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Health of adolescents: Quantitative and qualitative perspective

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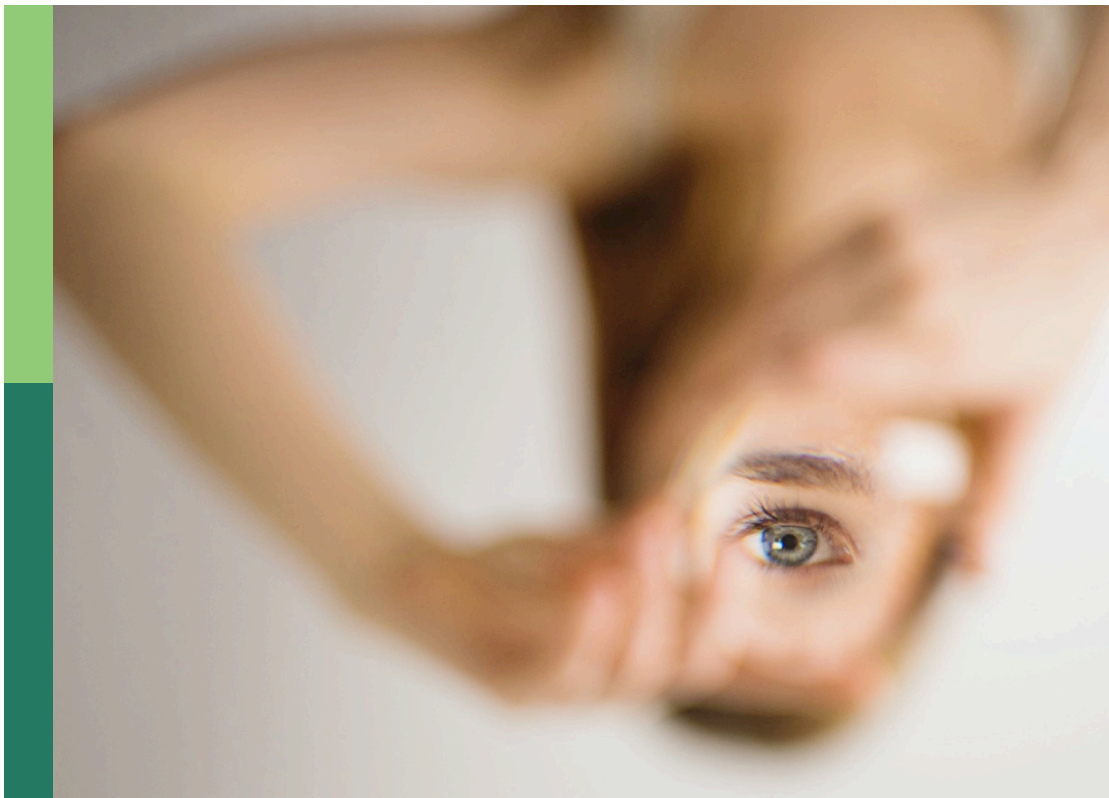

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Health of adolescents: Quantitative and qualitative perspective

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Editorial: Health of adolescents: Quantitative and qualitative perspective

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Editorial on the Research Topic
Health of adolescents: Quantitative and qualitative perspective

The current generation of adolescents differs from previous generations, because the development of new technologies and their use in ever-younger children is an unprecedented formational influence, especially during the Covid pandemic. Based on trends in international research, quantitative and qualitative participatory approach seems to be the most important source of information about health and health-related behavior of the current adolescent generation.

This Research Topic aimed to highlight the health of adolescents from the quantitative and qualitative perspectives of research. Adolescence is a period of extensive psychological changes, such as the need to explore, growing independence, developing self-concept and the need for peer acceptance and family support. The benefits of an active childhood can carry over into adulthood, therefore the establishment of healthy patterns during childhood and adolescence plays important role. Unfortunatelly, the current generation of adolescents has to face several socio-economic challenges and crises (the Covid pandemic, the war conflict in Ukraine, the energy crisis, the climate crisis, etc.), which have a significant impact on their mental health. Research showed, that adolescents often experience feelings of helplessness, insecurity, isolation, insignificance or loneliness (Šiňanská, 2019). Moreover, approximately 10–20% of children and adolescents suffer from emotional and behavioral problems (Jaspers et al., 2012), what is also confirmed by the findings of the Health Behavior in School-Aged Children Study (Lacková Rebičová et al., 2019; Inchley et al., 2020). During the Covid pandemic, there was an even larger increase in adolescent mental health problems such as depression (Ma et al., 2021; Thorisdottir et al., 2021), hyperactivity, behavioral problems (Waite et al., 2021), anxiety and sleep problems (Ma et al., 2021). Previous research also suggests that older adolescents may suffer a decline in mental health outcomes, with older girls reporting poorer mental health than older boys (Inchley et al., 2020). This evidence has led to growing awareness of the need to address adolescents' mental health requirements by identifying the factors that can promote or hinder their mental health in a different setting.

Mental health, like other aspects of health, can be affected by a range of factors that need to be addressed through comprehensive strategies of support, prevention and treatment. Determinants of mental health and mental disorders do not include individual attributes alone, but social, cultural, economic, political and environmental factors (Currie and Morgan, 2020; World Health Organization, 2021) as well, which are covered in Bronfenbrenner's ecological model (Bronfenbrenner, 1992). At the individual level, these are factors such as gender, age, level of physical activity, length, and quality of sleep, risk behavior, presence of chronic disease and medication use (Levin et al., 2009; Gobina et al., 2011; Santos et al., 2015; Kleszczewska et al., 2018; Evans et al., 2019). In the context of social factors, the environment in which adolescents live and spend time, including relationships with peers, classmates, and teachers, plays a significant role (Currie and Morgan, 2020). These factors influence each other and interact at different levels within the family, school and peers (Moore et al., 2018). Understanding the impact of risk factors on mental health is essential to mitigating the impact of the various negative events of the present time.For this reason, the topic of mental health has become part of the action plan of the World Health Organization, whose vision is a world in which mental health is valued, supported and protected (World Health Organization, 2021).

In the current Research Topic, we covered a wide range of mental health issues among adolescents. A study by Lackova Rebicova et al. focused on adverse childhood experiences which can cause serious mental problems in adolescents and therefore may be expected to be associated with higher use of psychosocial care, potentially varying by type of specific adverse childhood experience. The study found that having three or more adverse childhood experiences as well as experiencing some specific adverse childhood experiences (death of a mother/father, death of somebody else you love, problems of a parent with alcohol or drugs, conflicts or physical fights between parents, and separation/divorce of parents) increased the likelihood of using psychosocial care.

Lukoševičiute et al. studied the happiness of adolescents in three European regions and they concluded that health complaints, bullying behaviors, and self-directed violence were related to lower levels of happiness. Macek et al. reported relatively stable levels of life satisfaction, self-esteem, and self-reported daily hassles in adolescents in the period from 1992 to 2019. The above-mentioned findings showed a negative impact on the mental health and wellbeing of adolescents.

Another study by Jozefiakova et al. studied Covid anxiety and its predictors among Slovak adolescents. Based on the results from this quantitative study, lower resilience, higher attachment anxiety, being a girl and having a higher age are predictors related to higher Covid anxiety. Similarly, the impact of the COVID lockdown was more negative in girls in the study of Furstova et al.. Based on these findings, the Covid pandemic seems to be harmful to adolescent mental health and girls are at higher risk.

Modern technology plays a significant role in the life of adolescents, but public perception and policy are mostly dominated by their perceiving as disadvantages and risks. The results of online semi-structured interviews with Slovak adolescents showed that adolescents perceived modern technology as the most supportive and helpful tool in their life (Bitto Urbanova et al.).

Even though digital technology is an important part of adolescents' everyday routine, social interactions with significant others play a key role, as well as the home environment and family climate. Adolescence is often connected with the occurrence of different types of risk behaviors. Qing et al. who studied sibling bullying showed, that 29% of Chinese adolescents in their sample were involved in this type of risk behavior. Furthermore, according to Jiang et al., deviant behavior is positively affected by academic pressure in Chinese adolescents.

The studies included in this Research Topic reflected several important issues in the health of adolescents. Eperiences of global threats like the Covid pandemic together with challenges including digital and social life affect the wellbeing and health of adolescents and therefore, the focus on adolescent health research is still very important and essential.

Author contributions

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

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Conflict of interest

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How Does the Parent–Adolescent Relationship Affect Adolescent Internet Addiction? Parents' Distinctive Influences

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Although previous research has demonstrated that parent–adolescent relationships have a significant effect on adolescent Internet Addiction (IA), the mechanisms underlying these associations and parental differences in these effects have received insufficient attention. We investigated the mediating role of Perceived Social Support and Dual System of Self-Control (DSSC) in the relationship between Father-Adolescent Relationships/Mother-Adolescent Relationships (FAR/MAR) and adolescent IA, as well as the differences in the effects of FAR and MAR. A cross-sectional survey of 732 Chinese adolescents was conducted using the Adolescent Pathological Internet Use Scale, Parent–Adolescent Relationship Scale, Multidimensional Scale of Perceived Social Support, and Dual System of Self-Control Scale. Multiple linear regression analysis, Pearson correlation analysis and structural equation modeling were used. The results of structural modeling analysis showed that neither FAR nor MAR directly predicted adolescent IA. In contrast, FAR/MAR had an impact on adolescent IA mainly through the mediating effects of Perceived Social Support and Impulsive System. Furthermore, in the relationship between FAR/MAR and adolescent IA, the Impulsive System and Perceived Social Support both served as chain mediators, as did Perceived Social Support and the Reflective System. And more importantly, unlike FAR, MAR affects adolescent IA through the mediating effect of the Reflective System. Multiple linear regression showed that the regression coefficient of MAR on adolescent IA had stronger significance compared to FAR, MAR is deserving of more attention than FAR. These findings contribute to our understanding of the mechanisms underlying the association between FAR/MAR and adolescent IA and suggest that family relationship-focused training approaches are critical for suppressing adolescent IA. These interventions should be tailored to the unique circumstances of each family.

Keywords: adolescents, parent–adolescent relationship, internet addiction, perceived social support, dual system of self-control

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INTRODUCTION

Internet devices (e.g., computers, smartphones, and tablets) have become increasingly popular among adolescents in recent years, and an increasing number of adolescents are overusing Internet devices, which has resulted in Internet addiction (IA) becoming a widespread problem worldwide (Talis, 2022). IA has been defined differently by various researchers. In Goldberg (1996), coined the

term "Internet Addiction Disorder (IAD)" to describe the effect of excessive Internet use on people's daily lives in the absence of addictive substances. Then some researchers define IA as a behavioral disorder that is unrelated to addictive substances and is therefore a typical mental illness disorder (Young, 2004). Davis (2001) proposed a cognitive-behavioral model, defined IA as problematic Internet use (PIU), classified PIU into general and specific pathological Internet use, and developed the problematic Internet use scale (PIUS) to assess individuals' irrational perceptions and usage behaviors. On the other hand, Young (1998) developed a questionnaire to assess IA behaviors based on the DSM-IV diagnostic criteria for pathological gambling; additionally, Li and Yang (2007) developed the Adolescent Pathological Internet Use Scale (APIUS) based on Davis' PIU model. Although there is no universally accepted definition of IA, existing definitions and questionnaires place a premium on describing people's emotional, attitude, and behavioral dependence on the Internet, as well as the negative consequences of this dependence on their lives.

Numerous studies have established that adolescents who suffer from IA have poorer mental health than adolescents who do not suffer from IA (Lauricella et al., 2014). IA demonstrated significant negative correlations with adolescents' self-esteem (Fioravanti et al., 2012; Peng et al., 2019), psychological well-being (Jia et al., 2017), and peer aggression (Jia et al., 2018). And IA has been shown to impair academic performance, anxiety disorders, feelings of stress, depression, and aggression in adolescents (Ha and Hwang, 2014; Shek and Yu, 2016; Cerniglia et al., 2017; Wang C. Y. et al., 2017; Zhao et al., 2022), thereby inhibiting adolescents' positive psychological development. More importantly, the prevalence of IA has remained high in adolescents over the last decade. The prevalence of IA among adolescents varies considerably across the globe, ranging from 26.8 percent in Hong Kong (Chung T. W. et al., 2019) to 14.7 percent in Taiwan (Lin et al., 2018), 1.5–8.2 percent in Europe and the United States (Kuss et al., 2014), 6.5 percent in Switzerland (World Health Organization, 2015), and 40.64 percent in mainland China (Bu et al., 2021). Thus far, the global situation for adolescents with IA has deteriorated, with prevalence rates ranging from 12.6 to 67.5% (Kuss et al., 2021). Why does the prevalence of IA vary by country or region among adolescents? Some researchers conducted a meta-analysis of the prevalence of IA in 31 countries or regions and discovered a significant correlation between the prevalence of IA and lower life satisfaction, increased air pollution, increased transportation commuting time, and lower national income (Cheng and Li, 2014). Cheng and Li also argue that as a country or region advances technologically, it may result in a sustained increase in the prevalence of IA. On the other hand, Blachnio et al. (2019) argue that the cultural presence of denial of one's addiction and loss of control over one's online time are significant manifestations of the IA epidemic (e.g., Taiwan).

Gaming content, social content, short video content (e.g., Tik Tok), and news and information on Internet devices are all intrinsically appealing and can provide instant feedback to users of all ages, making them happy and enjoyable (Peris et al., 2020). While any group has the potential to develop an addiction to the Internet, there are several reasons why adolescents are more likely to develop an addiction than other age groups: (1) More eager for attention: Compared to other age groups, adolescents are more eager for attention from others to satisfy their sense of belonging and self-expression (Kim and Kim, 2015), and, in comparison to real life, the Internet provides a platform for adolescents to demonstrate themselves, and they are more willing to establish and sustain social relationships on online platforms, making them more likely to generate IA (Seidman, 2013). (2) More impulsive: there is evidence that impulsivity increases from childhood to adolescence and then declines (Rosenbaum and Hartley, 2019), and that increased impulsivity in adolescents may be related to ventral striatum hyperresponsivity (Sherman et al., 2018). Comparing groups revealed that IA individuals were more impulsive than healthy controls (Li et al., 2021), and behavioral experiments also indicate that IA individuals are more focused on immediate gratification (Wang L. et al., 2017). These findings suggest that impulsivity is strongly associated with IA in adolescents. (3) More negative coping styles: Adolescents undergo rapid physical, emotional, intellectual, and life development and are susceptible to a variety of negative events such as peer pressure, academic stress, school bullying, emotional difficulties, and social discrimination (Kuss et al., 2013; Lin et al., 2018; Chung S. et al., 2019). Adolescents, on the other hand, often struggle to actively deal with these life frustrations, and instead turn to the Internet environment to vent and escape from real-world problems, eventually developing an unhealthy reliance on the Internet. As a result, adolescents have a higher risk of developing IA than other age groups (Anderson et al., 2017).

Parent–Adolescent Relationship and Adolescent Internet Addiction

Previous research has indicated that the primary causes of IA in adolescents are either individual factors (e.g., self-control, personality traits) or environmental factors (e.g., family economic environment, school environment) (Xu et al., 2012; Zhou et al., 2017). However, an increasing number of researchers have discovered that relationships between parents and adolescents in the family environment may be a significant influence factors for adolescent IA. Through a questionnaire study, Park et al. (2008) discovered significant differences in parent-child relationships between three groups: IA, addictive tendency, and non-addiction. *Post hoc* comparisons revealed that the parent–child relationship was significantly less positive in the addiction and addictive tendency groups compared to the non-addiction group. Additionally, Xu et al. (2014) examined the parent–child relationships and family environment of adolescent parents. They discovered that, while family socioeconomic status had no effect on adolescent IA prevalence, the quality of the parent-adolescent relationship had a significant negative effect on adolescent IA prevalence. In conclusion, while a positive parent-child relationship can help adolescents feel accepted and act as a protective factor against IA (Ahmadi and Saghafi, 2013), prolonged parent–child conflict can cause adolescents to perceive themselves as rejected and act as a risk factor for IA (Ko et al., 2015). Thus, strengthening the parent-child relationship can

help adolescents develop adaptive functioning and reduce their risk of developing IA (Kapetanovic et al., 2019; Skinner et al., 2021). For instance, Liu et al. (2015) discovered that family group therapy can address adolescents' psychological needs by enhancing parent-adolescent communication and facilitating parent–adolescent relationships, ultimately resulting in effective treatment for adolescent IA.

Recently, researchers have begun to investigate the mediating effects of parent–adolescent relationships on adolescent IA in order to better understand how parent–adolescent relationships affect IA. There is evidence that factors such as emotion regulation ability (Wang J. et al., 2018) and peer relationships (Ding et al., 2017) mediate the relationship between parent-adolescent relationships and adolescent IA. The Problem-Behavior Theory (PBT) aims to explain how parent-adolescent relationship further influences adolescent IA as a risk behavior by altering individual characteristics of adolescents (Jessor, 2014). PBT recognizes that adolescents' problem behaviors (e.g., alcohol abuse, violence, and IA) are the result of the relationship of environmental and individual factors. Family is the primary environment in which adolescents live, and parenting, supervision, and behavioral control interact with adolescents' traits, thinking, and emotions to influence the quality of parent-adolescent relationships (Mo et al., 2018; Chung T. W. et al., 2019; Martins et al., 2020). The quality of the parent–adolescent relationship may enhance adolescents' perceptions of social support and self-control, thereby influencing their IA (Li et al., 2017; Shek et al., 2018). With the increasing prevalence of adolescent IA in recent years, the relationship between the parent-adolescent relationship and adolescent IA has also been explored to some extent. However, these previous studies made little distinction between father–adolescent relationships (FAR) and mother–adolescent relationships (MAR), and thus do not know whether FAR/MAR both influence adolescent IA in the same way. Previous empirical studies on FAR/MAR and adolescent IA have found that, while increased father control over adolescent behavior predicted a slower decline in adolescent IA, increased maternal psychological control predicted a faster decline in IA (Shek et al., 2018). Additionally, Xu et al. (2014) concluded that relationships between mothers and adolescents are more likely to influence adolescent IA. Therefore, the first aim of this study was to distinguish FAR from MAR to explore how the direct and mediating effects of FAR and MAR differ in influencing adolescent IA.

The Mediating Role of Perceived Social Support

Perceived Social Support is a subjective emotional experience, and the more support and understanding an individual receives from family, peers, teachers, and others, the stronger the subjective social support (Kang et al., 2018). Adolescents generally receive social support from members of their environment, such as family, school, and community, and thus their Perceived Social Support is classified into three categories: family support, peer support, and other support (Hyun et al., 2015; Wang Y. et al., 2017). Adolescence is a period of rapid physical and psychological development during which adolescents frequently exhibit defiance, emotional instability, and difficulties with adaptation. Relational Regulation Theory (RRT) suggests that Perceived Social Support is always associated with good and healthy emotions and behaviors. Perceived Social Support is a positive experience resulting from ordinary and emotionally consequential conversations and shared activities that can effectively regulate adolescents' feelings, thoughts, and actions, buffer adolescents from stress, promote mental health, and avoid problematic behaviors (Lakey and Orehek, 2011). Numerous studies have discovered that adolescents with low Perceived Social Support have impaired emotional regulation and report feelings of loneliness (Wang J. et al., 2018), depression (Ren et al., 2018; Wang P. et al., 2018), and psychological distress (Ren et al., 2018; Zhang et al., 2018). Although no empirical study has examined the relationship between Perceived Social Support, FAR/MAR, and adolescent IA directly, some indirect evidence suggests that Perceived Social Support mediates these associations. On the one hand, FAR/MAR is the primary channel through which adolescents access Perceived Social Support (Shaheen et al., 2019), and both daily positive parent-adolescent communication and behavioral relationships help adolescents increase their Perceived Social Support (Taylor et al., 2015). On the other hand, existing studies have found that Perceived Social Support can significantly and negatively predict adolescent IA (Karaer and Akdemir, 2019). In a family setting, elevated Perceived Social Support can be effective in preventing IA in adolescents (Gunuc and Dogan, 2013). Thus, FAR/MAR is associated with Perceived Social Support, which in turn may be associated with adolescent IA.

The Mediating Role of Dual System of Self-Control

Hofmann et al. (2009) proposed the Dual-System of Self-Control Model, arguing that a complete model of self-control should include both the Impulsive and Reflective Systems. The Impulsive System is a relatively fast processing method that rarely requires cognitive processing or attentional resources. It is an automatic behavioral schema that individuals gradually form based on their previous behavioral patterns and long-term learning experiences. The reflective System, which processes information in the opposite direction of the impulsive system, is primarily responsible for restraining an individual's tendency to react impulsively and automatically through the establishment of high-level goals for assessing, monitoring, and managing behavior, and its operation requires the involvement of individual volitional effort and attentional resources (Lieberman, 2007). The system confers a greater degree of flexibility and control over decision-making and behavior, overcoming impulsive responses elicited by stimuli or temptations. Individual self-control is achieved through the manipulation of executive functions, which enable individuals to make deliberate judgments and assessments that either inhibit or overwhelm impulsive behavior (Hofmann et al., 2009; Gillebaart, 2018).

Puberty has been shown to be strongly associated with impulsivity (Niv et al., 2012). In adolescents, a decrease in

the thickness of the cerebral cortex in the area of value selection is indicative of impulsivity (Pehlivanova et al., 2018). Additionally, there is an upward trend in executive functions among adolescents as they transition from adolescence to adulthood (Friedman et al., 2016). In general, the relationship of impulsivity and executive function results in significantly lower self-control in adolescence than in adulthood (Meldrum et al., 2012; Oliva et al., 2019). Numerous studies have established a link between the DSSC, Parent–Adolescent Relationship, and IA. For instance, Niu et al. (2020) discovered a positive correlation between self-control and the Parent–Adolescent Relationship and a negative correlation between self-control and adolescent problematic internet use. Additionally, self-control mitigates the effect of the Parent–Adolescent Relationship on problematic adolescent internet use. However, no study has examined the mediating role of DSSC to our knowledge. On the one hand, the relationship between a parent and an adolescent has a significant impact on adolescents' impulsivity and executive functioning (Fay-Stammbach et al., 2014; Bennett and Blissett, 2017). Adolescents' self-control is highly dependent on the parent–adolescent relationship (Brody et al., 2005; Liu et al., 2019). On the other hand, increased impulsivity (Babakr et al., 2019; Zhang Y. et al., 2021), as well as a deficiency in executive function (Li et al., 2014; Fumero et al., 2018; Kuo et al., 2018), are also major contributors to IA in the adolescent population. Thus, FAR/MAR is associated with DSSC in adolescents, which may be associated with IA.

Additionally, Perceived Social Support has been demonstrated to have a significant positive predictive effect on adolescent self-control. According to the Dual-System Model of Self-Control, social support may reduce impulsivity and increase executive function activation in adolescents (Sims et al., 2011; Khoo and Yang, 2020). FAR and MAR may affect DSSC via Perceived Social Support, which in turn affects adolescent IA. As a result, Perceived Social Support and DSSC may function as a chain mediating mechanism in FAR/MAR and adolescent IA.

