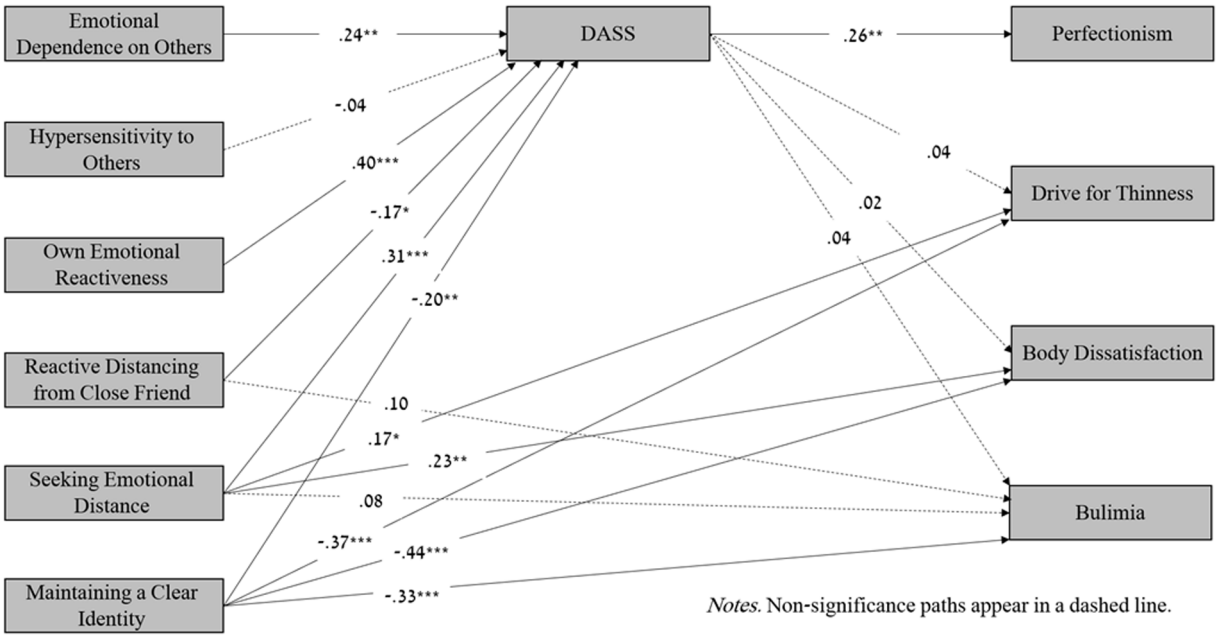

FIGURE 1
Mediation model: The associations between differentiation of self and risk of eating disorders mediated by depression, anxiety and stress (DASS) among females. Non-Significance paths appear in a dashed line.

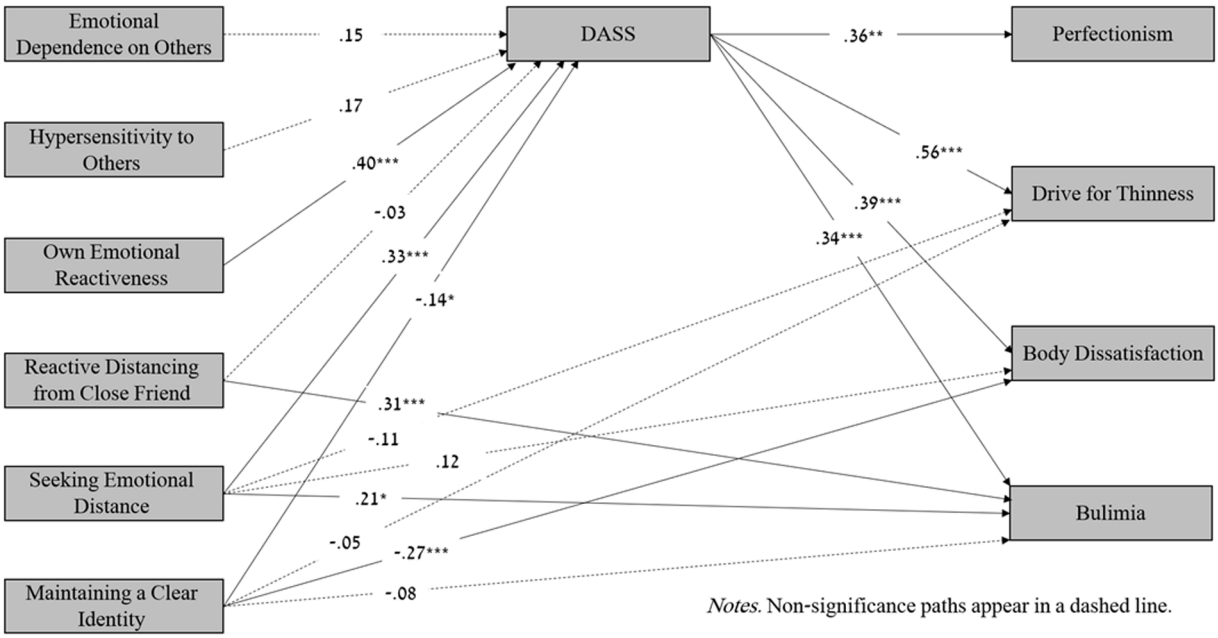

FIGURE 2
Mediation model: The associations between differentiation of self and risk of eating disorders mediated by depression, anxiety and stress (DASS) among males. Non-Significance paths appear in a dashed line.

(Gilmore and Meersand, 2013) and thus decrease emotional distress. For this purpose, we suggest planning workshops for teenagers, tailored to each sex separately, which deal with emotional distress by improving DoS and direct communication and thus helping to reduce the risk of EDs. For example, boys could be helped to improve their emotion regulation and to share

their emotions instead of repressing them, while girls could be helped to work on their tendency toward perfectionism. These workshops should be able to prevent escalation and deterioration during adolescence, which is a critical age for the outbreak of EDs. We also recommend holding workshops for parents to provide them with coping skills aimed at improving DoS and relationships with their children.

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 College Institutional Review Board approved the complete study protocol on 9.12.2019 (EMEK YVC 2020–13). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

OP constructed the research plan, chose the research tools, and was responsible for data collection, analysis, and interpretation of the data, and was a significant contributor to writing the manuscript. MB-N was a significant contributor in interpreting the data and writing the manuscript. OT helped in interpreting the data. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Does parental phubbing aggravates adolescent sleep quality problems?

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Objective: Based on the theoretical model for the "stress–sleep" relationship, this study investigated the impact of parental phubbing on adolescent sleep quality problems and a moderated mediation mechanism.

Methods: A total of 781 adolescents was surveyed using the Chinese version of Parental Phubbing Scale, the Ultra-brief Screening Scale for Depression and Anxiety Scale, the Self-Control Questionnaire for Chinese children, and the Chinese version of Pittsburgh Sleep Quality Index Scale.

Results: Parental phubbing and negative emotions were significantly and positively correlated to sleep quality problems, but self-control was not correlated to sleep quality problems. Parental phubbing directly influenced sleep quality problems and also indirectly influenced sleep quality problems through the mediating effect of negative emotions. Moreover, self-control played a moderating role in the path of parental phubbing affecting negative emotions. That is, the effect was more significant for adolescents low in self-control relative to those high in self-control.

Conclusion: Parental phubbing is a risk factor for adolescent sleep quality problems. This study is the first to demonstrate empirical evidence for the relationship between parental phubbing and sleep quality problems.

KEYWORDS

parental phubbing, negative emotions, sleep quality problems, self-control, adolescents

1. Introduction

With the development of information technology, cell phones are becoming more and more popular in modern society. Parental phubbing is an emerging issue in family context, which is defined as parents' concentrating on using cell phones while neglecting their children in parent–child interaction (Xie and Xie, 2020; Zhang et al., 2021). Previous research has found that parental phubbing negatively affected adolescent mental health (Wang and Qiao, 2022; Xiao and Zheng, 2022), behavior (Wang et al., 2020; Zhang et al., 2021), and academic performance (He et al., 2022; Wang X. et al., 2022). Because of the salient negative effects of parental phubbing on adolescents, it is necessary to expand the research in this area. However, the effect of parental phubbing on physical health, which is equally important for adolescent health development, has not been studied. Good sleep quality is an important indicator of the physiological health of adolescents, and sleep quality problems could hamper adolescent health development (Wang et al., 2016). Sleep quality problems include insomnia, frequent nightmares, staying up late, and lack of sleep (Wang W. et al., 2022). A meta-analysis study showed that adolescents around the world had varying degrees of sleep quality problems (Gradisar et al., 2011). In China, children's sleep quality is reported to be severely poor. According to a white paper released by the Chinese Sleep Research Society in March 2019, nearly 63% of Chinese children and adolescents aged between 6 and 17 years slept less than 8 h per day. And a recent meta-analysis has found that 20% adolescents in junior high school and 28%

adolescents in senior high school have sleep disturbances (Liang et al., 2021). Therefore, the present study would examine the effect of parental phubbing on adolescent sleep quality problems.

1.1. Parental phubbing and adolescent sleep quality problems

Although there is no direct evidence to support the idea that parental phubbing increases adolescent sleep quality problems, this assumption can be extrapolated from empirical results in previous research and the theoretical model of the "stress – sleep" relationship. The theoretical model of the "stress – sleep" relationship contends that stressors (family, social, and work) have a great impact on individuals' sleep quality, and stress response and stress coping are important in regulating the relationship between stress and sleep quality (Yan et al., 2010). According to the theoretical model of the "stress – sleep" relationship and many empirical studies (Liu et al., 2017; Yeung et al., 2017; Wang W. et al., 2022), stress is one of the most common precipitants of sleep quality problems. As parental phubbing has been prevalent in recent years (Hong et al., 2019; Zhang et al., 2021) and 35% parents in a study have reported frequently using their mobile phones while interacting with their children (Kildare and Middlemiss, 2017), parental phubbing may have become one of adolescent main stressors today. If parents frequently use mobile phones, the ongoing parent–child communication would be interrupted, resulting in parents not being able to respond to their children's needs in time. Specifically, in parent–child interaction, parental phubbing prevents adolescents from normally enjoying parental attention and companionship (Xiao and Zheng, 2022), and it directly decreases the quality of parent–child relationships and family cohesion (Niu et al., 2020; He et al., 2022). Moreover, some researchers pointed out that phubbing is a kind of social exclusion behavior (David and Roberts, 2017; Xie and Xie, 2020), and chronic experience of social exclusion could be regarded as a stressful situation (Wang H. et al., 2017). Thus, parental phubbing as a kind of stressor may lead to sleep quality problems in adolescents. Therefore, this study proposes hypothesis 1 (H1): Parental phubbing has a significant positive effect on adolescent sleep quality problems.

In addition, the mechanism by which stress affects sleep quality may be influenced by other factors. According to the theoretical model of the "stress – sleep" relationship, stressors can also affect sleep quality through the emotional responses and stress coping of individuals (Yan et al., 2010). Therefore, to further discuss the influence of parental phubbing on adolescent sleep quality problems, this study will test emotional responses as a mediator and stress coping as a moderator on the relationship between parental phubbing and adolescent sleep quality problems grounded on this theoretical model.

1.2. Negative emotions as the mediator

According to the theoretical model of the "stress – sleep" relationship, stressors are not only correlated to sleep quality, but also indirectly correlated to sleep quality through the mediation of stress responses such as physiological responses, cognitive responses, and emotional responses (Yan et al., 2010). Considering that negative emotions, for example, depression and anxiety, are common results of parental phubbing (Xie and Xie, 2020; Wang et al., 2021; Wei et al., 2022; Xiao and Zheng, 2022), we speculate that negative emotions as typical emotional responses mediate the relationship between parental phubbing and adolescent sleep quality problems.

On the one hand, children's healthy development of social-emotions relies on the reality that parents are responsive and sensitive to children's needs during parent–child interactions (Swain et al., 2010). However, parental phubbing renders it difficult for parents to identify and respond to their children's various needs in time, leading to a series of emotional problems for their children. For example, some studies indicated that adolescents expect their parents to be highly involved in parent–child interactions (He et al., 2022; Xiao and Zheng, 2022). In this case, adolescents may develop negative emotions if treated by parental phubbing, a form of social exclusion and rejection usually unaware by parents (David and Roberts, 2017; Xie and Xie, 2020). In addition, a series of previous studies have confirmed that parental phubbing is positively associated with negative emotions such as depression and anxiety in adolescents (Wang et al., 2021; Xiao and Zheng, 2022).

On the other hand, based on the theoretical model of the "stress – sleep" relationship, the emotional response is one of the ways by which stress acts on sleep quality (Yan et al., 2010). This argument is supported by some empirical studies. For example, a recent study has shown that stressful life events increases negative emotions thereby indirectly influencing sleep quality (Wang and Matsuda, 2021). Compared to stressful life events, depressive emotional response was a stronger predictor for sleep disturbance among women with metastatic breast cancer (Palesh et al., 2007). Furthermore, numerous studies have agreed on the result that negative emotions (e.g., anxiety, depression) are important triggers of sleep quality problems (Guo and Sun, 2016; Bjorøy et al., 2020; Wang and Matsuda, 2021; Wang W. et al., 2022). Therefore, the present study proposes hypothesis 2 (H2): Negative emotions mediate the association between parental phubbing and sleep quality problems.

1.3. Self-control as the moderator

Additionally, the theoretical model of the "stress – sleep" relationship suggested stress coping (e.g., cognitive regulation, emotion regulation, coping style, social support and personalities) may moderate the relationship between stressful events (e.g., parental phubbing) and stress response, sleep quality (Yan et al., 2010). Likewise, the stress and coping theory contends that cognitive and emotional control can mitigate or even eliminate the stressors' effects (Lazarus and Folkman, 1984). Both theories prompt that individuals' capacity for cognitive and emotional regulation/control may moderate the effects of parental phubbing on negative emotions. Self-control, which refers to the ability to modify and regulate their behavior, thoughts, and emotions to conform to social or ego standards (Muraven and Baumeister, 2000; Tangney et al., 2004), was found to be an important factor that buffers the negative influence of stressful events on individuals' stress response (Rosenbaum, 1989; Niu et al., 2020; Schnell and Krampe, 2021). When external stressors elicit stress responses in individuals, self-control can interrupt these responses and return the body to the normal state (Baumeister et al., 1998; Muraven et al., 1998). Therefore, we speculate that self-control may moderate the association between parental phubbing and adolescent negative emotions.

First, from the perspective of self-control resources, self-control represents a relatively stable resources in the individual resource pool (Hagger et al., 2010). Despite that social stress in the form of parental phubbing might cause adolescent negative emotions, adolescents higher

in self-control have a higher baseline of total self-control resources, which means they are more capable to regulate their emotions and effectively control negative emotions at a lower level. Second, from the perspective of response patterns, individuals with different levels of self-control should respond differently to social stress (e.g., parental phubbing). As those adolescents higher in self-control have a higher ability to shift their attention from parental phubbing to other places (de Ridder et al., 2012), their negative emotions might maintain at a relatively lower level. Third, empirical studies have found that self-control moderated the relationship between COVID-19 stress and general mental distress such as depression and anxiety (Schnell and Krampe, 2021). Individuals high in self-control experience less emotional distress compared to those low in self-control (Gramzow et al., 2000). Accordingly, based on the above theories and empirical evidence, the present study proposes hypothesis 3 (H3): Self-control moderates the effect of parental phubbing on negative emotions.

1.4. The present study

In summary, based on the theoretical model of the "stress – sleep" relationship, the present study intends to investigate the relationship between parental phubbing, negative emotions, self-control and adolescent sleep quality problems and their mechanisms. We constructed a moderated mediating hypothesis model that parental phubbing significantly and positively predicted adolescent sleep quality problems through the mediation of negative emotions, and self-control moderated the first path of this mediating effect (Figure 1).

2. Methods

2.1. Participants and procedure

All the participants (Grades 7–12) came from two junior high schools and two senior high schools in central China through convenient sampling. Before the questionnaire investigation, we received permission to conduct this survey from the Ethical Committee for Scientific Research in our institution, and we sought consent from the school, teachers, and parents. The assessment was conducted in school classrooms. In the course of data collection, the trained graduate students gave standardized instructions in front of the class, and all of the participants were guaranteed that their answers would be kept confidential and used solely for academic research. Of 896 participants available on the day of the survey, 823 adolescents (all of them were living with their father, mother, or both in the last year, and their parents had at least one smartphone and regularly used it in the last year) participated in the study survey. After removing the invalid questionnaires with missing answers and consistent responses, 781 valid questionnaires were obtained, with an effective rate of 94.5%. Among the valid participants, 506 students were from rural areas and 275 students were from urban areas; 415 students were male and 366 students were female; 389 students were junior high school students and 392 students were senior high school students. Their ages ranged from 12 to 18, the average age was 14.89, and the standard deviation was 1.79. Parents' education levels were very close to those in the latest census data in central China; 30.9% of the fathers and 25.0% of the mothers had a high school education or higher.

2.2. Measures

2.2.1. Parental phubbing

Adopted the Parental Phubbing Scale revised by Ding et al. (2020). As a single dimension, the scale consists of 9 items (Roberts and David, 2016), such as "During a typical mealtime that my parents and I spend together, my parents pull out and check their cell phone." Participants rated each item on a 5-point Likert scale from 1 (never) to 5 (always). Higher scores indicated more severe parental phubbing in parent–child interactions. Previous studies showed that the scale had good reliability and validity when used with Chinese adolescents (Zhang et al., 2021; He et al., 2022; Xiao and Zheng, 2022). The index of CFA based on the original structure showed a good fit: $\chi^2/df = 4.63$, CFI = 0.95, GFI = 0.96, TLI =0.94, RMSEA = 0.07. In this study, the Cronbach's α value of the scale was 0.82.

2.2.2. Negative emotions

Negative emotions were measured using the Ultra-brief Screening Scale for Depression and Anxiety Scale revised by Qian et al. (2021), which was adopted with the original Patient Health Questionnaire-4 (PHQ-4; Kroenke et al., 2009). The scale comprises 4 items, such as "Feeling nervous, anxious or on edge." Participants rated each item from 0 (never) to 3

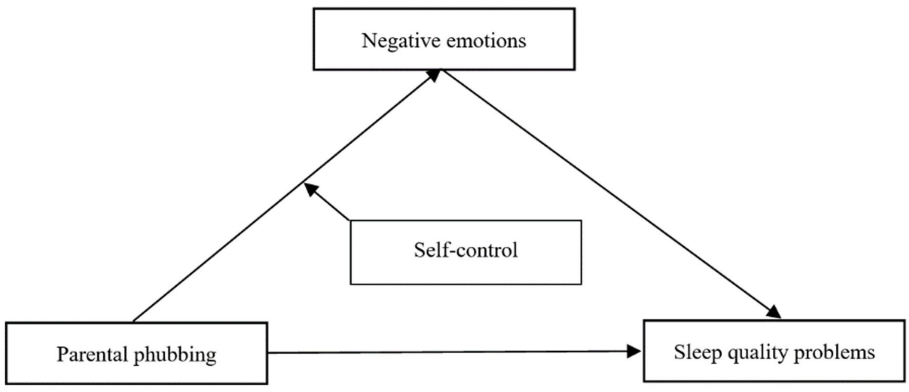

FIGURE 1
The hypothetical model.

(almost daily). Higher scores indicated higher levels of negative emotions of depression and anxiety. The index of CFA based on the original structure showed a good fit: χ^2/df = 3.98, CFI = 0.96, GFI = 0.95, TLI =0.98, RMSEA = 0.06. In this study, the Cronbach's α value of the scale was 0.86.

2.2.3. Self-control

The level of self-control was assessed using the Self-Control Questionnaire for Chinese children designed by Dong and Lin (2011). This questionnaire consists of 5 items. Each item is scored according to 1–4 points. With higher total scores indicating a higher level of self-control for the individual. Previous study had demonstrated the questionnaire's good reliability and validity for Chinese adolescents (e.g., Zhu et al., 2018). The index of CFA based on the original structure showed a good fit: χ^2/df = 5.47, CFI = 0.95, GFI = 0.98, TLI =0.89, RMSEA = 0.07. In this study, the Cronbach's α value of this questionnaire was 0.76.

2.2.4. Sleep quality problems

Sleep quality problems were measured using the Chinese version of Pittsburgh Sleep Quality Index scale (PSQI; Liu et al., 1996), which has good validity, internal consistency and test–retest reliability, and been widely used among Chinese adolescents (e.g., Deng et al., 2021; Wang W. et al., 2022; Ye et al., 2022). The PSQI comprises 18 self-rated items, including seven factors: subjective sleep quality, time to sleep, sleep duration, sleep efficiency, sleep disturbance, hypnotic medication, and daytime function. Each item is scored according to 0–3 points. The average scores on the PSQI ranged from 0 to 3, with higher scores indicating more sleep quality problems. The index of CFA based on the original structure showed a good fit: χ^2/df = 5.44, CFI = 0.90, GFI = 0.97, TLI =0.88, RMSEA = 0.07. In this study, the Cronbach's α value of the scale was 0.76.