The Present Study

The purpose of this study was to examine how FAR/MAR affects adolescent IA. This study investigates the mediating effects of Perceived Social Support and DSSC on FAR/MAR and adolescent IA, as well as the differences in the effects of FAR and MAR on adolescent IA. To our knowledge, this is the first empirical study to examine the roles of FAR/MAR, Perceived Social Support, and DSSC in IA concurrently. The Hypothesis Model is illustrated in **Figure 1**. It is based on the RRT, PBT, and Dual-System of Self-Control Model (Hofmann et al., 2009; Lakey and Orehek, 2011; Jessor, 2014). We can hypothesize that (1) FAR/MAR has a significant negative predictive effect on adolescent IA; (2) Perceived Social Support mediates the effect between FAR/MAR and adolescent IA; (3) DSSC mediates the effect between FAR/MAR and adolescent IA; (4) Perceived Social Support and DSSC act as a chain mediator between FAR/MAR and adolescent IA; (5) The effect of MAR on adolescent IA was stronger compared to FAR.

MATERIALS AND METHODS

Participants

A total of 976 Chinese adolescents were recruited from two public schools in Sichuan Province. Before beginning the study, we obtained informed consent from the adolescents, their guardians, and teachers. Adolescents could stop filling out the questions if they felt uncomfortable with them. A total of 732 valid questionnaires were returned after excluding non-completed questionnaires. The sample included 317 boys and 415 girls, ranging in age from 11 to 16 years (M_{age} = 13.83 years, SD = 1.20 years). Of these, 36 (4.9%) were 11-year-old students, 44 (6.0%) were 12-year-old students, 183 (25%) were 13-year-old students, 280 (38.3%) were 14-year-old students, 121 (16.5%) were 15-year-old students, and 68 (9.3%) were 16-year-old students. All students completed the questionnaire in a quiet classroom at the school.

Sample Size Determination

Considering the structural equation modeling approach used in this study, the sample size at the time of data analysis needed to meet the criterion of matching at least 10 participants for each free parameter (Bentler and Chou, 1987; Hu and Bentler, 1999). Because the Hypothesis Model contains 58 free parameters and the Correction Model contains 55 free parameters in this study, the minimum sample size should be greater than 580 participants. This study's sample size was adequate.

Measurement

Parent–Adolescent Relationship Scale

The Parent–Adolescent Relationship Scale (PARS scale), developed by Buchanan et al. (1991), is widely used to assess parent-adolescent relationships. Parent–child relationships span a variety of dimensions, most notably attachment, parenting styles, parent–child communication, parent–child bonding, and parent–child conflict (Armstrong et al., 2018; River et al., 2022). The PARS used in this study focuses on parent–child communication and bonding and reflects the status of FAR and MAR by inquiring about adolescents' communication and bonding with their fathers and mothers. The scale contains a total of 20 items and can be divided into two subscales: FAR (10 items, e.g., "Do you feel comfortable and natural when you express your emotions to your dad?") and MAR (10 items, e.g., "When you want to talk to your mom, will she be willing to talk to you?"). Respondents were asked to rate the extent to which each item was true for them on a five-point scale (1 = strongly disagree, 5 = definitely applies). We summed items in each subscale, with higher scores indicating higher levels of parent–adolescent relationship. This scale has shown good reliability and validity in Chinese adolescents (Zhang et al., 2011). The Cronbach's α coefficient in our study was 0.85 (FAR) and 0.89 (MAR).

Adolescent Pathological Internet Use Scale

The Adolescent Pathological Internet Use (APIU) scale developed by Li and Yang (2007) is widely used to assess IA. The scale contains a total of 38 items and can be divided into six subscales: salience (3 items, e.g., "Once I'm online, I don't

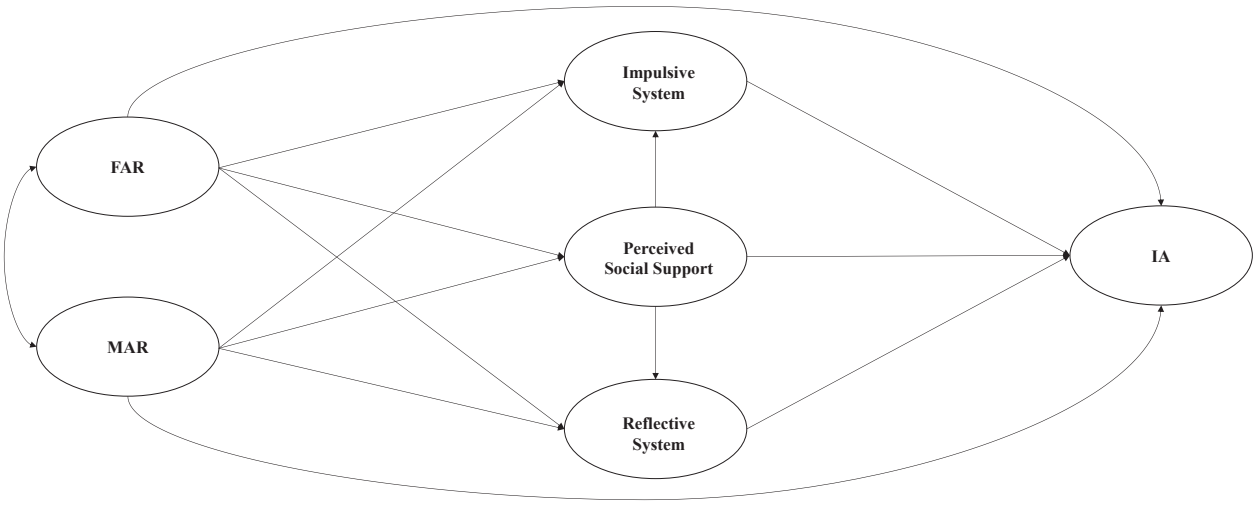

FIGURE 1 | The hypothesis model.

think about anything else"), tolerance (5 items, e.g., "I would rather hold back my bowel movements in order to stay online"), withdrawal symptoms (11 items, such as "When I can't go online, I really want to know what's happening online"), mood alteration (5 items, such as "When I'm depressed, going online can make me feel better "), social comfort (6 items, e.g., "I feel more comfortable when I communicate with others online") and negative outcomes (8 items, e.g., "I sometimes skip class to go online "). Respondents were asked to rate the extent to which each item was true for them on a five-point scale (1 = never, 5 = always). We summed items in each subscale, with higher scores indicating higher levels of IA. This scale has shown good reliability and validity in Chinese adolescents (Liu et al., 2012). The Cronbach's α coefficient in our study was 0.94.

Multidimensional Scale of Perceived Social Support

The Chinese version of the Multidimensional Scale of Perceived Social Support (MSPSS) is used to assess Perceived Social Support (Zimet et al., 1988). The scale contains a total of 12 items and can be divided into three subscales: family (four items, e.g., "My family can help me in a practical and concrete way"), friends (four items, such as "My friends can really help me"), and significant others (four items, such as "My teachers, relatives, and classmates are there for me when I have problems"). Respondents were asked to rate the extent to which each item was true for them on seven-point scale (1 = Very strongly disagree, 7 = Very strongly agree). We summed items in each subscale, with higher scores indicating higher levels of Perceived Social Support. This scale has shown good reliability and validity in Chinese adolescents (Wang L. et al., 2017). The Cronbach's α coefficient in our study was 0.86.

Dual System of Self-Control Scale

The Chinese version of the Dual System of Self-Control (DSSC) scale is used to assess self-control ability, and it contains two subscales, impulse system and Reflective System (Xie et al., 2014). The impulse system subscale includes subscales: impulsive (six items, e.g., "I often do or say things without thinking"); easy distraction (three items, e.g., "I often feel unable to complete my tasks"); and delay gratification (three items, e.g., "I can't save money for future purchases"). The Reflective System subscale includes two subscales: problem-solving (six items, e.g., "I will try everything to deal with this") and future time view (three items, e.g., "I think we should plan our day in the morning"). Respondents were asked to rate the extent to which each item was true for them on five-point scale (1 = not at all true, 7 = very true).The higher the score on the impulse system subscale, the stronger the factors of impulsiveness, distraction, and delay gratification, and the weaker the self-control ability. The higher the score in the control system subscale, the more likely the problem is solved satisfactorily, the stronger the future time view, and the stronger the self-control. This scale has shown good reliability and validity in Chinese adolescents (Wang L. et al., 2017). The Cronbach's α coefficient in our study was 0.82.

Data Analysis

Statistical analysis was performed using SPSS 23.0 software and Amos 26.0 software. It was divided into the following steps: (1) Data standardization and descriptive statistics (including the mean, standard deviation, Cronbach's α, and correlation for each variable) were performed using SPSS software. (2) Multiple regression analysis using SPSS software was used to compare the effects of FAR and MAR on adolescent IA. (3) Structural equation modeling (SEM) was conducted to test the mediating role of preceived social support and DSSC between FAR/MAR and adolescent IA (with Maximum Likelihood estimation). Where the Chi-square to degrees of freedom ratio (x^2/df) < 5, the comparative fit index (CFI) and Tucker-Lewis Index (TLI) indices were above 0.90, and the standardized root mean square residual (SRMR) and the root mean square error of approximation (RMSEA) were less than 0.08 show good model fit (Bentler and Chou, 1987). (4) Bias was corrected for by a bias-corrected non-parametric percentile bootstrap method with

5000 replicate samples using 95% confidence intervals (CI). Indirect effects were significant if the 95%CI did not include zero (Preacher and Hayes, 2008).

Normal Distribution and Multicollinearity

We used the Kolmogorov–Smirnov test to determine whether each variable was normally distributed on 732 valid samples, and the results indicated that each variable was normally distributed with a two-sided significance range of 0.058–0.18, implying that each variable was normally distributed. Additionally, the variance inflation factor (VIF) is a parameter that indicates the degree of cointegration in a multiple linear regression model, with tolerance equal to 1/VIF. If the VIF of the independent variables is greater than 5 and the tolerance value is greater than 0.2, the model is considered to have severe multicollinearity (Akinwande et al., 2015). The VIFs of the variables in this study ranged from 1.011 to 1.827; the tolerance ranged from 0.547 to 0.998, indicating that the model was not significantly multicollinear.

Item Parceling

The FAR and MAR are both one-dimensional instruments, and the questions are highly homogeneous. To avoid measurement error inflation of latent variables, which reduces the model's fit, the factorial algorithm method was used in this study to package the FAR and MAR questions, and the ten FAR/MAR questions were combined into two questions each (Rogers and Schmitt, 2004). After factor analysis, the questions with the highest factor loadings were included as anchor items in the package, followed by the questions with the next highest factor loadings in reverse order according to the direction of the balance, and the score for each question combination after the package was equal to the average of the questions in the package. Due to the fact that the other questionnaires have their own dimensions, there is no reason to use the factorial algorithm method.

Control Variables

This study includes two demographic variables as control variables: age and gender (1 = male, 2 = female). The demographic control variables were chosen based on the findings of the study. To begin, adolescents may exhibit greater impulsivity than other age groups due to a more active nervous system, specifically the ventral striatum, during adolescence (Sherman et al., 2018; Rosenbaum and Hartley, 2019). Additionally, there is a non-linear increase in adolescents' self-control throughout adolescence, which means that adolescents may have varying levels of self-control at various ages (Casey, 2015). Second, girls have greater self-control than boys among adolescents, which may be explained by the fact that girls are less impulsive during adolescence (Chapple and Johnson, 2007) and are better at contemplation and reflection (Burwell and Shirk, 2007). As a result of the preceding study, we used age and gender as control variables in our study and assigned them to the column of independent variables in multiple regression analysis. In SEM analysis, we assigned the two variables age and gender to the three latent variables: Impulsive System, Reflective System, and IA (Yang et al., 2010).

RESULTS

Descriptive Statistics and Correlations

Table 1 contains the means, standard deviations, and correlation coefficients for each variable. The results indicated that Adolescent IA was significantly positively correlated with Impulsive System and negatively correlated with FAR/MAR, Perceived Social Support, and Reflective System; FAR/MAR was significantly positively correlated with Perceived Social Support, Reflective System, and Impulsive System; Perceived Social Support was significantly positively correlated with Reflective System and negatively correlated with Impulsive System; Impulsive System was significantly positively correlated with Reflective System; Impulsive System was significantly Additionally, the correlation coefficients between the main variables ranged between 0.34 and 0.55 in absolute value, and the significance coefficients between all variables were less than 0.001.

Multiple Linear Regression Analysis

Multiple linear regression analysis was used to compare the direct effects of FAR and MAR on adolescent IA while accounting for demographic and other primary variables. Clogg et al. (1995) contended that when variables are standardized to unify their scales, the magnitude of the effects of various independent variables on the dependent variable can be compared using regression coefficients. However, this comparison is not absolute; regression coefficients represent differences in the slopes of the various variables, which means that when the coefficient for variable an is greater than the coefficient for variable b, it indicates that changes in variable a have a greater effect on the dependent variable than changes in variable b. Therefore, after standardizing all variables, we used the demographic variables and the main variables including FAR/MAR as our independent variables and adolescent IA as the dependent variable.

The model's results were summarized in **Table 2**. The fit of the model was satisfactory ($F = 68.016$, $p < 0.001$). The standardized R^2 value was 0.397, indicating that the independent variables could account for 39.7 percent of the variance in the model IA. In addition, the results show that FAR had no effect on adolescent IA ($\beta = -0.071$, $t = -1.88$, $p = 0.061$), whereas MAR had a significant effect on adolescent IA ($\beta = -0.108$, $t = -2.904$, $p = 0.003$). In comparison to FAR, the regression coefficient of MAR on adolescent IA was larger and more significant. This suggests that mothers may exert a greater inhibitory effect on adolescent IA than fathers do in this model condition, a finding that is consistent with previous research (Xu et al., 2014; Shek et al., 2018). It is worth noting that, while the regression coefficients for MAR were greater than those for FAR, this does not imply that MAR had a greater effect on adolescent IA under any condition. More precisely, it means that for each unit increase in MAR, the propensity for adolescent IA may decrease by 0.108 units, when these independent variables are taken into account. Relatively, due to the non-significant regression coefficients for FAR, there may not be a significant change in adolescent IA propensity for each unit of FAR enhancement. Which of the following has a greater impact on adolescent IA: MAR or FAR? It may

TABLE 1 | Descriptive statistics and correlations for key variables (N = 732).

Variables	Age	Gender	IA	FAR	MAR	Perceived social support	Impulsive system	Reflective system
Age								
Gender	–0.01							
IA	–0.10**	–0.06						
FAR	0.07	–0.01	–0.42***					
MAR	0.10**	–0.01	–0.43***	0.55***				
Perceived social support	0.07	0.00	–0.49***	0.55***	0.51***			
Impulsive system	–0.07	0.03	0.52***	–0.42***	–0.38***	–0.47***		
Reflective system	0.05	0.01	–0.42***	0.38***	0.44***	0.49***	–0.34***	
M	13.83	—	2.53***	2.87***	3.10***	4.52***	2.74***	3.32***
SD	1.20	—	0.75***	0.99***	1.09***	1.44***	0.88***	0.79***

$^{**}p < 0.01$, $^{***}p < 0.001$.

TABLE 2 | Multiple linear regression analysis (N = 732).

Independent variables	β	*T*	95% CI		Tolerance	VIF
			Lower	Upper		
Age	–0.049	–1.683	–0.088	0.007	0.989	1.011
Gender	–0.074	–2.563*	–0.264	–0.035	0.998	1.002
FAR	–0.071	–1.880	–0.146	0.003	0.582	1.717
MAR	–0.108	–2.904**	–0.185	–0.038	0.598	1.671
Perceived social support	–0.172	–4.421***	–0.251	–0.097	0.547	1.827
Impulse system	0.317	9.370***	0.248	0.382	0.727	1.376
Reflective system	–0.147	–4.286***	–0.217	–0.082	0.704	1.421

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

TABLE 3 | Model fitness.

Models	x^2/df	*p*	$\triangle x^2(\triangle df)$	CFI	TLI	RMSEA	SRMR
Hypothesis model	2.969	<0.001	3.712(3)	0.980	0.974	0.052	0.039
Correction model	2.935	<0.001		0.980	0.975	0.051	0.040

produce inconsistent results under different conditions, which may be influenced by how the parent-adolescent relationship is measured (Li et al., 2014; Kim and Kim, 2015), necessitating additional research.

Structural Equation Model Analysis

Due to the inconsistent range of scores across questionnaires, and to avoid impairing model fit by inflating the measurement error of the variables, this study transformed all variables into standardized variables with a mean of 0 and a standard deviation of 1 before conducting SEM analysis (Wang and Wang, 2019).

The test results of the Hypothesis Model are presented in **Table 3** and **Figure 2**. where the regression coefficients of FAR on adolescent IA (β = –0.02, $p > 0.05$, 95% CI = [–0.12, 0.08]) and MAR on adolescent IA (β = –0.06, $p > 0.05$, 95% CI = [–0.15, 0.04]) were too small to be significant; the regression coefficients of FAR on Reflective System regression coefficient was small (β = 0.06, $p > 0.05$, 95% CI = [–0.05, 0.18]) with p-values greater than 0.05 and 95% CI including 0, all of which were non-significant paths. As a result, these paths have been eliminated from the Correction Model. The Correction Model's test results are depicted in **Figure 3**.

The difference in cardinality between the Hypothesis Model and Correction Model was $x^2 = 3.712$, $p < 0.05$. As shown in **Table 3**, the Correction Model fit well and all criteria were met (Bentler and Chou, 1987). SEM and bootstrap analysis (5000 replicate samples) were used to validate the hypothesized mediated paths. As shown in **Table 4**, (1) in terms of total effect, both FAR and MAR had a significant negative predictive effect on adolescent IA [FAR: β = –0.271, 95% CI: (–0.342) – (–0.204); MAR: β = –0.276, 95% CI: (–0.347) – (–0.204)]. (2) In terms of direct effects, neither FAR ($p > 0.05$) nor MAR ($p > 0.05$) had a significant direct effect on adolescent IA, suggesting that FAR and MAR affect adolescent IA primarily through indirect effects (Preacher and Hayes, 2008). (3) In terms of indirect effects, the mediating effect of Perceived Social Support between FAR/MAR and adolescent IA was significant [FAR: β = –0.065, 95% CI: (–0.133) – (–0.004); MAR: β = –0.050, 95% CI: (–0.105) – (–0.004)]; Impulsive System had a significant mediating effect between FAR/MAR and adolescent IA [FAR: β = –0.075, 95%

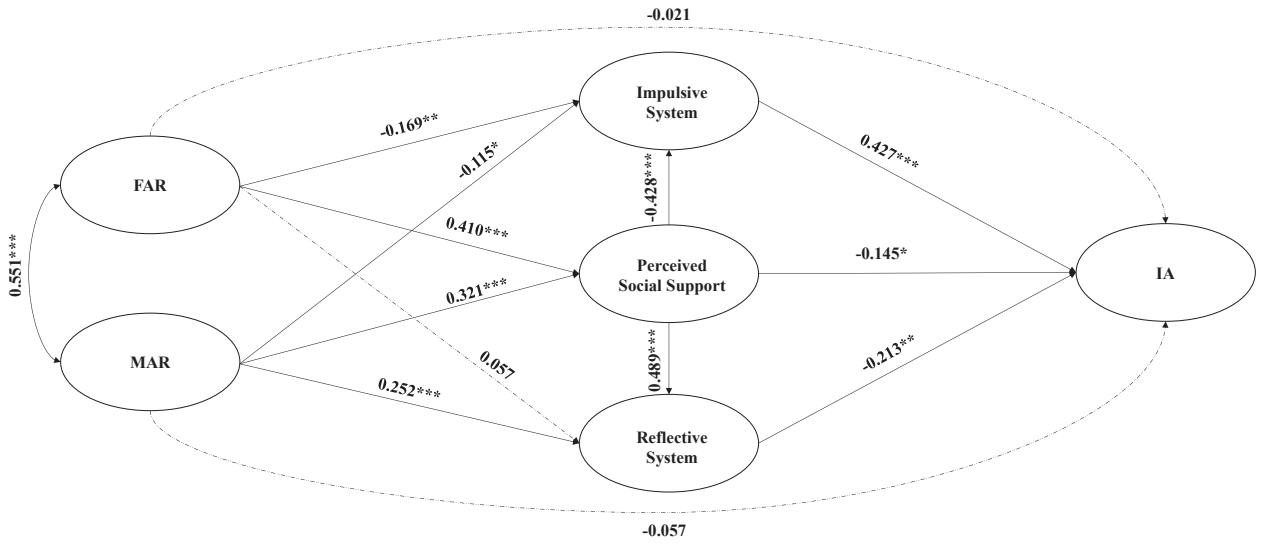

FIGURE 2 | Hypothesis model. The dashed lines indicate paths with non-significant regression coefficients; control variables and precursor measures are not shown.

CI: (–0.129) – (–0.028); MAR: β = –0.054, 95% CI: (–0.102) – (–0.014)]; Reflective System had a significant mediating effect between MAR and adolescent IA [β = –0.070, 95% CI: (–0.143) – (–0.023)]; Perceived Social Support and Impulsive System had a significant chain mediating effect between FAR/MAR and adolescent IA [FAR: β = –0.077, 95% CI: (–0.119) – (–0.050); MAR: β = –0.060, 95% CI: (–0.093) – (–0.039)]; the chain mediated effect of Perceived Social Support and Reflective System between FAR/MAR and adolescent IA effects were significant [FAR: β = –0.054, 95% CI: (–0.104) – (–0.024); MAR: β = –0.042, 95% CI: (–0.087) – (–0.017)]. In summary, several of this study's hypotheses were validated.

DISCUSSION

Direct Relationship Between Father–Adolescent Relationships/Mother–Adolescent Relationships and Adolescent Internet Addiction

The purpose of this study was to examine the mechanism of the effect of FAR/MAR on adolescent IA and to compare the effect of FAR and MAR. In terms of the direct relationship between FAR/MAR and adolescent IA, both FAR and MAR demonstrated a significant negative correlation with IA, i.e., the stronger the FAR and MAR, the less likely adolescents were to develop IA, which was also consistent with prior research (Xu et al., 2014). However, inconsistent with existing research (Wang W. et al., 2018), the test results of the Hypothesis Model suggest that FAR and MAR do not have a direct effect on adolescent IA. One reason for this could be that this study did not directly analyze the parent-adolescent relationship as a separate variable when constructing the SEM for adolescent IA, but instead separated it into FAR and MAR to compare parent differences, weakening the direct effects of FAR and MAR on adolescent IA overall (Wang W. et al., 2018). Another reason could be that the FAR/MAR effect on adolescent IA in the multiple regression model is directed, whereas the effect of FAR/MAR on adolescent IA in the SEM contains indirect effects, and the coefficients of these mediating effects would somewhat attenuate the magnitude of the direct effects if they were larger (Iacobucci et al., 2007; Wang and Wang, 2019). Furthermore, Preacher and Hayes (2008) argued that the lack of a significant direct effect does not mean that FAR and MAR have no effect on IA, but rather that they influence adolescent IA primarily through mediating effects.

Mediating Relations Between Father–Adolescent Relationships/Mother–Adolescent Relationships and Adolescent Internet Addiction

To elucidate the relationship between FAR/MAR and adolescent IA, a chain-mediated model was developed in this study. We discovered that Perceived Social Support and DSSC play a significant role in the association between FAR/MAR and adolescent IA. Reduced FAR/MAR specifically reduces adolescents' Perceived Social Support, increasing their risk of IA. According to the deficiency-compensation theory, the primary reason adolescents become addicted to the Internet world is their inability to obtain emotional fulfillment in the real world. As a result, adolescents develop an increasing reliance on Internet socialization, Internet gaming, and Internet entertainment activities to compensate for unmet emotional needs in real life, which gradually results in IA (Gao and Chen, 2006). Thus, a lack of Perceived Social Support as a result of a decrease in FAR or MAR may be a significant factor in adolescent IA. Additionally, the lower FAR/MAR found in this study may

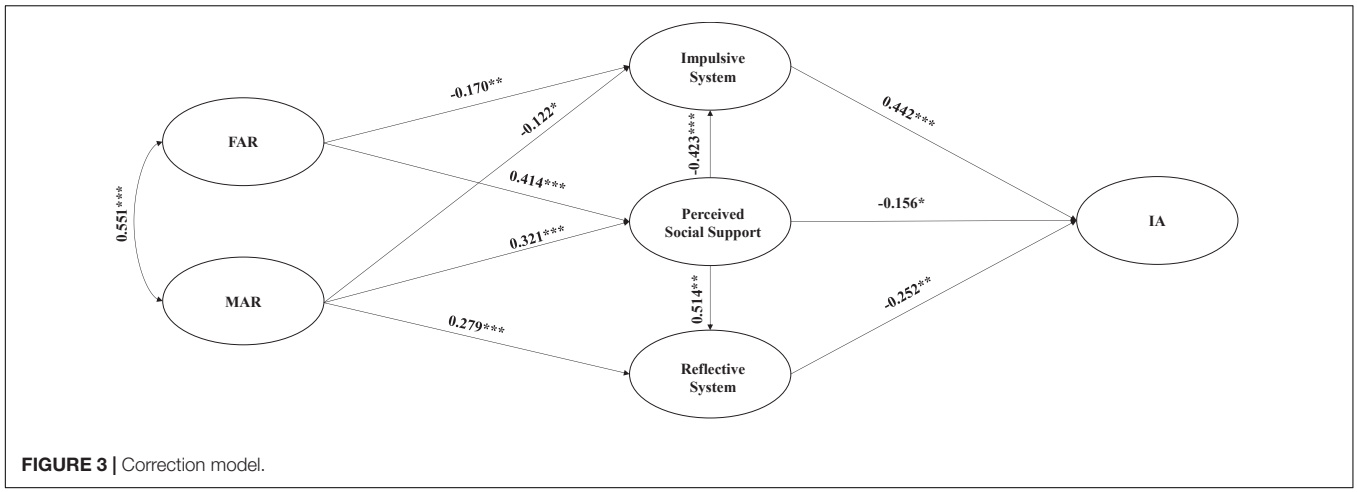

FIGURE 3 | Correction model.

TABLE 4 | Total, direct, and indirect effects among the variables (*N* = 732).

Model paths	Standardized estimated value	*SE*	*p*	95% CI	
				Lower	Upper
FAR					
FAR→IA (total effect)	–0.271	0.035	<0.001	–0.342	–0.204
FAR→IA (direct effect)	—				
FAR→Perceived Social Support→IA	–0.065	0.032	0.038	–0.133	–0.004
FAR→Impulse System→IA	–0.075	0.026	0.002	–0.129	–0.028
FAR→Reflective System→IA	—				
FAR→Perceived Social Support→Impulse system→IA	–0.077	0.017	<0.001	–0.119	–0.050
FAR→Perceived Social Support→Reflective System→IA	–0.054	0.020	<0.001	–0.104	–0.024
MAR					
MAR→IA (total effect)	–0.276	0.037	<0.001	–0.347	–0.204
MAR→IA (direct effect)	—				
MAR→Perceived Social Support→IA	–0.050	0.025	0.035	–0.105	–0.004
MAR→Impulse System→IA	–0.054	0.023	0.008	–0.102	–0.014
MAR→Reflective System→IA	–0.070	0.031	<0.001	–0.143	–0.023
MAR→Perceived Social Support→Impulse system→IA	–0.060	0.014	<0.001	–0.093	–0.039
MAR→Perceived Social Support→Reflective System→IA	–0.042	0.017	<0.001	–0.087	–0.017

increase the risk of IA by activating the Impulsive System and enhancing impulsivity in adolescents. Previous research has established a strong link between adolescence and impulsivity (Niv et al., 2012), and impulsivity in adolescence is primarily due to two physiological and environmental factors. With age, physiologically induced impulsivity decreases (Friedman et al., 2016; Pehlivanova et al., 2018). However, PBT suggests that problems in the living environment, particularly family problems, may play a significant role in adolescent impulsivity and ultimately lead to IA. A significant manifestation of family problems is the deterioration of the parent-adolescent relationship. Adolescents are prone to conflict with their parents, impairing their FAR or MAR (Chaplin et al., 2012). As a result of declining FAR or MAR, parental discipline and management of adolescents become more difficult, promoting impulsivity and ultimately increasing the risk of IA (Ding et al., 2017). In contrast, effective FAR and MAR can assist parents in communicating with their adolescents and reducing impulsivity, thereby suppressing adolescent IA (Liu et al., 2012; Martins et al., 2020).

More importantly, this study discovered that FAR/MAR enhanced adolescents' Perceived Social Support, which in turn inhibited the Impulsive System's activation and promoted the Reflective System's activation, ultimately promoting adolescents' self-control and lowering their risk of IA. According to the Dual-System Model of Self-Control, the impulsivity and Reflective Systems work in tandem to determine adolescents' motivation for self-control. FAR/MAR can significantly improve adolescents' perceptions of parental support (Karaer and Akdemir, 2019), thereby mitigating adolescents' conflict with their parents and inhibiting impulsivity (Hamama and Ronen-Shenhav, 2012). Furthermore, increased parental support enables parents to carry out normal monitoring and parenting functions for their adolescents, reinforcing adolescents' self-monitoring functions (Pilcher and Bryant, 2016). Thus, the processes contribute to

the Reflective System's dominance in the DSSC, which ultimately exhibits greater self-control (Zhang R. et al., 2021). In conclusion, this study demonstrates the importance of emphasizing both Perceived Social Support and DSSC when attempting to reduce the risk of IA in adolescents via FAR/MAR. Furthermore, if parents, teachers, or adolescents themselves wish to reduce the risk of adolescent IA via FAR/MAR, particular attention should be paid to the combined role of Perceived Social Support and DSSC.

Differences Among Father–Adolescent Relationships, Mother–Adolescent Relationships to Adolescent Internet Addiction

The most significant and intriguing findings in this study suggest that the Reflective System mediates the relationship between MAR and adolescent IA, but that FAR does not affect adolescent IA via the Reflective System. i.e., MAR can enhance the activation of the adolescent Reflective System, thereby promoting self-monitoring and reflection and lowering the risk of IA in adolescents, whereas FAR does not. The current findings cast doubt on the hypothesis that the main method of preventing IA in adolescents is to enhance parent-adolescent relationship and that FAR acts similarly to MAR (Wang W. et al., 2018). In opposition to that, the current study suggests that MAR may play a more prominent role in promoting adolescent self-reflection and monitoring functions necessary for preventing IA. The presence of MAR is critical for the development of adolescent self-regulation, i.e., MAR facilitates adolescent self-monitoring, assessment, modification, and inhibition of their behavior or emotions more than parent-adolescent relationships or parenting styles do (Moilanen et al., 2010). Self-reflection and monitoring functions, on the other hand, enable adolescents to keep a watch on and monitor their Internet use, effectively lowering the risk of IA among adolescents (Leménager et al., 2016; Wang et al., 2021).

Additionally, we discovered that low FAR was associated with adolescent IA, but the association was less significant than the association with MAR, which is consistent with previous research (Xu et al., 2014). This finding may imply that MAR has a more pronounced and representative effect on adolescent IA than FAR. According to parental investment theory, fathers and mothers contribute differently to adolescent development. Mothers are primarily responsible for preventing adolescent emotional and behavioral development, whereas fathers are primarily responsible for ensuring the family's proper functioning (Bjorklund and Kipp, 1996). Although FAR and MAR are essentially the same relationship and both are used to reflect the emotional cohesion between father/mother and adolescent (Russell and Saebel, 1997), parental involvement in parenting styles contributes to the FAR/differential MAR's effects on adolescent IA. The differences in Perceived Social Support and DSSC elicited by FAR/MAR resulted in FAR/MAR having a different effect on adolescent IA. In diverse cultural contexts, a low FAR is more likely to trigger emotional and behavioral problems in adolescents than a high MAR (Baker, 2017; Pitsoane and Gasa, 2018). The primary reason for this may be that fathers exert less behavioral control over adolescents than mothers (Shek et al., 2018). Through their thoughts and emotions, mothers are more likely to convince adolescents that "IA is unacceptable behavior," and good MAR facilitates this process of change. As a result, the presence of MAR is more important than the presence of FAR in promoting Reflective System activation and preventing IA in adolescents. When combined with the direct and indirect associations between FAR/MAR and adolescent IA found in this study, these findings suggest that FAR and MAR exert distinct effects on adolescent IA and that MAR is critical for reducing the risk of adolescent IA. From a cultural standpoint, the majority of Chinese adolescents regard fathers as serious and cognitive figures. Fathers frequently impose numerous behavioral restrictions on adolescents to teach them what they are not allowed to do, including restrictions on the use of Internet devices (Li and Lamb, 2013). This parental restraint contributes to adolescents' reflection and monitoring of Internet device use, thereby lowering their risk of IA. However, when communication between fathers and adolescents breaks down for a variety of reasons, resulting in low FAR (Russell and Saebel, 1997; Pitsoane and Gasa, 2018), adolescents may become liberated from their fathers' restraint, and FAR loses its ability to influence adolescents' IA via the Reflective System.

Additional research is needed in the future to elucidate additional mechanisms underlying the effects of FAR/MAR on adolescent IA and to compare the effects of FAR and MAR. Mothers are more likely to influence adolescents' perceptions of "IA as unacceptable behavior" through their thoughts and emotions, and a positive MAR aids in this process of change. As a result, the presence of MAR is more important than FAR in promoting Reflective System activation and preventing IA in adolescents. Taken together with the direct and indirect associations between FAR/MAR and adolescent IA found in this study, these findings suggest that FAR and MAR exert distinct effects on adolescent IA and that MAR is critical for reducing the risk of adolescent IA. Additional research is required in the future to elucidate additional mechanisms underlying the effects of FAR/MAR on adolescent IA and to compare the effects of FAR and MAR.

Implications for Practical Services

To our knowledge, this is the first study to examine the mediating role of perceived and congregational support, as well as DSSC, in the relationship between FAR/MAR and adolescent IA, by comparing the effects of FAR and MAR on adolescent IA and contributing to our understanding of adolescent IA.

From a practical standpoint, our findings may contribute to the development of practical prevention and intervention strategies for reducing IA in adolescents. To begin, family intervention programs for adolescents with IA should be expanded to increase adolescents' Perceived Social Support through FAR/MAR promotion. And, on this basis, adolescents should be guided toward developing self-reflective and monitoring abilities to rein in their impulsivity and thus reduce their risk of IA (Gunuc and Dogan, 2013). Second, and perhaps most importantly, different intervention plans should

be developed for families with varying FAR/MAR statuses in various situations. For families with low FAR but a high MAR, priority can be given to fostering FAR to compensate for the perceived lack of social support and to promoting self-control to prevent adolescent IA (Liu et al., 2015). Priority should be given to fostering MAR in families with both low FAR and MAR, as MAR plays a critical role in inhibiting adolescent IA. Thirdly, the discovery that Perceived Social Support has a negative predictive effect on the Impulsive System while having a positive predictive effect on the Reflective System provides critical practice insights. To prevent and intervene with IA in adolescents, families, schools, and communities can establish a strong social support system (Shaheen et al., 2019). This system can help adolescents receive more social support, which can help reduce Impulsive System activation and promote the development of the Reflective System, which can help adolescents achieve self-control of IA.

Limitations of This Study

This study is not without limitations. To begin, this study's participants were concentrated in early adolescence. IA was more prevalent in early adolescence than in late adolescence (Moilanen et al., 2010). This means that the study's findings may be slightly skewed and may not accurately reflect the general adolescent population. Second, this study focused primarily on the effect of perceived family support on adolescents' IA. However, social support from school and community settings is critical in suppressing adolescent IA, and the family, school, and community all influence adolescent IA in different ways (Liu et al., 2015; Shaheen et al., 2019). As a result, additional research is required in the future to examine the effects of social support on adolescent IA in a variety of contexts. Third, only the cases of Perceived Social Support, Impulsivity System, and Reflective System as variable conditions were considered when comparing the differences in effects between FAR and MAR. MAR and FAR may also have opposite predictive effects on adolescent IA in other circumstances. As a result, the explanation for the causal relationship between FAR/MAR and adolescent IA becomes weaker. Future research should consider a longitudinal design that incorporates additional data on adolescent Internet use in order to reach more conclusive conclusions. Fourthly, future research could focus on family-centered approaches to adolescent IA interventions. Adolescents today face a complex and changing world filled with Internet device temptations, and not every adolescent is able to successfully avoid or overcome IA. Positive parental attitudes toward adolescents can contribute to the development of positive parent–adolescent relationships, which can significantly reduce or eliminate adolescent IA. Once adolescents develop an Internet addiction, parents should attempt to minimize the adolescent's Internet identity. Parents' love and trust motivate their children to overcome IA, and parents' and children's collaborative efforts are critical in assisting their children in overcoming IA.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

HQ: significant contribution to the design and writing of the study. QK: significant contribution to the writing and data collection and analysis. CB: significant contribution to the design and data collection aspects of the study. All authors: contributed to the article and approved the submitted version.

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BRIEF RESEARCH REPORT
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Are Adverse Childhood Experiences Associated With Being in the System of Care?

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Background: Adverse childhood experiences (ACEs) can cause serious mental problems in adolescents and therefore may expected to be associated with higher use of psychosocial care, potentially varying by type of specific ACE. The aim of our study is to explore the association of the number of ACE and types of specific ACE with entering and using psychosocial care.

Methods: We used data from the Slovak Care4Youth cohort study, comprising 509 adolescents from 10 to 16 years old (mean age 13.2 years, 48.6% boys). We used logistic regression models adjusted for age, gender, and family affluence to explore the associations of number and type of specific ACE with the use of psychosocial care.

Results: Having three or more ACE as well as experiencing some specific ACE (death of a mother/father, death of somebody else you love, problems of a parent with alcohol or drugs, conflicts or physical fights between parents, and separation/divorce of parents) increased the likelihood of using psychosocial care. Regarding experience with the death of somebody else you love, we found a decreased likelihood of the use of psychosocial care.

Conclusion: Experiencing ACE above a certain threshold (three or more) and parent-related ACE increase the likelihood of adolescent care use.

Keywords: adverse childhood experiences, parent-related ACE, use of psychosocial care, adolescence, mental health

INTRODUCTION

Adverse childhood experiences (ACEs) represent various negative events during a child's development (DeLisi et al., 2017; Sheikh, 2018; Lackova Rebicova et al., 2019, 2020; Paclikova et al., 2019). Accumulation of ACEs has been shown to have long-lasting effects on adolescents' mental health (Danese and McEwen, 2012; Lackova Rebicova et al., 2020), which may be associated with their enrolment into the system of care (Paclikova et al., 2020) and consequent utilization

of the system of care (Aalsma et al., 2016). As a dose–response was found between ACE and adolescents' mental health (Lackova Rebicova et al., 2020), we would expect a similar pattern when it comes to use of psychosocial care. However, currently evidence is lacking on the influence of the number of ACE on being in and using psychosocial care among adolescents.

ACE regard different types of negative events with different levels of severity such as abuse and/or neglect of a child, domestic violence toward a youth's mother, household substance abuse, household mental illness, parental separation/divorce, and other events. They represent harm that affects the child either directly (such experiences may include neglect and abuse) or indirectly by affecting the environment in which they live (such as family mental disorders, parental divorce, family psychoactive substance use, etc.; Danese and McEwen, 2012; DeLisi et al., 2017; Sheikh, 2018; Paclikova et al., 2019). It has been suggested that ACE can be divided into several groups with differing impacts—ACE related to parents, to other family members and to other negative events—and those types of ACE that are directly related to parents (Finkelhor et al., 2013; Schwartz et al., 2019; Wright and Schwartz, 2021) seem to have a more significant impact on a child's life (Finkelhor et al., 2013; Schwartz et al., 2019; Wright and Schwartz, 2021). Recent studies have revealed that in particular conflicts between parents, divorce, or parents drinking alcohol seem to have a negative influence on adolescents' mental health (Maier and Lachman, 2000; Bevilacqua et al., 2021). Such parent-related ACE may have a stronger impact, as parents might be more self-centered and as a result less sensitive and responsive to their children. Therefore, family functioning is being compromised and other sources for dealing with the problems are needed (Morris et al., 2007).

The theoretical background of such findings might be in the Complex trauma theory. Complex trauma in children or adolescents is a result of exposure to severe adverse experiences, often in the family system—from persons who should be sources of security, protection and stability, with the consequence in the form of disruption of the sense of self leading to mental health problems and the need for psychosocial care (Cook et al., 2017). As regards other types of ACE, a lot of adolescents have experienced the death of somebody else he or she loves, which can have a significant impact as well (Johnson et al., 2017; Pachalla et al., 2020). Overall, ACE have been shown to have an impact (Lackova Rebicova et al., 2020), but it may be expected that the influence of a specific type of ACE is different (Negriff, 2020; Mackova et al., 2021). Studies that comprehensively address the association of specific types of ACE on the use of psychosocial care are lacking. To sort out the effect of other related ACE requires an assessment per ACE adjusted for the associations of the other ACE.

To summarize, the previous studies have mostly explored the association of ACE with adolescent mental health and/or enrolment in care for mental health problems in general (Lackova Rebicova et al., 2019; LaBrenz et al., 2020; Paclikova et al., 2020; Meeker et al., 2021). Evidence is lacking on the potential dose–response association between ACE and the use of psychosocial care. The same holds for understanding which specific ACE are most strongly associated with use of psychosocial care when adjusted for each other. Therefore, the aim of our study was to explore the association between ACE (number and type of specific ACE) and entering and using the system of psychosocial care.

MATERIALS AND METHODS

Sample and Procedure

We used data from the Slovak Care4Youth cohort study that comprises both adolescents from the general community and adolescents entering psychosocial care, i.e., two subsamples. The respondents had to meet the following criteria: adolescents should be aged 10–16 years old, should be able to understand the Slovak language, should be able to fill out the questionnaires on their own, and should come from the Kosice region in eastern Slovakia.

Participants (10–16 years old) from the community were recruited *via* randomly chosen primary schools in the Kosice region in eastern Slovakia; they were approached from January until June 2017 *via* a two-stage sampling. In the first stage, we contacted the schools; in the second stage, the parents or legal representatives of the pupils were contacted. After being thoroughly informed about the study and participation in the study, parents (when children were <18, we had to ask parents only) were asked to provide us with signed informed consent on behalf of their children. Detailed information on response rates and the number of participants with basic descriptive information is shown in **Figure 1**.

Participants from the care system were recruited *via* institutions providing psychosocial care for adolescents with emotional and behavioral problems in the Kosice region in eastern Slovakia. These were approached from January 2017 until December 2018 using a two-step sampling. In the first step, we contacted institutions and, in the second step, we contacted the parents or legal representatives of the adolescents. Parents received full information on the study and provided a signed informed consent on behalf of their children. Detailed information on participants' flow with basic descriptive information is shown in **Figure 1**.

For the purpose of this study, we used a final sample consisting of 509 adolescents (mean age 13.20 years, 48.6% boys). Respondents with missing responses on the variables to be studied were excluded. The study was approved by the Ethics Committee of the Medical Faculty at the Pavel Jozef Safarik University in Kosice (protocol 2N/2015).

Measures

Adverse childhood experiences (*ACEs*) were measured by a series of questions on events: "Have you ever experienced any of the following serious events?" (Death of a brother/sister, Death of your father/mother, Death of somebody else you love, Long or serious illness of yourself, Long or serious illness of one of your parents or of someone else close to you, Problems of one of your parents with alcohol or drugs, Repeated serious conflicts or physical fights between your parents, Separation/

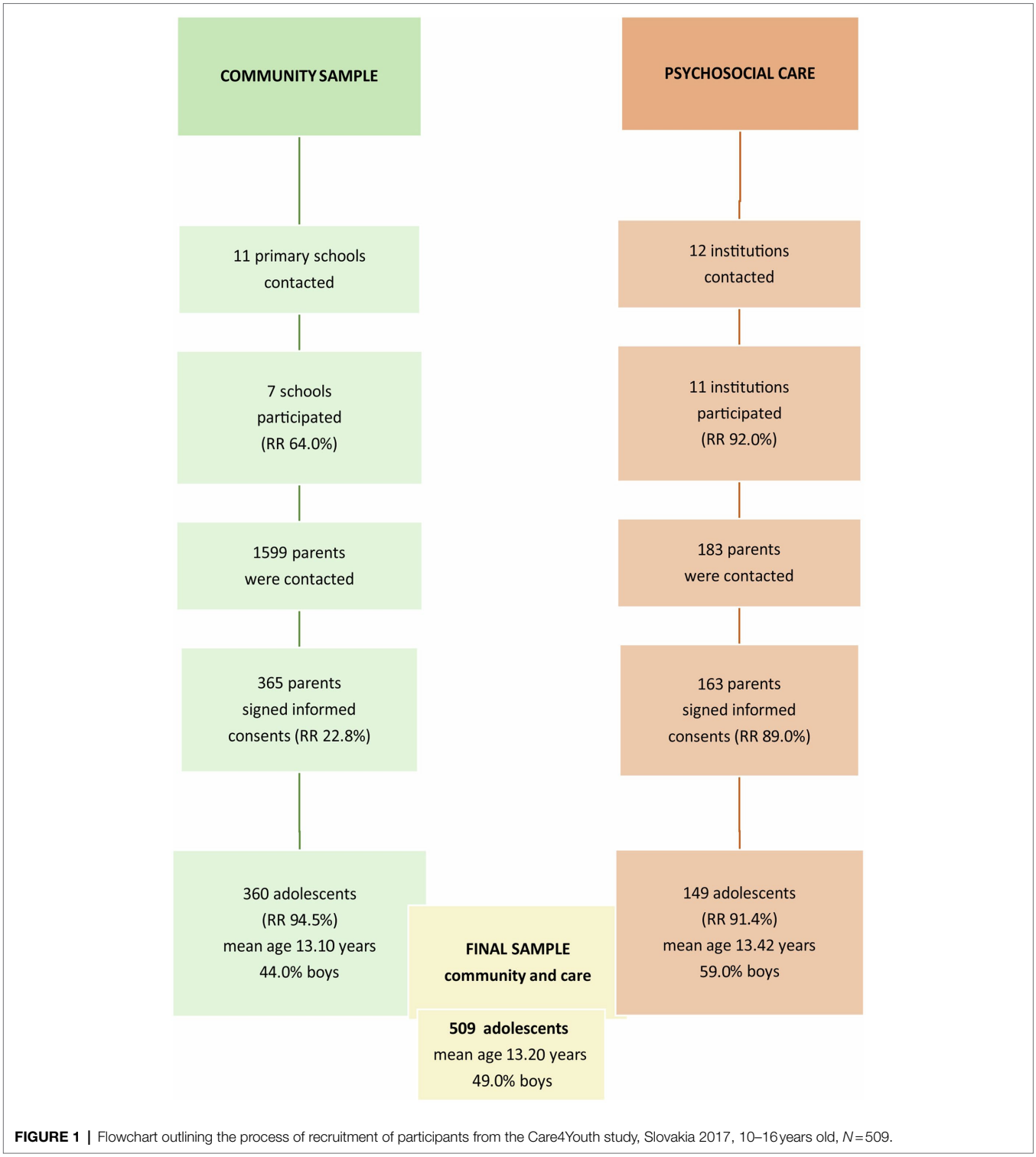

FIGURE 1 | Flowchart outlining the process of recruitment of participants from the Care4Youth study, Slovakia 2017, 10–16 years old, $N = 509$.

divorce of your parents, and Separation of your parents due work abroad). These questions were derived from the ISRD 2: Standard Student Questionnaire and piloted in the Slovak context (ISRD2 Working Group, 2005; Lackova Rebicova et al., 2020). The response categories were "Yes" and "No." We created a sum score for the number of ACE experienced, with a higher score indicating more ACE. Consequently, we categorized the number of ACE into three categories: no ACE, one or two ACE and three or more ACE. We used in our analysis the cumulative ACE (three categories: 0 ACE vs. 1–2 ACE vs. 3 and more ACE) and also the specific ACE, as listed above (two categories: No/Yes).