2.3. Statistical analyzes

In this study, trained postgraduates majoring in psychology conducted the test on a class basis, and the questionnaires were distributed and collected on the spot. We used PROCESS version 3.0 (Hayes, 2013) to test the mediation and moderation models and performed descriptive statistics and correlation analyzes on SPSS 21.0. Significance testing of regression coefficients was performed using Bootstrap (sampling repeated 5,000 times) to obtain robust standard errors and a 95% bias-corrected confidence interval (CI) for parameter estimation. In addition, age and gender were included as control variables. The Harman single-factor test method was applied to process all measurement items through nonrotating exploratory factor analysis. According to the analytical results, there are a total of 7 common factors with eigenvalues greater than 1 extracted, and the first common factor can be used to explain 21.10% of the total change, which falls short of the 40% standard threshold. That is, there is no deviation caused by the same method for data collection in this study (Podsakoff et al., 2003).

3. Results

3.1. Preliminary analyzes

Pearson correlations as well as the means and standard deviations of the main variables were presented in Table 1. Parental phubbing was significantly and positively associated with negative emotions and sleep quality problems, while not associated with self-control. Negative emotions were significantly negatively associated with self-control and significantly positively associated with adolescent sleep quality problems. Self-control is not associated with sleep quality problems.

3.2. Mediation and moderation analyzes

We used Model 4 of PROCESS (Hayes, 2013) to examine the possible association between parental phubbing and sleep quality problems as well as the possible mediating effect of negative emotions. After controlling for age and gender, we first found that parental phubbing positively predicted sleep quality problems, $\beta = 0.20$, $p < 0.001$. Second, parental phubbing positively predicted negative emotions, $\beta = 0.27$, $p < 0.001$; negative emotions positively predicted sleep quality problems, $\beta = 0.49$, $p < 0.001$. Third, the bias-corrected bootstrapping mediation test indicated that the process by which parental phubbing predicted sleep quality problems through negative emotions was significant, with indirect effect = 0.13, $SE = 0.02$, 95% CI = [0.09, 0.17]. The indirect effect (parental phubbing → negative emotions → sleep quality problems) accounted for 64.76% of the total effect. The results of the mediation analysis support H1 and H2.

We employed Model 7 of PROCESS (Hayes, 2013) to investigate whether self-control moderated the association between parental phubbing and negative emotions. Regression analysis indicated that parental phubbing positively predicted negative emotions ($\beta = 0.27$, $p < 0.001$) and self-control was not a significant predictor of negative emotions ($\beta = -0.06$, $p > 0.05$), while the interaction term between parental phubbing and self-control was a significant predictor of negative emotions [$\beta = -0.05$, $p < 0.05$, 95% CI (−0.10, −0.01)]. This result suggests that self-control moderates the first half of the mediating pathway"parental phubbing → negative emotions → sleep quality problems," which supports H3. The results of the mediation and moderation analysis are presented in Table 2 and Figure 2.

To more clearly reveal how self-control moderates the relationship between parental phubbing and negative emotions, self-control was divided into high and low groups by mean plus or minus one standard deviation, a simple slope test was conducted and an interaction plot was drawn (Figure 3). The predictive effect of parental phubbing on negative emotions was significant for adolescents low in self-control ($\beta_{simple} = 0.33$, $t = 7.38$, $p < 0.001$) and diminished for adolescents high in self-control ($\beta_{simple} = 0.22$, $t = 5.36$, $p < 0.001$).

Moreover, the results of PROCESS model 7 also showed the mediation mechanism was moderated by self-control [the index of moderated mediation = −0.03, Boot $SE = 0.01$, 95% CI = (−0.06, −0.01)], which indicated the significant differences in mediation effect sizes between the high self-control groups and low self-control groups. Specifically, for the low self-control adolescent group, the mediation effect of negative affect was 0.15 [Boot $SE = 0.02$, 95% CI = (0.11, 0.20)]; for the high self-control group, the mediation effect of negative affect was 0.10 [Boot $SE = 0.02$, 95% CI = (0.06, 0.15)].

4. Discussion

Parents usually neglect their children in social settings by concentrating on phone use and are unaware of the potential negative outcomes. In fact, a large number of correlational studies have revealed

TABLE 1 Means, standard deviations and correlations for the main variables (N=781).

Variables	*M*	*SD*	1	2	3	4
1. Parental phubbing	2.48	0.80	1			
2. Negative emotions	1.19	0.81	0.28***	1		
3. Self-control	2.64	0.60	−0.02	−0.08*	1	
4. Sleep quality problems	1.10	0.43	0.22***	0.54***	−0.06	1

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

TABLE 2 The mediation and moderation model.

Predictor	Criterion: NE				Criterion: SQP			
	β	*SE*	*t*	[LLCI, ULCI]	*β*	*SE*	*t*	[LLCI, ULCI]
Gender	−0.05	0.07	0.48	[−0.18, 0.09]	−0.02	0.06	−0.30	[−0.13, 0.10]
Age	0.09	0.02	4.54***	[0.05, 0.12]	0.09	0.02	5.64***	[0.06, 0.13]
PP	0.27	0.03	8.00***	[0.21, 0.34]	0.07	0.03	2.31*	[0.01, 0.13]
NE					0.49	0.03	15.64***	[0.43, 0.55]
SC	−0.06	0.04	0.09	[−0.13, 0.01]				
PP × SC	−0.05	0.03	−2.07*	[−0.10, −0.01]				
R^2	0.11				0.32			
F	19.37***				91.46***			

*$p < 0.05$, ***$p < 0.001$; Gender: female = 0, male = 1; PP = parental phubbing; NE = negative emotions; SQP = sleep quality problems; SC = Self-control.

a positive association between parental phubbing and problem behaviors (Xie and Xie, 2020; Wang et al., 2021; Zhang et al., 2021; He et al., 2022; Wang and Qiao, 2022; Wei et al., 2022; Xiao and Zheng, 2022). Among these problems, mental health has received considerable attention from both the public and academics (Xie and Xie, 2020; Xiao and Zheng, 2022). However, no research to date has directly focused on the association between parental phubbing and adolescent physical health, such as sleep quality which has become an increasing burden on Chinese society now. To fill this gap, the current study examined the association as well as the mediator–negative emotions–to explain the emotional response mechanism underlying this association. Furthermore, we examined whether a protective factor for this mediating effect exists by introducing self-control as a moderator. The implications and limitations of the current study are discussed below.

4.1. Parental phubbing on adolescent sleep quality problems

First, the present study examined the relationship and potential mechanisms between parental phubbing and adolescent sleep quality problems. To our knowledge, the present study was the first to find a positive predictive effect of parental phubbing on adolescent sleep quality problems, validating research hypothesis H1. This result supports the theoretical model of the "stress – sleep" relationship (Yan et al., 2010) and the argument that stress is one of the most common factors of sleep quality problems (Liu et al., 2017; Yeung et al., 2017; Wang and Matsuda, 2021; Wang W. et al., 2022). For adolescent sleep quality, previous researches paid more attention to stressful life events (Brand et al., 2011; Wang and Matsuda, 2021), especially academic stress (Deng et al., 2021). Recently, some studies considered the COVID-19 pandemic and the policies to contain it as a stressor that adversely affected sleep quality (e.g., Wang W. et al., 2022). These factors are important and relatively obvious stressors for adolescent sleep quality, however, parental phubbing can easily be ignored. Based on relevant theoretical and empirical research (David and Roberts, 2017; Wang R. et al., 2017; Xie and Xie, 2020), this study regarded parental phubbing as a kind of social stress between parents and children, and found that parental phubbing significantly and positively predicted adolescent sleep quality problems, which contributes to the field of adolescent sleep quality problems by enriching the predictors. Unlike other negative parenting behaviors, parental phubbing as a technology-era product is characterized by covert nature. Previous negative parenting behaviors including violence and reprimand, are overt negative approaches and have been alerted to and avoided by the public. In contrast, parental phubbing is not accompanied by overt violence or conflict. Moreover, in the technology era, cell phone use is often justified by the need to work and relax. As a result, it is difficult for parents to realize their own mistakes when they engage in phubbing at home.

In addition, the present study further illustrated the harmful effects of parental phubbing, not only deepening the understanding of parental phubbing but also expanding the research on the effects of the technological era on adolescents' physical and mental development. Previous studies (Xie and Xie, 2020; Wang et al., 2021; Zhang et al., 2021; He et al., 2022; Wang and Qiao, 2022; Wei et al., 2022; Xiao and Zheng, 2022) emphasized that parental phubbing, as a novel negative parent–children interaction, leads to adolescent internalizing and externalizing problems (e.g., anxiety, depression, cell phone addiction, cyberbullying). Our findings indicated that parental phubbing also had the potential to affect adolescent physiological health, resulting in sleep quality problems. Adolescent health development involves combined development of psychological and physical conditions. Moreover,

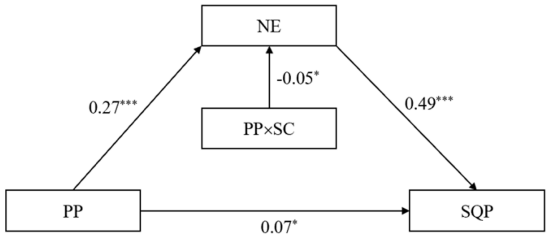

FIGURE 2
The integrated model. *p<0.05, ***p<0.001. PP, parental phubbing; NE, negative emotions; SQP, sleep quality problems; SC, Self-control.

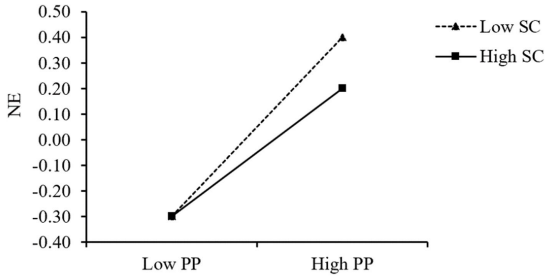

FIGURE 3
The interaction of parental phubbing and self-control on negative emotions. PP, parental phubbing; NE, negative emotions; SC, Self-control.

having good quality of sleep helps to confront intense academic tasks. Therefore, along with previous studies on the negative effects of parental phubbing, we believe it is necessary and meaningful to draw attention to the negative effects of parental phubbing on adolescent sleep quality.

4.2. The mediation of negative emotions

Second, this study revealed that negative emotions are a mediator that explains the effect of parental phubbing on adolescent sleep quality problems, which proved research hypothesis H2. We adopted the theoretical model of "stress – sleep" relationship to explain the effect of parental phubbing on adolescent sleep quality problems. The theoretical model of "stress – sleep" relationship emphasizes the importance of stress response (e.g., emotional response) as a key risk factor in individuals' sleep quality problems (Yan et al., 2010). In accordance with this theoretical model, our findings indicated that adolescents who are highly phubbed by their parents had experienced more anxiety and depression and therefore caused a higher likelihood of their sleep quality problems. To further test the universality of the results of this study, future research should examine whether other forms of stress responses (e.g., cognitive responses, behavioral responses) mediate the association between parental phubbing and sleep quality problems. For example, previous researches showed that a typical behavioral response to parental phubbing was adolescent problematic mobile phone use (Niu et al., 2020; Zhang et al., 2021), which had be found as a significant cause of sleep quality problems (Zou et al., 2019). It suggested that problematic mobile phone use as a kind of behavioral response might mediate the association between parental phubbing and adolescent sleep quality problems.

In accordance with the result of this study, previous studies have also found that negative emotions can play a mediating role in the relationship between stressors and sleep quality. For examples, a study by Zhao et al. (2021) found that anxiety mediated the relationship between perceived stress and sleep quality among the non-diseased general public in China during the COVID-19 pandemic. A study by Wang and Matsuda (2021) found that negative emotions play a mediating role in stressful life events and sleep quality among Chinese and Japanese undergraduate students. These results suggest that previous studies mainly focused on negative emotions mediating the associations between stressors related to overt life events and sleep quality. However, our research examined the mediating role of negative emotions by focusing on stressors related to parent–children interaction which is covert social stress. The results of this study expand our understanding of the mechanism of stressors affecting sleep quality. Additionally, it is worthy of noting that previous studies found sleep quality also affects adolescent emotional control functions, and adolescents with sleep quality problems showed more negative emotions such as anxiety and depression (Soffer-Dudek et al., 2011; Liu et al., 2022; Wang W. et al., 2022). In other words, negative emotions trigger sleep quality problems, and sleep quality problems in turn exacerbate negative emotions. Thus, if adolescents suffer from parental phubbing, they might also be caught in a vicious cycle of negative emotions and sleep quality problems, future research could use longitudinal design to explore this problem.

4.3. The moderation of self-control

Third, the present study also found that self-control moderated the relationship between parental phubbing and negative emotions, which supported the research hypothesis H3. The theoretical model of the "stress – sleep" relationship suggested stress coping, especially cognitive regulation and emotion regulation, may moderate the relationship between stressors and stress response (Yan et al., 2010). In line with previous studies that adopted self-control as a moderator (Niu et al., 2020; Schnell and Krampe, 2021), the present study also showed a protective effect of self-control in cases of stressors. Specifically, adolescents high in self-control had less negative emotions as a result of parental phubbing than those low in self-control. The stress and coping theory state that coping is an action taken to minimize perceived "threat" (Lazarus and Folkman, 1984). In terms of coping consequences, stress coping can be divided into positive coping and negative coping, positive coping is more mature and usually involves problem solving, help seeking, cognitive and emotional regulation; negative coping is immature and includes self-blame, fantasy, and avoidance (Yan et al., 2010).

Self-control, as a self-regulation ability, allows individuals to effectively control their thoughts, impulses, behaviors, and emotions to ensure that they minimize the impact of the "threat" (Tangney et al., 2004; Finkenauer et al., 2005). Thus, adolescents high in self-control are more capable of taking a positive coping to parental phubbing, such as controlling their thoughts of interpreting parental phubbing as social exclusion or parental rejection, controlling their negative emotions, and not overreacting. In addition, studies have shown that lower self-control is associated with lower psychological resilience. Psychological resilience is the ability of an individual to respond positively and return to a good state despite experiencing setbacks or adversity (Ge et al., 2021). Therefore, relative to adolescents higher in self-control, those lower in self-control have more difficulty controlling and regulating their emotions when experiencing parental phubbing, and they eventually fall into negative emotions and have difficulty recovering to a normal state, which leads to more sleep quality problems.

5. Theoretical and practical implications

The study has both theoretical and practical implications. To begin, this study has two theoretical implications. First, the present study was one of the studies that adopted both stress response and stress coping as mechanism in the influence of stress on sleep quality problems (Yan et al., 2010; Liu et al., 2020). Previous studies had demonstrated the effect of stress on adolescent sleep quality (Liu et al., 2017; Yeung et al., 2017), the present study identified a new stressor in the digital age, and further revealed how parental phubbing as a stressor affect sleep quality in adolescents through the mediation of emotional response (e.g., negative emotions) and the moderation of positive coping (e.g., self-control). The results contributed to the understanding of the detailed process of stress on sleep quality and supported the theoretical model of the "stress – sleep" relationship (Yan et al., 2010). Second, the present study expanded our understanding of the diversity of parental phubbing on adolescent physical and mental health. As we know, the present study was the first to discuss the relationship between parental phubbing and sleep quality problems. Previous research had shown that parental phubbing is positively associated with adolescent behavioral problems such as problematic smartphone use and cyberbullying perpetration (e.g., Wang et al., 2020; Zhang et al., 2021; Wei et al., 2022; Wang X. et al., 2022), psychological problems such as depression (e.g., Xie and Xie, 2020; Xiao and Zheng, 2022), and academic problems such as learning burnout (He et al., 2022; Wang X. et al., 2022). These results suggest that previous studies mainly focused on parental phubbing and adolescent mental health, however, the present study found that parental phubbing is also positively associated with adolescent sleep quality problems, which is a typical physical health topic.

In addition, this study has three practical implications. First, the results of this study suggested that parental phubbing, as a social stressor between parents and children, was a risk factor for adolescent sleep quality in recent days. Although cell phones have become an essential daily tool and phubbing has become a common occurrence, parents still need to appropriately manage the time and occasions of using cell phone at home. Second, the results of this study showed that proximal factors (e.g., negative emotions) have a more direct impact on sleep quality than distal context factors (e.g., parental phubbing). Thus, intervention strategies for adolescent emotional regulation may be more effective in improving sleep quality. Apart from reducing phubbing, parents also need to actively express care for and give adequate attention to their adolescent children and provide some encouragement and guidance to reduce adolescent negative emotions. Third, this study also found that self-control alleviated the influence of parental phubbing on adolescent negative emotions. Therefore, self-control should be given more attention for the intervention of adolescent negative emotions. Previous studies suggested that exerting self-control may consume self-control strength (Muraven and Baumeister, 2000). To maintain self-control, it is better to reduce other stressors in adolescent daily life. Furthermore, previous evidence showed that priming self-awareness and self-affirmation contributed to improving self-control (Schmeichel and Vohs, 2009; Alberts et al., 2011).

6. Limitations and future orientation

The present study also has several limitations. First, this study utilized a cross-sectional design, but individuals' sleep quality fluctuated from day to day. Therefore, a diary and experience sampling research design which is characterized by collecting individuals' immediate responses at multiple time points, could be considered for future studies to more accurately understand the effects of parental phubbing on adolescent sleep quality. Second, all variables in this study were measured by adolescent self-reports. Considering that adolescents are sensitive to self-esteem and emotions, they may conceal or exaggerate the true situation of emotion and sleep quality problems, future studies should adopt multiple measurements (e.g., reports from important others, such as parents, teachers, and friends; or other objective indicators, such as automatic recording through apps) to make it more comprehensive and objective. Third, the relationship between stress, emotions, and sleep quality is not unique. For example, some studies have found that sleep quality can also influence individuals' stress perception and emotional experience (Liu et al., 2022; Wang W. et al., 2022). Therefore, future research can consider this perspective and examine multiple mechanisms between the three. Fourth, the subjects of this study are only Chinese adolescents, limiting its generalizability. As a collectivist society, Chinese culture emphasizes family relationships and social stress, it must be cautious about generalizing the findings of this study to other cultures (Wang et al., 2020). Thus, future studies should survey adolescents from different cultural groups and examine whether similar findings can be obtained in countries with an individualistic culture. Lastly, future studies should expand the scope of factors that may serve as mediators or moderators. According to the theoretical model of the "stress – sleep" relationship, emotional response is just one form of stress responses (Yan et al., 2010). Thus, future studies should examine whether other forms of stress responses (e.g., cognitive response, behavioral response) can significantly mediate the relationship between parental phubbing and adolescent sleep quality problems.

7. Conclusion

In summary, parental phubbing is an important factor that influences adolescent sleep quality problems. Negative emotions mediate the relationship between parental phubbing and adolescent sleep quality problems. And self-control moderated the effect of parental phubbing on adolescent negative emotions. Specifically, the mediating effect of negative emotions was more significant for adolescents low in self-control relative to those high in self-control. Therefore, in order to help adolescents decrease sleep quality problems, we can reduce their parental phubbing, reduce their negative emotions, and maintain their moderate self-control.

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 Research Ethics Committee of School of Educational Science, Xinyang Normal University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

QD and YZ designed the work and were responsible for the overall development of this study, including the planning of sample collection, data analysis, writing, and polishing of the manuscript. QD, SD, and YZ were responsible for revising the manuscript and made a great contribution to the final acceptance of the manuscript. QD provided the manuscript fee. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Secular trends in mental health profiles among 15-year-olds in Sweden between 2002 and 2018

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Background: Studies of secular trends in mental unhealth indicate that adolescents in the Nordic countries, especially girls, have an increased reported prevalence of mental health problems the last decades. This increase needs to be seen in the light of the adolescents' assessments of their perceived overall health.

Objective: To investigate whether a person-centered approach to research can enhance understanding of changes over time in the distribution of mental health problems among Swedish adolescents.

Method: A dual-factor approach was used to study changes over time in mental health profiles among nationally representative 15-year-old adolescent samples from Sweden. Cluster analyses of subjective health symptoms (psychological and somatic) and perceived overall health from the Swedish Health Behavior in School-aged Children (HBSC) surveys of 2002, 2006, 2010, 2014, and 2018 were used to identify these mental health profiles (n = 9,007).

Results: Four mental health profiles were identified by a cluster analysis which combined all five data collections—Perceived good health, Perceived poor health, High psychosomatic symptoms, and Poor mental health. There were no significant differences in the distributions of these four mental health profiles between the survey years 2002 and 2010, but substantial changes took place between 2010 and 2018. Here, particularly the High psychosomatic symptoms profile increased among both boys and girls. The Perceived good health profile decreased among both boys and girls, and the Perceived poor health profile decreased among girls. The profile involving the most pronounced mental health problems, the Poor mental health profile (perceived poor health, high psychosomatic problems), was stable from 2002 to 2018 among both boys and girls.