Psychosocial care use regarded as being either in the care sample or in the community sample and using psychosocial care from the institutions providing social and mental health care (e.g., counseling centers, in-patient and out-patient psychiatric care, out-patient psychological care, and state and non-profit organizations providing social services) according to information provided by the parents over the past 12 months.

We further assessed age, gender, and socioeconomic position as potential confounders. *Socioeconomic position* (*SEP*; Inchley et al., 2018) was used as a measure of socioeconomic status and was measured by a previously validated tool (Ekehammar et al., 1987) on a 10-point scale (0—the worst, 10—the best); the adolescents were asked to assess where they see their families on this ladder according to their financial status (Adler et al., 2000). To illustrate what is meant, a description was provided, e.g., about how well-off their family is, how much money the family had, what level of education their parents had achieved and how profitable the work of their parents is.

Statistical Analyses

First, we described the sample using descriptive statistics. Second, we assessed the crude association of the number and type of the specific ACE with the use of psychosocial care (Model 1). Third, we assessed the univariate association of the number and type of specific ACE with use of psychosocial care adjusted for gender, age and SEP (Model 2). Finally, we assessed the association of type of specific ACE with use of psychosocial care adjusted for gender, age and SEP (Model 3). For the last three steps, we used logistic regression models. Statistical analyses were performed using SPSS v.25.

RESULTS

Background Characteristics

The background characteristics of the sample are presented in **Table 1**. Our full sample consisted of 509 adolescents aged 10–16 years old (boys: 48.6%; $n = 240$). Of these, 360 were in the community sample (boys: 44.1%) and 149 in the care sample (boys: 59.1%).

Association of Use of Psychosocial Care With the Number of ACE and With the Type of ACE

We assessed the crude association of number of ACE and type of ACE with the use of psychosocial care using logistic regression models (**Table 2**, Model 1). Having three or more ACE as well as experiencing some of type of specific ACE (Death of a mother/father; Death of somebody else you love, Problems of one of your parents with alcohol or drugs; conflicts or physical fights between parents; Separation/divorce of parents) increased the likelihood of use of psychosocial care (OR = 8.51; 0.54; 3.59; 3.31; and 2.22, respectively). In comparison, the ACE Death of somebody else you love decreased the likelihood of use of psychosocial care (OR = 0.54).

Association of Use of Psychosocial Care With the Number of ACE and With the Type of ACE Adjusted for Gender, Age, and SEP

Model 2 in **Table 2** shows that having three or more ACE (OR = 1.80) as well as experiencing some type of specific ACE (Death of a mother/father, Problems of one of your parents with alcohol or drugs, Conflicts or physical fights between parents, and Separation/divorce of parents) increased the

TABLE 1 | Descriptive statistics of the sample (Care4Youth study, Slovakia 2017, 10–16 years old, $N = 509$).

	Total	Care sample	Community sample
	***N* = 509**	***N* = 149**	***N* = 360**
Gender (*N*, %)			
Boys	240 (48.6)	88 (59.1)	152 (44.1)
Age (mean, SD)	13.19 (1.55)	13.42 (1.77)	13.10 (1.44)
Socioeconomic position (mean, SD)	6.80 (1.80)	5.97 (2.09)	7.15 (1.55)
Number of ACE (*N*, %)			
0 ACE	140 (28.9)	34 (23.1)	106 (31.5)
1–2 ACE	254 (52.5)	70 (47.6)	184 (54.6)
3 or more ACE	90 (18.6)	43 (29.3)	47 (13.9)
Type of specific ACE (*N*, %)			
Death of a brother/sister (yes)	8 (1.7)	3 (2)	5 (1.5)
Death of a mother/father (yes)	33 (6.8)	23 (15.6)	10 (3)
Death of somebody else you love (yes)	203 (41.9)	50 (34)	153 (45.4)
Long or serious illness of yourself (yes)	45 (9.3)	16 (10.9)	29 (8.6)
Long or serious illness of a parent or of someone else close to you (yes)	142 (29.3)	35 (23.8)	107 (31.8)
Problems of a parent with alcohol or drugs (yes)	52 (10.7)	30 (20.4)	22 (6.5)
Repeated serious conflicts or physical fights between your parents (yes)	72 (14.9)	37 (25.2)	35 (10.4)
Separation/divorce of your parents (yes)	110 (22.7)	52 (35.4)	58 (17.2)
Separation of your parents due work abroad (yes)	35 (7.2)	17 (11.6)	18 (5.3)
Use of psychosocial care	186 (36.5)	149 (100.0)	37 (10.3)

N - number of respondents; ACE - adverse childhood experiences; and SD - standard deviation.

TABLE 2 | Association between ACE (number and type of specific) and use of psychosocial care; results from logistic regression models leading to odds ratios (OR) and 95% confidence intervals (95% CI), crude (Model 1), adjusted for confounders (age, gender and socioeconomic position; Model 2), and adjusted for the associations with other ACE (Model 3; Care4Youth study, collected in 2017–2018, Slovakia, 10–16 years old, *N* = 509).

	Model 1	Model 2	Model 3
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Number of ACE			
0	Ref.	Ref.	
1–2	1.22 (0.79|1.89)	0.97 (0.61|1.55)	
3 or more	2.49 (1.44|4.31)***	1.80 (1.00|3.23)*	
Type of specific ACE			
Death of a brother/sister (vs. no)	0.99 (0.23|4.18)	0.68 (0.14|3.37)	0.47 (0.08|2.77)
Death of a mother/father (vs. no)	8.51(3.44|21.05)***	11.84 (4.21|33.30)***	11.37 (3.80|33.66)***
Death of somebody else you love (vs. no)	0.54 (0.37|0.79)***	0.49 (0.32|0.73)***	0.50 (0.32|0.80)**
Long or serious illness of yourself (vs. no)	1.23 (0.66|2.28)	1.03 (0.53|1.99)	1.20 (0.59|2.43)
Long or serious illness of a parent or of someone else (vs. no)	0.75 (0.50|1.13)	0.65 (0.42|1.01)	0.71 (0.43|1.19)
Problems of a parent with alcohol or drugs (vs. no)	3.59 (1.96|6.57)***	2.71 (1.42|5.14)***	1.19 (0.53|2.70)
Repeated serious conflicts or physical fights between your parents (vs. no)	3.31 (1.97|5.56)***	2.71 (1.55|4.74)***	2.20 (1.10|4.37)*
Separation/divorce of your parents (vs. no)	2.22 (1.44|3.42)***	1.94 (1.24|3.06)***	1.68 (1.00|2.84)*
Separation of your parents due work abroad (vs. no)	1.82 (0.91|3.63)	1.27 (0.67|2.65)	1.00 (0.44|2.24)

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

likelihood of use of psychosocial care (OR = 11.84; 2.71; 2.71; and 1.94, respectively). In contrast, Death of somebody else you love decreased the likelihood of use of psychosocial care (OR = 0.49).

Association of Use of Psychosocial Care With Type of ACE After Adjustment for Gender, Age, and SEP

Finally, Model 3 in **Table 2** shows that Death of a mother/father, Conflicts or physical fights between parents; Separation/divorce of parents increased the likelihood of use of psychosocial care (OR = 11.37; 2.20; and 1.68, respectively). Experience with Death of somebody else you love still reduced the likelihood of use of psychosocial care (OR = 0.50).

DISCUSSION

We found that a higher number of ACE (three or more) increased the likelihood of using psychosocial care among adolescents. For specific ACE, the parent-related ones increased the likelihood of using care in particular. One specific ACE—Death of somebody else you love—decreased this likelihood.

We found that the use of psychosocial care by adolescents was more likely when experiencing an accumulation of ACE (three or more) than when experiencing no, one or two ACE. This is in line with recent research, showing an accumulation of ACE to have a deleterious effect on the mental health of adolescents (Bevilacqua et al., 2021; Meeker et al., 2021). Previously, we reported a similar dose–response association between ACE and emotional and behavioral problems (Lackova Rebicova et al., 2020). The occurrence of mental problems and problems related to ACE directly can lead to a need for psychosocial care among adolescents (Nanninga, 2018). The higher use of psychosocial care is likely explained by this occurrence of problems, with the sources in family/school/community being no longer sufficient to manage it. Adolescents having experienced ACE and few resources are more likely to enter and use psychosocial care (Nanninga, 2018), including specific care from professionals (Negriff, 2020; Mackova et al., 2021).

We further found a different effect of certain specific ACE on adolescents' use of psychosocial care, with care use being more likely for only three specific parent-related ACE (Death of a mother/father; Conflicts or physical fights between parents; and Separation/divorce of parents). These findings are in line with existing, though partial, knowledge on the association between such specific type of ACE and worsening mental health leading to use of psychosocial care (Murphy et al., 2016; LaBrenz et al., 2020). As is stated in the Tripartite model of the impact of the family on children's emotion regulation and adjustment, the ability for emotional regulation and subsequent positive adjustment and development in mental health among adolescents is influenced *via* the parent–child attachment relationship, parenting style and the marital relationship (Morris et al., 2007). Once the parent-related ACE occurs, threating the attachment relationship, parenting style and marital relationship, the family's potential for emotional regulation and adjustment declines, and the adolescent might need additional help from professionals in the system of care. Thus, our findings show the important role of ACE related to parents in association with use of psychosocial care and is in contrast with our finding on the ACE – Death of a mother/father where loss of parents as a crucial attachment figures might activate further discomfort and disorganization in adolescents, which in turn, might increase the use of psychosocial care.

To our surprise, we also found that the death of somebody else you love decreased the likelihood of being in and using the system of care, both crude and fully adjusted. Our findings are in contrast with previous research, which typically have described

the association of loss of a significant other due to death with negative outcomes (Johnson et al., 2017). An interpretation might regard the process during which the death of a significant other encourages greater family, peer, school, and/or community activation in relation to a child. As a result, a child may receive additional support and attention and such a situation may result in a positive adjustment and personal growth, making the utilization of the system of care less likely (Pachalla et al., 2020). This is consistent with our findings that a specific ACE—Death of somebody else you love—decreased the use of psychosocial care among adolescents.

Strengths and Limitations

The main strength is that our study involved adolescents from both the community and the system of care and covered a range of ACE. However, our study has some limitations too. A first limitation regards the cross-sectional design of this study; this makes it impossible to formulate conclusive statements about causality. A second limitation may regard our use of self-reported data for measuring ACE and SEP. However, the previous studies have shown the validity of self-reported measurement of ACE (Meinck et al., 2017; Lackova Rebicova et al., 2019, 2020) and SEP (Ekehammar et al., 1987; Adler et al., 2000).

Implications

Our study showed that the number of ACE is associated with the using of care among adolescents, with more ACE having a stronger association with use of psychosocial care, and that parent-related ACE increase the likelihood of being in and using the system of care among adolescents in particular. These results imply a need to help adolescents with cumulative ACE and with parent-related ACE by strengthening support in the form of external resources (extended family, community, and school). Moreover, to address above mentioned limitations of our study, we suggest to use in the future research a longitudinal follow-up design and the triangulation of data sources with data from parents, teachers or care providers being collected and analyzed.

Conclusion

Accumulation of ACE above a certain threshold (three or more) and specific, parent-related, ACE increase the likelihood of adolescent using the system of care. Special attention should be given to those adolescents, as they could be considered as an at-risk population.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

All procedures performed in the study were in accordance with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. The study was approved by the Ethics Committee of the Medical Faculty at the PJ Safarik University in Kosice (protocol 16/2017). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

MR participated in the design of the study and coordination, drafted the manuscript, analyses, and interpretation of the data. ZV participated in the design and coordination of the study and interpretation of the data, helped to draft the manuscript, and provided supervision. SR, AG, DJ, and JD participated in the interpretation of the data, contributed with their comments to the final version, and provided supervision. All authors contributed to the article and approved the submitted version.

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Single-Item Happiness Measure Features Adequate Validity Among Adolescents

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Background: Happiness is becoming increasingly relevant in recent research, including adolescents. Many studies are using the single-item measure for adolescent happiness, however, its validity is not well known. We aimed to examine the validity of this measure among adolescents in three countries from distinct European regions – Eastern (Lithuania), Southern (Portugal), and Western (Scotland).

Materials and Methods: The analysis included data from Health Behaviour in School-aged Children (HBSC) study from three countries and three last surveys (2009/10, 2013/14, and 2017/18). The total sample comprised 47,439 schoolchildren. For validity, the indicators reflecting subjective health, life satisfaction, quality of life, well-being, social support, health complaints, bullying, and self-directed violence were assessed. The calculations were conducted in the total sample and by gender, age, survey year, and country.

Results: The different indicators of concurrent and convergent validity revealed consistent correlations with happiness, with better well-being, health, and subjective perceptions being related to higher happiness. Meanwhile, health complaints, bullying behaviors, and self-directed violence were related to lower happiness. The subgroup differences were consistent across gender, age groups, countries, and survey rounds. The extent of differences was more expressed among girls.

Conclusion: The single item for adolescent happiness measurement features a consistent pattern of validity concerning indicators of concurrent and convergent validity. Higher self-reported happiness is associated with better mental and physical health and well-being, and less expressed negative factors (complaints, bullying, and self-directed violence). In addition, among girls the correlations tend to be stronger than boys.

Keywords: happiness, validity, well-being, health complaints, bullying, violence, social support

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INTRODUCTION

Adolescence is a time when young people face many challenges relating to their biological and psychological changes. It is the period from ages 10 to 19 years which is specific stage of human development laying the foundations of good health [World Health Organization [WHO], 2022]. Positive youth development could offer young people a way to acquire and strengthen resources to

enable them to grow and flourish throughout life (Park, 2004). There has been an increase in the number of studies looking at positive psychology, but most happiness studies have been conducted in adults (Işik and Üzbe Atalay, 2019), even though happiness is associated with positive health and healthier development during adolescence (Steptoe, 2019).

Happiness is generally defined as a mental or emotional state of well-being, characterized by positive or pleasant emotions ranging from contentment to intense joy (Sundriyal and Kumar, 2014). According to Veenhoven (2010), happiness may also be defined as the appreciation of one's life as a whole, involving both a cognitive and emotional evaluation of life (Veenhoven, 2008; Lucas and Diener, 2009).

The most widely used and easiest measure of adolescent happiness is a single item asking the adolescents to rate how happy they are. However, information about the validity of this question among adolescents is still scarce. A recent systematic review on adolescent happiness (Lukoševičiūtė et al., 2022) found that almost half of the studies have evaluated happiness using single-item measures. When young people were asked to define happiness, they mentioned not having negative thoughts or feelings, and experiencing positive feelings (Işik and Üzbe Atalay, 2019). Adolescents described a happy person as someone helpful, cheerful, optimistic, and expresses his or her positive feelings, and includes behavior such as helping others, laughing, having fun, and making people happy. Happiness also meant spending time with family and friends. Several studies have shown that academic success, satisfaction of needs, more leisure time, and having future plans are also important to what adolescents perceive to make someone happy (Işik and Üzbe Atalay, 2019).

According to the literature, different factors are linked with adolescent happiness, including subjective well-being and health, social support, experience of bullying, and self-directed violence. A growing body of research consistently demonstrates a close connection between health and happiness (Veenhoven, 2008; Diener and Chan, 2011; Ngamaba et al., 2017; Steptoe, 2019). Theories suggest that this relationship is bi-directional. Good health is an important predictor of happiness, and greater happiness is associated with good health through behavioral and biological processes (Steptoe, 2019). The robust health-happiness association has been shown in cross-national samples of adolescents. For instance, Van de Wetering et al. (2010) found that Dutch adolescents who reported better health were more likely to report greater happiness. Among Brazilian adolescents, Câmara and Strelhow (2019) also found that a higher level of current happiness was a significant predictor of better self-perceived health. Esteban-Gonzalo et al. (2020) similarly reported an association between higher levels of happiness and better self-rated health in Spanish adolescent girls and boys.

Lower subjective happiness further correlates with a range of physical and mental health symptoms in adolescents. A study among Spanish adolescents found that a lower level of happiness correlated with more physical and mental health complaints, including symptoms of somatization, depression, and anxiety (Garaigordobil, 2015). Freire and Ferreira (2020) found that depressive symptoms were negatively associated with happiness, while Shen et al. (2018) revealed that lower happiness was related to sleep problems in Australian adolescents. In sum, the studies with adolescents point to a consistent positive association between happiness and various measures of physical and mental health.

Additionally, social support is considered an important aspect of overall health and well-being. Adolescents receive social support from different groups (parents, wider family members, teachers, friends, and classmates), and they may influence adolescents in different ways (Tomás et al., 2020). Social support serves as a buffer for adolescents in stressful life events, with the perception of social support, rather than the actual support received, serving as a better predictor of a person's ability to cope (Alshammari et al., 2021).

Ryan and Deci (2000) argue that close relationships with other people are a basic psychological need, with other researchers further stating that positive social relationships are a prerequisite for happiness (Diener and Oishi, 2005). A number of studies demonstrate the association between positive social relationships and subjective well-being in young people (Uusitalo-Malmivaara and Lehto, 2013). For instance, positive family relationships predict higher happiness in both genders (Uusitalo-Malmivaara and Lehto, 2013). Likewise, friendships are seen in children as both a source of happiness and, in case of conflict, a source of unhappiness (Holder and Coleman, 2015).

In addition to the family, because adolescents spend a significant amount of time at school, the school environment can impact their well-being (O'Reilly et al., 2018). Teacher support is not only considered necessary for academic development but also may impact students' emotional outcomes (Lei et al., 2018), while better relationships with school staff are also associated with positive subjective well-being (Moore et al., 2018).

Adolescent happiness is also associated with experiencing less violence or conflict, such as quarreling and bullying (López-Pérez and Zuffianò, 2020). Uusitalo-Malmivaara and Lehto (2016) showed that bullying victims reported lower levels of well-being and happiness, with adolescents who experienced dual victimization (bullying and cyberbullying) reporting even more negative impact on their happiness and depression. Moreover, experiencing bullying and cyberbullying is negatively correlated with indicators of subjective well-being such as optimism, global and school-related happiness, and specific domains of life satisfaction (Navarro et al., 2015).

Finally, evidence suggests that adolescents reporting a lower level of happiness were at greater risk of deliberate self-harm (Lung et al., 2020). The latter includes any form of intentional self-injury, irrespective of motive or suicidal intent (Curtis et al., 2018). Self-harm is a relevant phenomenon among adolescents and includes various types of expressions of injury on the body (Remaschi et al., 2015). Low levels of happiness correlate with prolonged stress and mental health difficulties (Wersebe et al., 2018) which in turn are highly associated with self-directed violence among adolescents, including cases with suicidal intentions (Abi-Jaoude et al., 2020). Studies examining the relationship of distress and mental health problems to self-directed violence show that they are associated, although these studies rarely include happiness (Kidger et al., 2015; Curtis et al., 2018).

This review of the literature suggests that the perception of happiness among adolescents is a relevant construct when assessing their well-being and health-related behaviors and outcomes. Given the associations between happiness and other important aspects outlined above, measuring adolescent happiness may provide not just a measure of construct but also an important insight into the general well-being of young people. This information could be used to inform the impact and need for public health interventions and policies. A single-item measure of happiness could readily be added to surveys to help monitor and study adolescent happiness, but its validity among adolescents is unclear, including cross-national differences in the validity due to language interpretation, culture, age, and gender differences across adolescence. Using survey data from the international Health Behaviour in School-aged Children (HBSC) survey, we, therefore, aimed to examine the validity of a single-item happiness measure among adolescents in three countries from distinct European regions – Eastern (Lithuania), Southern (Portugal), and Western (Scotland) – using psychological, health, and social variables that are known to vary with happiness and explore possible gender, age, country, and temporal differences across surveys.

MATERIALS AND METHODS

Study Procedure

The Health Behavior in School-aged Children survey is a cross-sectional survey currently conducted in 50 countries across Europe and North America in collaboration with the World Health Organization. The data were collected using standardized protocols [2009/10 (Currie et al., 2010), 2013/14 (Currie et al., 2014), and 2017/18 (Inchley et al., 2018)] and provides nationally representative samples of 11-, 13-, and 15-year-old boys and girls for each participating country, using a cluster sampling method (with the school classes as the primary sampling unit) and ensuring representation by age, gender, and school type. For this study, we included data from Lithuania, Portugal, and Scotland as these participating countries had included the single-item measure of happiness in their surveys during different years and represent a culturally diverse sample of adolescents from different regions of Europe. We included data from the three most recent survey rounds (2009/10; 2013/14; 2017/18), which provide information on the relative stability of the happiness measure over time and increase the sample size as well as study power.

Each country applied for ethical approval of the study in their own country. In Lithuania and Scotland, data were collected through a school-based survey using paper-pencil questionnaires, while in Portugal data were collected using paper-pencil questionnaires in 2010 and electronic questionnaires in 2014 and 2018.

Participants

This analysis involved the study sample of 47,439 schoolchildren (mean age 13.7 ± 1.71 years). It was designed to be a representative sample of schoolchildren in Lithuania, Portugal, and Scotland. Detailed characteristics of the study sample by country and survey round are presented in **Table 1**.

Measures

Happiness was measured using a single item: "*In general, how do you feel about your life at present?. "* The responses ranged from *"I feel very happy"* to *"I am not happy at all"* and later reversed to make higher scores indicating higher level of happiness.

Self-rated health was measured with a single item asking, *"Would you say your health is. . .?"* with four response categories (*"excellent," "good," "fair," and "poor").* Later the scores were reversed to make higher scores indicating better health.

The Multiple Health Complaints scale asks about the frequency of eight common health symptoms in the past 6 months: headache, stomachache, backache, sleeping difficulties, feeling low, irritability or bad mood, feeling nervous, and dizziness. Higher scores indicated higher frequency of symptoms. All eight health complaints were also combined and coded into two groups of "two or more health complaints more than once a week" and "less than that" (Haugland and Wold, 2001).

Social support. We included perceived levels of social support that adolescents feel from four different people's groups:

- **Teacher support.** Three questions ask whether the adolescents feel accepted by their teachers, trust their teachers, and feel that their teachers cared about them. The items are based on the Teacher and Classmate Support scale (Torsheim et al., 2000). Responses are on a 5-point scale from 1 (*"strongly agree")* to 5 (*"strongly disagree").* The overall mean score was calculated as the mean score of items, with lower scores indicating a perception of higher support. Further the scores were reversed to make higher scores indicating higher level of teacher support.

- **Student support.** Three questions ask whether the adolescent enjoys being with other students, feels accepted by them, and if the students are kind and helpful. The items are based on the Teacher and Classmate Support scale (Torsheim et al., 2000). The five response options range from 1 (*"strongly agree")* to 5 (*"strongly disagree").* The reversed mean score was calculated with higher scores indicating a perception of higher support.

- **Friend support.** Four questions from the Multidimensional Scale of Perceived Social Support (MSPSS) ask about the support received from friends, including if their friends help them, are they able to rely on friends, and discuss problems. There are seven response options ranging from 1 (*"very strongly disagree")* to 7 (*"very strongly agree")* (Zimet et al., 1988). The responses were combined and a mean score was calculated, with higher scores indicating a perception of higher support.

- **Family support.** Family support was measured using the family aspects of MSPSS (Zimet et al., 1988). Adolescents were asked if they feel their family tries to help them, if they get emotional support from their family when needed,

TABLE 1 | Main characteristics of study sample size by country and survey round.

Gender and age	Country						Round					
	Lithuania		Portugal		Scotland		2009/10		2013/14		2017/18	
Boys 11–12 years	2,019	17.6%	2,735	15.7%	2,796	16.1%	2,697	15.6%	2,820	16.2%	2,033	17.6%
Boys 13–14 years	1,974	17.2%	3,181	18.3%	2,912	16.8%	2,812	16.3%	3,224	18.6%	2,031	17.5%
Boys 15–16 years	1,903	16.6%	2,373	13.7%	2,828	16.3%	3,053	17.7%	2,551	14.7%	1,500	13.0%
Girls 11–12 years	1,970	17.2%	2,904	16.7%	2,954	17.0%	2,706	15.7%	2,962	17.0%	2,160	18.7%
Girls 13–14 years	1,975	17.2%	3,342	19.2%	2,936	16.9%	2,806	16.2%	3,253	18.7%	2,194	19.0%
Girls 15–16 years	1,641	14.3%	2,832	16.3%	2,953	17.0%	3,200	18.5%	2,569	14.8%	1,657	14.3%
Total	11,482	100.0%	17,367	100.0%	17,379	100.0%	17,274	100.0%	17,379	100.0%	11,575	100.0%

if they can talk to their family about problems, and if their family helps them make decisions. The responses are scored on a 7-point Likert scale, ranging from 1 (*"very strongly disagree")* to 7 (*"very strongly agree")*. Higher mean scores indicate a stronger perception of social support.

Life satisfaction was measured using the Cantril ladder (Cantril, 1965). The top of the ladder (10) indicates *"the best possible life"* and the bottom (0) means *"the worst possible life."*

The Kidscreen-10 Index (Ravens-Sieberer, 2006) was used to evaluate **health-related quality of life**. It is unidimensional index with 10 items ranging from 1 (*"never"*) to 5 (*"always"*). The overall mean score of the 10 items was used in the analysis. Higher scores indicate better quality of life.

Schoolchildren's **well-being** was assessed using the *WHO-5 Well-being Index* (World Health Organization, 1998). Five statements ask about the frequency of positive feelings over the past 2 weeks with responses on a scale from 0 (*"at no time"*) to 5 (*"all the time"*). The overall mean score was used in this analysis with higher scores indicating higher level of well-being.

Bullying and cyberbullying included both victims and perpetrators of bullying or cyberbullying. Reports of being bullied at least 2 or 3 times a month in the past 2 months were considered to be chronic victims and perpetrators of bullying or cyberbullying (Harel-Fisch et al., 2011; Johnston et al., 2015). Higher scores indicate more frequent bullying.

Self-directed violence included suicidal ideation (whether the children have considered, planned, or attempted suicide) and self-harming behavior in the last 12 months. These variables had responses *"yes"* or *"no."*

The sociodemographic **indicators** included in this study were age, gender, country, and year of data collection.

The internal consistency of the scales was analyzed by gender and age group using Cronbach's alpha. The calculations showed consistent results by age and gender; differences between these groups were mainly below 0.02 and at most 0.06. In contrast, the consistency by country and survey year revealed larger variation, although in the majority of cases the alphas were high or very high (**Table 2**).

Statistical Analysis

The data were analyzed using IBM SPSS Statistics, version 27 (IBM Corp, 2020). The descriptive analysis included the calculation of the means with standard deviations (±SD) and percentages of health behaviors and perceptions. The items were dichotomized based on the cut-offs used in the international HBSC study protocols and outlined in the "Measures" subsection.

The validity of the happiness item was examined in relation to other indicators as criterion concurrent validity (life satisfaction, health-related quality of life, well-being, and social support measures) and construct convergent validity (subjective health, physical and psychological complaints, bullying, and self-directed violence). The indicators for validity were chosen based on the previous literature on happiness. The associations were calculated using a Spearman's rank correlation (rho) for ordinal indicators and point-biserial correlation (rpb) for dichotomous indicators of suicidal ideation. The strength of associations was expressed by looking at differences between happy and unhappy adolescents. To assess the consistency of associations, the calculations were conducted not only for the whole sample but also by gender, age, survey year, and country.

The statistical significance level was set at $p < 0.05$.

RESULTS

Descriptive Statistics

In the overall sample, the majority of adolescents (87.1%) reported feeling happy (quite happy or very happy) (**Figure 1**). Lower levels of happiness were observed amongst girls and older adolescents, in Portugal, and the most recent survey round of 2017/18.

The descriptive analysis of indicators used for validity revealed some differences by country and survey round (**Table 3**). However, none of the countries or survey years were associated with consistently better or worse outcomes. This suggests a good basis for comparability of validation measures across countries and survey years. Note that some of the variables were not collected in every country at every round, though the majority were collected in all three countries in all years. The cyberbullying measure was introduced in 2013/14 and the well-being measure – in 2017/18.

Concurrent Validity

Concurrent validity was assessed using indicators of previously validated life satisfaction, well-being, and social support measures

TABLE 2 | Internal consistency of the scales by country and survey round.

Variable	Country			Round		
	Lithuania	Portugal	Scotland	2009/10	2013/14	2017/18
Kidscreen-10 Index	n.a.	0.74	0.83	0.80	0.60	0.83
WHO-5 Index	n.a.	n.a.	0.86	n.a.	n.a.	0.86
Family support	n.a.	0.90	0.95	0.92	0.89	0.96
Teacher support	0.84	0.84	0.87	0.86	0.85	0.86
Student support	0.79	0.75	0.78	0.76	0.80	0.77
Friend support	0.92	0.93	0.95	0.92	0.93	0.94

n.a., not available.

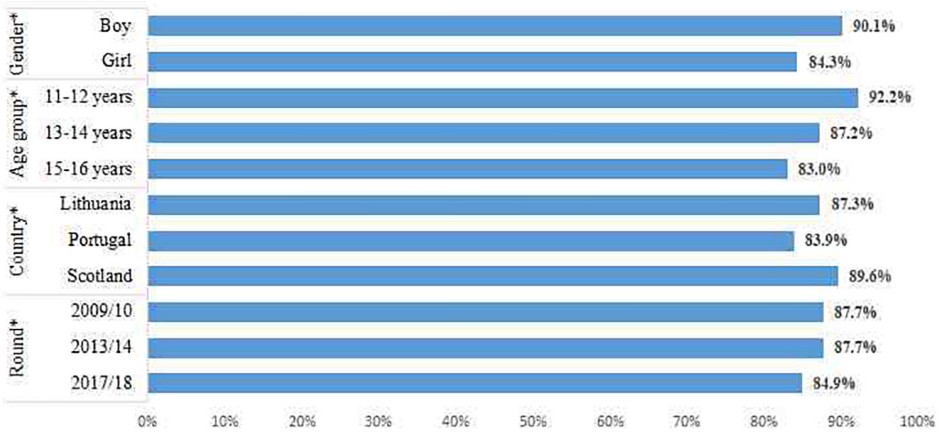

FIGURE 1 | Prevalence of happy adolescents by gender, age group, country, and survey round.

(**Table 4**). In total sample, happiness most strongly correlated with well-being (rho = 0.62), life satisfaction (rho = 0.56), and quality of life (rho = 0.42). Likewise, the different social support also significantly correlated with happiness but to smaller extent. The subgroup analysis demonstrated that correlations were consistent and similar across gender, age groups, countries, and survey rounds. The differences in correlations varied a little, with slightly stronger correlations observed among girls and adolescents from Scotland. All observed correlations were highly significant (rho < 0.001).

Convergent Validity

Convergent validity of the happiness item was assessed using measures of self-reported health, health complaints, bullying behaviors and perceptions, and self-directed violence (**Table 5**). Overall, the correlations tended to be in general lower than in case of concurrent validity indicators. In total sample, it most strongly correlated with total amount of frequent symptoms (rho = −0.34), especially with feeling low (rho = −0.40), irritability or bad temper (rho = −0.31), and feeling nervous (rho = −0.31). The close-to-moderate correlations were also observed with general perception of health (rho = 0.31), slightly lower – with suicidal and self-harming indicators, especially considering suicide (rpb = −0.26). Other indicators, including somatic symptoms and bullying behaviors and perceptions, were weakly though significantly correlated with happiness of adolescents.

Similarly like in case of concurrent validity indicators, the convergent validity measures correlated stronger with happiness among girls and Scotland's adolescents. No consistent pattern was observed based on schoolchildren's age group and survey year.

DISCUSSION

Adolescent happiness is an important construct that relates to a range of positive health and behavioral outcomes and the overall well-being of young people. We aimed to assess the validity of a single-item happiness measure, overall and across gender, age groups, survey years, and countries, using a range of behavioral, physical, psychological, and social factors shown to be relevant to happiness. Our findings showed that all the selected measures were consistently associated with the single-item measure of happiness. This was observed with convergent and concurrent validity measures. The results indicate that a single-item happiness measure is a valid tool for population-based adolescent studies, yielding comparable results across gender, age, countries, and time. We discuss the findings from a perspective of the related constructs.

Adolescent self-reported happiness was strongly associated with measures of both mental and physical health, providing

TABLE 3 | Description of validity indicators by country and survey round.

Variable	Round			Country		
	2009/10	2013/14	2017/18	Lithuania	Portugal	Scotland
Life satisfaction (lowest = 0, highest = 10)	7.5 ± 1.92	7.7 ± 1.93	7.7 ± 1.85	7.7 ± 2.03	7.5 ± 1.87	7.7 ± 1.86
Quality of life (lowest = 10, highest = 50)	38.4 ± 6.25	33.6 ± 5.35	36.7 ± 7.52	n.a.	36.2 ± 6.60	37.0 ± 6.49
Well-being (lowest = 1, highest = 6)	n.a.	n.a.	3.9 ± 1.14	n.a.	n.a.	3.9 ± 1.14
Family support (lowest = 1, highest = 7)	5.8 ± 1.41	5.6 ± 1.63	5.7 ± 1.81	n.a.	5.9 ± 1.52	5.4 ± 1.85
Teacher support (lowest = 1, highest = 5)	3.7 ± 0.87	3.8 ± 0.91	3.8 ± 0.87	3.8 ± 0.89	3.8 ± 0.85	3.8 ± 0.92
Student support (lowest = 1, highest = 5)	3.9 ± 0.80	3.8 ± 0.84	3.8 ± 0.80	3.7 ± 0.89	4.0 ± 0.76	3.7 ± 0.78
Friend support (lowest = 1, highest = 7)	5.9 ± 1.39	5.4 ± 1.73	5.3 ± 1.82	5.4 ± 1.79	5.6 ± 1.61	5.2 ± 1.83
Health (excellent or good)	83.3%	85.8%	85.5%	86.5%	87.2%	81.2%
Health complaints (not more than 1 from 8 once a week)	70.5%	71.9%	66.9%	66.5%	73.2%	69.3%
Headache (less than once a week)	83.4%	84.4%	85.9%	81.3%	86.3%	84.5%
Stomachache (less than once a week)	90.5%	90.9%	93.4%	87.4%	94.4%	91.0%
Backache (less than once a week)	88.3%	88.8%	86.2%	88.3%	85.4%	90.4%
Feeling low (less than once a week)	84.2%	84.4%	81.3%	80.3%	85.1%	84.0%
Irritable (less than once a week)	78.8%	79.7%	76.2%	75.9%	81.7%	76.9%
Nervous (less than once a week)	81.3%	79.6%	74.9%	77.1%	78.8%	80.5%
Sleep difficulty (less than once a week)	80.0%	81.5%	75.7%	81.5%	82.6%	74.9%
Dizzy (less than once a week)	90.3%	90.0%	90.5%	88.0%	93.5%	88.4%
Bullied others (less than once or twice)	85.6%	60.6%	97.6%	77.9%	65.2%	94.6%
Been bullied (less than once or twice)	86.6%	82.8%	90.3%	72.3%	92.1%	89.5%
Cyberbullied others (less than once or twice)	91.7%	86.4%	98.4%	n.a.	92.6%	98.5%
Been cyberbullied (less than once or twice)	n.a.	94.5%	96.6%	n.a.	96.2%	95.4%
Considered suicide (no)	83.9%	76.1%	n.a.	78.8%	n.a.	n.a.
Planned suicide (no)	90.5%	86.2%	n.a.	87.7%	n.a.	n.a.
Attempted suicide (no)	92.9%	86.8%	n.a.	89.0%	n.a.	n.a.
Self-harm (no)	84.4%	79.7%	80.4%	n.a.	81.4%	n.a.

n.a., not available.

evidence for the validity of the single happiness item. In line with previous work, we observed marked differences between those who reported being happy and unhappy in self-rated health (Van de Wetering et al., 2010; Câmara and Strelhow, 2019; Esteban-Gonzalo et al., 2020), physical health complaints (Garaigordobil, 2015; Shen et al., 2018), and psychological health complaints (Freire and Ferreira, 2020). In addition, our results show that the total number of health complaints also correlated with happiness. Overall, self-reported happiness correlated most strongly with psychological health complaints, especially feeling low. This is unsurprising given the close inverse relationship between happiness and poor mental health. Although theoretically distinct concepts, unhappiness may be interpreted as a symptom of poor mental health and vice versa. Moreover, mood states at the time of the survey, such as feeling low, may negatively influence the report of overall happiness. Across all health measures, the associations with happiness were stronger among girls than boys, indicating that girls' assessment of happiness may be more influenced by their physical and mental health than among boys.

This study supports previous theories and evidence that social support is associated with happiness and that support from different sources is related to adolescent happiness. Whilst it is beyond the scope of this manuscript to compare the relative importance of each form of social support, we see there is particular importance on family support compared with friend support, especially amongst girls. This reflects previous research which indicates that family support impacts more on girls' happiness (Uusitalo-Malmivaara and Lehto, 2013). Contrary to some of the literature (Holder and Coleman, 2015), we do not see the importance of family relations decreasing with age.

Within this study, it was not possible to establish the direction of association between happiness and social support – so, this is likely to be bi-directional. Young persons who are unhappy may perceive their relationships in a more negative way (Natvig et al., 2003). In addition, not having supportive relationships may be a source of unhappiness and unhappy people may struggle to establish good relationships due to their maladjusted behavior (Uusitalo-Malmivaara and Lehto, 2013). It may also be argued that social support is indirectly associated with happiness. For example, it is through social support that young people develop important attributes such as self-concept, self-efficacy, self-esteem, and school engagement which themselves may bring about greater happiness (Ikiz and Savi, 2010; Holder and Coleman, 2015; Tomás et al., 2020).

Social contacts at school play an important part in adolescents' lives. There may therefore be merit in teaching young people the skills to establish and maintain good social relationships in

TABLE 4 | Concurrent validity of happiness in relation to life satisfaction, well-being, and social support: Spearman's correlation.

Variable	Total sample*	Gender*		Age group*			Round*			Country*		
		Boys	Girls	11–12 years	13–14 years	15–16 years	2009/10	2013/14	2017/18	Lithuania	Portugal	Scotland
Life satisfaction (min = 0, max = 10)	0.56	0.52	0.60	0.53	0.54	0.56	0.54	0.59	0.57	0.59	0.48	0.61
Quality of life (min = 10, max = 50)	0.42	0.36	0.47	0.34	0.37	0.45	0.45	0.37	0.49	n.a.	0.33	0.58
Well-being (min = 1, max = 6)	0.62	0.58	0.65	0.53	0.64	0.60	n.a.	n.a.	0.62	n.a.	n.a.	0.62
Family support (min = 1, max = 7)	0.32	0.28	0.37	0.28	0.33	0.31	0.34	0.35	0.30	n.a.	0.34	0.34
Teacher support (min = 1, max = 5)	0.31	0.28	0.34	0.27	0.27	0.25	0.28	0.30	0.36	0.32	0.29	0.32
Classmate support (min = 1, max = 5)	0.28	0.27	0.28	0.31	0.26	0.22	0.24	0.30	0.32	0.29	0.24	0.37
Friend support (min = 1, max = 7)	0.18	0.20	0.21	0.20	0.19	0.16	0.20	0.19	0.18	0.17	0.21	0.20

*n.a., not available, *all $p < 0.001$.*

the school environment (Natvig et al., 2003; Tomás et al., 2020) with schools being not only places of learning but also a social institution where adolescents develop their social functioning (Bond et al., 2004). Moreover, for young people from less supportive families, fostering stronger social relationships, and support outside of home may be a way to improve happiness (Uusitalo-Malmivaara and Lehto, 2013).

Concerning bullying behaviors (victimization and perpetration), we found that being a victim was more slightly stronger related to happiness than being a bully, with a greater effect through face-to-face bullying than cyberbullying. Several authors (Navarro et al., 2015; Fullchange and Furlong, 2016; Uusitalo-Malmivaara and Lehto, 2016) concluded that the impact of bullying and cyberbullying on adolescents is far-reaching and can have medium- and long-term consequences for young people's development. Kwan et al. (2020) argue that bullying and cyberbullying can be a consequence or a source of mental health problems and unhappiness in children and adolescents. This aspect is even more significant when the same adolescent is both victim and perpetrator. Nonetheless, in our study the correlation between bullying and happiness was relatively low.

Our study demonstrated that happiness among adolescents correlates negatively with self-directed violence. This reflects results found in other studies that examined the associations between subjective happiness and self-directed violence: a recent study in Taiwan found that adolescents perceiving a lower level of happiness are at higher risk of deliberate self-harm (Lung et al., 2020). Several studies about suicidal ideation also showed that youth with suicidal ideation reported lower levels of subjective happiness than those without suicidal ideation (Choi et al., 2014; Kim, 2017; Shin and Lee, 2020).

Limitations

We should acknowledge that our study also had some limitations. While our study investigated the validity of single-item happiness measure, we did not assess its reliability in a test-retest manner. Nonetheless, we consider our study to be of high scientific and practical value, as it included a large sample, a decade frame of measurements, and a relatively diverse sample from three culturally different countries Europe amongst a population from early to mid-adolescence. On the other hand, we compared the cross-national validity of the happiness item across three European countries, so the results may not be generalizable to other countries or cultures (moreover, some indicators in some countries were not available in some survey rounds). Also, since suicidal and self-harm indicators were less systematically collected across the analyzed countries, the differences between survey rounds should be interpreted with caution.

CONCLUSION

The single item for adolescent happiness measurement features a consistent pattern of validity in relation to indicators of concurrent and convergent validity. Specifically, higher self-reported happiness is associated with better mental and physical

TABLE 5 | Convergent validity of happiness in relation to subjective health, health complaints, bullying behaviors and perceptions, and self-directed violence: Spearman's correlation.

Variable	Total sample*	Gender*		Age group*			Round*			Countries*		
		Boys	Girls	11–12 years	13–14 years	15–16 years	2009/10	2013/14	2017/18	Lithuania	Portugal	Scotland
Health	0.31	0.27	0.32	0.28	0.30	0.27	0.26	0.35	0.31	0.34	0.31	0.34
Total frequent symptoms	−0.34	−0.25	−0.39	−0.28	−0.34	−0.34	−0.29	−0.34	−0.42	−0.29	−0.30	−0.41
Headache	−0.21	−0.14	−0.25	−0.16	−0.21	−0.20	−0.18	−0.23	−0.25	−0.19	−0.22	−0.26
Stomach ache	−0.17	−0.12	−0.18	−0.14	−0.17	−0.15	−0.14	−0.19	−0.17	−0.17	−0.16	−0.23
Back ache	−0.20	−0.16	−0.22	−0.16	−0.17	−0.16	−0.17	−0.22	−0.21	−0.15	−0.19	−0.22
Feeling low	−0.40	−0.31	−0.46	−0.30	−0.40	−0.43	−0.35	−0.40	−0.47	−0.33	−0.40	−0.46
Irritability or bad temper	−0.31	−0.25	−0.36	−0.25	−0.30	−0.31	−0.27	−0.33	−0.37	−0.31	−0.31	−0.35
Feeling nervous	−0.31	−0.25	−0.34	−0.25	−0.30	−0.32	−0.28	−0.34	−0.33	−0.31	−0.28	−0.34
Difficulties in sleeping	−0.25	−0.20	−0.27	−0.21	−0.26	−0.24	−0.20	−0.27	−0.28	−0.22	−0.23	−0.32
Feeling dizzy	−0.19	−0.14	−0.22	−0.15	−0.21	−0.17	−0.14	−0.21	−0.23	−0.19	−0.17	−0.26
Bullying others	−0.10	−0.12	−0.10	−0.14	−0.11	−0.08	−0.18	−0.05	−0.08	−0.11	−0.07	−0.12
Been bullied past months	−0.16	−0.17	−0.17	−0.21	−0.20	−0.14	−0.16	−0.17	−0.16	−0.20	−0.08	−0.18
Cyber bullied others	−0.11	−0.11	−0.13	−0.12	−0.13	−0.10	−0.10	−0.17	−0.10	n.a.	−0.10	−0.12
Been cyber bullied	−0.13	−0.10	−0.14	−0.11	−0.13	−0.15	n.a.	−0.09	−0.15	n.a.	−0.11	−0.18
Considered suicide **	−0.26	−0.16	−0.33	n.a.	−0.28	−0.27	−0.25	−0.29	n.a.	−0.26	n.a.	n.a.
Planned suicide **	−0.19	−0.10	−0.26	n.a.	−0.22	−0.18	−0.15	−0.22	n.a.	−0.19	n.a.	n.a.
Attempted suicide **	−0.17	−0.10	−0.24	n.a.	−0.21	−0.17	−0.12	−0.21	n.a.	−0.17	n.a.	n.a.
Self−harm behaviour **	−0.22	−0.13	−0.28	n.a.	−0.22	−0.23	−0.17	−0.26	−0.22	n.a.	−0.22	n.a.

*n.a., not available, *all $p < 0.001$, **point-biserial correlation.*

health and well-being. Stronger sense of happiness correlates with higher self-rated health, quality of life, and social support as well as lower levels of physical and psychological complaints, bullying, and self-directed violence. In addition, these correlations among girls were slightly stronger than boys.

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 institutional ethics bodies in Lithuania (Kaunas Regional Biomedical Research Ethics Committee), Portugal (Health Ethics Committee of the Centro Hospitalar de São João), and Scotland (University of St Andrews' University and Teaching Research Ethics Committee). In Lithuania written informed consent to participate in this study was provided by the participants of the study and their parents or legal guardians. In Portugal and Scotland, written informed consent from the participants and legal guardian was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

JL and KŠ framed the overall concept of study, conducted the analyses, and had overall input to all parts of the manuscript. GG, JM, TG, and RJ-L had main inputs in introduction and discussion, but also essentially revised all other parts of manuscript. All authors contributed to the article and approved the submitted version.