Conclusion: The study shows the added value of using person-centered analyses to describe differences in mental health indicators between cohorts of adolescents over longer periods of time. In contrast to the long-term increase in mental health problems seen in many countries, this Swedish study did not find an increase among young persons, both boys and girls, with the poorest mental health, the Poor mental health profile. Rather, the most substantial increase over the survey years, predominantly between 2010 and 2018, was found among the 15-year-olds with High psychosomatic symptoms only.

KEYWORDS

mental health, psychosomatic symptoms, dual-factor model, cluster analysis, secular trends, sex differences

Introduction

Adolescents are generally considered healthy, and severe illness and mortality are uncommon. Nevertheless, many young people experience mental health problems in their daily lives during adolescence (1). The greatest burden of disease among young people globally is related to mental health problems (2). Approximately half of the mental health problems that affect people throughout their lifetimes are known to initially manifest themselves by the mid-teenage years (3). Studies of self-reported mental health symptoms among young people have shown a long-term increase over the past 30 years in many countries in northern Europe [for reviews, see (4–6)]. Comparative research has shown that the Nordic countries, especially Norway and Sweden, are among the countries with the largest increases in mental health problems globally (7–11).

In Europe and north America, the prevalence of mental health problems among young people is as high as 35% in representative samples from 2018 (12). Secular trends have been reported and are summarized in several meta-analysis. Rutter and Smith (13) conducted a comprehensive review of the secular trends from the 1950s to the 1990s in the psychosocial disorders of young people. They found evidence of a substantial increase in psychosocial disorders, including depressive disorders, in developed countries. A more recent systematic review of mental health problems in the general adolescent population from 1983 to 2010 (5) concluded that internalizing problems (mental health symptoms) may be increasing, especially among girls, while externalizing problems (such as rule-breaking behavior, drug use and ADHD) appear to be stable. A meta-analysis by Twenge et al. (14) identified a large generational increase in psychopathological symptoms, including depression, among general populations of young people in the US between 1937 and 2007.

A trend of increasing adolescent psychosomatic and depressive symptoms internationally has been reported for non-clinical populations between the 1970s and 2010s. Potrebny et al. (7) found 21 studies with data covering 1982 to 2013 from 36 countries that met the inclusion criteria for their meta-analysis. Their results indicate a weak increasing trend in psychosomatic symptoms in the general adolescent population. The increase was confined to the period from the 1980s to the 2000s and occurred mostly in the northern European region. A recent comparative study of 36 countries suggested that, although psychological and somatic indicators of mental health problems increased slightly between 2002 and 2018, there was no evidence of a global trend, due to great heterogeneity among the countries (15). The increase was mainly found in countries in northern and western Europe. Hence, the temporal trends need to be made more specific. They differed between time periods, countries, and subgroups.

Previous research suggests that the country-specific processes and mechanisms that affect mental health need to be considered (15). This study will use information about mental health indicators from one Nordic country, Sweden. Therefore, previous studies using Swedish data need to be taken into account. In 2010, a systematic review by the Royal Swedish Academy of Sciences noted a lack of Swedish studies of secular trends in adolescent mental health and concluded that it is "not possible to verify or disprove the general perception of a sharply rising frequency of mental disorders among Swedish children and adolescents" (16). A Nordic study including Sweden (NordChild) (9) analyzed psychosomatic symptoms among 7–17-year-olds in four surveys (1984, 1996, 2001, and 2017) and found an increasing trend in symptoms of this kind. Young in Värmland is a survey of Swedish 15–16-year-olds that was conducted eight times between 1988 and 2011 (11, 17). Analyses reveal a trend toward increasing psychosomatic problems, but also different trends for girls and boys.

A more diversified picture of adolescents' health and unhealth is not provided in these studies, because they made use of a bipolar model with one single dimension ranging from lack of symptoms of unhealth to a high prevalence of symptoms. Lack of symptoms of unhealth is not the same as a high level of health (18). Here, the dual-factor model (19, 20) can be used as a guiding principle for ensuring a more complete description of the mental health status of the population.

The dual-factor model of mental health uses two dimensions of mental health simultaneously: one dimension concerns mental illness or psychopathology (subjective symptoms through to psychiatric diseases), while the other dimension concerns wellbeing (subjective wellbeing and health). The model allows for the possibility that an increase in one dimension is not necessarily associated with a decrease in the other. A recent scoping review (20) found empirical support for the dual-factor model; that is, two related factors fitted the data better than one. In the present study, it is assumed that a more complete view of an adolescent's health is obtained by integrating adolescents' reports of psychological and somatic symptoms with their overall perception of health. Such integration is achieved by simultaneously cluster analyzing adolescents' reports of their psychosomatic symptoms and their perceptions of their overall health.

The current study

The current study applies a person-centered technique using data from Swedish 15-year-olds who participated in five HBSC data collections: 2001/2002, 2005/2006, 2009/2010, 2013/2014, and 2017/2018. In line with the dual-factor model, the current study encompasses two dimensions: one, a non-clinical psychosomatic symptom checklist used in population-based surveys (the HBSC Symptom Checklist, HBSC-SCL), the other a measure of perceived overall health.

Perceived overall health (SRH) is based on an individual's perception and evaluation of her or his overall health. SRH can be distinguished from more specific health constructs in that it captures an overall conception of health, rather than a summation of measures across specific health domains. SRH, as typically operationalized, extends over a continuum ranging from what have been termed "negative" to "positive" health states.

The aim of this study is to explore differences in the distributions of Swedish school-aged adolescents' mental-health profiles or clusters over the years 2002–2018. The intention is to investigate whether analyses of mental health profiles can enhance our understanding of changes in mental health over several years.

TABLE 1 Participation in different years. Percent of participants who were girls or boys are reported within brackets.

	2002	2006	2010	2014	2018
15-year-olds	1218	1526	2090	2766	1606
Girls	609 (50)	752 (50)	1059 (51)	1358 (49)	777 (48)
Boys	609 (50)	774 (50)	1031 (49)	1408 (51)	829 (52)
School level	84	83	88	77	47

Methods

Data material

The data were obtained from Swedish Health Behavior in School-aged Children (HBSC) surveys and included 15-year-olds participating in the data collections of 2001/2002, 2005/2006, 2009/2010, 2013/2014, and 2017/2018. The HBSC study comprises cross-sectional data collections of nationally representative samples of adolescents every 4 years. In whichever country it is used, the HSBC follows a standardized protocol for sampling, survey instrumentation and data collection. Data collection is carried out in school classes *via* the self-completion of questionnaires (21). The Swedish Public Health Agency and its predecessors have been responsible for the HBSC in Sweden. The sampling and data collection for the latest surveys were performed by Statistics Sweden. A two-step cluster-sampling design was used for each grade. First, a random, nationally representative sample of schools was drawn, and thereafter, one class in each school that had agreed to participate was randomly selected.

The participation rates and number of participants for the five data collections are given in Table 1. Participation by schools was lower in 2018, but the participation rate among school children in the participating schools was between 81 and 88% during the earlier five data collections. The low school participation level in 2018 was partly due to a restriction laid down by the Swedish Data Protection Agency, which prohibited keeping track of specific schools and reminding them to participate. This restriction was withdrawn for the 2021/2022 HBSC data collection.

Measures

Clustering variables include two measures. One is the HBSC Symptom Checklist (HBSC-SCL), and the other is perceived overall health.

The HBSC Symptom Checklist (HBSC-SCL), also referred to as a measure of ***psychosomatic symptoms***, has been used in all HBSC surveys since 1986. The scale is a non-clinical measure of subjective health symptoms. It poses the stem question, "In the last 6 months, how often have you experienced …?," followed by eight items: "Headache," "Stomachache," "Backache," "Feeling low," "Irritability or bad temper," "Feeling nervous," "Difficulties in getting to sleep," and "Feeling dizzy." The response categories are: (1) "rarely or never," (2) "about every month," (3) "about every week," (4) "more than once a week", and (5) "about every day." The symptoms measure has been shown to have acceptable test-retest reliability and internal consistency (22). A recent study of HBSC-SCL using item response theory and differential test function analysis concluded that it was a consistent and one-dimensional scale in two-thirds of the countries where it was used, including the Nordic countries (23).

Perceived overall health was measured by the single item "Would you say your health is …?" Participants were asked to rate their overall health by choosing one of the response categories: (1) "poor," (2) "fair," (3) "good," and (4) "excellent. The question has remained unchanged since the 2001/2002 survey. The time trends in perceived overall health among adolescents in the five Nordic countries have been found to differ (24). Both psychosomatic symptoms and perceived overall health were presented in the reverse order in the questionnaire.

Sex was coded as boy (0) or girl (1).

Analytic methods

The identification of subgroups from two grouping variables can be either predetermined by cut-offs from median splits or data-driven. We adopted the second approach and performed cluster analysis to identify the naturally occurring patterns/profiles of psychosomatic symptoms and perceived overall health in the samples. Cluster analysis creates groups of people with patterns that are similar to each other and are independent of the median splits of the grouping variables.

A factor analysis of the eight items in the HBSC/SCL produced one factor each survey year, which was then used in further cluster analyses together with the single item on global health. Both measures were standardized. We then applied a hierarchical cluster analysis (Ward's method) to identify the number of clusters. The lower explanatory limit was set at 67% of the total error sums of squares for the number of clusters selected (25). As recommended by Kinder et al. (26), with knowledge of the number of clusters, a non-hierarchical cluster analyses, *K*-means clustering, was used to arrive at the final cluster solution.

First, we combined the data sets and performed one cluster analysis with the same centroid for all years. A cluster analysis for all years combined requires an equal number of persons from each year. The numbers of participants with complete data on the two mental health measures for each of the years from 2002 to 2018 were 1,196, 1,503, 2,030, 2,067, 2,667, and 1,611. Hence, we included all 1,196 persons from year 2002 and randomly selected 1,196 participants from each of the other four survey years. Thereby, the common cluster analysis was based on a total of 5,980 persons. For all cross-tabulations we used the EXACON program, which tests whether a specific cell frequency in a contingency table is larger or smaller than could be expected according to an independence model [the hypergeometric distribution (27)]. A Bonferroni adjusted p-value of 0.05 was used to determine which specific cells in the contingency table occurred more often (a Type) and less often (an Antitype) than expected by chance contingency tables (27). The analyses also cover differences between boys and girls.

Results

Trends in psychosomatic symptoms and perceived overall health over the study years

We start by reporting the levels of psychosomatic symptoms and perceived overall health for each of the survey years. As seen in

TABLE 2 Changes over the years 2002 to 2018 in self-rated psychosomatic symptoms and overall health.

	Psychosomatic symptoms			Perceived overall health		
	Total	Boys	Girls	Total	Boys	Girls
2002	2.27^{a}	2.02^{ab}	2.50^{a}	3.15^{a}	3.33^{ab}	2.98^{a}
2006	2.33^{b}	2.07^{ab}	2.58^{a}	3.19^{a}	3.33^{ab}	3.06^{a}
2010	2.25^{a}	2.00^{a}	2.51^{a}	3.21^{b}	3.38^{b}	3.04^{a}
2014	2.40^{c}	2.10^{b}	2.68^{b}	3.16^{a}	3.27^{a}	3.05^{a}
2018	2.50^{d}	2.21^{c}	2.77^{c}	3.24^{c}	3.36^{ab}	3.14^{b}

Psychosomatic symptoms: Total: $F = 26.45$, $p < 0.001$, $eta^2 = 0.01$; Boys: $F = 9.84$, $p < 0.001$, $eta^2 = 0.01$; Girls: $F = 16.95$, $p < 0.001$, $eta^2 = 0.01$.
Perceived overall health: Total: $F = 4.99$, $p < 0.001$, $eta^2 = 0.00$; Boys: $F = 4.18$, $p = 0.002$, $eta^2 = 0.00$; Girls: $F = 5.04$, $p < 0.001$, $eta^2 = 0.00$.
The superscripts ^{a,b,c,d} represent significant differences ($p < 0.05$) between survey years in SNK *post-hoc* tests.

TABLE 3 Mental health profiles among 15-year-olds obtained by cluster analysis, aggregated over the years 2002–2018.

Four cluster profiles:	Perceived good health	Perceived poor health	High symptoms	Poor mental health
Psychosomatic symptoms[b]	−0.78	−0.08	0.67	1.78
Overall health[b]	0.56	−1.80	−0.03	−1.67
N	2,902	436	2,171	471
%	48.5	7.3	36.3	7.9
Boys %	63.3^{t}	6.6	26.2^{a}	3.9^{a}
Girls %	34.5^{a}	8.0	45.8^{t}	11.7^{t}

The cluster analysis combines all 5 data collections with N = 1,196 each year. Sex differences are examined with the EXACON program.
^{t} = type, cell frequency more often than expected by chance; ^{a} = antitype, cell frequency less often than expected by chance.
[b]Low value is <-0.70, Average value is between −0.70 and 0.70, High value is >0.70.
Sex differences: Chi^2 (3 df) = 530.90, $p < 0.001$; contingency coefficient = 0.29.

Table 2, in all years, girls scored significantly higher than boys on psychosomatic symptoms and lower than boys on perceived overall health ($p < 0.001$). The effect sizes (Cohen's *d*) were medium for psychosomatic symptoms, ranging between −0.61 and −0.69, but were small for overall health, between 0.30 and 0.49. Considering changes over the survey years, psychosomatic symptoms significantly increased from survey year 2002 to survey year 2018 for both boys and girls, but the effect sizes, Cohen's *d*, were small (−0.24 and −0.30). Perceived overall health did not change from survey year 2000 to 2018 for boys but increased somewhat for girls (Cohen's $d = -0.25$). It is in light of these seemingly contradictory trends over the years for psychosomatic and perceived overall health that we adopted the cluster approach in order to identify characteristic profiles that cover both psychosomatic symptoms and perceived overall health.

A cluster analysis including all survey years

Combining data across the five survey years yielded a common centroid for all data sets, and a *K*-means cluster analysis of psychosomatic symptoms and perceived overall health resulted in the cluster solution reported in Table 3. Almost half of the adolescents belonged to a Perceived good health profile, which was characterized by a low psychosomatic symptom level and quite high value for perceived overall health. At the other end, the Poor mental health profile included 8% of the 15-year-olds. This profile had a high level of psychosomatic symptoms and a low level of perceived overall health. The High psychosomatic symptoms profile contained 36% of the adolescents and had a high level of psychosomatic symptoms (close to the 0.70 cutoff) and an average level of perceived overall health, while the Perceived poor health profile (7% of the sample) showed a low level of perceived overall health and an average level of psychosomatic symptoms. The proportion of the total variance explained by the four clusters was 72.9%.

There were significant differences between boys and girls for the set of four mental health profiles (Chi^2 (3 df) = 596.37, $p < 0.001$). An EXACON analysis showed that Perceived good health was more common among boys while High psychosomatic symptoms and Poor mental health were more common among girls. The most obvious sex difference was that, whereas about two of three boys belonged to the Perceived good health profile, this was the case for only a minority of the girls, 35%. In fact, belonging to the High psychosomatic profile was more common among girls than belonging to the Perceived good health profile. There were no sex differences for the Perceived poor health profile, but it was three times more common for girls than boys to belong to the Poor mental health profile (12 vs. 4%).

Changes in mental health profiles from 2002 to 2018

As a first step toward identifying stability and change in the four mental health profiles, the distributions of the profiles were plotted over the five survey years. Figure 1 reports these plots for the total sample. They indicate that stability characterized the trends of all four mental health profiles from year 2002 to year 2010, but that more substantial increases and decreases took place between 2010 and 2018. Follow-up analyses testing these changes between 2002 and

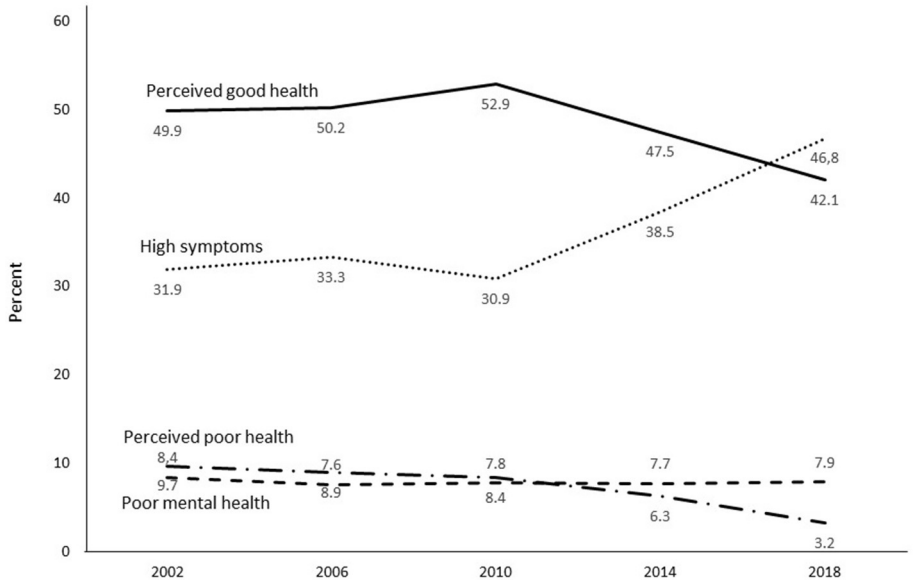

FIGURE 1
Secular trends from 2002 to 2018 for four mental health profiles among representative samples of 15-year-old adolescents.

TABLE 4 Comparisons of the distributions of the four mental health profiles between 2002 and 2010 and between 2010 and 2018 for the total samples and for boys and girls separately.

	Perceived good health	Perceived bad health	High symptoms	Poor mental health
Total sample:				
2002	49.9	9.7	31.9	8.4
2010	52.9	8.4	30.9	7.8
Chi^2 (3df) = 2.76, $p = 0.430$, Cramér's $V = 0.03$				
2010	52.9[t]	8.4[t]	30.9[a]	7.8
2018	42.1[a]	3.2[a]	46.8[t]	7.9
Chi^2 (3df) = 81.31, $p < 0.001$, Cramér's $V = 0.18$				
Boys:				
2002	64.5	8.3	23.5	3.7
2010	68.3	6.3	21.8	3.6
Chi^2 (3df) = 2.64, $p = 0.451$, Cramér's $V = 0.05$				
2010	68.3[t]	6.3	21.8[a]	3.6
2018	57.2[a]	3.8	34.9[t]	4.1
Chi^2 (3df) = 27.27, $p < 0.001$, Cramér's $V = 0.15$				
Girls:				
2002	35.6	11.1	40.2	13.1
2010	37.2	10.5	40.3	12.0
Chi^2 (3df) = 0.59, $p = 0.899$, Cramér's $V = 0.02$				
2010	37.2[t]	10.5[t]	40.3[a]	12.0
2018	29.1[a]	2.7[a]	57.0[t]	11.3
Chi^2 (3df) = 51.20, $p < 0.001$, Cramér's $V = 0.21$				

The table shows the percentages for each of the four mental health profiles for respective survey year.
[t] = type, cell frequency higher than expected by chance; [a] = antitype, cell frequency lower than expected by chance.

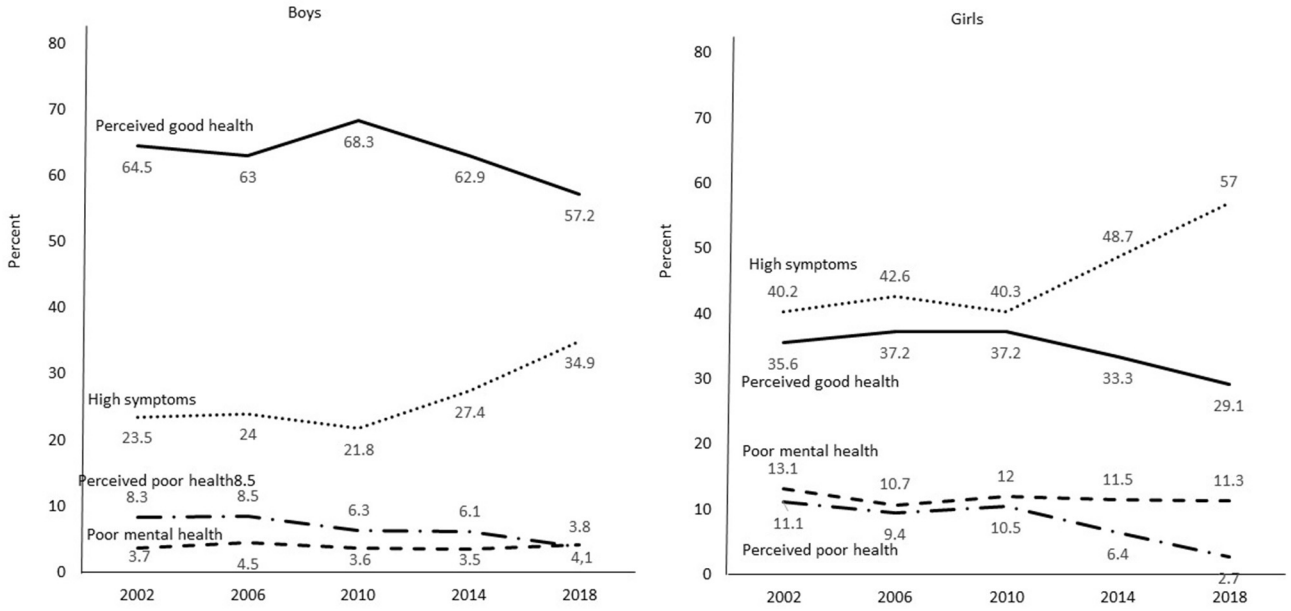

FIGURE 2
Secular trends from 2002 to 2018 for four mental health profiles among representative samples of 15-year-old boys and girls.