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Prevalence and Associated Family Factors of Sibling Bullying Among Chinese Children and Adolescents

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Sibling bullying is the most common form of aggression within family worldwide, while the prevalence and correlations of sibling bullying is little known in China. The current research focused on the association between family factors and sibling bullying among Chinese adolescents, and explore sex differences in sibling bullying in the context of Chinese culture. A cross-sectional study was conducted to explore the characteristics of sibling bullying by sampling 6302 children and adolescents who had at least 1 sibling living in the household. Of the participants, 1827 (29.0%) were involved in sibling bullying over the past half year, and pure victims, pure bullies, and bully-victims were 486 (7.7%), 510 (8.1%), and 831 (13.2%), respectively. Family factors of sibling bullying were partly different between boys and girls. Parental absence of both father and mother was a risk factor of being a pure bully and a bully-victim for boys, and of being a pure victim for girls. Parental son preference increased the odds of being a pure victim and a bully-victim for boys, and of being all roles of sibling bullying involvement for girls. Besides, parent–parent violence, parent–child violence, and living with a single parent were risk factors of sibling bullying. The results underline the importance of home environment on sibling relationship, and intervention of sibling bullying should include improving family climate.

Keywords: sibling bullying, family environment, Chinese, children and adolescents, family factors

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INTRODUCTION

Sibling bullying refers to any unwanted aggressive behavior by a sibling, which is featured by an observed or perceived power imbalance and repetitiveness (Wolke and Samara, 2010; Wolke et al., 2015). Sibling bullying is a common incident in childhood and adolescence within households worldwide (Khan and Cooke, 2013; Yu et al., 2017). According to a systematic study, nearly 50% of children are involved in sibling bullying every month, and 16–20% experience sibling bullying several times a week (Menesini et al., 2011; Wolke and Skew, 2012). Though sibling bullying is usually considered by parents or researchers as a normal or harmless phenomenon (Kettrey and Emery, 2006; Dale et al., 2014), there is ample evidence to support that sibling bullying can predict a number of internalizing and externalizing problems in childhood or early adulthood, which include depression, anxiety, self-harm behavior, and even suicide (Bowes et al., 2014; Jasmin and Anat, 2018; Foody et al., 2020). Sibling bullying was associated with clinical diagnosis of depression and suicidal ideation as well as suicidal self-harm (Dantchev et al., 2019; Sharpe et al., 2021).

However, compared with the volume of studies conducted in the western countries (Dantchev and Wolke, 2018; Dantchev et al., 2018), there are a paucity of studies with regard to aggressive behavior between siblings in the East (Yu et al., 2017), especially in China. Few is known about the characteristics of sibling bullying in this one of the most populous countries. With the one-child policy have been replaced by the two-child policy since 2011, there is an increasing number of families with two or multiple children in both rural and urban areas of China (Zeng and Hesketh, 2016). Therefore, it is necessary to understand the prevalence or factors relating to sibling bullying among Chinese population.

Family climate is the primary environment in where children interact with their sibling(s) (Wolke et al., 2015). According to family systems theory, family members are interdependent and can affect one another in a mutual and continuous way (Feinberg et al., 2012). Moreover, from a perspective of social learning theory, behavior learning of children can occur through direct experience or indirect observation of others' behavior (Goodman et al., 2015). Several existing studies have identified significant associations between sibling bullying and family environmental factors, which were generally categorized into three categories: family structure, socioeconomic factors, and parental behavior (Wolke et al., 2015). Family structural factors generally include family composition (Tucker et al., 2014a), number of siblings (Tippett and Wolke, 2015), sibling's gender (Menesini et al., 2011), age difference between siblings (Tucker et al., 2013), and birth order (Zeng and Hesketh, 2016). The resource control theory suggests that social group (for example, family systems) asymmetry may foster competitive behavior for social resources (Hawley, 1999), Siblings who are very asymmetrical in family structure, such as age, size, sex, birth order, abilities and so on, may provoke sibling conflict or sibling bullying in order to access to limited parental resources (e.g., affection, attention, and material goods) (Toseeb et al., 2020). For example, when a new sibling was born in the family, the first-born child may face the risk of losing some parental resources and then perpetrate sibling bullying in order to regain parental resources (Toseeb, 2021). Socioeconomic factors include family income (Eriksen and Jensen, 2009), parental education (Dantchev et al., 2018), and other characteristics that can represent socioeconomic status of household (Wolke et al., 2015). Research has shown that low-economic status was associated with sibling victimization, and economic hardship and a lack of financial resources were associated with greater physical aggression between siblings (Hardy, 2001). High socio-economic parents usually require more cooperative behavior among siblings, and they are particularly sensitive to sibling bullying and more likely to inhibit it effectively (Tucker et al., 2013). Parental behavior mainly include parental violence and parent–child violence (Button and Gealt, 2010; Radford et al., 2013). Studies have suggested that children may imitate the behavior patterns (e.g., aggression behavior) of their family members (Bandura, 1978), and children who witness or experience violence against parent or sibling (parent assault of a sibling) were at greater risk of becoming victims of sibling bully (Renner et al., 2020).

Apart from these family characteristics, there are other factors within household may also have effect on sibling bullying, such as parental absence and son preference, which root from the social and cultural background of the oriental countries. In China, there are over 61 million left-behind children, who have being left behind in home by one or both parents who migrate for economic reasons (Zhao et al., 2015; Chen and Ling, 2016). Previous studies had indicated that parental absence has strong links to psychological and behavioral problems of children (Zhao et al., 2014; Guo et al., 2015). Another potential factor that differs from the traditional context of the West is son preference. Chinese couples, particularly those in rural areas, still have historically a strong son preference, which refer to parents value sons more than daughters (Murphy et al., 2011). The different position of boys and girls within the family is reflected in such a Chinese traditional saying, "a son keeps incense at the ancestral alter burning" while "raising a daughter is like pouring water to other people's field" (Shi, 2009). Therefore, son preference generally plays a sizeable impact on parents' treatment of their offspring and often results in discriminatory behavior toward girls, which may motivate aggressive behavior between sons and daughters (Hesketh et al., 2011; Volk et al., 2012).

Current studies have shown that sex differences in sibling bullying with mixed results. Researchers have found that boys reported higher acceptability of sibling bullying as well as more likely to be involved in perpetrating sibling bullying than girls (Zhao et al., 2014), and girls have a higher rate being victims of sibling bullying (Button and Gealt, 2010). Some studies have also found no sex differences in sibling bullying (Wolke and Samara, 2010). Further work is needed to better understand this issue.

To the best of our knowledge, there is little research has assessed the association between sibling bullying and home environment based on Chinese population. What's more, there are several family characteristics that may be associated with sibling bullying have not been explored, including parental absence and son preference. Therefore, the current research focused on the association between family factors and sibling bullying by a cross-sectional approach among Chinese adolescents, and explore sex differences in sibling bullying in the context of Chinese culture.

MATERIALS AND METHODS

Procedure and Participants

This cross-sectional study was conducted from April to July, 2019. The participants were recruited from Hunan Province, China by a multi-stage cluster sampling. We used a geography-based stratified sampling frame which included three cities selected randomly from southern, central, and northern parts of the province, respectively. Three junior high schools and three senior high schools were selected randomly from each chosen city. Within each school, all the students of grade 7–12 were invited to the research.

The study received the approval from the Ethical Committee of Xiangya School of Public Health, Central South University.

Before the investigation in each school, a survey team was established, which included several teachers and two investigators. All members of these teams received training for research tool, study process, and quality control. Informed consent was obtained from the principal of each chosen school, the student who participated in the study, and their parents. In addition, the purpose of the study as well as the questionnaire sections were explained to all respondents by investigators. They were free to discontinue their participation at any time, and they were assured of the anonymity and confidentiality of the answers that they provided. The self-reported questionnaire averaged 30 min in length.

We sent out 8918 questionnaires to the students from 18 sampled schools, and recollected 8717 questionnaires without missing values, with a response rate of 97.7%. The current study focused on 6302 children and adolescents aged 9–18 who had at least 1 brother or sister in their family.

Measurements

Sibling Bullying

Sibling bullying was measured by using the Chinese version of Olweus Bully/Victim Questionnaire (OBVQ). First, sibling bulling victimization was assessed by asking that have you ever been bullied by siblings in the last 6 months using the following six items: (1) having been hit, kicked, pushed, or shoved; (2) having belongings been taken or damaged; (3) having been called nasty name; (4) having been made fun of; (5) having been kept out of things on purpose, excluded from the group or completely ignored; and (6) they told lies or spread rumor about you and/or tried to make others dislike you. Second, sibling bullying perpetration was measured by asking that have you ever bullied siblings over the past half a year using the six items as above. The frequency was coded on a 5-point scale ranging from 1 to 5 (1 = never happened, 2 = only once or twice, 3 = two or three times a month, 4 = about once a week, 5 = several times a week). Respondents were considered to be involved in sibling bullying victimization or perpetration if they chose 3, 4, or 5 for any items from OBVQ (Sharpe et al., 2021). The Chinese version of OBVQ showed good reliability according to the existing literature (Zhang and Wu, 1999). In this study, the internal consistency reliability (Cronbach' alpha coefficient) for victimization and perpetration of sibling bullying were 0.79 and 0.86, respectively.

For roles of sibling bullying involvement, a pure victim was defined as he/she was involved in victimization but not engaged in perpetration, a pure bully was classified as he/she perpetrated bullying behavior but not been bullied, a bully-victim was defined as he/she experienced both victimization and perpetration of bullying. Those who neither bullied siblings nor were bullied by siblings were classified as "non-involved" (Toseeb et al., 2018).

Potential Family Factors

In the current study, the family factors were classified into three aspects: structural factors, socioeconomic factors, and parental behavioral factors.

Structural factors included six variables: family composition, parental absence, number of siblings (1, 2, 3, or more), birth order (first, second, third, or other), sibling' gender, and age difference between siblings (1 = 0–4 years, 2 = over 4 years). Family composition was categorized into three groups: children living with (1) two parents, (2) single parent, and (3) other caregivers. According to the definition of left-behind children (Wang et al., 2014), parental absence was obtained by the question "Who had gone to a city for a job over the past 6 months in your family?" The answer had four options (1) none, (2) father, (3) mother, and (4) both. Socioeconomic factors included three variables: family location, parental education, and perceived family income. Family location had two options (urban, rural). Parental education for the parent with the most education, representing (1) primary school or less, (2) junior high school, (3) senior high school, and (4) college or more. The perceived family income was assessed by the question "How would you like to evaluate your family income within your region?" The answer was measured by 3 Likert scales ranging from 1 to 3 (1 = poor, 2 = medium, 3 = good). Parental behavioral factors included three variables: parental violence, parent–child violence, and son preference. Parental violence was measured by the question "How often your parents or other caregivers fight with each other in the last 6 months?" Parent–child violence was measured by the question "How often your parents or other caregivers hit or abused you in the last 6 months?" The frequency of two questions as above coded on a 5-point scale, ranging from 1 to 5 (1 = never happened, 2 = only once or twice, 3 = two or three times a month, 4 = about once a week, 5 = several times a week). If the respondent answered 3, 4, or 5, parental violence or parent–child violence was coded as 1, otherwise, it was coded 0. Son preference was measured by the question "How much do you think your parents or caregivers prefer sons to daughters?" The answer was measured by 5 Likert scales ranging from 1 to 5 (1 = not at all, 2 = a little bit, 3 = moderately, 4 = quite a bit, 5 = extremely). If the respondent answered 3, 4, or 5, Son preference was coded as 1, otherwise, it was coded 0.

Demographic factors of participants included gender, age, and grade (7–12).

Data Analysis

The characteristics of participants, prevalence of sibling bullying, and percentage of roles of sibling bullying involvement were summarized by descriptive statistics [n (%)]. Chi-square test was used to analyze difference in prevalence of sibling bullying as well as in percentage of roles of sibling bullying involvement between boys and girls. Multinomial logistic regression analysis was employed to explore the potential family factors of sibling bullying. For assessing underlying gender differences in son preference, two models were conducted for boys and girls separately after controlling demographic factors. Dependent variables of the two models were the roles of sibling bullying involvement, which included four categories: (0) non-involved group, (1) pure victim group, (2) pure bully group, and (3) bully-victim group. The associations between potential family factors and sibling bullying were reported by odd ratios and 95% confidence intervals [OR (95% CIs)]. The significance level was set at $p < 0.05$. All of the data analysis was conducted by SPSS 22.0.

RESULTS

The Characteristics of the Sample

Of 6302 children and adolescents in the study, 45.2% were boys and 54.8% were girls. The participants aged 9–12 (56.9%) were more than those aged 13–18 (43.1%), and the average age was 11.69 (SD 1.28).

In terms of family structure, most of children lived in families with two parents (90.1%). About 40% of the sample were identified as left-behind children, more specifically, 15.6% with father left, 4.4% with mother left, and 20.5% with parental absence of both father and mother. Up to one third of participants had only one brother or sister (75.8%). For family socioeconomic status, the sample was approximately evenly divided by family location. The parental education distribution was primary school or less (17.4%), junior high school (55.7%), senior high school (21.7%), and college or more (5.1%). Most of children believed that their family income ranked medium within their region (78.3%). In parental behavior, 11.8% of participants had witnessed domestic violence between parents and 4.3% had experienced parent–child violence over the past half year. Nearly 30% of children believed that their parents or caregivers had son preference (**Table 1**).

TABLE 1 | The characteristics of the sample.

Factors	*n*	%
Gender		
Boy	2846	45.2
Girl	3456	54.8
Age		
9–12	3585	56.9
13–18	2717	43.1
Family composition		
Two parents	5676	90.1
Single parent	265	4.2
Adopted or other	361	5.7
Parental absence		
Non	3749	59.5
Father	986	15.6
Mother	277	4.4
Both	1290	20.5
Sibling's gender		
Boy	3184	50.5
Girl	3118	49.5
Age difference		
0–4	2116	33.6
5 or more	4186	66.4
Number of siblings		
1	4779	75.8
2	1201	19.1
3 or more	322	5.1
Birth order		
First	2978	47.3
Second	2833	45.0
Third or other	491	7.8
Family location		
Urban	2985	47.4
Rural	3317	52.6
Parental education		
Primary school or less	1098	17.4
Junior high school	3513	55.7
Senior high school	1369	21.7
College or more	322	5.1
Perceived family income		
Poor	930	14.8
Medium	4935	78.3
Good	437	6.9
Parental violence		
No	5559	88.2
Yes	743	11.8
Parent–child violence		
No	6030	95.7
Yes	272	4.3
Son preference		
No	4460	70.8
Yes	1842	29.2
Total	6302	100.0

Prevalence and Percent of Roles of Sibling Bullying Involvement

Within the sample, 1827 (29.0%) involved in sibling bullying in the last half a year. Specifically, 1317 (20.9%) were bullied by their siblings, while 1314 (21.3%) perpetrated bullying behavior toward their siblings. Boys (22.2%) were higher than girls (19.8%) in prevalence of sibling bullying victimization.

With respect to roles of sibling bullying involvement, 486 (7.7%) of children reported being victims only, 510 (8.1%) reported being pure perpetrators, and 831 (13.2%) reported being both victims and bullies. Significant gender difference was only found among pure victims, and boys (8.5%) were higher than girls (7.1%) in percentage of pure victims (**Table 2**).

Family Factors Associated With Sibling Bullying

For boys, those living with a single parent were at greater risk of being a bullying (OR = 2.07, 95% CI 1.12–3.82) than those living with two parents. Being left behind by both father and mother was at greater risk of being a bully (OR = 1.69, 95% CI 1.18–2.42) and being a bully-victim (OR = 1.35, 95% CI 1.00–1.81). The male participants whose sibling was a brother had higher odds of being all three roles of sibling bullying involvement. Age difference between siblings was a protective factor for the three roles of sibling bullying involvement. Children born third or more were at greater risk of being a victim than those first-born (OR = 1.99, 95% CI 1.21–3.27). Children from medium-income families were at less risk of being a victims than those from poor-income families (OR = 0.64, 95% CI 0.45–0.89). Both parental violence and parent–child violence were risk factors of sibling bullying involvement. Those boys whose parents had son preference were more likely to be a victim (OR = 1.90, 95% CI 1.41–2.58) and a bully-victim (OR = 2.29, 95% CI 1.79–2.92) compared with those who were not involved in sibling bullying (**Table 3**).

For girls, those living with a single parent were at greater risk of being a victim (OR = 1.81, 95% CI 1.06–3.11) than those living

TABLE 2 | Prevalence and percent of roles of sibling bullying by gender.

	Total (*n* = 6302)		Boy (*n* = 2846)		Girl (*n* = 3456)		*P*-value
	n	%	*n*	%	*n*	%	
Prevalence							
Victimization	1317	20.9	631	22.2	686	19.8	0.024
Perpetration	1341	21.3	620	21.8	721	20.9	0.373
Roles of involvement							
Non-involved	4475	71.0	1985	69.7	2490	72.0	0.108
Pure victim	486	7.7	241	8.5	245	7.1	0.041
Pure bully	510	8.1	230	8.1	280	8.1	0.977
Bully-victim	831	13.2	390	13.7	441	12.8	0.271

with two parents. Those who were left behind by both father and mother had increased odds of being a victim (OR = 1.57, 95% CI 1.12–2.21). What's more, having a male sibling was significantly associated with being a victim (OR = 1.37, 95% CI 1.03–1.83). Age difference between siblings was a protective factor of being a bully-victim. Children born third or more were at greater risk of being a victim than those first-born (OR = 2.00, 95% CI 1.13–3.55). Those who live in rural areas were at greater risk of being victims than those who live in urban (OR = 1.33, 95% CI 1.04–1.70). Parental violence was risk factor of being a victim (OR = 1.68, 95% CI 1.16–2.43). Moreover, experiencing parent–child violence and son preference were risk factors of being a victim, a bully and a bully-victim of sibling bullying (**Table 4**).

DISCUSSION

This is the first study to investigate the prevalence of sibling bullying based on the sample of Chinese children and adolescents. Over a quarter of children and adolescents were involved in sibling bullying in the last 6 mouths, and most of them were bully-victims. The finding is consistent with the previous studies which suggested that being both a victim and perpetrator was the most frequent role of sibling bullying involvement (Wolke and Skew, 2012; Jasmin and Anat, 2018). The possible explanations could include: first, the change of roles in sibling bullying involvement might owing to a fluid power dynamic that siblings usually gain more resource than each other by their familiarity (Wolke et al., 2015). Moreover, due to it is hard for victims to escape from sibling bullying behavior, conversely, they may act aggressive behavior against their siblings to protect themselves in the way learning from sibling's perpetration.

This study found that boys were at greater risk of being pure victims in sibling bullying. There were no gender differences in pure bullies and bullying-victims. This is inconsistent with previous studies that boys were more likely to be bullies in the sibling bullying (Ersilia et al., 2011; Toseeb et al., 2020). This may be related to the different cultures. In the Chinese cultural context of collectivism and son preference, boys are more likely to be overprotected or coddled by their parent, which may inhibit boys' aggression at home. This requires further cross-cultural research.

TABLE 3 | Multinomial logistic regression of roles of sibling bullying among boys (*N* = 2846).

Factors	Pure victim	Pure bully	Bully-victim
Family composition			
Two parents	Ref	Ref	Ref
Single parent	0.52 (0.23, 1.15)	2.07 (1.12, 3.82)*	1.04 (0.58, 1.87)
Adopted or other	0.69 (0.31, 1.54)	1.02 (0.56, 1.86)	1.33 (0.82, 2.16)
Parental absence			
No	Ref	Ref	Ref
Father	0.87 (0.58, 1.31)	1.28 (0.86, 1.90)	1.23 (0.89, 1.69)
Mother	1.08 (0.55, 2.12)	1.82 (0.95, 3.48)	1.44 (0.83, 2.49)
Both	1.06 (0.74, 1.52)	1.69 (1.18, 2.42)**	1.35 (1.00, 1.81)*
Sibling's gender			
Girl	Ref	Ref	Ref
Boy	1.36 (1.03, 1.81)*	1.37 (1.03, 1.83)*	1.79 (1.41, 2.28)***
Age difference			
0–4	Ref	Ref	Ref
5 or more	0.66 (0.49, 0.88)**	0.62 (0.46, 0.84)**	0.39 (0.31, 0.49)***
Number of siblings			
1	Ref	Ref	Ref
2	1.01 (0.68, 1.49)	1.29 (0.89, 1.91)	0.99 (0.72, 1.36)
3 or more	1.12 (0.59, 2.13)	1.32 (0.69, 2.51)	1.48 (0.92, 2.37)
Birth order			
First	Ref	Ref	Ref
Second	1.33 (0.97, 1.84)	0.26 (0.19, 0.37)***	0.66 (0.51, 0.85)**
Third or other	1.99 (1.21, 3.27)**	0.26 (0.14, 0.49)***	1.29 (0.86, 1.92)
Family location			
Urban	Ref	Ref	Ref
Rural	0.99 (0.73, 1.35)	1.01 (0.73, 1.38)	1.31 (0.99, 1.71)
Parental education			
Primary school or less	Ref	Ref	Ref
Junior high school	0.79 (0.55, 1.14)	1.19 (0.76, 1.85)	1.01 (0.73, 1.40)
Senior high school	0.91 (0.59, 1.39)	1.37 (0.84, 2.25)	0.77 (0.52, 1.15)
College or more	1.06 (0.52, 2.14)	1.23 (0.60, 2.51)	0.63 (0.31, 1.27)
Perceived family income			
Poor	Ref	Ref	Ref
Medium	0.64 (0.45, 0.89)*	1.09 (0.72, 1.63)	1.01 (0.74, 1.38)
Good	0.82 (0.46, 1.45)	1.74 (0.99, 3.07)	0.91 (0.53, 1.56)
Parental violence			
No	Ref	Ref	Ref
Yes	2.27 (1.54, 3.34)***	1.70 (1.10, 2.63)*	1.67 (1.16, 2.41)**
Parent–child violence			
No	Ref	Ref	Ref
Yes	2.08 (1.21, 3.58)**	2.82 (1.65, 4.83)***	5.03 (3.36, 7.51)***
Son preference			
No	Ref	Ref	Ref
Yes	1.90 (1.41, 2.58)***	1.27 (0.91, 1.78)	2.29 (1.79, 2.92)***

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

According to the combination of family systems theory and social learning theory, family environment plays an important role in children's growth and development (Dantchev et al., 2018). In the study, family composition is a predictor of sibling bullying.

Consistent with previous research that age differences and birth order had the same effect on boys and girls (Tucker et al., 2013). But we were surprised to find that there are a lot of gender differences in the influence of family structure on sibling bullying.

TABLE 4 | Multinomial logistic regression of roles of sibling bullying among girls (*N* = 3456).