2010 and between 2010 and 2018 are reported in Table 4. For the total sample there were no significant changes in the distributions for the mental health profiles between year 2002 and year 2010. By contrast, there were significant decreases for Perceived good health and Perceived bad health profiles, and a significant increase for the High psychosomatic symptoms profile between the year 2010 and year 2018. There was no significant change in the Poor mental health profile between these two survey years. Overall, these results indicate that the window for changes in the mental health profiles was between the survey years 2010 and 2018.

This also seems to be the case when analyzing the secular trends of the mental health profiles separately for boys and girls. As shown by the plots in Figure 2, the distributions of the four mental health profiles did not change much between survey years 2002 and 2010 for either boys or girls. As reported in Table 4, for both boys and girls, no significant changes in the distributions of the four mental health profiles were found between 2002 and 2010. However, there were significant differences between the survey years 2010 and 2018. Significant decreases were found for the Perceived good health profile and increases for the High psychosomatic symptoms profile for both sexes. A decrease in the Perceived poor health profile was found for girls. These findings suggest, first, that when significant changes over time occur in a mental health profile for one sex, they also occur for the other sex (with the exception of no significant differences for the Perceived poor health profile among boys). Second, the changes in distributions of the mental health profiles took place primarily between 2010 and 2018 for both sexes. Of note is that there were no significant changes in the distributions of the Poor mental health profile either from 2002 to 2010 or from 2010 to 2018.

As seen in Figure 2, already in 2010 it was considerably more common for boys to belong to the Perceived good health profile than for girls (68 vs. 37%), and more common for girls to belong to the High psychosomatic symptoms profile than for boys (40 vs. 22%). Girls were also more likely to belong to the Poor mental health profile (12 vs. 4%). The changes that took place between 2010 and 2018 seems to occur to the same extent for both girls and girls. The decrease in Perceived good health over this time span (from 68 to 57% for boys, and from 37 to 29% for girls) amounts to 16% for girls and 22% for boys. The strong increase in High psychosomatic symptoms (from 22 to 35% among boys and from 40 to 57% among girls) was actually higher for boys (60%) than for girls (41%). Also, there was a small increase in the Poor mental health profile for boys (14%) but a small decrease for girls (6%). However, the decrease in Perceived poor health was considerably larger for girls (11 to 3%), which is an increase of 74%, than for boys (6 to 4%), which is a decrease of 40%. In sum, there were major sex differences for the mental health profiles, Perceived good health, High psychosomatic symptoms and Poor mental health, already in the survey year 2010. The changes that took place between 2010 and 2018 were generally about the same for girls and boys, with the result that the sex differences in 2018 were similar to those that prevailed in 2010.

Mental health profiles for each survey year

When the data sets from the five survey years were analyzed separately, the cluster analyses resulted in four mental health profiles for each of these years (see Supplementary Table S1). Three of them—Perceived good health, High psychosomatic symptoms, and Poor mental health—were present for all years. The profile Perceived poor health was present for the first four survey years. However, the cluster analysis of the 2018 sample generated an Average health profile instead, with average levels of both psychosomatic symptoms and perceived overall health. In short, the cluster analyses for each of the five survey years were, with one exception, similar to the cluster analysis that combined all 5 years.

Discussion

Previous studies have shown increased mental health problems among adolescents, particularly among girls (4–7). The increase has been reported on in studies using adolescent as well as parental reports (9). International (1, 8, 15), Swedish HBSC studies (16, 28), and regional Swedish studies (11, 17) have all reported more problematic mental health over the years among adolescents. The present study shows an increase in psychosomatic symptoms from 2002 to 2018, but also a slight increase in perceived overall health over the same years. How this translates into normally occurring patterns of psychosomatic symptoms and perceived overall health was examined here.

This study used cluster analysis to shed new light on what has happened to adolescents' perceptions of their mental health in Sweden between 2002 and 2018. We simultaneously cluster-analyzed 15-year-old adolescents' reports on their psychosomatic symptoms and perceived overall health in the years 2002, 2006, 2010, 2014, and 2018 ($n = 5{,}980$). Four clusters were identified when combining all five data sets: Perceived good health (quite high level of perceived overall health and low level of psychosomatic symptoms), Perceived poor health (low level of perceived overall health and average level of psychosomatic symptoms), High psychosomatic symptoms (high level of psychosomatic symptoms and average level of perceived overall health), and Poor mental health (low level of overall health and high level of psychosomatic symptoms). With one exception, cluster analyses performed for each of the five survey years also produced the same four types of mental health profiles. These latter cluster analyses show that the four mental health profiles in the study remained intact over many years, from 2002 to 2018.

Few differences in the distributions of these four mental health profiles were found between the survey years 2002 and 2010, but substantial increases and decreases took place between 2010 and 2018. For the total sample, there was a substantial increase over these years for belonging to the High psychosomatic profile, a substantial decrease for belonging to the Perceived good health profile, and a decrease for belonging to the Perceived poor health profile. In sum, the changes that took place in the cluster profiles over the study years occurred chiefly from 2010 to 2018.

In contrast to the common findings of increased mental health problems over time, particularly among girls (15, 17, 28), we did not find any changes over the years 2002 to 2018 in the proportion of adolescents in the cluster characterized by the poorest mental health—having both High psychosomatic symptoms and low perceived overall health. This means that the proportion of adolescents with the most serious form of mental ill-health appears not to have changed much over the years covered by the study.

The different developmental trends for Poor mental health and High psychosomatic symptoms should be noted. The Poor mental health profile did not change much in size over the years. It included about 12% girls and 4% boys. In a non-clinical sample of 15-year-olds such as ours, it was expected that the serious mental ill-health group would be small (2, 7). By contrast, the High psychosomatic symptoms profile, with young people having High psychosomatic symptoms but an otherwise average level of perceived overall health, increased between 2010 and 2018 among both boys and girls. Here, it appears necessary to both differentiate between and combine information about the two health indicators. First, there was only a modest negative correlation of -0.40, $p < 0.001$ between self-rated psychosomatic symptoms and perceived overall health. Thus, they do not measure opposite things. Second, of all the 15-year-olds in the clusters that were characterized by High psychosomatic symptoms—the Poor mental health cluster and the High psychosomatic symptoms cluster—there were less than one in five who combined high levels of psychosomatic symptoms with low perceived overall health. Potentially, the Poor mental health profile encompasses clinical conditions that can account for an important part of the burden of disease among young people (2). A recent validation of the four mental health profiles for Swedish 15-year-olds in 2018, comparing measures of a positive self (mental wellbeing, self-esteem, and general self-efficacy), positive school experiences, and perceived social support from parents and friends, found the adolescents in the poor mental health profile to have considerably lower levels on these measures than the adolescents in the three other mental health profiles (23).

Note that of the two clusters in the current study, High psychosomatic symptoms and Poor mental health, the latter appears as the cluster of adolescents in particular need of attention and support from school health services and other treatment facilities. Further analyses of these adolescents regarding possible chronic conditions, psychiatric disorders, and pharmacologic and psychotherapeutic treatments would be beneficial. One hypothesis is that the adolescents with High psychosomatic symptoms and average perceived overall health still have the coping skills needed to navigate their everyday life environments, but that this might change if their perceived overall health is affected.

We can only speculate about what contributed to the increase in the mental profile characterized by High psychosomatic symptoms and the decrease in perceived good health among the adolescents that took place between 2010 and 2018. One characteristic of this time period was the strong emergence of adolescents' encounters with social media. In Sweden 2010 the majority of adolescents used electronic media communication (EMC) 5 days or more (29). Social media use impacts social and emotional wellbeing in a negative way when it has addiction-like symptoms (30, 31). Social media also has had the result that bullying at school extends to cyber bullying. Further research on the relationship between EMC and mental health might be facilitated by person-centered analyses with regard to both EMC and mental health.

Sex differences

There was little evidence that problematic mental health increased more for girls than for boys over the survey years. Sex differences in the indicator of mental unhealth among adolescents in the present study—psychosomatic symptoms—need to be seen in light of what happened between survey years 2002 and 2018. Already in 2002, girls scored higher on psychosomatic symptoms than did boys. Cohen's d was -0.64. In 2018, again girls scored higher for psychosomatic symptoms than boys, and Cohen's d was about the same, -0.69. What happened between the years 2002 and 2018 was that the level of psychosomatic symptoms increased to about the same extent for both boys and girls, and the sex differences that appeared in 2002 reappeared at about the same level 16 years later.

A similar tendency over the years pertains to the mental health profile, High psychosomatic symptoms. Most of the changes in this

profile took place between 2010 and 2018. More girls than boys belonged to the High psychosomatic symptoms profile in 2010 (40 vs. 22%). There was a substantial increase in being a member of this profile from 2010 to 2018 for both boys and girls (an increase of 60 and 41%, respectively). Again, the same strong sex difference also existed in 2018: 57% of girls and 35% of boys then belonged to this mental health profile. Concerning the Poor mental health profile, there were few changes over the whole period from 2002 to 2018. In 2002, 4% of boys and 12% of girls belonged to this profile, while 16 years later 4% of the boys and 11% of the girls belonged. In sum, there were substantial sex differences for psychosomatic symptoms and the two mental health profiles with high levels of psychosomatic symptoms in 2002. Sixteen years later, the magnitudes of these differences between boys and girls were about the same. The changes that took place in psychosomatic symptoms and the two mental health profiles with high levels of psychosomatic symptoms between 2002 to 2018 were of the same magnitude for boys and girls (or lack of change over time for the Poor mental health profile).

The opposite is true for the Perceived good health profile. Considerably more boys than girls belonged to this profile in 2010: a majority of boys, 68%, but only a minority of girls, 37%. There were decreases in belonging to this profile among both boys and girls (a decrease of 16 and 22%, respectively). In the end, in 2018, about the same sex difference prevailed as in 2010 (57% of boys and 29% of the girls belonged to this profile). The low figure for the Perceived good health for girls is noteworthy. In fact, more girls belonged to the High psychosomatic symptoms profile than to the Perceived good health profile during all the years. All in all, the sex differences that existed for the Perceived good health, High psychosomatic symptoms, and Poor mental health prevailed over the years. When increases or decreases in the distributions of the mental health profiles changed for one of the sexes, they also changed for the other sex to about the same extent over the same time.

One further observation, that we have little explanation for, is that the proportion of girls who belonged to the Perceived poor health profile decreased substantially from 2010 to 2018 (from 11 to 3%), and more than for boys (from 6 to 4%), at a time when, simultaneously, the High psychosomatic symptoms profile increased, and the Perceived good health profile decreased substantially among girls.

The sharp focus on the increase in mental health problems among girls over the last decades might have had the consequence that the link between girls' and boys' reports of mental health problems has gone unnoticed. Undoubtedly, girls report considerable higher levels of mental health problems than boys, but the points in time for increases and decreases in mental health profiles were found to be very similar for the sexes in this study, and the rates of these changes over time were also similar. Theoretically, this might mean that the evocative conditions for changes in the distribution of mental health profiles over time can be quite similar for girls and boys. The question then is not what has contributed to changes in girls' mental health problems, but what contributed to the changes in both girls' and boys' mental health problems. The answer might indicate that the evocative conditions behind the secular trends for mental health problems might not be unique to girls but could cover conditions that affect both sexes. These are speculations, but they offer another entry point into the interpretation of the secular trends in mental health problems among adolescents that have been seen over longer periods of time.

Strengths and weaknesses

The present cluster analysis of Swedish 15-year-olds' mental health problems over time provides better understanding of the windows in time when changes in these problems have occurred, and not occurred, and gives more information on which profiles of mental health problems have increased and which have remained stable or decreased.

A major strength of the study is that the same study protocol was used for the variables included in the present analyses at all data collections. The measures used have good validity and reliability according to previous research (12, 15, 21). The participation rate at individual level was consistently high, although the participation rate of schools decreased in 2017/2018. The identified profiles were similar across the five data collections and the results are statistically robust. The monitoring of mental health among adolescents is based on self-reports, which may be a weakness, but it is essential for understanding adolescent mental health through the eyes of adolescents themselves, in line with the UN Child Convention. Further interesting research would explore which protective or risk factors are important for being in not just the Perceived good health cluster or the Poor mental health cluster but also the High psychosomatic symptoms and Perceived poor health clusters.

A weakness of the study is that it only investigates Swedish 15-year-olds. As decreased mental health among adolescents has been observed in other northern European countries (4–6, 8–11), it would be of interest to extend the analysis to more countries; a further cluster analysis for five Nordic countries combined is planned.

The cross-sectional design is a further limitation of the study; only longitudinal studies enable the analysis of causal inferences. However, when analyzing trends, measuring mental health for representative samples of adolescents over time in different countries can effectively trace secular trends. The study used non-clinical measures of subjective health. Future studies need to compare the findings with screening and diagnostic instruments used in clinical settings.

Conclusion

The present study used person-centered analysis to describe inter individual variations in adolescent mental health over repeated cross-sectional samples of 15-year-olds from 2002 to 2018. Cluster analysis found four distinct mental health profiles, based on levels of psychosomatic symptoms and perceived overall health, in all but one sample: Perceived good health, Perceived poor health, High psychosomatic symptoms, and Poor mental health. The last group of adolescents, with the most serious form of ill-health, both high levels of psychosomatic symptoms and low levels of overall health, made up about 8% of the sample at each data collection from 2002 to 2018 (around 4% of the boys and 12% of the girls). For the other three mental health profiles, changes took place primarily between the years 2010 and 2018. The most notable increases over these years were seen among girls and boys who had a High psychosomatic symptom

load but were otherwise still content, i.e., the High psychosomatic symptoms group, from 22 to 35% among boys, and from 40 to 57% among girls. The Perceived good health group decreased among boys and girls over these years (from 68 to 57% of the boys, and from 37 to 29% of the girls). Also, the Perceived poor health group, with low levels of perceived overall health but average levels of psychosomatic symptoms, decreased among both boys (6 to 4%) and girls (11 to 3%) over the later years. Apparently, the increase in mental health problems between 2002 and 2018 among Swedish 15-year-olds took place between 2010 and 2018 primarily among adolescents who displayed high levels of psychosomatic symptoms but otherwise had average levels of perceived overall health. There were no changes over the years 2002 to 2018 in the proportion of adolescents who belonged to the cluster Poor mental health. Already 2002 three times as many girls belonged to this cluster than boys.

Data availability statement

Open access to the data on the mandatory questions in the 2018 HBSC survey cycle can since October 2022 be achieved through the HBSC Open Access portal. More information can be found on the webpage: https://hbsc.org/data/.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent for participation was not provided by the participants' legal guardians/next of kin because the study was conducted according to the Guidelines of the Declaration of Helsinki. The Swedish study using HBSC data is deemed exempt from human subject research review by the Regional Ethical Review Board in Stockholm.

Author contributions

CE and HS designed the study. CE drafted the manuscript. HS performed the analyses. Both authors have reviewed, edited the manuscript, read, and agreed to the published version of the manuscript.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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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.2023.1015509/full#supplementary-material

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Inequalities in health complaints: 20-year trends among adolescents in Scotland, 1998–2018

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This study examined trends in inequalities in health complaints among early adolescents in Scotland from 1998 to 2018. We analysed data from the Health Behaviour in School-aged Children (HBSC) survey conducted in Scotland in 1998, 2002, 2006, 2010, 2014 and 2018. A self-report questionnaire was administered in schools to a nationally representative sample of 11-, 13-, and 15-year-olds (n=29,250). Health complaints were measured using a scale comprising four psychological symptoms (feeling low, feeling nervous, irritability and sleep difficulties) and four somatic symptoms (headache, backache, stomachache and dizziness). Socio-economic status was measured using the Family Affluence Scale. Between 1998 and 2018, there were significant increases in the proportion of girls and boys reporting feeling low, feeling nervous, sleep difficulties and backache. Prevalence of the eight individual health complaints was higher among girls and adolescents from lower affluence families. Socio-economic inequalities increased over time, such that declines in mental health were greatest among low affluence adolescents. The data show worsening trends in health complaints among Scottish adolescents between 1998 and 2018, particularly for girls and adolescents from low affluence families. Increasing inequalities in mental health highlight the need to address the underlying social and structural determinants of adolescent mental health.

KEYWORDS

adolescents, mental health, health complaints, social inequalities, school survey, HBSC

Introduction

Mental health conditions such as anxiety, depression and behavioural disorders are major causes of ill health among young people [World Health Organization (WHO), 2022]. There is widespread concern about worsening mental health among the adolescent population, with evidence of declining mental wellbeing in recent years. The State of the World's Children Report (United Nations Children's Fund [UNICEF], 2021) estimates that 16% of adolescents in Europe have a mental health condition such as depression, anxiety, eating disorders and attention deficit hyperactivity disorder. Similarly, recent data from the UK indicate that one in six young people aged 6–16 years has a probable mental disorder, an increase from one in nine in 2017 (Newlove-Delgado et al., 2021). A review of secular trends in population prevalence of child and adolescent mental health problems in the UK found that clinical diagnosis and treatment of child and

adolescent psychiatric disorders had increased in recent decades and that substantial increases in emotional and behavioural problems were evident (Collishaw, 2015). More recently, a large-scale community-based survey of adolescents in England reported that two-fifths of adolescents aged 11–14 years scored above the abnormal threshold for emotional problems, conduct problems or hyperactivity (Deighton et al., 2019). Longitudinal studies have also shown increases in depressive symptoms (Patalay and Gage, 2019), and a study in five high-income countries found evidence of increasing antidepressant use among children and adolescents between 2005 and 2012, with highest rates in Denmark, Germany and the UK (Bachmann et al., 2016). A more recent study reported that antidepressant prescribing has continued to increase among 12–17-year-olds in England (Jack et al., 2020).

Similar trends have been found in other high-income countries (Bor et al., 2014; Cosma et al., 2020), suggesting that this may be, in part, a result of broader cultural shifts affecting adolescent wellbeing. For example, health complaints have increased among Italian adolescents between 2010 and 2018 with the strongest effect for psychological symptoms among 15-year-olds (Bersia et al., 2022). Potrebny et al. (2019) reported a similar increase among Norwegian adolescents, with increases in psychological complaints more evident among older adolescent girls compared with boys and younger adolescents. In Sweden, there was an increase in frequent and co-occurring psychosomatic symptoms among 15-year-olds from 1985 to 2017, with higher prevalence amongst girls (Högberg et al., 2022).

Identifying groups of young people who may be at greater risk of experiencing mental health problems is important for targeting interventions and resources effectively. As well as evidence of clear age and gender differences emerging from recent studies, there are clear socio-economic inequalities in mental health: young people from more deprived backgrounds are more likely to experience poor subjective wellbeing and mental ill health. For example, a systematic review published in 2013 found that children and adolescents from more socioeconomically disadvantaged backgrounds were two to three times more likely to develop mental health problems (Reiss, 2013). Prevalence of emotional problems, conduct problems and hyperactivity among early adolescents in England was higher among those eligible for free school meals (Deighton et al., 2019). Furthermore, higher prevalence of adolescent anxiety and depression have been found to be associated with living in a single-parent household (Hafstad et al., 2021), and maternal education at birth is associated with socio-emotional problems at age 14 (Straatmann et al., 2019). Findings from the cross-national Health Behaviour in School-aged Children (HBSC) study show fairly consistent inequalities in mental health across countries; adolescents from higher affluence families report higher life satisfaction, better self-rated health and lower levels of multiple health complaints (Inchley et al., 2020a). International findings from this study have shown similar patterns (e.g., Hammami et al., 2022) and suggest that inequalities in subjective health have widened in recent years (Elgar et al., 2015; Chzhen et al., 2016).