Factors	Pure victim	Pure bully	Bully-victim
Family composition			
Two parents	Ref	Ref	Ref
Single parent	1.81 (1.06, 3.11)*	1.14 (0.59, 2.20)	1.05 (0.62, 1.78)
Adopted or other	0.59 (0.30, 1.17)	1.16 (0.72, 1.87)	0.99 (0.64, 1.54)
Parental absence			
No	Ref	Ref	Ref
Father	1.06 (0.72, 1.58)	0.88 (0.60, 1.29)	1.04 (0.76, 1.42)
Mother	1.21 (0.64, 2.29)	1.21 (0.65, 2.25)	1.39 (0.85, 2.26)
Both	1.57 (1.12, 2.21)**	1.06 (0.76, 1.48)	1.27 (0.97, 1.66)
Sibling's gender			
Girl	Ref	Ref	Ref
Boy	1.37 (1.03, 1.83)*	1.30 (0.99, 1.70)	1.24 (0.99, 1.55)
Age difference			
0–4	Ref	Ref	Ref
5 or more	0.82 (0.61, 1.09)	0.99 (0.75, 1.31)	0.47 (0.38, 0.59)***
Number of siblings			
1	Ref	Ref	Ref
2	1.18 (0.85, 1.63)	1.74 (1.29, 2.33)***	1.25 (0.97, 1.60)
3 or more	1.04 (0.58, 1.90)	1.54 (0.90, 2.64)	1.51 (1.00, 2.26)
Birth order			
First	Ref	Ref	Ref
Second	1.13 (0.84, 1.50)	0.31 (0.23, 0.42)***	0.62 (0.49, 0.79)***
Third or other	2.00 (1.13, 3.55)*	0.37 (0.19, 0.71)**	1.05 (0.67, 1.65)
Family location			
Urban	Ref	Ref	Ref
Rural	1.19 (0.88, 1.61)	1.06 (0.80, 1.41)	1.33 (1.04, 1.70)*
Parental education			
Primary school or less	Ref	Ref	Ref
Junior high school	1.05 (0.73, 1.51)	0.95 (0.66, 1.36)	1.22 (0.90, 1.65)
Senior high school	1.00 (0.64, 1.58)	1.09 (0.72, 1.66)	1.20 (0.83, 0.73)
College or more	1.35 (0.66, 2.73)	1.19 (0.64, 2.22)	1.37 (0.76, 2.49)
Perceived family income			
Poor	Ref	Ref	Ref
Medium	0.73 (0.51, 1.03)	1.01 (0.70, 1.46)	0.85 (0.64, 1.13)
Good	0.61 (0.31, 1.20)	1.51 (0.88, 2.61)	0.89 (0.54, 1.48)
Parental violence			
No	Ref	Ref	Ref
Yes	1.68 (1.16, 2.43)**	1.01 (0.68, 1.51)	1.29 (0.93, 1.79)
Parent–child violence			
No	Ref	Ref	Ref
Yes	2.76 (1.15, 5.28)**	2.28 (1.10, 4.70)*	3.41 (2.00, 5.81)***
Son preference			
No	Ref	Ref	Ref
Yes	2.17 (1.66, 2.84)***	1.86 (1.44, 2.40)***	2.54 (2.05, 3.14)***

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

First of all, those children living with a single parent were at greater odds of being pure bullies for boys, and pure victims for girls. The finding is in contrast to the prior work, which reveal that living in a single-parent family or a stepfamily has no significant association with aggressive behavior between siblings (Wolke et al., 2015). The inconsistency could be interpreted from different family composition of participants between the West and China. Tucker et al. (2014b) found that over one fifth of children live with a single parent in western countries, while the percent is far more than that in China from the present study (4.2%).

The second, parental absence is a risk factor of sibling bullying, and being left behind by both father and mother is related to being pure bullies and bully-victims for boys and pure victims for girls. Existing studies have found that long-term parental absence is associated with poor well-being of children because of inadequate family bonding, emotional vulnerability, and exposure to violence (Givaudan and Pick, 2013; Amato and Anthony, 2014), and left-behind children are at greater risk of psychological abuse and neglect, mental health problems, and behavioral problems (Eriksen and Jensen, 2009; Button and Gealt, 2010). The finding of this study extends our understanding of adverse status of left-behind children. Therefore, it may be practical to reduce sibling bullying among left-behind children by giving sufficient care and supervision from their parents.

The third, children whose sibling was a brother had higher odds of being all three roles of sibling bullying involvement for boys, and pure victims for girls. Consistent with the previous studies that brother–brother sibling were more likely to experience multiple incidents (Tucker et al., 2013), and girls with a male siblings are at higher risk of being victims (Menesini et al., 2011). These sex differences may show that boys are more aggressive, competitive, and sensitive to each other's status, studies have shown more tensions between males (Zhang, 2020). While girls are raised to be easy-going and may be seen as a easy target of bullying in the family (Liu et al., 2021).

In our study, overall economic factors play a relatively small role in the impact of sibling bullying, but children living in economically disadvantaged families may indeed experience a greater risk of sibling bullying. Boys from poor-income families were at higher risk of being victims than those from medium-income families. Girls living in rural areas were at greater odds of being bully-victims than those living in urban. This is consistent with previous research that children from low-income families were more involved in sibling bullying (Bowes et al., 2014). Parents of low-income families were busy making a living and pay less attention to their children (Kochanova et al., 2022), which increases the likelihood of children being bullied by others or sibling due to the lack of parental supervision. Especially for girls in rural China, who have been taught from an early age to take responsibility for their families and be humble to their fellow family members, they are more likely to become victims of sibling bullying. Of course, they may also bully their sibling for limited parental resources.

Within three aspects of family environment, parental behavior have the most robust link to sibling bullying. Consistent with prior findings (Tucker et al., 2014a; Tippett and Wolke, 2015), both parent–parent violence and parent–child violence can predict greater risk of sibling bullying involvement, though girls were only at higher odds of being a pure victim compared with those girls who reported neither victimization nor perpetration. Conflict and aggression between parents as well as between a parent and a child could build a insecure climate within household (Zeng and Hesketh, 2016), which may lead to poor sibling relationship and even aggression between siblings (Piotrowski et al., 2021). This finding has a important implication

for intervention of sibling bullying, which is that anti-bullying programs at home should not only help to improve sibling relationship but also take account of building harmonious parent–parent and parent–child relationship at the same time.

Son preference is a risk factor of sibling bullying. Surprisingly, those boys whose parents overtly value sons more than daughters were at greater risk of being a pure victim but were not more likely to be a pure bully compared with those boys whose parents had no behavior of son preference. What's more, for girls, son preference increased odds of being all roles of sibling bullying involvement. The interesting finding may comes from two aspects. First, parental son preference would break the balance of sibling relationship and increase unequal interaction between boys and girls within household. Second, different parental treatment for sons and daughters may motivate those girls to perpetrate bullying behavior toward their brothers for obtaining sufficient resources and improving her status at home. Parents' preference for sons is common in countries in East Asia through South Asia, to the Middle East and North Africa. In China, son preference stems from deep-rooted Confucian values and patriarchal family systems (Das Gupta et al., 2003), which could lead to discrimination against girls and neglect of health care and nutrition (Guo et al., 2015). Besides, the present study provides a new insight into negative influence of son preference, and indicates the significant association between parental son preference and sibling bullying of children.

Despite the potential contributions to the knowledge of sibling bullying, there were several limitations of the study. First, the cross-sectional nature limits our study to draw causality between sibling bullying and risk family characteristics. Second, this is a exploratory study to examine the association between sibling bullying and son preference, and we have not comprehensively control the potential effect of sibling dyad. Future studies should exclude brother–brother and sister–sister sibling dyad and further explode whether there is gender difference in the association among the children who have only one opposite-sex sibling. Finally, the study was conducted in a limited geographical setting. The extent to which this sample represents is also unclear, because information of respondents was only collected from children and adolescents in Hunan Province, central China. Future studies can further increase the sample size and recruit a national representative sample from different regions of China.

CONCLUSION

In this study, we first explored family factors of sibling bullying in the context of eastern tradition and culture by using a large sample of Chinese children and adolescents. Our findings indicate that a number of people have experienced sibling bullying perpetration, sibling bullying victimization in this adolescent sample. Boys are at greater risk of becoming victims. The prevalence of sibling bullying indicates that bullying behavior between siblings has become an important public health issue with the implement of the two-child policy in China. Most important, the findings contribute new information about the association between sibling bullying and family environment, and we explore sex differences in sibling bullying in the context of Chinese culture. Furthermore, the study has practical implications for intervention of sibling bullying in China. Specifically, preventive efforts should be aimed at those children who live in the family with a single parent, parental absence of both father and mother, a male sibling, a sibling closing in age, parent–parent violence, parent–children violence, and son preference. This highlights the need for parents and health professionals to educate these children to learn to control behavior, and establish healthy and positive sibling relationships. At the same time, it is necessary to encourage their parents to eliminate son preference and construct a harmonious and positive family environment.

DATA AVAILABILITY STATEMENT

The original contributions presented in this 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 Ethical Committee of Xiangya School of Public Health, Central South University. Written informed consent to participate in the study was provided by the participants' legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

ZQ and XL: study the conception and design. ZQ: data collection and draft manuscript preparation. YM: analysis and interpretation of results. All authors reviewed the results and approved the final version of the manuscript.

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BRIEF RESEARCH REPORT
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Uptake of and Motivational Responses to Mental Health-Promoting Practices: Comparing Relaxation and Mindfulness Interventions

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Background: Comparative analyses of alternative interventions within the same trial enable acceptability and fidelity of each to be investigated more critically. In addition, whereas so far studies have focused on efficacy evaluations, more understanding is needed on motivational factors influencing the uptake of mental health-promoting practices rather than solely their effects.

Purpose: This study investigates whether the motivational responses to a mindfulness intervention are different from a relaxation intervention. We compare social cognitions outlined by the reasoned action approach and their roles in practice uptake, self-reported reasons for non-practice, and experienced benefits.

Methods: In a cluster-randomized trial (ISRCTN18642659; *N* = 3134), 12–15-year-old participants were given a 9-week intervention and followed up to 52 weeks. Main statistical analyses included *t*-tests, mixed ANOVAs, path models, and chi-square tests.

Results: Social cognitions in the mindfulness arm were slightly more positive immediately post-intervention, but recipients mostly responded similarly to the two interventions in the longer term. While attitudes, norms, intention, and self-efficacy were relatively high post-intervention, most of them slightly decreased by 26 weeks. Main reasons for non-practice in both arms included not finding the exercises helpful, no felt need, boringness of exercises and forgetting. The most common benefits experienced by practicing respondents were stress management and concentration ability. Better sleep was a more frequently reported benefit in the relaxation arm, but no other major differences emerged.

Conclusion: This study offers an example of comparing motivational responses to experimental and active control arm interventions, a potentially helpful approach in improving intervention adherence.

Keywords: reasoned action approach, behavior change, mental health, adolescents, intervention acceptability, mindfulness practice, relaxation practice

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INTRODUCTION

Interventions have attempted to promote mental health *via* several different practices, such as engaging in relaxation practices or practicing mindfulness. While intervention studies have examined effectiveness on mental health outcomes, evaluations rarely investigate social cognitive responses (e.g., attitudes, norms, and intention to practice) and the uptake of practice after the intervention, or their changes in the long-term. Moreover, evaluations of mental health-promoting interventions often fall short of making sense out of participant engagement due to an absence of a meaningful comparison arm. Usually control arms in such trials are passive, i.e., are not subjected to any other alternative, active treatment. Therefore, the levels of the resulting attitudes, motives, strength of motivation, etc., have no reasonable comparison point, a "benchmark," which would aid in making better sense of the results.

In order for health behavior interventions to have their intended effects, the intervention has to be well received by the participants: They need to be motivated to enact the skill taught in interventions later in their daily lives (Bellg et al., 2004). If this chain of implicit assumptions in RCTs does not occur, conclusions drawn from the trial may not be valid. Unfortunately, there is a dearth of research into receipt and enactment of health behavior change interventions (Rixon et al., 2016; Walton et al., 2017; Hankonen, 2020). This study has a unique opportunity to compare and contrast social cognitive responses to mental health promoting interventions and asks: Are the motivation base and cognitive response to mindfulness practices essentially different from relaxation practices, in a school-based intervention? Do motivational factors predict similarly both types of practice?

We study several motivational, social cognitive factors that could potentially explain practice behavior, based on the reasoned action approach (RAA). Motivation to practice, or motivational responses to interventions can be studied from the perspectives of (1) social cognitive determinants of motivation, e.g., the RAA constructs, and (2) perceived reasons for non-practice and benefits experienced. The RAA posits that attitudes, perceived norms, and perceived behavioral control/self-efficacy regarding the behavior predict intention to perform the behavior, which predicts performance of the behavior. In adolescent populations, a particularly strong link has been found between descriptive norms and behavior (McEachan et al., 2016). Attitudes toward the behavior, perceived norms, and perceived behavioral control have been found to be associated with intention to meditate (Lederer and Middlestadt, 2014; Beattie et al., 2019, 2020; Erbe et al., 2019). However, to date, there is still a dearth of empirical evidence, however, on what factors predict mindfulness and relaxation practice at home for adolescents in spite of low adherence (Zenner et al., 2014; Felver et al., 2016). Due to the lack of previous research, our research is exploratory, and we did not form hypotheses about what the differences would be. We may conjecture that there could be differences, e.g., mindfulness practice may be seen as more foreign, hippie, or religious or may be experienced as more difficult, even frustrating.

Secondly, motivation to practice can also be studied from the perspective of reasons for not practicing (e.g., barriers), and perceived benefits. As for reasons for not practicing, time constraints are one of the most frequently found reasons in previous research (Gryffin et al., 2014; Laurie and Blandford, 2016; Kerr et al., 2019; Toivonen et al., 2020). As for experienced benefits post-intervention, improvements in relationships and stress management have been reported in adult populations (Parra et al., 2019; Erbe et al., 2020). However, there are more that have not been studied, potentially specific to an adolescent student population (e.g., concentration when involved in school). Reasons for not practicing and benefits are conceptually similar to RAA constructs, but unlike the RAA constructs, they are explicitly stated as reasons for not practicing and benefits experienced from having practiced. In other words, participants themselves report them as preventing practice or resulting from practice (respectively); by contrast, RAA constructs are tested as being related to practice statistically.

The authors' previous work has found the RAA to be applicable to the prediction of mindfulness uptake in the same Healthy Learning Mind trial (Beattie et al., 2020). Here we extend the analyses to the relaxation arm and compare predictors of practice uptake in the same trial. This will help make sense out of the immediate evaluative, cognitive response of mental health-promoting interventions, which can be a sign of intervention acceptability and successful receipt (Rixon et al., 2016). In order to understand the specific, explicit barriers and benefits the participants perceive, the present study examines these in addition to the RAA.

We investigate, in a longitudinal follow-up of two active trial arms:

Social cognitive and behavioral responses and changes over time

Are there differences in social cognitions (outcome expectations, perceived norms, self-efficacy, and intentions) and practice between the arms and across time?

Does the RAA predict intention and behavior for both relaxation and mindfulness practice similarly?

Self-reported motives and gained benefits

What reasons do youth self-report for non-practice, what benefits do the youth report from practicing, and do the arms differ?

METHOD

Participants and Design

The cluster-randomized trial Healthy Learning Mind (ISRCTN18642659) evaluated comparative effectiveness of mindfulness, relaxation, and non-treatment arms on psychological outcomes in 56 schools and the primary evaluation has been published (Volanen et al., 2020). The current study analyzes data from the participants in the two active arms: mindfulness (n = 1,646; k = 94) and relaxation (n = 1,488; k = 85). Surveys were administered at baseline (0 weeks), 10, 26, and 52 weeks. For further details, see the study protocol (Volanen et al., 2016).

Interventions

Both interventions took place in weekly 45-min sessions in school for 9 weeks. In the experimental arm, participants were taught mindfulness techniques [based on the. b program (Kuyken et al., 2013)], e.g., breath counting, observing thoughts and bodily sensations, and awareness in everyday tasks. In the active control arm (i.e., relaxation), exercises included, e.g., progressive muscle relaxation, a breathing exercise, visualization, choose your emotion for the rest of the day and a short break for regaining energy (Volanen et al., 2016).

Measures

The measures are described in **Supplementary Table 1**. The social cognitive variables were constructed with guidance from Francis et al. (2004). Injunctive norms were measured by two items about friends' and parents' approval of practice, and descriptive norms by one item about friends' practice. Intention was measured with a single item about intention to practice in the following months. As for the practice measures, the follow-up surveys asked participants to report their use of short and long exercises during the past month and the past half year resulting in four items for each arm. The practice measures were similar for the two arms; the only differences were that the exercises were labeled as breathing or relaxation exercises and examples were given for the mindfulness arm. The surveys also provided six choices of reasons the participants could check for not practicing, and eight choices of benefits on a Likert scale.

Statistical Analyses

For the continuous variables, mean differences between the two arms were assessed using independent *t*-tests, and between time points with paired *t*-tests. Mean differences by group and time were assessed with Mixed ANOVAs. Holm–Bonferroni sequential correction was applied to correct for multiple comparisons. Differences between the trial arms in reasons for not practicing were analyzed using chi-square tests, Bayes factors (multinomial models with fixed rows since the number in each arm was fixed), and odds ratios.

The RAA path model was tested using a multi-group path analysis, adjusted for grade level. The measure of practice chosen for this analysis was practice of short exercises during the past half year because it had the lowest skewness and kurtosis scores (see **Supplementary Table 2**). Standard errors and confidence intervals were adjusted for clustering at the class level. A chi-square difference test was used to evaluate whether the RAA model paths varied across trial arms. More specifically, the chi-square statistic of the constrained model (the regression paths were forced to be similar between groups) was compared with that of the unconstrained model (the paths were allowed to vary freely) using the Satorra–Bentler scaled chi-square difference test. Full Information Maximum Likelihood estimator with robust standard errors was applied to handle missing data (the lowest covariance coverage between variables was 44% for mindfulness participants and 50% for relaxation participants) and to take into account deviations from normality and non-independence of observations.

TABLE 1 | Differences in social cognitive variables.

		Mindfulness							Relaxation							Mixed ANOVA	
							Paired *t*-test						Paired *t*-test		Independent *t*-Test			
Social cognitive variable	**Time**	**Mean**	**SD**	**MIN**	**MAX**	**Skewness**	**Kurtosis**	***p***	***d*[a]**	**Mean**	**SD**	**MIN**	**MAX**	**Skewness**	**Kurtosis**	***p***	***d*[a]**	***p***	***d*[a]**	***P*-value**	η_p^2
Positive outcome expectancies	10 Weeks	3.73	0.86	1	5	−0.756	0.910			3.59	0.94	1	5	−0.633	0.495			0.001*	0.16		
								0.958	<0.01							0.927	<0.01			0.672	0.000
	26 Weeks	3.75	0.89	1	5	−0.759	0.848			3.62	0.93	1	5	−0.612	0.394			0.006	0.14		
Negative outcome expectancies	10 Weeks	2.39	1.06	1	5	0.356	−0.549			2.54	1.05	1	5	0.317	−0.321			0.002*	−0.14		
								0.006*	0.11							0.034	0.08			0.917	0.000
	26 Weeks	2.50	1.01	1	5	0.280	−0.382			2.64	1.02	1	5	0.192	−0.387			0.006	−0.14		
Self-efficacy	10 Weeks	2.96	0.61	1	4	−0.387	0.606			2.87	0.67	1	4	−0.422	0.401			0.003*	0.14		
								0.334	0.03							0.121	0.05			0.625	0.000
	26 Weeks	2.98	0.60	1	4	−0.506	1.006			2.92	0.64	1	4	−0.568	0.894			0.019	0.10		
Injunctive norms	10 Weeks	3.68	1.04	1	5	−0.542	0.034			3.47	1.10	1	5	−0.380	−0.164			<0.001**	0.20		
								<0.001**	−0.17							0.005*	−0.10			0.202	0.001
	26 Weeks	3.51	1.78	1	5	−0.443	−0.384			3.37	1.23	1	5	−0.411	−0.537			0.016	0.09		
Descriptive norms	10 Weeks	2.46	1.10	1	5	0.047	−0.899			2.24	1.14	1	5	0.422	−0.732			<0.001**	0.20		
								<0.001**	−0.45							<0.001**	−.046			<0.001**	0.007
	26 Weeks	1.99	1.09	1	5	0.767	−0.268			1.93	1.07	1	5	0.776	−0.399			0.254	0.06		
Intention	10 Weeks	3.55	1.88	1	7	−0.007	−1.19			3.09	1.86	1	7	0.361	−1.10			<0.001**	0.25		
								<0.001**	−0.54							<0.001**	0.39			0.001*	0.007
	26 Weeks	2.64	1.74	1	7	0.707	−0.613			2.46	1.69	1	7	0.774	−0.629			0.018	0.10		

[a]*Cohen's d from http://www.socscistatistics.com/effectsize/Default3.aspx and http://www.cognitiveflexibility.org/effectsize/effectsizecalculator.php.*

**P-value = 0.01, **P-value = 0.001 after Holm-Bonferroni sequential correction.*

Analyses were conducted using IBM SPSS Statistics 24/25 with the following exceptions: multi-group path analyses were performed with Mplus Version 7 and effect sizes not given by SPSS were calculated with online calculators (Wiseheart, 2018; Stangroom, 2021). We used 0.01 rather than the common 0.05 cut-off due to a relatively large sample size.

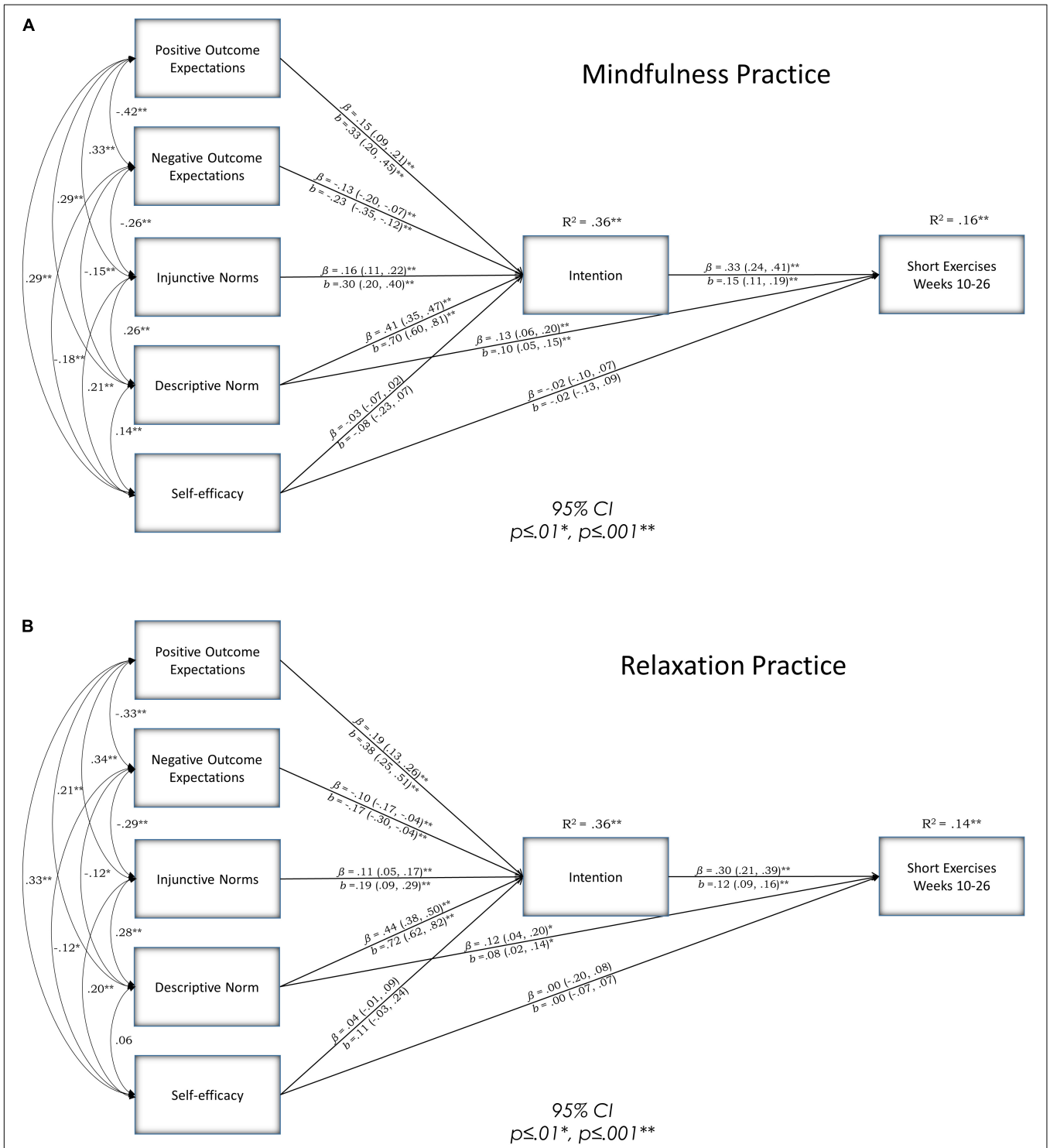

FIGURE 1 | Multi-group path models: **(A)** Mindfulness and panel **(B)** relaxation. Results 95% CI, $p \leq 0.01$*, $p \leq 0.001$**. The model was adjusted for grade level, i.e., specified to predict intention and practice. Multi-group modeling was used to produce separate parameter estimates for the relaxation and mindfulness arms. All variables except for the practice variables come from the 10-week survey. The practice variables come from the 26-week survey.