Adolescence is a critical development period during which many mental health issues emerge, with the majority of long-term mental health conditions developing before the age of 24 (Blakemore, 2019). Poor mental health in adolescence can have a major impact on young people's lives, affecting their social relationships, experiences at school, as well as longer term health and educational outcomes. Therefore, identifying mental health concerns at an early age and providing access to appropriate support and services are particularly important. However, evidence suggests that mental health services are stretched and many young people are not able to access the services they need. For many, the situation appears to have been exacerbated by the COVID-19 pandemic and particularly for those adolescents who were already vulnerable (Samji et al., 2022). School closures and lockdown measures stripped young people of the social structures and support that are so critical for healthy development during the adolescent years. Access to outside spaces and physical activity opportunities were also limited, and many recreational activities stopped. While not all young people experienced the impact of the pandemic in the same way, adverse effects on mental wellbeing, feelings of loneliness and sleep were found, particularly for young people with pre-existing vulnerabilities (e.g., Mansfield et al., 2021; Thakur et al., 2022; Tyack et al., 2022).

Monitoring long-term trends in mental health is important for understanding changing prevalence in disease burden on young people over time, identifying priorities for action and monitoring the impact of national policies and programmes as well as social changes. However, the ability to track mental health trends has been undermined by a lack of long-term studies that use comparable measures over time. The HBSC study provides data on early adolescents from the 1990s, thus providing a unique data source to investigate secular changes in mental health and other health outcomes over time. Using data from the HBSC Scotland survey, we investigated changes in psychological and somatic health complaints as an indicator of mental health over a 20-year period from 1998 to 2018. Somatic complaints are included because there is evidence that mental health problems in children and adolescents may initially present as somatic symptoms (Shapiro and Nguyen, 2010). Other studies amongst adolescents indicate an association between the number of somatic symptoms and poorer mental health (Ando et al., 2013; Högberg et al., 2022). Further, we examined the extent to which trends differ by gender and socio-economic status. Specifically, we aimed for to address the following research questions: (1) Did the prevalence of multiple health complaints and individual psychological or somatic symptoms among 11–15-year-olds in Scotland change between 1998 and 2018? and (2) Did the rate of change vary by gender or family affluence?

Method

Procedure

The Health Behaviour in School-aged Children (HBSC) study is a World Health Organization Collaborative Cross-National Survey, conducted every four years in member countries. The HBSC survey collects self-reported data on the health and wellbeing of adolescents and the social context in which they grow up. The survey is administered in schools to a nationally representative sample of 11-, 13-, and 15-year-olds with students completing the questionnaire anonymously in a classroom setting. Scotland joined the HBSC Study in 1986 and has conducted national surveys since 1990. In each survey year, the class is the primary sampling unit, stratified by school grade, and the sample is proportionally stratified by school funding (Local

Education Authority (LEA) funded or independent) and by education authority (for LEA funded schools). Ethical approval for each survey round was granted at institutional level by the University hosting the national HBSC team.

Participants

We analysed data from the Scottish HBSC surveys from 1998 to 2018. Because our primary research question focused on the effects of gender and family affluence, we semi-randomly selected a subsample of students from each year to ensure that our findings were not confounded by small differences in the distribution of gender and our measure of socio-economic position (the Family Affluence Scale) across survey years. The final dataset fixed the distribution of the three-category family affluence measure in the samples such that 20% of girls and 20% of boys within a year were in the low FAS group, 60% of each were in the medium FAS group, and 20% of each were in the high FAS group (see Supplementary Table 1); further, because FAS scores are relative to gender, we ensured equivalent numbers of girls and boys within each survey year. This restricted dataset provided greater confidence that any trends over time were not due to varying distributions of family affluence across survey year. The resulting subsample comprised 29,250 students: 1998 ($n = 5{,}140$), 2002 ($n = 2{,}390$), 2006 ($n = 5{,}520$), 2010 ($n = 4{,}010$), 2014 ($n = 8{,}330$), and 2018 ($n = 3{,}860$). Of the overall analytic sample, 49.9% were girls, 34.6% of students were in Primary 7 (11-year-olds), 34.0% in Secondary 2 (13-year-olds), and 31.4% in Secondary 4 (15-year-olds).

Measures

Health complaints

The HBSC Symptom Checklist (HBSC-SCL) was used to measure students' subjective health complaints. Health complaints are self-reported health symptoms which provide an indicator of mental health. Symptoms commonly co-occur and may be experienced by individuals with or without a specific diagnosis, reflecting both everyday experiences and health problems (Haugland and Wold, 2001). The HBSC-SCL is a non-clinical measure comprising eight items across two domains: psychological (i.e., feeling low, irritability, feeling nervous, sleeping difficulties) and somatic (i.e., headache, stomach-ache, backache, dizziness), which has been shown to be valid and reliable within adolescent populations (Haugland and Wold, 2001; Ravens-Sieberer et al., 2009; Heinz et al., 2022). Students reported how often they experienced each of the eight symptoms over the last 6 months: "about every day," "more than once a week," "about every week," "about every month" and "rarely or never." We defined multiple health complaints as experiencing two or more of the eight symptoms at least once a week (Ravens-Sieberer et al., 2009), which is an approach that can aid practical interpretation of the findings and has been used in international publications (e.g., Hammami et al., 2022). Further, we examined the individual psychological and somatic symptoms.

Family affluence

The Family Affluence Scale (FAS) is a composite measure of material wealth. FAS is a useful socioeconomic proxy for family wealth in youth surveys where parental responses about income or wealth are unavailable. Across three decades, FAS has been revised to reflect changing historical and technological conditions. The first version of the scale, FAS I, included family cars, child having a separate bedroom, and telephone ownership (Currie et al., 1997). For the 2002 HBSC survey, FAS II was created to include number of computers in the family and holidays abroad, and removing telephone ownership (Currie et al., 2008). For the 2014 HBSC survey, an extensive validation study led to the development of the six-item FAS III: car ownership, own bedroom, holidays abroad, number of computers, dishwasher, and number of bathrooms (Torsheim et al., 2016). To compare scores across these three versions of FAS used from 1998 to 2018, we used summed scores to create indices of relative ranks within survey year, gender, and age group, using ridit transformations (Elgar et al., 2017). Students were categorized into three categories based on their ranked scores: low FAS (bottom 20%), medium FAS (middle 60%), and high FAS (upper 20%). Because of the limited number of FAS categories, perfect 20/60/20 splits are not always obtained. As described under participants above, to simplify interpretation of trends over time a semi-random subsample was drawn for each year matching the desired 20/60/20 distribution of the three affluence categories (see Supplementary Table 1).

Analysis

We used Stata's (version 16.1) complex survey analysis functions to incorporate weighting and survey design. Post-stratification weights were applied to surveys from 2010 onwards to make the sample representative of Scottish Primary 7, Secondary 2 and Secondary 4 pupils with respect to relative representation between Local Education Authorities (geographic strata), school funding (state or independent), school denomination status (non-denominational or denominational) and rurality of school (based on Scottish Government rural–urban 6-point classification). To test our research questions, we conducted hierarchical binary logistic regression models with multiple health complaints as the outcome. In the first step of the model (RQ1), predictor variables included survey year (continuous), gender (dichotomous), and family affluence (trichotomous) with school grade (trichotomous) as a covariate. In the second step (RQ2), we included interaction terms testing whether the effect of survey year was moderated by gender or family affluence. We provided 95% confidence intervals for odds ratios and indicated whether they were statistically significant ($\alpha < 0.05$).

Results

Multiple health complaints

The percentage of students reporting multiple health complaints in surveys ranged from 26.1% in 2006 to 35.0% in 2018 (Table 1), with a small but significant increase on average from 1998 to 2018. Controlling for school grade, girls were more likely than boys to report at least two symptoms more than once a week, and low FAS students had greater odds of reporting multiple health complaints than both medium and high FAS students (Table 2). Further, trends over time significantly differed between low FAS and high FAS students. As

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TABLE 1 Percentages of multiple health complaints, somatic symptoms, and psychological symptoms, by survey year.

	1998	2002	2006	2010	2014	2018
Multiple health complaints						
At least 2 of 8 weekly	30.6	30.1	26.1	28.3	29.8	35.0
95% CI	(29.3–31.8)	(28.3–32.0)	(24.9–27.3)	(26.9–29.8)	(28.5–31.2)	(33.3–36.8)
Psychological Symptoms						
Feel low	10.5	12.4	10.8	13.5	16.5	19.0
95% CI	(9.7–11.4)	(11.1–13.8)	(10.0–11.7)	(12.5–14.6)	(15.4–17.6)	(17.6–20.4)
Irritable	24.8	24.0	22.0	22.9	22.9	23.5
95% CI	(23.6–26.0)	(22.3–25.8)	(20.9–23.1)	(21.6–24.3)	(21.6–24.1)	(22.0–25.1)
Nervous	14.9	15.6	12.1	15.2	19.6	24.4
95% CI	(14.0–16.0)	(14.2–17.1)	(11.2–13.0)	(14.1–16.4)	(18.5–20.8)	(22.9–26.0)
Sleep difficulties	22.2	21.8	21.7	24.3	23.1	30.2
95% CI	(21.1–23.4)	(20.2–23.5)	(20.7–22.9)	(22.9–25.6)	(21.9–24.4)	(28.6–31.9)
Somatic Symptoms						
Headache	18.2	16.1	13.0	15.4	14.9	16.1
95% CI	(17.2–19.3)	(14.7–17.6)	(12.1–13.9)	(14.3–16.6)	(13.9–16.0)	(14.8–17.4)
Stomachache	11.3	9.9	7.8	9.1	8.9	9.1
95% CI	(10.4–12.2)	(8.7–11.1)	(7.1–8.5)	(8.2–10.0)	(8.1–9.8)	(8.0–10.2)
Backache	7.9	6.5	6.8	9.3	8.8	10.4
95% CI	(7.2–8.7)	(5.6–7.6)	(6.2–7.5)	(8.5–10.3)	(8.0–9.7)	(9.3–11.6)
Dizzy	11.4	11.0	10.1	11.3	10.7	12.7
95% CI	(10.6–12.3)	(9.8–12.4)	(9.3–10.9)	(10.4–12.4)	(9.8–11.6)	(11.6–14.0)
Denominator	5,125	2,390	5,469	3,979	8,267	3,829

TABLE 2 Odds ratios of reporting multiple health complaints (i.e., at least two of eight weekly symptoms).

	OR	95% CI	*p*
Step 1			
Survey year	1.01	1.00–1.01	<0.001
Sex (ref = Boy)			
Girl	1.69	1.59–1.79	<0.001
FAS (ref = Low)			
Medium	0.74	0.69–0.79	<0.001
High	0.70	0.64–0.76	<0.001
Grade (ref = P7)			
S2	1.37	1.27–1.47	<0.001
S4	1.67	1.55–1.80	<0.001
Step 2			
Survey year*Sex			
Girl	1.01	1.00–1.02	0.164
Survey year*FAS			
Medium	0.99	0.98–1.00	0.059
High	0.96	0.95–0.98	<0.001

FAS, Family Affluence Scale; P7, primary level 7 (11-year-olds); S2, secondary level 2 (13-year-olds); S4, secondary level 4 (15-year-olds).

depicted in Figure 1, this significant interaction was characterized by a generally increasing percentage of low FAS students reporting at least two symptoms more than once a week from 1998 to 2018 compared with slight decreases for high FAS students during this period.

Psychological symptoms

Descriptive statistics are presented by survey year for individual psychological and somatic symptoms (Table 1). On average, prevalence of three of the four psychological symptoms—feeling low, feeling nervous, and sleep difficulties—significantly increased from 1998 to 2018. Reports of feeling low changed the most over time; there was a 3.9% annual increase in the percentage of students reporting this symptom when controlling for sex, FAS, and grade. During this period, girls were more likely than boys to report experiencing each of the four psychological symptoms more than once a week (Table 3), and the percentage of girls reporting feeling nervous increased at a greater rate from 1998 to 2018 than it did for boys (Figure 2). Low FAS students had greater odds of reporting each psychological complaint than high FAS students. Further, trends over time significantly differed between low FAS and high FAS students for all four psychological symptoms. For feeling low, feeling nervous, and sleep difficulties, this significant interaction was

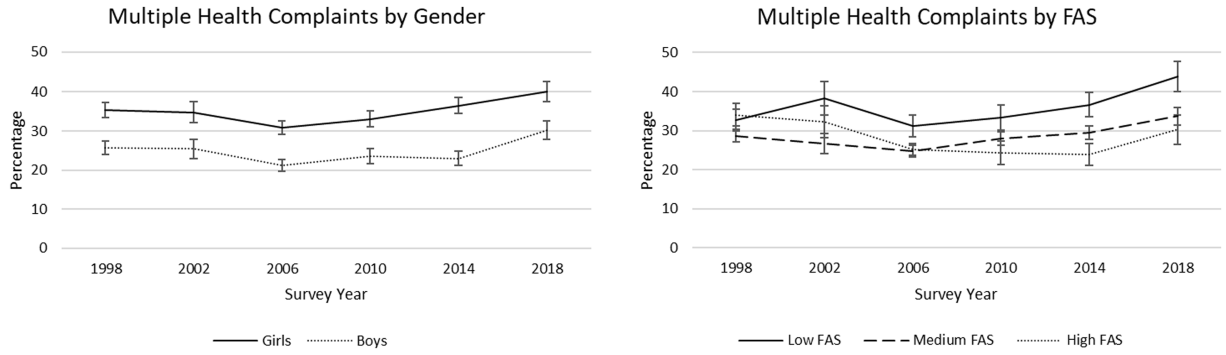

FIGURE 1
Trends in percentages of reported multiple health complaints (i.e., at least two of eight weekly symptoms), by gender and by Family Affluence Scale (FAS). 95% confidence intervals are depicted.

TABLE 3 Odds ratios of reporting weekly psychological symptoms.

	Feel Low			Irritable			Nervous			Sleep Difficulty		
	OR	95% CI	*p*	OR	95% CI	*p*	OR	95% CI	*p*	OR	95% CI	*p*
Step 1												
Survey year	1.04	1.03–1.05	<0.001	1.00	0.99–1.00	0.142	1.03	1.03–1.04	<0.001	1.02	1.01–1.02	<0.001
Sex (ref = Boy)												
Girl	2.10	1.94–2.28	<0.001	1.25	1.18–1.33	<0.001	1.87	1.73–2.01	<0.001	1.40	1.21–1.49	<0.001
FAS (ref = Low)												
Medium	0.70	0.64–0.77	<0.001	0.72	0.67–0.78	<0.001	0.82	0.75–0.89	<0.001	0.82	0.76–0.88	<0.001
High	0.66	0.59–0.75	<0.001	0.68	0.62–0.75	<0.001	0.73	0.64–0.81	<0.001	0.76	0.69–0.84	<0.001
Grade (ref = P7)												
S2	1.70	1.51–1.87	<0.001	1.54	1.42–1.67	<0.001	1.33	1.22–1.46	<0.001	0.92	0.85–0.99	0.026
S4	2.26	2.04–2.50	<0.001	1.71	1.57–1.85	<0.001	1.53	1.40–1.68	<0.001	1.11	1.03–1.20	0.006
Step 2												
Survey year*Sex												
Girl	0.99	0.98–1.00	0.189	1.01	1.00–1.02	0.033	1.02	1.01–1.03	<0.001	1.01	1.00–1.02	0.124
Survey year*FAS												
Medium	0.99	0.98–1.00	0.189	0.99	0.98–1.00	0.115	0.99	0.98–1.00	0.173	1.00	0.99–1.01	0.682
High	0.97	0.95–0.98	<0.001	0.97	0.96–0.99	<0.001	0.97	0.95–0.98	<0.001	0.97	0.96–0.99	<0.001

FAS, Family Affluence Scale. P7, primary level 7 (11-year-olds). S2, secondary level 2 (13-year-olds). S4, secondary level 4 (15-year-olds).

characterized by the percentage of low FAS students reporting each symptom increasing at a greater rate from 1998 to 2018 than the increases in high FAS students during this period (Figure 3). However, the percentage of low FAS students reporting feeling irritable was generally stable from 1998 to 2018 while fewer high FAS students reported this symptom over time.

Somatic symptoms

On average, students' reports of backache significantly increased from 1998 to 2018 but prevalence of headache and stomachache significantly decreased during this period. Reported backache changed the most over time; there was a 2.0% annual increase in the percentage of students reporting this symptom when controlling for sex, FAS, and grade. Girls were more likely than boys to report experiencing each of the four somatic symptoms more than once a week (Table 4), and the percentage of girls reporting backaches and dizziness increased from 1998 to 2018 but remained relatively stable for boys (Figure 4). Low FAS students had greater odds of reporting each somatic complaint than both medium and high FAS students. Further, trends over time significantly differed between low FAS and high FAS students for all four somatic symptoms. This significant interaction was characterized by the percentage of low FAS students reporting backaches and dizziness increasing from 1998 to 2018 while prevalence of these symptoms remained

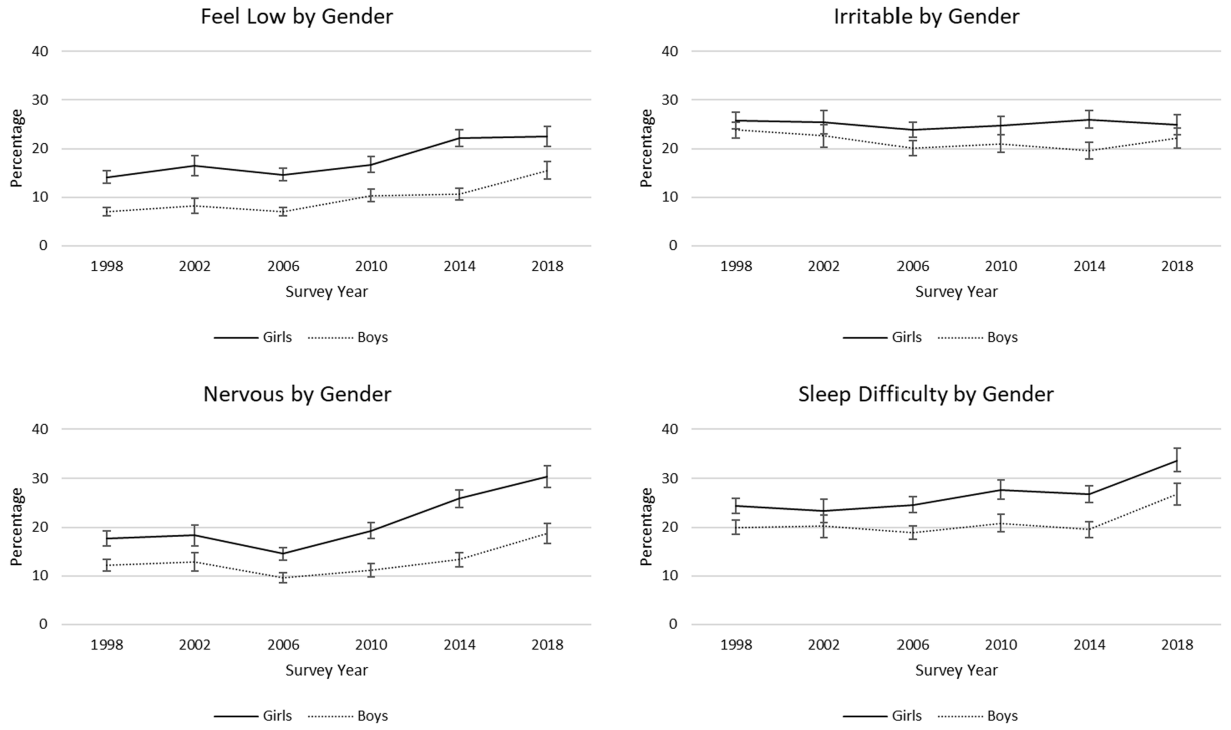

FIGURE 2
Trends in percentages of reported psychological symptoms, by gender. 95% confidence intervals are depicted.

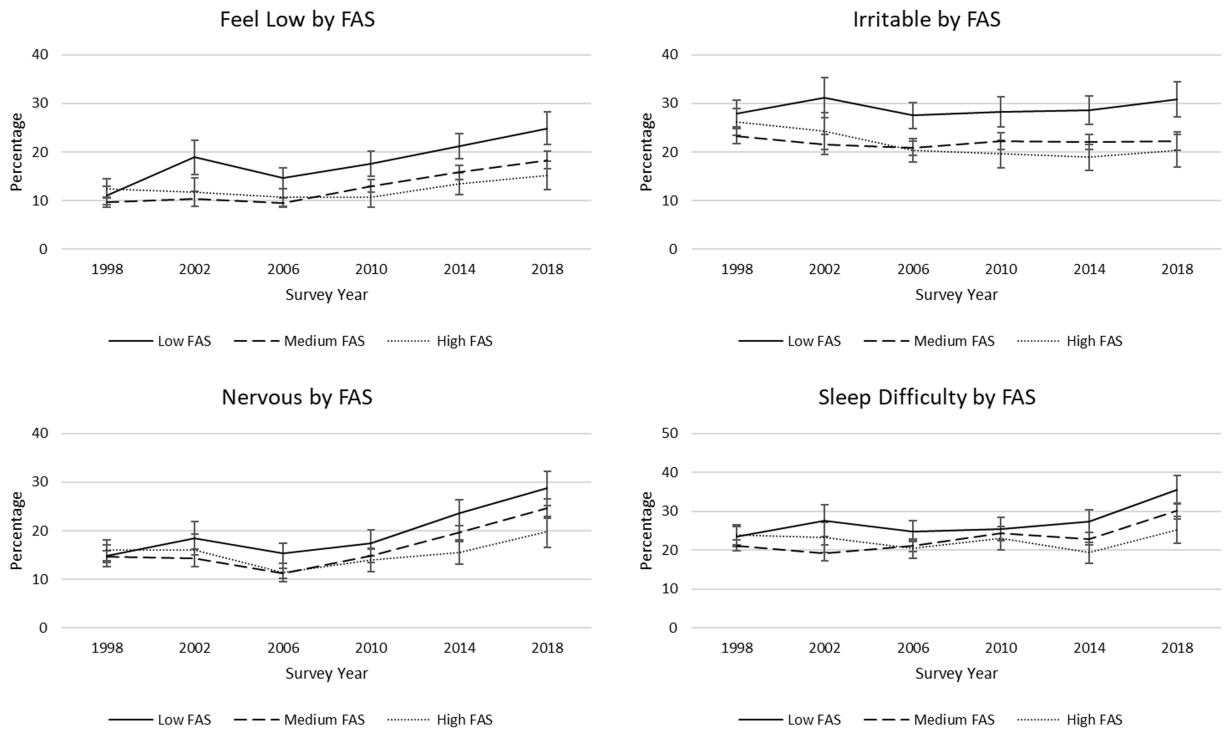

FIGURE 3
Trends in percentages of reported psychological symptoms, by Family Affluence Scale (FAS). 95% confidence intervals are depicted.

generally stable for high FAS students during this period (Figure 5). For headaches, the percentage of low FAS students was stable from 1998 to 2018 while fewer high FAS students reported this symptom over time. Finally, the percentage of low FAS students reporting stomach-ache decreased at a slightly slower rate than it did for high FAS students.

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TABLE 4 Odds ratios of reporting weekly somatic symptoms.

	Headache			Stomachache			Backache			Dizzy		
	OR	95% CI	*p*	OR	95% CI	*p*	OR	95% CI	*p*	OR	95% CI	*p*
Step 1												
Survey year	0.99	0.99–1.00	0.013	0.99	0.98–1.00	0.001	1.02	1.01–1.03	<0.001	1.00	1.00–1.01	0.243
Sex (ref = Boy)												
Girl	2.00	1.86–2.16	<0.001	2.34	2.23–2.58	<0.001	1.39	1.26–1.53	<0.001	1.57	1.44–1.71	<0.001
FAS (ref = Low)												
Medium	0.76	0.69–0.83	<0.001	0.72	0.65–0.81	<0.001	0.82	0.73–0.92	<0.001	0.83	0.75–0.92	<0.001
High	0.81	0.72–0.90	<0.001	0.79	0.69–0.90	<0.001	0.81	0.70–0.93	0.004	0.80	0.70–0.91	<0.001
Grade (ref = P7)												
S2	1.46	1.32–1.61	<0.001	1.11	0.99–1.24	0.073	1.66	1.45–1.90	<0.001	1.30	1.17–1.44	<0.001
S4	1.83	1.67–2.01	<0.001	1.10	0.98–1.23	0.096	2.76	2.43–3.13	<0.001	1.43	1.29–1.59	<0.001
Step 2												
Survey year*Sex												
Girl	1.01	1.00–1.02	0.159	0.99	0.98–1.01	0.375	1.02	1.01–1.04	0.004	1.01	1.00–1.03	0.022
Survey year*FAS												
Medium	0.99	0.98–1.00	0.125	1.01	0.99–1.02	0.551	1.00	0.98–1.01	0.667	0.99	0.97–1.00	0.087
High	0.97	0.96–0.99	0.002	0.98	0.96–1.00	0.101	0.98	0.98–1.00	0.046	0.97	0.95–0.99	0.001

FAS, Family Affluence Scale. P7, primary level 7 (11-year-olds). S2, secondary level 2 (13-year-olds). S4, secondary level 4 (15-year-olds).

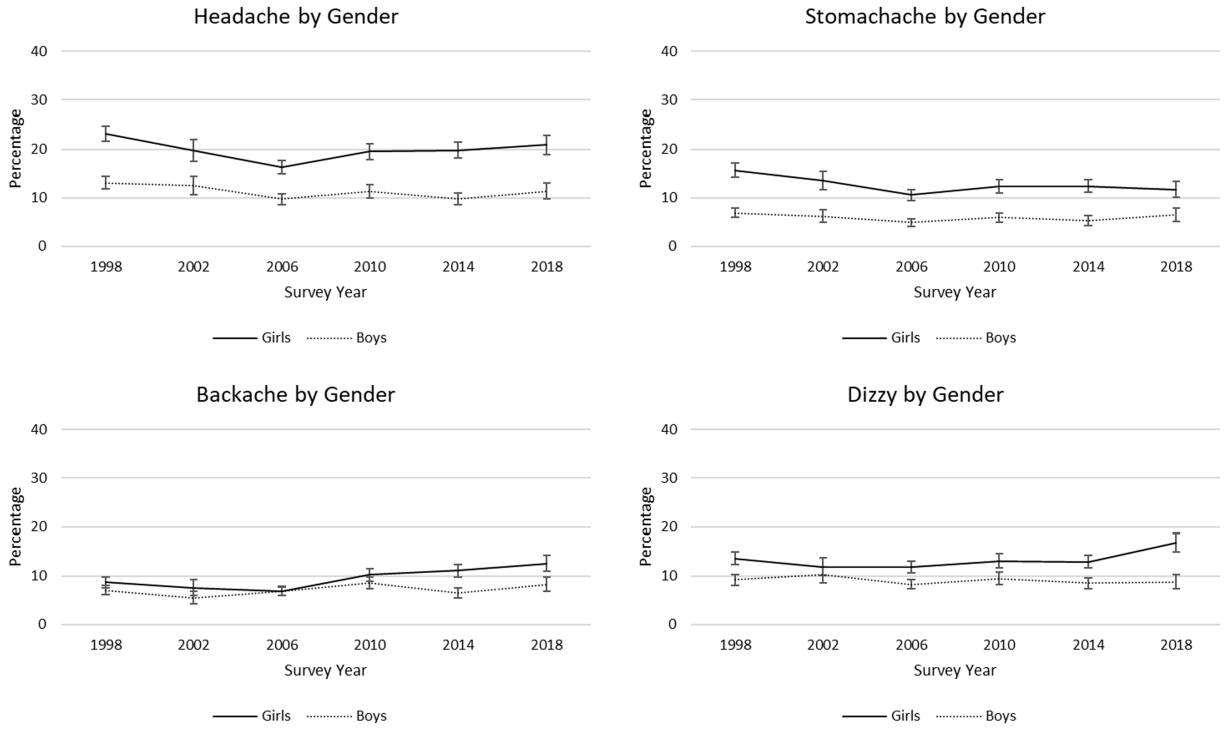

FIGURE 4
Trends in percentages of reported somatic symptoms, by gender. 95% confidence intervals are depicted.

Discussion

This paper describes trends in health complaints among early adolescents in Scotland over the last two decades. In line with other recent studies, prevalence of health complaints was consistently higher among girls and among young people from less affluent families (Reiss, 2013; Bor et al., 2014). This was the case for the composite measure of health complaints as well as several individual symptoms. Prevalence was highest for psychological symptoms reflecting growing

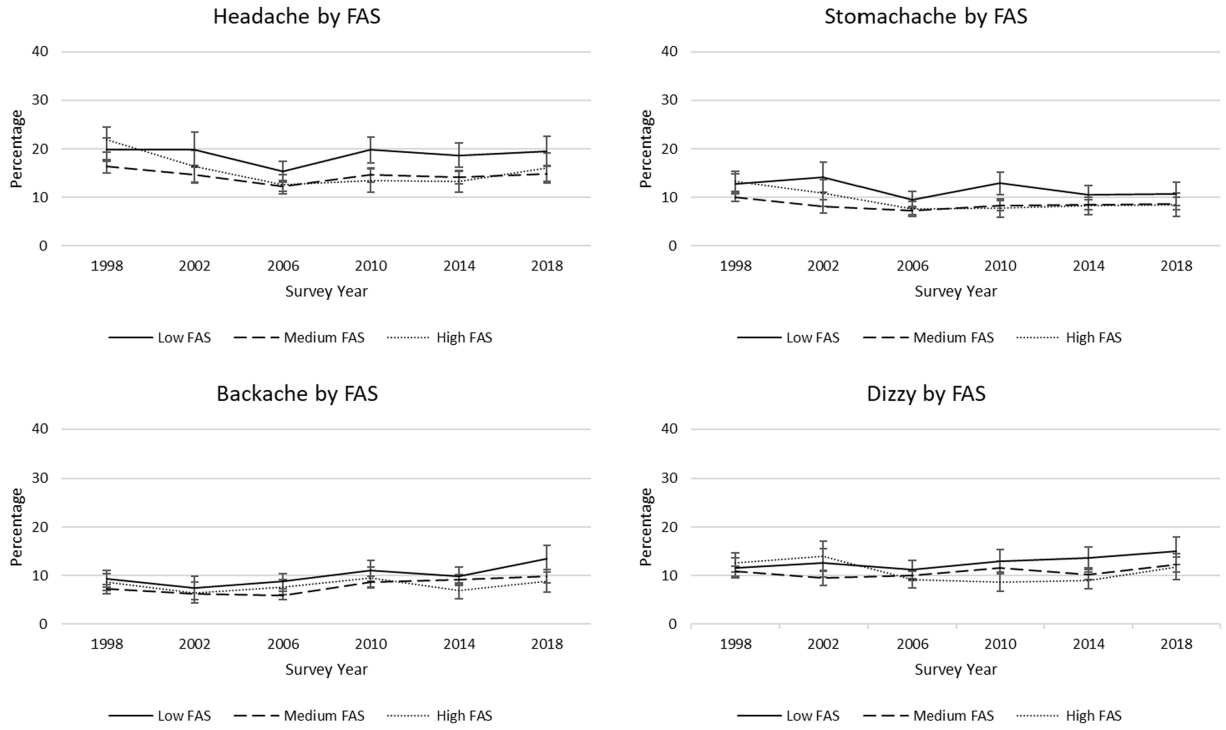

FIGURE 5
Trends in percentages of reported somatic symptoms, by Family Affluence Scale (FAS). 95% confidence intervals are depicted.

concerns about poor psychological wellbeing among adolescents, especially older adolescent girls. Changes over time were observed mainly for psychological symptoms with more marked increases in recent years. Since the late 1990s, the proportion of adolescents reporting that they regularly feel low has doubled; smaller but significant increases existed for feeling nervous and sleep difficulties. Even though increased negative mood is common during the early adolescent years these findings are concerning because this symptom can be a precursor to more serious psychological problems for some young people (Dietvorst et al., 2021). Similarly, sleep is essential for healthy development during the adolescent years and poor sleep is associated with impaired cognitive function, depressive symptoms and risk behaviours (Owens et al., 2014). Feeling nervous may reflect higher levels of anxiety or lower levels of confidence, both of which can affect young people's ability to function well across a range of domains including school and social situations. Fewer changes over time were observed for somatic symptoms except for backache, for which prevalence fluctuated over time but appears to have increased since the mid-2000s among girls. Our finding of an increasing prevalence of backpain corresponds with a recent study from Denmark, which also found higher prevalence among adolescents from lower socio-economic families (Holstein et al., 2022).

There was clear evidence of widening inequalities in mental health in that the gap between low affluence adolescents and their high affluence peers increased for each of the eight health complaints, particularly in more recent years. Sharper increases in several psychological and somatic symptoms were observed among lower affluent adolescents. Further, while prevalence of irritability and headaches remained relatively stable over time for low affluent adolescents, these complaints decreased among higher affluence adolescents across this same period. A decline in reported stomachache was observed across the sample on average but was less marked among low affluence individuals. These trends reinforce previous evidence that the burden of poor mental wellbeing disproportionately affects young people from more disadvantaged backgrounds, and that this disparity between young people from different socio-economic backgrounds has worsened in recent years.

A range of structural and social factors may be perpetuating these trends and contributing to discrepancies in mental health risk and outcomes. Increases in academic pressure, social media use, economic instability and family breakdown have all been proposed as potential drivers (Gunnell et al., 2018). One of the main explanatory theories is the social causation hypothesis which focuses on differential exposure to stressful life events associated with deprivation (Reiss, 2013). Young people growing up in more disadvantaged circumstances are more likely to experience stressors across a range of domains (e.g., financial, social and educational) and may also have less access to important resources or buffers such as social support and health or community-based services. Recent studies among European adolescents, for example, have found that negative life events are associated with higher prevalence of mental health problems (Reiss et al., 2019) and that exposure to negative life events and family stressors explains some of the association between low socio-economic status and poor mental health (Bøe et al., 2018).

In relation to school, the educational stressors hypothesis states that mental health problems are linked to stressors within the school context (Högberg, 2021). Greater focus on educational attainment within knowledge economies may raise academic expectations and increase the pressure on adolescents to perform well at school. Several studies have demonstrated a relationship between schoolwork pressure and poor mental health. For example, Cosma et al. (2020) examined cross-national trends in mental wellbeing and found that

schoolwork pressure was associated with more frequent psychosomatic health complaints and partly explained increases in psychosomatic complaints over time. Data from the HBSC study also show that levels of perceived schoolwork pressure are particularly high among Scottish 15-year-olds, with 74% of girls and 53% of boys reporting a lot or some pressure from schoolwork, and similar findings observed for other UK countries (Inchley et al., 2020a). Furthermore, levels of perceived schoolwork pressure have increased in Scotland since 1994 (Inchley et al., 2020b) and, in 2018, were much higher among boys from low affluence families compared to those from high affluence families whereas there was no significant difference among girls (Inchley et al., 2020a). Schools have a key role in promoting and supporting the mental health of adolescents and have the potential to address inequalities in health by reaching the whole school population, although evidence on the extent to which this occurs in practice is mixed (Moore et al., 2015). Our findings suggest that adolescents may be more vulnerable to mental health problems at particular stages of their school career, such as following the transition to secondary school and the exam years, likely reflecting a combination of biological, psychological and social influences during this important developmental and transitional period.

Early adolescence is a critical time for early intervention to prevent longer-term mental health problems and there is an urgent need for more investment in mental health services and support to meet increasing demand, particularly targeted at young people from more disadvantaged backgrounds who may, not only have greater vulnerability and exposure to risks, but also be less able to access available support. Schools are increasingly on the frontline dealing with mental health crises on a day-to-day basis, but with very limited resources. Again, there is a need for support and training for school staff to enable them to meet the mental health needs of their school communities more effectively, as well as effective referral pathways on to more specialist support for those young people that need it.

A major strength of this study is the ability to draw on unique 20-year data from six consecutive waves of the HBSC Scotland survey using the same survey design items to maximise comparability over time. Some caution should be applied to interpretation of the trends as we have no information on the intervening years and the data are cross-sectional. We used the HBSC health complaints scale as an indicator of mental health. This is a well-used and validated measure internationally. However, mental health is a complex construct and other mental health indicators might show different patterns by gender and socio-economic status over time.

In conclusion, our findings highlight important gender and socio-economic inequalities in mental health over the past 20 years in Scotland. Overall, prevalence of psychosomatic symptoms has increased reflecting worsening mental health among the adolescent population. These increases are not equally distributed across the population, with young people from less affluent backgrounds having experienced more marked increases, particularly in relation to low mood, nervousness and sleep difficulties. That such inequalities have persisted for two decades demonstrates the need for further investment and action to address the underlying social and structural determinants of mental health within the adolescent population, alongside more universal prevention strategies. Ongoing monitoring is also important, particularly in the context of the COVID-19 pandemic, to assess its longer-term impact among adolescents and particularly among those from lower socioeconomic backgrounds who may be more at risk of developing mental health problems.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: https://www.uib.no/en/hbscdata/113290/open-access.

Ethics statement

The studies involving human participants were reviewed and approved by the University of St Andrews Medical School Teaching and Research Ethics Committee (2014 and 2018), University of Edinburgh School of Education Ethics Committee (2002, 2006, 2010), and University of Edinburgh Medical School Ethics Committee (1998). Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

MW led the data analysis. JI led on writing of the manuscript. DC, JM, and JB contributed to drafting of the manuscript and final review. All authors conceived and designed the study.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1095117/full#supplementary-material

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Predictive relationship between COVID-19 anxiety and psychological distress in adolescents during the COVID-19 pandemic

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COVID-19 was a novel stressor that gave rise to pandemic related anxiety and increased the risk of mental health issues, particularly in youth. It is important to understand how such events contribute to psychological distress in young people to adequately intervene in the aftermath and to plan for future similar events. Using cross-sectional data from the CoSPACE Ireland study dataset this paper reports on the predictive relationship between COVID-19 anxiety and psychological distress for Irish adolescents ($N = 314$, $M = 14.05$, $SD = 2.7$, 11–18 years), while controlling for other influencing factors across multiple levels of a bioecological systems approach. Covariates were age, gender, ethnicity, social economic status, Peer Support, School Support and Parent–Child Closeness. Findings indicate that COVID-19 anxiety was a significant predictor of adolescents' psychological distress. Specifically, Consequence Anxiety (worries about the indirect consequences of COVID-19) was found to be a predictor of adolescents' psychological distress rather than Disease Anxiety (worries about the COVID-19 virus itself). Individual factors (e.g., age, ethnicity, special educational needs) and microsystem factors (e.g., parent child closeness, peer support) were also found to impact on adolescents' levels of psychological distress. A significant moderation analysis revealed that greater parent–child closeness reduced the strength of the positive association between Consequence Anxiety and psychological distress. These findings suggest that strategies to alleviate adolescents' psychological distress during pandemics should focus on reducing pandemic-related anxiety, specifically Consequence Anxiety. A multisystemic approach is also recommended to reduce the negative mental health impacts of the pandemic on adolescents.

KEYWORDS

COVID-19, adolescents, psychological distress, pandemic anxiety, parental closeness

Introduction

The COVID-19 pandemic spread across the globe at an unprecedented rate and has affected the lives of millions of people worldwide (Guo et al., 2021). Negative consequences of the pandemic span further than those related to the virus itself (e.g., contracting the virus, serious illness, death etc.) and can also relate to growing concerns regarding the impact of the pandemic on populations' mental health (Talevi et al., 2020; Nochaiwong et al., 2021; Santomauro et al., 2021). While fears around the virus itself may cause distress for individuals, additional factors such as government policies and restrictions can also negatively impact the mental health of individuals (Ghebreyesus, 2020). For example, evidence on the impacts of isolation, social distancing, and quarantine from previous pandemics (e.g., SARS, Ebola) as well as the COVID-19 pandemic has shown significant negative and long-lasting psychological effects (Brooks et al., 2020; Henssler et al., 2020).

Emerging evidence indicates that adolescents are at particular risk for developing poor mental health outcomes from the pandemic (Hossain et al., 2022; Mansfield et al., 2022; Theberath et al., 2022). According to Zhou (2020), adolescents are more susceptible than adults to the psychological effects of the pandemic because they possess underdeveloped cognitive and emotional regulation systems. Indeed, a systematic review by Nearchou et al. (2020) found that the COVID-19 pandemic has had an impact on youth mental health and de Figueiredo et al. (2021) warn that the abrupt changes in daily routines, such as school closures, lack of a social life, and lack of outdoor activities, negatively affect the mental health of adolescents both in the short and long-term. The potentially long-term consequences are particularly worrying because the biopsychosocial stressors experienced during the pandemic can negatively impact upon adolescents' neurological development, making them more susceptible to developing psychiatric disorders in adulthood (Orben et al., 2020; de Figueiredo et al., 2021). Developing an understanding of the mental health impact of the COVID-19 pandemic and related restrictions on adolescents is therefore important to inform interventions that offset possible harm.

Existing empirical research suggests that individual factors can impact on adolescents' likelihood of experiencing adverse mental health impacts from the pandemic. Studies have identified multiple risk and protective factors that influence the degree of psychological distress experienced by adolescents during the pandemic. For example, in a sample of Chinese adolescents, Zhou et al. (2020) found depressive and anxiety symptoms were more prevalent among female and older adolescent populations. This study also found adolescents' awareness surrounding COVID-19 was a protective factor against these symptoms (Zhou et al., 2020). Zhou et al. (2020) study was replicated with over 1 million Chinese school-aged children and adolescents and found that in addition to age, gender and COVID-19 knowledge, engagement in physical activity and following of COVID-19 recommendations were also found to be protective factors against psychological distress (Qin et al., 2021).

Additional individual factors including Special Educational Needs (SEN), Socio-Economic Status (SES) and ethnicity can increase adolescents' risk of experiencing higher levels of psychological distress during the pandemic. Existing evidence has indicated, for example, that adolescents with Attention Deficit Hyperactivity Disorder (ADHD) present with known risk factors (e.g., social isolation, motivation problems) for poorer mental health outcomes during the pandemic (Sibley et al., 2021). Furthermore, loss of employment and financial burden during the pandemic is more likely to impact those families of low SES and these additional stressors are likely to have negative consequences on the mental health of adolescents from these families (Darmody et al., 2020). Adolescents from minority ethnic and migrant groups may also be more likely to experience psychological distress during the pandemic due to the poverty, overcrowded conditions, stigma and discrimination they are often subjected to (Darmody et al., 2020; You et al., 2020).

In addition to individual factors, research has also pointed towards broader factors (e.g., presence of close relationships) as protecting against psychological distress in adolescents during the COVID-19 pandemic. For example, a longitudinal study which compared adolescents' mental health prior to and during the pandemic found that while adolescents' mental health had declined during the pandemic, higher levels of social connection predicted lower levels of anxiety, and depression and higher levels of life satisfaction (Magson et al., 2021). Conversely, adverse mental health consequences may be associated with a lack of social connectedness and subsequent feelings of loneliness in adolescents during the COVID-19 pandemic, as evidenced by a rapid systematic review (Loades et al., 2020). It is clear then that the determinants of adolescents' psychological distress during the COVID-19 pandemic are complex and widely ranging, including both individual and broader societal factors.

One key aspect of adolescents' psychological distress during the pandemic that has been largely neglected in the literature, relates to COVID-19 anxiety. However, a study by Lee et al. (2020) set out to examine the extent to which COVID-19 anxiety, uniquely predicts indicators of psychological distress experienced during the COVID-19 pandemic (i.e., depression, generalized anxiety and death anxiety) in an adult sample. Within this study, COVID-19 anxiety was found to be a unique predictor of psychological distress indicators during the pandemic. In another adult study, COVID-19 related anxiety was highest in those at greatest risk of mortality, i.e., over 65 s. (Hyland et al., 2020). These findings equip both researchers and healthcare professionals with the knowledge that pandemic related anxiety is a key risk factor for mental health issues in adults during the pandemic, which in turn has important implications for interventions during and following on from the COVID-19 pandemic. Given the unique developmental stage of adolescence extending our understanding of pandemic-related anxiety to the adolescent context is an important next step in identifying and treating young people at risk of developing mental health problems during a pandemic. Studies on COVID-19 anxiety tend to focus specifically on anxiety related to being infected by the disease itself and do not observe additional aspects of COVID-19 anxiety. McElroy et al. (2020) recognised that COVID-19 anxiety is multidimensional, differentiating between anxiety related to the COVID-19 virus itself (i.e., disease anxiety) and anxiety related to the associated consequences of the pandemic (i.e., consequence anxiety). Both disease anxiety and consequence anxiety can impact on the health and wellbeing of populations; however, some individuals may be more likely to experience one over the other depending on specific characteristics. For example, most COVID-19 hospitalizations and deaths affected older populations and those with underlying health conditions (Jordan et al., 2020), therefore it is not surprising that disease anxiety might be more prevalent with these groups. Similarly, McElroy et al. (2020), found that those with underlying health conditions were more likely to be concerned about the disease

itself. In contrast older adolescents and those with lower income were more likely to be concerned about the long-term consequences of the pandemic (McElroy et al., 2020). Given that young people and those with less financial stability may be more likely to feel the negative consequences of the pandemic due to disrupted education, loss of employment, lack of social contact and greater uncertainty about the future (Ahmed et al., 2020) pandemic consequence anxiety is likely to be particularly salient in these populations.

To the best of our knowledge, no studies examining the degree to which aspects of COVID-19 anxiety uniquely predicts psychological distress in adolescents during the pandemic have been conducted thus far, either within the Irish context or further afield. However existing research has linked COVID-19 anxiety to a range of negative psychological and somatic outcomes in adults (Shevlin et al., 2020; Savolainen et al., 2021). To scaffold the exploration of the effect of COVID-19 anxiety in adolescents we draw on Ecological Systems Theory (Bronfenbrenner, 1979). Ecological Systems Theory (Bronfenbrenner, 1979) views human development in the context of their immediate and wider social environment (Fearnley, 2020). The theoretical framework provides a useful lens for understanding the many factors that impact on the developmental outcomes of children and adolescents. According to Bronfenbrenner (1979), human development is complex and is influenced by multiple interrelated systems within the 'ecological environment' namely, the microsystem (i.e., immediate environment), mesosystem (i.e., interactions of microsystems such as between home and school), exosystem (i.e., social structures) and macrosystem (i.e., wider society and culture) (Bronfenbrenner, 1979; Ashiabi and O'Neal, 2015). In this study, several microsystem factors will be examined as these have been shown to be strong protective factors against poor psychological outcomes for young people. For example, evidence shows that young people with strong supportive relationships with parents significantly impacts young people's wellbeing and life satisfaction, while also mitigating against poor outcomes such as internalising difficulties and low mood (Oberle et al., 2011; Patrick et al., 2020; Hartas, 2021; Smyth and Nolan, 2022). While family relationships are important for young people, as they get older adolescents begin to rely on additional support from their peers and school as well (Viner et al., 2012). Friendships and peer support have also been shown to promote positive wellbeing in young people and act as a buffer or protective factor against poor psychological outcomes such as stress and anxiety (Beeble et al., 2009; Butler et al., 2022). Furthermore, several studies have found that positive supportive relationships with teachers can positively impact on students' wellbeing and psychological outcomes, and this is particularly true for young people who experience adversity and have a lack of supportive relationships at home (Heard-Garris et al., 2018; Hughes et al., 2018).

Previous research (Guo et al., 2021) has successfully applied Ecological Systems Theory to explain the psychological distress of adults during the pandemic. Drawing on Bronfenbrenner's theory we explore the effect of COVID-19 anxiety on young people's psychological distress, while controlling for risk and protective factors at different levels (i.e., individual and microsystem).

The present study

The specific aim of this paper is to assess the predictive relationship between COVID-19 anxiety and psychological distress in a sample of Irish adolescents. This study took place between April –June 2020, a time when COVID-19 restrictions were in place. Most intense. In the First Wave (February to August 2020) cases of COVID-19 increased significantly, from 8,089 in early April to 24,990 (+16,901, 523 per 100,000 of the population) in late May (Lima, 2021). At this time schools parks, restaurants, bars, cinemas, non-essential shops and services were closed in Ireland for 120 days from March 12th (Hale et al., 2021). In addition to school and business closures, people were expected to isolate in their homes and were permitted to exercise within a two-kilometre radius of their houses, in May 2020 this was extended to five kilometres. With the restrictions in place at this time, adolescents' interaction with others outside of their family was dramatically reduced. Previous research combined with Bronfenbrenner's (1979) Ecological Systems Theory will help inform the selection of factors which will be controlled for across levels. Based on the previous evidence, we hypothesize the following: (1) COVID-19 anxiety (comprised of Disease Anxiety and Consequence Anxiety) will be a significant predictor of psychological distress, even when controlling for other influencing factors; (2) Microsystem level factors (e.g., parent and peer) will moderate the relationship between COVID-19 anxiety and psychological distress.

Methods

Design

The results reported in this paper form part of the larger CoSPACE (COVID-19: Supporting Parents, Adolescents and Children during Epidemics) Ireland study, which is a longitudinal, online survey designed to track the mental health of parents and their children (aged 4–18 years old) throughout the COVID-19 pandemic in the Republic of Ireland. This paper focuses exclusively on cross-sectional data collected during the early stages of the COVID-19 pandemic, from both parents reporting on the mental health of their school-aged adolescent children (aged 11–18 years old) and the adolescents themselves.

Procedure

Convenience sampling was used to recruit participants. This was achieved through a variety of means, including (social) media, targeted online advertising and distribution through partner organisations, networks and charities. The online survey was conducted via Qualtrics Online Software. Ethical approval was received from the University of Limerick's ethics committee (ref: 2020_04_22_EHS). The survey was divided in two sections, the first to be completed by the parents and the second to be completed by the adolescent. Informed consent was obtained from both the parents and adolescents prior to their participation.

Participants

A total of 314 adolescents and their parents completed the survey between April and June 2020. While adolescents' self-report measures

are the focus in this study, a selection of parent-reported measures have been included as covariates in the analysis.

Mean age was 14.05 years (Range 11–18 years). Males comprised the largest portion at 51% ($n = 160$), while females accounted for 48.7% ($n = 153$), which is largely in line with the national average. One respondent self-identified their gender as 'not sure/questioning' (0.3%). Most respondents were White Irish, at 91.7% ($n = 288$) (national average is 82.2%). Non-Irish White made up 3.8% ($n = 12$), Non-Chinese Asian made up 1% ($n = 3$), 2.9% comprised other including mixed background ($n = 9$), while the remaining responses were African ($n = 1$), and Chinese ($n = 1$), at 0.3% each. Most respondents' (72.3%) annual household income was greater than €34,000 ($n = 227$), while 17.2% had an annual household income of less than €34,000 ($n = 54$). 9.6% of respondents did not wish to disclose their household income ($n = 30$), while the remaining 1% were missing responses ($n = 3$) (national average household income 2019 was €43,500). A majority (86.9%; $n = 273$) of respondents did not have an SEN. 13.1% ($n = 41$) were reported to have an SEN, which is significantly higher than the national average of 3.3%.

Measures

Kessler psychological distress scale (K6)

Psychological distress was assessed using the Kessler Psychological Distress Scale (K6; Kessler et al., 2003). The scale consisted of six questions, where adolescents reported how often they had been feeling nervous, hopeless etc. during the past week. Responses were rated on a 5-point Likert scale and scored from 0 'none of the time' to 4 'all of the time'. Scores were summed to obtain total scores with a possible range of 0 to 24, with higher scores indicating higher levels of psychological distress. In the current study, Cronbach's α for the K6 scale was found to be 0.85, which indicates good internal consistency. The K6 scale has been demonstrated to be valid and reliable in an epidemiological sample of youth (Ferro, 2019). For the purpose of descriptive statistics, we report on risk for serious mental illness using the clinical cut-off score of >13, in line with (Umucu et al., 2022). However, the continuous score was used in the main analyses.

Pandemic anxiety scale

COVID-19 anxiety was assessed using the Pandemic Anxiety Scale (PAS), developed by McElroy et al. (2020). The 7-item PAS asked participants to rate their responses to seven statements, which assessed how they were feeling during the COVID-19 outbreak, on a 5-point Likert scale ranging from 'strongly disagree' (0) to 'strongly agree' (4). The PAS captures two forms of COVID-19 anxiety which were divided into two subscales: Disease Anxiety [measures anxiety surrounding the COVID-19 disease itself, four items, and Consequence Anxiety (measures anxiety surrounding the consequences of the COVID-19 pandemic and the resulting lockdowns, three items)]. Disease Anxiety items were "*I am worried I will catch COVID-19*," '*I am worried that my friends and family will catch COVID-19*', '*I am afraid to leave the house right now*' and '*I am worried I might transmit the infection to someone else*'. Consequence Anxiety items were "*I am worried about missing schoolwork*," '*I am worried about the amount of money we have coming in*' and '*I am worried about the long-term impact which will have on my job prospects and the economy.*' Total scores ranged from 0 to 28, with higher scores indicating higher levels of COVID-19 anxiety. Summed scores for Disease Anxiety and Consequence Anxiety were also calculated, with Disease Anxiety score potentially ranging from 0 to 16 and Consequence Anxiety score potentially ranging from 0 to 12. Although the PAS is a new scale, it has been found to be both reliable and valid, and suitable for use with adults and adolescents in large-scale survey studies. The measure was initially validated in a sample recruited in the first 6 weeks of Covid-19 lockdown, parents ($N = 4{,}793$) and adolescents ($N = 698$) in a UK population and demonstrated to be a reliable measure of two distinct types of anxieties arising due to the COVID-19 pandemic (disease anxiety and consequence anxiety). In the current study, the total COVID-19 anxiety scale had a Cronbach's $\alpha = 0.77$, which indicates acceptable internal consistency. For the Disease Anxiety subscale Cronbach's $\alpha = 0.81$, indicating good internal consistency. For the Consequence Anxiety subscale, Cronbach's $\alpha = 0.66$, which indicates questionable internal consistency, although above 0.6 is reported to be generally acceptable (Ursachi et al., 2015). Furthermore, McElroy et al. (2020) noted that the Cronbach's Alpha can be unduly low in this instance as a result of the low number of items in this sub scale.

Covariates

Individual level covariates

Variables controlled for at the individual level included socio-demographic variables (i.e., Age, Gender, Ethnicity, SES) and a variable regarding the presence or absence of an SEN. Age and Gender were self-reported by the adolescents and Ethnicity, SES and SEN were reported by parents/caregivers on their adolescent children. Ethnicity was measured using a multiple-choice response where parents selected from options: White Irish, Irish Traveller, any other White background, African, any other Black background, Chinese, any other Asian background, other (including mixed background), and prefer not to say. Those that selected 'other (including mixed background)' were given the opportunity to provide more detail in an open text box. Given that 91.7% of the sample identified as White Irish, ethnicity was recoded into a binary variable reflecting White Irish and everyone else. SES was operationalized as a measure of total gross household income, with scaled response options ranging from < €18,000 to > €136,000 per year as follows: 1 = Under €18,000 per year (€350 per week), 2 = €18,000 to €34,000 per year (€350–€653 per week), 3 = €34,001 to €68,000 per year (€653–€1,307 per week), 4 = €68,001 to €102,000 per year (€1,307–€1961 per week), 5 = €102,001 to €136,000 per year (€1961–€2,615 per week), 6 = More than €136,001 per year (€2,615 per week) and 7 = Prefer not to say. Finally, SEN was assessed by the question "Does your child have any special educational needs?," with the response options of yes or no.

Microsystem level covariates

Variables controlled for at the microsystem level included Peer Support, School Support and Parent Child Closeness. Peer Support and School Support were reported by parents and Parent Child Closeness was reported by the adolescents themselves. Peer Support was assessed by the degree to which parents agreed with the statement "*My child has at least one friend that they can turn to for support*" and School Support was measured by the degree to which parents agreed

with the statement "*My child would still be able to turn to an adult at school for support if they needed to*." Both variables were measured on single-item scales and scored on a four-point Likert scale ('not at all,' 'a bit,' 'a lot' and 'completely'). Similar single-item scales have been demonstrated to be reliable measures of support in other population studies (Slavin et al., 2020; Gallagher et al., 2022). Parent proxy measures have also been found to be robust in other studies with youth (Erhart et al., 2009) although there are mixed findings on the use of such measures (Jokovic et al., 2004). Parent Child Closeness was measured though the question "*Overall, how close would you say you are to your parent(s)/caregiver(s)?*," and again responses were scored on a four-point Likert scale ('not very close,' 'fairly close,' 'very close' and 'extremely close'). This single item question was adapted from the Millennium Cohort Study Age 14 Sweep (Study, 2016 MCS Sweep 6, 2016).

Statistical analyses

All statistical analyses were conducted using IBM SPSS Statistics Version 26.0. Frequencies, Means and Standard Deviations were firstly calculated to obtain descriptive information on the full sample of adolescents. Bivariate Pearson and Point-Biserial correlation analyses were then conducted to establish associations between PAS score (total and subscales) and K6 score as well as between all covariates and K6 score. Independent samples *t*-tests were carried out for binary categorical variables that were found to have a statistically significant relationship with K6 in the correlation matrix to further explore these associations. A hierarchical multiple regression analysis was employed to determine the unique relationship between COVID-19 anxiety (in the form of its two sub-constructs, disease anxiety and consequence anxiety) and adolescents' psychological distress, with significant covariates identified in the correlation analysis inputted in the regression model The regression model was constructed as follows: first, the covariates situated at the individual level of the ecological environment were inputted, i.e., Age, Gender, SEN and Ethnicity; second, the covariates located within the microsystem level were inputted, i.e., Peer Support, School Support, Parent Child Closeness; t finally, Consequence Anxiety and Disease Anxiety were inputted. The dependent variable was K6 score.

Lastly, two simple moderation analyses were conducted using PROCESS macro version 3.5 for SPSS, to assess whether the microsystem level factors that were found to be significant predictors in the regression model (Peer Support, and Parent Child Closeness), moderated the relationship between Consequence Anxiety (which was identified as a significant predictor of K6 score when controlling for Disease Anxiety in the regression model) and K6 score. Significant covariates identified in the regression model, as well as Disease Anxiety, were controlled for in the moderation analyses. Changes in degrees of freedom reflect missing data.

Results

Descriptive statistics

Participants' mean K6 score was 5.27 ($SD = 4.99$), with 11% of participants at high risk for serious mental illness (K6 score ≥ 13). The mean PAS score for participants was 16.72 ($SD = 6.37$) and the subscale means for PAS were 7.76 ($SD = 3.68$) for Disease Anxiety and 4.77 ($SD = 3.04$) for Consequence Anxiety. See Table 1 for Means and SDs for all other continuous variables included in the regression analyses.

A series of correlation analyses were run to test the association between K6 score and scores on all other possible predictor variables. When examining the associations between predictor variables and K6 score, zero order correlations were used and are presented in the correlation matrix table below (see Table 2).

Independent samples *t*-tests

Correlation analyses revealed that three categorical variables were statistically significantly correlated with K6 score, namely, whether the adolescent has an SEN, adolescent gender and ethnicity. A series of independent samples *t*-tests revealed there was a significant difference in K6 score between adolescents with a SEN ($M = 7.81$, $SD = 5.33$), and adolescents without an SEN ($M = 4.89$, $SD = 4.83$), $t(270) = 3.333$, $p < 0.001$. A second independent *t*-test found that there was also a statistically significant difference in K6 score between adolescent males ($M = 4.54$, $SD = 3.96$), and adolescent females ($M = 5.94$, $SD = 5.72$), $t(269) = -2.346$, $p = 0.020$. A third independent t-test found that there was also a statistically significant difference in K6 score between adolescents who were identified as White Irish ($M = 4.97$, $SD = 4.68$) and everyone else ($M = 8.68$, $SD = 6.92$), $t(269) = -2.466$, $p = 0.022$.

Hierarchical multiple regression analyses

A hierarchical multiple regression analysis was conducted to examine whether Consequence Anxiety and Disease Anxiety significantly predicts psychological distress (K6 score) in adolescents, while controlling for several influencing factors across individual (i.e., Age, Gender, SEN, Ethnicity) and micro-system levels (i.e., Peer Support, School Support, Parent Child Closeness).

The first step of the model, which included individual level covariates (e.g., Age, Gender, SEN, and Ethnicity) was significant, $F(4,255) = 9.344$, $p < 0.001$, adjusted $R^2 = 0.114$. As can be seen in Table 3, Age, Gender, SEN and Ethnicity were significant predictors of K6 score with this first step of the model explaining 11.4% of the variance in K6 score.

TABLE 1 Means and standard deviations for included continuous variables ($N = 314$).

Variables	Mean ± SD	Range
Age (years)	14.05/2.7	11–18 years
Peer support	3.15/0.938	1–4
School support	2.81/1.03	1–4
Parent child closeness	3.24/0.799	1–4
Pandemic anxiety scale	16.72/6.37	0–28
PAS disease anxiety	7.76/3.68	0–16
PAS consequence anxiety	4.77/3.04	0–12
K6	5.27/4.99	0–24

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TABLE 2 Correlation matrix of psychological distress and predictor variables.

	K6	Child age	Gender	Ethnicity	Income	Child SEN	Peer support	School support	Parent child closeness	PAS total score	PAS disease anxiety	PAS consequence anxiety
K6	–											
Child age	0.183**	–										
Gender	0.142*	0.093	–									
Ethnicity	0.203**	−0.007	0.099	–								
Income	−0.053	0.053	−0.009	−0.070	–							
Child SEN	−0.199***	0.142*	0.145*	−0.089	0.117*	–						
Peer support	−0.161**	0.218***	0.109	−0.121*	0.033	0.242***	–					
School support	−0.176**	0.053	−0.041	−0.237***	0.001	0.058	0.340***	-				
Parent child closeness	−0.260***	−0.299***	−0.009	−0.173**	−0.056	0.005	−0.016	0.233***	–			
PAS total score	0.403***	0.207***	0.097	0.118	−0.046	−0.081	−0.068	−0.204***	−0.068	–		
PAS disease anxiety	0.282***	0.070	0.035	0.094	0.001	−0.129*	−0.058	−0.116	0.007	0.855***	–	
PAS consequence anxiety	0.433***	0.350***	0.171**	0.103	−0.071	−0.019	−0.043	−0.204***	−0.146**	0.786***	0.393***	–

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. SEN: 0 = Yes, 1 = No; Gender: 0 = Male, 1 = Female; Ethnicity: 0 = White Irish, 1 = Everyone else.

The second step of the model including the microsystem level covariates (e.g., Peer Support, School Support and Parent Child Closeness) led to a significant change in the model; $F(7,252) = 8.158$, $p < 0.001$, adjusted $R^2 = 0.162$, R^2 change = 0.057. As displayed in Table 3, Peer Support and Parent Child Closeness together with the step 1 variables account for 16.2% of the variance in K6 score.

The final step of the model including the addition of Consequence Anxiety and Disease Anxiety was associated with a significant change to the model ($p < 0.001$) and the overall model was significant, $F(9,250) = 11.507$, $p < 0.001$, adjusted $R^2 = 0.267$, R^2 change = 0.108. As shown in Table 3, Consequence Anxiety was a significant, positive predictor of K6 score, while controlling for covariates and Disease Anxiety. Disease Anxiety was a non-significant predictor in K6 score. The final model for Consequence Anxiety and Disease Anxiety, together with the step 1 and 2 variables accounted for 26.7% of the variance in K6 score.

Moderation analyses

Two simple moderation analyses were conducted to determine if the significant microlevel factors that were significantly associated with psychological distress (Peer Support and Parent Child Closeness), moderated the relationship between Consequence Anxiety and K6 score.

For the first moderation, covariates in the model include age, gender, SEN, ethnicity, peer support and disease anxiety. The overall model was significant; $F(9, 250) = 12.99$, $p < 0.001$, $R^2 = 0.32$. The Parent–Child-Closeness*Consequence Anxiety interaction was significant, with greater Parent–Child Closeness significantly reducing the strength of the positive association between Consequence Anxiety and Psychological Distress; $B = -0.33$, $t(250) = -3.12$, $p = 0.002$. Figure 1. depicts the Parent–Child-Closeness*Consequence Anxiety interaction. Finally, the main effect of Consequence Anxiety had a significant positive association with K6 score; $B = 1.60$, $t(250) = 4.35$, $p < 0.001$. The main effect of Parent Child Closeness was not significantly associated with K6 scores; $b = 0.53$, $t(250) = 0.820$, $p = 0.413$.

As the data presented are cross-sectional, the alternative moderation model was also checked (i.e., would Parent Child Closeness moderate the association between K6 scores as the predictor and Consequence Anxiety as the outcome). Covariates include age, gender, SEN, ethnicity, peer support and disease anxiety. The overall model was significant; $F(9, 250) = 14.37$, $p < 0.001$, $R^2 = 0.34$, but the interaction effect [$B = -0.01$, $t(260) = -0.36$, $p = 0.72$] and main effects for K6 score [$B = 0.21$, $t(260) = 1.90$, $p = 0.06$] and Parent Child Closeness [$B = 0.05$, $t(260) = 0.16$, $p = 0.88$] were non-significant, indicating that the original model best predicts adolescent psychological distress and fits within our theoretical framework.

For the second moderation, covariates in the model include age, gender, SEN, ethnicity, parent–child closeness and disease anxiety. The overall model was significant; $F(9, 250) = 11.47$, $p < 0.001$, $R^2 = 0.29$. The Peer Support*Consequence Anxiety interaction was non-significant; $B = 01$, $t(250) = 0.06$, $p = 0.95$. Furthermore, main effects were non-significant for Consequence Anxiety; $B = 0.48$, $t(250) = 1.49$, $p = 0.14$ and Peer Support; $B = -0.61$, $t(250) = -1.13$, $p = 0.26$.

Discussion

This study examined the unique relationship between COVID-19 anxiety and psychological distress in a sample of Irish adolescents during the early stages of the COVID-19 pandemic. As hypothesized, higher levels of COVID-19 anxiety predicted higher levels of psychological distress, whilst controlling for a variety of covariates situated at multiple levels of Bronfenbrenner's (1979) ecological framework.

Specifically, consequence anxiety (when entered in the regression model alongside disease anxiety) accounted exclusively for 10.8% of the variance in adolescents' psychological distress, and the overall hierarchical multiple regression model accounted for 26.7% of the variance in adolescents' psychological distress, when controlling for age, gender, SEN, ethnicity, peer support, school support and parent child closeness. Disease Anxiety did not significantly predict distress when consequence when simultaneously entered into the regression model with Consequence Anxiety, suggesting that the anxiety related to the consequences of contracting COVID-19 was the key predictor of distress. This important finding is in line with Magson et al.'s (2021) discovery that adolescents were more concerned about the government restrictions implemented to prevent the COVID-19 viruses' spread than they were about the virus itself. Indeed, the comparatively lower levels of anxiety/concern surrounding the COVID-19 virus may be at least partially explained by the extremely low adolescent COVID-19 mortality rate and the low chances of adolescents becoming seriously ill from COVID-19 (Bhopal et al., 2021), unlike older adults who are at greater risk of having underlying health conditions that can be exasperated by COVID-19 (Hyland et al., 2020). Meanwhile, the higher levels of anxiety/concern regarding the consequences of the COVID-19 pandemic may be understood by considering the severe impact of the public safety measures which were implemented to contain the virus. Isolation, lack of access to schooling and limited contact with peers, could have had serious consequences on young people during such a critical developmental period (de Figueiredo et al., 2021). Theoretically our findings are consistent with an ecological systems approach to anxiety in youth, which emphasises bi-directional influences ranging from proximal (i.e., child age, gender, SEN) to distal influences (i.e., parent relationships) (Mian et al., 2011). Youth may be more concerned about the consequences of COVID-19 if they are predisposed to worry about associated restrictions (de Figueiredo et al., 2021), have concern about transmitting the virus and fear future uncertainty (Saurabh and Ranjan, 2020). This can be compounded when family relationships are poor or worsen (Kılınçel et al., 2021).

Factors at the individual level, such as Age, Ethnicity and SEN were also found to determine adolescents' levels of psychological distress during the COVID-19 pandemic in this study. Existing research supports the finding that these individual factors, e.g., age (i.e., being older) (Zhou et al., 2020), belonging to an ethnic minority group (i.e., Darmody et al., 2020) and presence of an SEN (Sibley et al., 2021), are all risk factors for psychological distress of adolescents.

Within the microsystem, family relationship was found to be an important factor for reducing psychological distress during the COVID-19 pandemic. In this study, Parent Child Closeness was a significant predictor of psychological distress, with the presence of a 'very' or 'extremely close' relationship predicting lower levels of psychological distress. Due to public safety advice advising citizens to stay at home as much as possible during periods of lockdown in the COVID-19 pandemic, adolescents' social relations have been mainly restricted to close family members (Fegert et al., 2020). While increased time with family members may have profound negative impacts on mental health in some circumstances (e.g., increased exposure to domestic violence) (Fegert et al., 2020) the presence of positive familial relations during the COVID-19 pandemic, can also positively impact on mental health outcomes. Strengthening familial bonds (e.g., increased sense of closeness between parents and adolescents), may act as a powerful protective factor against adolescents' psychological distress during the pandemic. This was not only evident in this study but has been supported by empirical research which found that closeness with parents during adolescence, can act as buffer against adverse mental health outcomes (Ge et al., 2009; Oberle et al., 2011; Wang et al., 2020; Hartas, 2021; Nolan and Smyth, 2021). Peer Support was also found to be a significant predictor of psychological distress, with the presence of Peer Support (i.e., at least one friend the adolescent could turn to) predicting less psychological distress. This finding is consistent with previously conducted empirical research, e.g., Magson et al.'s (2021) reporting on social connectedness as a protective factor against adolescents' poor mental health during the COVID-19 pandemic. Erikson's model of psychosocial development suggests that social relationships are of great importance during the adolescent years as hormonal changes make adolescents more highly attuned to social status, peer groups and relationships (Imran et al., 2020). Conversely, adolescents may find public safety measures during the COVID-19 pandemic, such as social distancing, particularly difficult, as their needs for social connection and acceptance by peers can go unmet (Andrews et al., 2020; Fegert et al., 2020). A study by McMahon et al. (2020) which reports on the national longitudinal Growing Up in Ireland (GUI) survey data found that while stressful life events can negatively impact on the psychological wellbeing of adolescents, parent and peer relationships can mediate this association, particularly for adolescent girls.

A series of moderation analyses were conducted to determine whether microsystem level factors moderated the relationship between Consequence Anxiety and psychological distress, while controlling for individual-level factors and disease anxiety. Whilst peer support was not a significant moderator in the relationship between consequence anxiety and psychological distress, parent child closeness was found to moderate the relationship between consequence anxiety and psychological distress, with the influence of Consequence Anxiety on Psychological Distress lesser for participants with closer parent–child relationships. This indicates that closer child/parent relationships attenuate the effect of anxiety about the consequences of COVID-19 on psychological distress. As such child/parental closeness is an important protective and modifiable factor with respect to adolescents' worries and distress relating to the effect of COVID-19. Our finding also aligns with prior research (Moretti and Peled, 2004; Ackard et al., 2006), which has highlighted that the adolescent-parent attachment bond is critical in supporting adolescents during difficult periods.

Therefore, strategies to reduce psychological distress during COVID-19 should focus directly on reducing pandemic anxiety, in particular consequence anxiety, but also on family supports that promote greater parent child closeness and can buffer against the negative effects of consequence anxiety.

TABLE 3 Summary of hierarchical multiple regression analysis for variables predicting psychological distress.

N = 260	Step 1					Step 2					Step 3				
	B	*β*	R^2	Adjusted R^2	R^2change	*B*	*β*	R^2	Adjusted R^2	R^2change	*B*	*β*	R^2	Adjusted R^2	R^2change
Constant	6.241***	–	0.128***	0.114***	0.128***	10.456***	–	0.185***	0.162***	0.057***	6.945***	–	0.293***	0.267***	0.108***
Age	0.386**	0.179		–		0.312*	0.145		–		0.057	0.027			–
Gender (ref = male)	1.204*	0.122		–		1.355*	0.137		–		0.955	0.097			–
SEN (ref = having a SEN)	−3.477***	−0.228		–		−2.827**	−0.185		–		−2.559**	−0.168			–
Ethnicity (ref = White Irish)	3.476***	0.192		–		2.389*	0.132		–		2.029*	0.112			–
Peer Support	–	–		–		−0.710*	−0.134		–		−0.628	−0.118			–
School support	–	–		–		−0.216	−0.045		–		0.143	0.030			–
Parent child closeness	–	–		–		−1.170**	−0.190		–		−1.211***	−0.196			–
Disease anxiety	–	–		–		–	–		–		0.146	0.108			–
Consequence anxiety	–	–		–		–	–		–		0.508***	0.306			–

Model = "Enter" method in SPSS Statistics; B = unstandardized regression coefficient; β, standardized coefficient; R^2, *R* square. SEN: 0 = Yes, 1 = No; Gender: 0 = Male, 1 = Female; Ethnicity: 0 = White Irish, 1 = Everyone else. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

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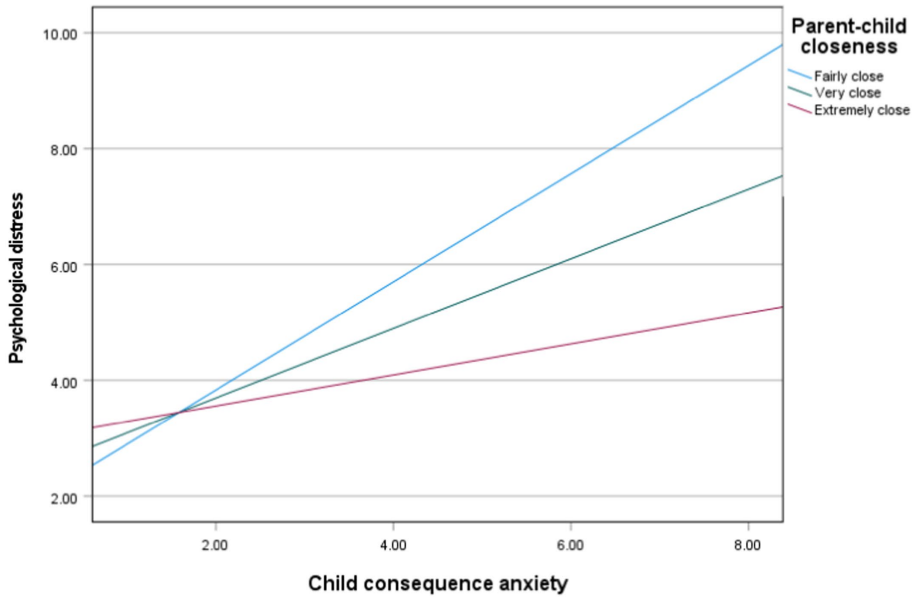

FIGURE 1
The moderation of parent–child closeness on the relationship between child consequence anxiety and psychological distress. Age, gender, SEN, peer support and disease anxiety are included as covarieties. Reference category of the moderator = 1 -Not very close.

Implications

The findings reported in this paper have several practical implications which are of value to health professionals, practitioners and researchers for improving psychological distress outcomes during pandemics. Most importantly, after controlling for individual and microsystem level factors, COVID-19 anxiety was found to predict psychological distress in adolescents. Specifically higher consequence anxiety related to COVID-19 was associated with increased psychological distress. This suggests that messaging about the impact of COVID-19 or other pandemic-related events, particularly the consequences of such events, is a stressor for youth and should receive more attention as an important factor leading to psychological distress during pandemics.

For healthcare providers, measures of COVID-19 anxiety could be utilized to screen for adolescents who may be at risk of developing mental health issues. Similarly, understanding the individual and micro-level risk factors (e.g., age, gender SEN, poor family relationships) for adolescents can help identify those that require additional support. Tailored therapeutic interventions could target adolescents presenting with these risk factors, specifically those with high consequence anxiety, to mitigate the potential development of negative mental health outcomes for these vulnerable adolescents (Talevi et al., 2020).

Furthermore, findings around COVID-19 anxiety could be used to inform the design and implementation of therapeutic interventions by specifically addressing COVID-19 anxiety and decreasing adolescents' levels of psychological distress. In line with Lee et al.'s (2020) recommendations, it might therefore be useful to offer internet-based Cognitive Behavioural Therapy (CBT) during pandemics to adolescents who display elevated levels of COVID-19 anxiety and to implement this therapy to address and reduce COVID-19 anxiety and levels of psychological distress. Indeed, our findings suggest that COVID-19 anxiety is an important predictor of adolescent psychological distress and as such directly intervening with COVID-19 anxiety will have benefits for adolescents' mental health outcomes. Enhancing the parent child relationship was also highlighted as a possible avenue of intervention, with findings indicating that a positive child/parental relationship may buffer against psychological distress linked to consequence anxiety related to the pandemic. This aligns with Zhou (2020) who advocates for a multi-systemic approach that encompasses psychological support for adolescents and those they are influenced by (e.g., family, peers, teachers etc.). In future research, subsequent studies could employ a longitudinal design to investigate how COVID-19 anxiety, psychological distress and the predictive relationship between them changes over the course of the pandemic. Future research should also concern itself with the after-effects of COVID-19 anxiety in the post-COVID-19 world, and whether any long-term adverse consequences of the pandemic on the mental health of adolescents can be identified. This line of research is perhaps the most critical in determining whether and to what extent the COVID-19 pandemic and its resulting anxiety has affected adolescent development and whether any adverse mental health effects experienced during the pandemic by adolescents, who are undergoing a crucial developmental period, result in psychopathological conditions in early and later adulthood (de Figueiredo et al., 2021).

Strengths and limitations

The study is, as far as we are aware, the first to examine whether COVID-19 anxiety is uniquely related to the mental health of adolescents during the COVID-19 pandemic. The identification of COVID-19 anxiety, particularly consequence anxiety, as a key risk

factor for increased psychological distress in adolescents during the pandemic has therefore filled a major gap in the literature and followed an avenue of research that has not previously been explored. The study has also added to the limited literature on the mental health impact of the COVID-19 pandemic and has thus shed light on the mental health costs of the pandemic for youth.

Limitations of the study should also be considered. First, the study employed a cross-sectional design and was conducted during the early phases of the COVID-19 pandemic, meaning that the findings may not be applicable to later stages of the pandemic (Xiong et al., 2020). The cross-sectional nature of the study is limited in its ability to account for the predictive relationship between COVID-19 anxiety and adolescents' psychological distress throughout the pandemic. Furthermore, the cause-effect relationship between COVID-19 anxiety and psychological distress cannot be established. Second, caution must also be taken in assuming generalizability of these findings outside of the Irish context as statistics from the World Health Organization (2021) have shown that parts of the world have been differentially impacted by the COVID-19 pandemic. For example in June 2020 deaths from COVID-19 ranged from as low as 4 deaths per million in Australia to as high as 829 deaths per million in Belgium (Balmford et al., 2020). Similarly containment restrictions ranged from 'no restrictions at all' to 'maximum containment' at varying times through the initial wave (Cascini et al., 2022). Third, participants were recruited through convenience sampling and the study is therefore not representative of Irish adolescents at a national level. The self-selecting nature of the survey may also have resulted in a sampling bias, wherein some groups of adolescents were over-represented in the survey, while others went under-represented. In particular, the online format of the survey may have led to sampling bias because only parents and adolescents with access to a computer or smartphone would have been able to complete the survey, with this 'digital divide' possibly leading to under-representation of socio-economically disadvantaged families (Darmody et al., 2020). Indeed, most participants reported their gross household income to be >€34,000 *per annum*, and it is possible that this exclusion of very low-income families may have resulted in an under-estimation of adolescents' COVID-19 anxiety and psychological distress levels. The sample was also predominantly White Irish (91.7%) limiting generalisability to ethnic minorities. A further limitation is that single-item scales were used to assess microsystem factors. Additionally, some of these scales (Peer Support and School Support) were completed by parents (not adolescents themselves). There are mixed findings on the use of parent proxy measures (Jokovic et al., 2004; Erhart et al., 2009), which limits the reliability of these measures and can potentially lead to discrepancies in reporting (Kim et al., 2020). Finally, Cronbach's α for the Consequence Anxiety subscale of the PAS was <0.70, which indicates questionable internal consistency. Although prudent interpretation of the findings in relation to consequence anxiety is warranted, McElroy et al. (2020) does suggest that the low alpha value can be explained by the low number of items of the scale.

Conclusion

This study indicated that COVID-19 anxiety is a predictor of psychological distress during the COVID-19 pandemic in a sample of Irish adolescents, particularly consequence anxiety. The identification of consequence anxiety as a key risk factor for adolescents' psychological distress during the pandemic has important practical implications. COVID-19 anxiety may serve as both an important indicator for identifying adolescents at-risk of developing psychological distress during pandemics and provide an area to focus on when developing strategies and interventions to mitigate these negative outcomes. The identification of predictors of psychological distress at both the individual level and microsystem level of Bronfenbrenner's (1979) ecological environment also suggests that a multisystemic approach, particularly targeting the parent child relationship, is best suited to reduce the negative mental health impacts of the pandemic on adolescents. Research, policy and practice should consider these findings to help strengthen future studies, risk identification and therapeutic intervention development.

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 humans were approved by Ethics Research Committee Faculty of Education and Health Sciences University of Limerick. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

JM, EG, SH, CO'C, MR, and EW contributed to study design and data collection. JM, AD, and KD contributed to data interpretation. All authors contributed to the write-up of the article. EG and EW contributed to data anlaysis.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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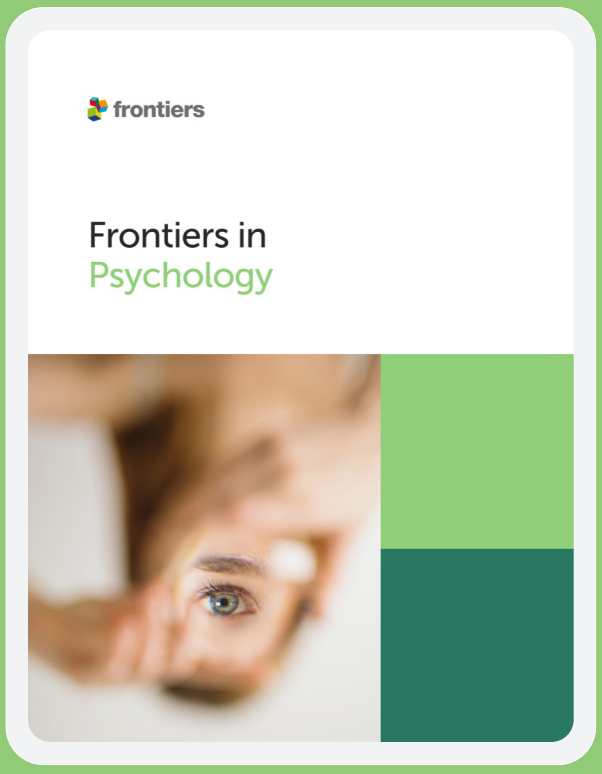

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