TABLE 2 | Differences in reasons for not practicing.

Reasons for not practicing		Percentages (row)		Pearson's chi-square			Bayes factor$_{01}$
		Mindfulness	*Relaxation*	χ^2	df	*p*	
I didn't find them helpful	26 Weeks	41.7%	46.9%	5.419	1	0.022	1.2
	52 Weeks	49.3%	47.5%	0.392	1	0.562	11.3
The exercises were too difficult	26 Weeks	3.5%	4.3%	0.915	1	0.360	29.3
	52 Weeks	4.6%	5.6%	0.705	1	0.432	22.1
I have forgotten to do the exercises	26 Weeks	27.6%	24.4%	2.597	1	0.115	5.6
	52 Weeks	26.9%	23.9%	1.442	1	0.232	7.7
I have been too busy to do the exercises	26 Weeks	19.6%	21.9%	1.721	1	0.206	9.3
	52 Weeks	20.7%	25.6%	4.026	1	0.047	2.2
I think the exercises are boring	26 Weeks	22.0%	25.8%	3.882	1	0.053	3.0
	52 Weeks	26.6%	26.1%	0.043	1	0.844	15.3
I have not needed the exercises	26 Weeks	26.8%	29.3%	1.532	1	0.233	9.3
	52 Weeks	26.3%	30.7%	2.907	1	0.095	3.6

To evaluate effect sizes, we used the references recommended by Cohen (1988). Skewness (>2) and kurtosis (>7) cutoffs were based on Finney and DiStefano (2006) recommendations. The model fit was evaluated with several types of fit indexes including the chi-square statistic, Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). TLI and CFI values $\geq$ 0.95 and RMSEA values $\leq$ 0.06 were defined to indicate a good fit (Hu and Bentler, 1999).

RESULTS

Social Cognitive and Behavioral Responses and Changes Over Time

There were significant albeit small differences between the arms at 10 weeks with the mindfulness arm showing a systematically more positively inclined social cognitive response: higher positive outcome expectations (d = 0.16), lower negative outcome expectations (d = –0.14), higher self-efficacy (d = 0.14), higher injunctive norms (d = 0.20), higher descriptive norms (d = 0.20), and higher intention (d = 0.25) compared to the relaxation arm. At 26 weeks, there were no statistically significant differences between the arms. From 10 to 26 weeks, neither arm had significant changes in positive or negative outcome expectations or self-efficacy (d = 0.00–0.11). However, both arms did have significant decreases in injunctive and descriptive norms and intention (d = [–0.10] – [–0.54]). The only interaction effects between time and group were found in descriptive norms ($p < 0.001$) and intention (p = 0.001) with those factors decreasing more in the mindfulness arm. However, the interaction effects were quite small (η_p^2 = 0.007 for both descriptive norms and intention). See **Table 1** for more details.

Whereas immediately after the intervention, 33.7% of respondents in the mindfulness arm and 23.6% in the relaxation arm agreed fully/partially in the intention question, only 14.5 and 13.2% (respectively) did at the 26 weeks follow-up. This demonstrates the drop in the proportion of motivated individuals to engage in the mental health-promoting practices after a period without any boosters.

As for behavioral practice variables changes over time, from 26 to 52 weeks, only *short mindfulness exercises* in the past half year decreased slightly (r = –0.16). No changes were detected in other behaviors (i.e., all *relaxation* exercises, *long mindfulness exercises during the past half year* and *4 weeks*, and s*hort mindfulness exercises during the past 4 weeks*; r = [–0.07] – [0.03]). Comparing the mindfulness to relaxation arms, they only statistically significantly differed at 26 weeks in long and short exercises during the past half year, with the relaxation arm reporting less practice. See **Supplementary Table 2** for more details.

Path Models

The RAA Path Model had a good fit for the data $\chi^2(6, N = 3134) = 13.055$, p = 0.042, TLI = 0.969, CFI = 0.993, and RMSEA = 0.967. The associations within the model did not differ across the arms ($\Delta\chi^2$ = 6.97, p = 0.539). Outcome expectations and injunctive and descriptive norms were predictive of intention but self-efficacy was not. Descriptive norms were the strongest predictor of intention. Similarly, intention and descriptive norms were predictive of practice but perceived behavioral control was not. See **Figure 1** for direct effects and **Supplementary Table 3** for indirect effects.

Self-Reported Motives and Gained Benefits

As for the self-reported reasons for not practicing, "not finding the exercises helpful" was the most frequently chosen reason in both arms and both timepoints, with about half of the respondents reporting this. There were no differences between the arms. See **Table 2** for more details. The most common experienced benefits by practicing respondents were "stress management" and "concentration ability." For both arms at 26 and 52 weeks, average levels of perceived benefits did not reach 3 on a scale from 1 to 5. There were no statistically significant changes over time for either arm in any of the benefits (all

TABLE 3 | Differences in benefits experienced[ab].

Benefits experienced	Time	Mindfulness						Relaxation									
						Paired T-test						Paired T-test		Independent T-Test		Mixed ANOVA	
		Mean	SD	Skewness	Kurtosis	*p*	d^c	Mean	SD	Skewness	Kurtosis	*p*	d^c	*p*	d^c	*p*	η_p^2
Concentrate better in class	26 Weeks	2.17	1.22	*0.66*	*−0.62*	0.132	−0.085	2.17	1.21	*0.58*	*−0.77*	0.456	−0.038	*0.998*	0.00	0.111	0.004
	52 Weeks	1.95	1.21	*0.94*	*−0.26*			2.15	1.26	*0.69*	*−0.63*			*0.014*	−0.16		
Concentrate better on hobbies	26 Weeks	2.23	1.28	*0.61*	*−0.80*	0.313	−0.053	2.19	1.28	*0.62*	*−0.81*	0.475	−0.036	*0.501*	0.03	0.226	0.002
	52 Weeks	1.99	1.24	*0.90*	*−0.39*			2.18	1.28	*0.65*	*−0.76*			*0.031*	−0.15		
Manage stress better	26 Weeks	2.26	1.26	*0.56*	*−0.85*	1.000	< −0.001	2.26	1.26	*0.51*	*−0.92*	0.406	−0.058	*0.955*	0.00	0.561	0.001
	52 Weeks	2.07	1.26	*0.79*	*−0.57*			2.27	1.32	*0.55*	*−0.95*			*0.039*	−0.15		
Cope better with difficult emotions, e.g., fear, anger, aggression, and anxiety	26 Weeks	2.16	1.23	*0.68*	*−0.61*	0.105	−0.094	2.19	1.27	*0.65*	*−0.74*	0.719	−0.016	*0.597*	−0.02	0.377	0.001
	52 Weeks	1.92	1.18	*0.97*	*−0.17*			2.16	1.25	*0.63*	*−0.75*			*0.004*	−0.19		
Sleep better	26 Weeks	2.18	1.29	*0.68*	*−0.76*	0.260	−0.063	2.24	1.29	*0.57*	*−0.88*	0.207	0.070	*0.382*	−0.05	0.091	0.005
	52 Weeks	1.95	1.24	*0.95*	*−0.37*			2.26	1.29	*0.53*	*−0.94*			*0.000***	−0.24		
Get better grades on exams	26 Weeks	2.05	1.22	*0.82*	*−0.46*	0.367	−0.053	2.09	1.21	*0.71*	*−0.59*	0.790	−0.015	*0.508*	−0.03	0.658	<0.001
	52 Weeks	1.85	1.17	*1.08*	*0.02*			2.09	1.25	*0.78*	*−0.51*			*0.004*	−0.19		
Get along better with my friends	26 Weeks	2.05	1.25	*0.86*	*−0.42*	0.470	−0.039	2.10	1.27	*0.77*	*−0.61*	659	−0.023	*0.378*	−0.04	0.854	<0.001
	52 Weeks	1.86	1.19	*1.08*	*−0.02*			2.09	1.27	*0.78*	*−0.58*			*0.007*	−0.18		
Get along better with my family members	26 Weeks	2.04	1.24	*0.88*	*−0.37*	0.351	−0.056	2.11	1.26	*0.76*	*−0.59*	0.751	−0.023	*0.332*	−0.06	0.675	<0.001
	52 Weeks	1.86	1.19	*1.08*	*−0.03*			2.09	1.26	*0.77*	*−0.55*			*006*	−0.18		

[a]*Means and standard deviations are based on all available cases rather than the cases available for each test. Therefore, the means do not correspond to each test. For example, the cases available for the change in managing stress for the mindfulness arm (n = 187) were a lot fewer than the total available cases (n_{26wk} = 607; n_{52wk} = 364). The means are the same at both time points for the cases available for the test, whereas the means are different for the total cases available.*

[b]*Min-Max:1–5 for all variables.*

[c]*Cohen's d from http://www.socscistatistics.com/effectsize/Default3.aspx and http://www.cognitiveflexibility.org/effectsize/effectsizecalculator.php.*

**P-value ≤0.01, **P-value ≤0.001 after Holm–Bonferroni Sequential Correction.*

$d < \mp 0.1$). Between the arms, only the benefit of better sleep at 52 weeks was significantly different with the relaxation arm experiencing it more ($d = -0.24$; others $d < \mp 0.19$). There were no interaction effects between time and group (all $p \geq 0.091$ and all $\eta_p{}^2 < 0.005$). See **Table 3** for more details.

DISCUSSION

This study set out to investigate social cognitive, motivational responses to two interventions teaching mental health-promoting practices to young adolescents. These are indicators of both the receipt (or even acceptability) and the future continuation of the practice behavior. We found that, on average, participants of both relaxation and mindfulness interventions reported moderately high positive outcome expectations for engaging in the taught practices, moderate negative outcome expectations, moderately high injunctive norms (friends' and parents' approval), moderately low descriptive norms (friends' behavior), and moderate self-efficacy. Immediately post-intervention, social cognition regarding mindfulness was more positive in the mindfulness arm compared to the relaxation arm. However, these differences seemed to disappear; the decline in these variables was stronger for the mindfulness arm (except the descriptive norm), rendering the mean levels similar at 26 weeks. These results then do not show differences in injunctive norms as may have been expected if mindfulness were perceived as more foreign, hippie, or religious, or in self-efficacy if mindfulness exercises were perceived as more difficult.

It should be noted, that although there were slight or major decreases in most social cognitive variables, the means of positive outcome expectancies and self-efficacy remained the same at follow-up. The driver in the major drop for intention, thus, may mostly reside in negative outcome expectations and normative beliefs. Descriptive norms showed the greatest drop, possibly due to the active intervention sessions at school having ended. It should also be noted that whereas "short mindfulness exercises" decreased more over time than did other forms of behavior, this may be due to a floor effect for the other behaviors rather than that the participants would keep up these other forms of exercises more than the short mindfulness ones: Short mindfulness exercises were higher to begin with. Also, the size of decrease was not very large, rendering practical significance of the decrease questionable (from 1.55 to 1.42).

This is the first study to compare social cognitive responses related to the mental health-promoting exercises (relaxation vs. mindfulness), and how they predict later behavior, to our knowledge. Evaluation of engagement with (fidelity of receipt and enactment) and acceptability of mental health-promoting programs is important across different phases of behavioral trials: (1) In pilot and feasibility trials, investigating responses gives important information for intervention optimization (feasibility and optimization). (2) Process evaluations in general can help interpret main outcomes of a trial (definitive trial phase). (3) Finally, as universal mental health-promoting programs are being increasingly rolled out nation-wide, we need to know what target participants' (likely) attitudes toward these programs are (implementation phase; Skivington et al., 2021). This study in particular provides information for intervention optimization.

Limitations of this study include self-report measures and partly suboptimal operationalizations of the RAA constructs [see section "Discussion" in Beattie et al. (2019)]. Strengths include a multifaceted investigation of various indicators of receipt and the design, which enabled a comparison of two active intervention arms. Secondly, the sample size allowed for reliable comparative investigations, rarely available thus far. Thirdly, it should be noted that these results about reasons for not practicing should be taken with caution as missing responses and not choosing the responses deliberately cannot be distinguished.

For mental health-promoting programs, it may be useful to consider the communication within the programs in terms of likely effects on recipients' self-efficacy, attitudes toward the behavior, and perceived norms. Such factors may influence enrollment into mindfulness programs as well as uptake and sustained use of mindfulness practices. In this intervention, there was room for all social cognitions to be improved by at least a point on the scale.

As for implications for future research, motivation and self-regulation theories may present an interesting addition to studying mental health promoting behaviors: they may pave the way for improved effectiveness of interventions through effectively intervening on predictors of practice behaviors (Hagger et al., 2020). These kinds of findings can inform the design of interventions to improve fidelity (Beattie et al., 2019). Improved attention to fidelity (receipt and enactment) of behavior change intervention trials helps acknowledge and tackle possible threats to trial validity (Toomey et al., 2020).

This study shed light on similarities and differences in reception and acceptability of two mental health-promoting interventions, through the lens of social cognitions and perceived benefits and barriers. Essentially, the results imply that both mindfulness and relaxation exercises are similarly acceptable, and have similar perceived benefits and the barriers for practice.

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 Humanities and Social and Behavioral Sciences Ethical Review Board of the University of Helsinki (Statement 1/2014). Written informed consent to participate in this study was provided by the participants or their legal guardian/next of kin.

AUTHOR CONTRIBUTIONS

MB: conceptualization, formal analysis, writing – original draft and review and editing, funding acquisition, and methodology.

NH: conceptualization, writing – original draft and review and editing, supervision, funding acquisition, and methodology. HK: methodology, formal analysis, writing – review and editing, supervision, and conceptualization. S-MV: investigation, resources, writing – review and editing, supervision, and funding acquisition. All authors contributed to the article and approved the submitted version.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.869438/full#supplementary-material

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Stable or changing well-being? Daily hassles and life satisfaction of Czech adolescents over the last three decades

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While the assumption that the sociopolitical and economic situation affects adolescents' well-being, encompassing life satisfaction and a positive sense of self, is plausible, few studies have confirmed such macrosocial influences. The case of the Czech Republic offers an example of a society transitioning from totalitarian government (from 1989) to western democracy. Our study provides statistical description of Czech adolescents' well-being over the past 30 years in association with the subjective perception of everyday problems. These daily hassles represent experiences and conditions of daily living that have been appraised as salient and harmful or threatening to adolescents' well-being. We analyzed four samples of adolescents aged 14–17years surveyed at four time points over the last three decades—1992, 2001, 2011, and 2019, total *N*=4,005 (1992: 255, 2001: 306, 2011: 363, 2019: 3081; 54.6% females). The results show that life satisfaction, self-esteem, and self-reported daily hassles changed only marginally from 1992 to 2019 with small differences related to the post-revolution 1992 cohort. Adolescents reported increasing problems in school, relationships with parents, sports, and leisure time over the study period. A model linking daily hassles and self-esteem to life satisfaction across four cohorts showed that daily hassles strongly predicted life satisfaction except in the post-revolution cohort of 1992 when life satisfaction was also the lowest. The effect was slightly higher in females. Across the cohorts, gender differences in life satisfaction changed from males being more satisfied in 1992 to females being more satisfaction in 2019. Limitations stemming from sampling differences across cohorts are discussed.

KEYWORDS

well-being, daily hassles, life satisfaction, self-esteem, adolescence, social change

Introduction

In recent decades, a growing body of research has focused on adolescent well-being in non-clinical adolescent populations (Pollard and Lee, 2003; Ben-Arieh et al., 2014). Research that focuses primarily on physical and mental health often relies on the WHO definition of well-being, which emphasizes how people develop their own potential, their relationships, and their ability to cope with everyday stress (The World Health Organisation, 2013). In our research, we focus only on subjective well-being (SWB), which refers to an individual's assessment of life (Moksnes and Espnes, 2013).

Widely accepted theoretical conceptualization of SWB (Diener, 1984, 2013) comprises three relatively independent components: perceived life satisfaction (cognitive component), positive experiences, and negative experiences (affective component). If more traditional approaches emphasize the presence or absence of negative feelings and experienced problems, then contemporary positive psychology posits that SWB is based more on positive quality of life indicators such as life satisfaction, happiness, self-esteem, and experiencing positive emotions.

From a developmental point of view, the content of SWB is not changing much, but the range of psychological phenomena influencing SWB expands with age. These include internal and external factors, including macrosocial determinants (social adaptation, cultural, social, and political factories). It also appears that the strength of some of the traditional personal and micro-social components or indicators of SBW is changing along with changing social conditions (Diener, 2013). However, capturing the direct effect of macrosocial changes is complicated. Objective indicators of quality of life, such as improved health care and more work or study opportunities, do not necessarily lead to higher SWB. People may find it difficult to adapt to changing life circumstances, and higher living standards may also increase personal aspirations, with new opportunities bringing new uncertainties (Diener et al., 2006). Moreover, in the adolescent population, the interplay of all the factors may be quite different from adult populations (Eccles et al., 2008).

Therefore, when studying the effects of social change on adolescents' SWB, we need to consider both short-term and long-term effects. Cohort comparisons of samples gathered at different historical points are suitable designs to achieve this aim (Bronfenbrenner, 1979; Crockett and Silbereisen, 1999; Due et al., 2019). In the present cohort-comparison study, we focused on the extent to which personality characteristics (self-esteem), proximal situational influences (daily hassles), and changes in the macrosocial environment during the period of three decades (tracking four cohorts of adolescents at intervals of 8–9 years) influenced adolescents' life satisfaction.

Life satisfaction

Life satisfaction (LS) represents the cognitive component, a conscious and global evaluation of one's own life, which can be evaluated based on one's standards (Shin and Johnson, 1978; Pavot and Diener, 1993). As a key indicator of SWB, LS life satisfaction focuses on identifying and using strengths as buffers against the development of psychopathological problems (Veenhoven, 1984; Proctor et al., 2009).

Similar to adults, life satisfaction appears to be relatively stable as most adolescents generally report a positive attitude toward life (Gilman and Huebner, 2003; Moksnes and Espnes, 2013; Opshaugh, 2013). Euro-American studies have found little differences between males and females. When small gender differences were found, boys usually reported higher LS (Gilman and Huebner, 2003). Culturally, the differences between countries are not substantial, only high individualism (vs. collectivism) consistently predicted differences in LS between nations when controlling for other variables (Diener et al., 1995). Based on findings from the early 1990s, Czech adolescents did not differ significantly in LS from adolescents across Europe (Macek, 1999). Nevertheless, some studies have shown that adolescents and adults in Eastern European countries scored slightly lower on LS compared to Western Europeans (Delhey, 2004).

Daily hassles

Daily hassles (DHs) represent "experiences and conditions of daily living that have been appraised as salient and harmful or threatening to the endorser's well-being" (Lazarus, 1986, p. 40). These recurring events, being a part of the micro-social environment of adolescents' lives, contribute to adolescents' negative feelings and irritability (DeLongis et al., 1982; Kanner et al., 1987). As chronic stressors, they affect SWB and mental health (Asselmann et al., 2017). DHs have a cumulative effect (Kanner et al., 1987); when they affect multiple domains of adolescents' lives with high frequency, stress levels increase significantly. Difficulties in specific domains of life (school, family, and peers) may be of varying importance to adolescents (Gelhaar et al., 2007; Booth and Anthony, 2015; Mize and Kliewer, 2017).

Most frequently reported problems and stressors come from the school context, family relationships, problems associated with risk behavior, health problems, and problems with romantic partners. Recently, problems with finances, leisure time, privacy and online activities, and personal psychological problems have also become increasingly common (Cheng and Li, 2010; Mize and Kliewer, 2017; Zorbaz et al., 2020).

Several studies have reported the specific effect of DHs on SWB and especially on life satisfaction (Huebner, 1991; Proctor et al., 2009; Cheng and Li, 2010; Udayar et al., 2021). For example, minor daily events and everyday difficulties (e.g., arguments with friends, poor exam performance, and enjoyment of a hobby) have been shown to contribute to unique variance over and above major stressful life events (Gilman and Huebner, 2003; Proctor et al., 2009).

Self-esteem

Self-esteem as a global self-evaluation fits well together with life satisfaction considerations of adolescents' SBW (Diener, 1984; Grob et al., 1996; Harter, 2006; Moksnes and Espnes, 2013). Diener and Diener (2009) found that self-esteem is a powerful predictor of life satisfaction, especially in individualist cultures (Kwan et al., 1997). Studies have shown that in adulthood, self-esteem is a relatively stable personality characteristic that, in relation to life satisfaction, can explain between-person variation (Anusic and Schimmack, 2016).

However, in early and middle adolescence, self-esteem is still forming and is more dependent on situational influences and interpersonal evaluations (Kuster and Orth, 2013; Sánchez-Queija et al., 2017).

The association between self-esteem and different types of personal difficulties has been documented theoretically and empirically. A social-cognitive explanation of depression (Oatley and Bolton, 1985; Higgins, 1987; Kernis et al., 1998) assumes that depriving one's self-defining role and deflating self-esteem are related to how one perceives and handles difficulties and problem situations (Cheng and Lam, 1997; Mann et al., 2004). Self-esteem is usually positively correlated with life satisfaction (Moksnes and Espnes, 2013), but the specific role of DHs in this association is unclear. Therefore, we propose a model in our study where we consider self-esteem and daily hassles as predictors of perceived life satisfaction.

Adolescent life in the changing Czech society

We compared Czech adolescents from different times, so a brief description of the social changes in this period is necessary for a better understanding of the macrosocial influences on the everyday life of adolescents.

The transformation to a democratic political system after the fall of the communist regime at the end of 1989 brought many economic and social changes in Czech society. Adolescents and their parents were experiencing a kind of "social moratorium." They reassessed their lives and sought a new personal perspective, seeing their future optimistically but rather vaguely. In the late 1990s, the social situation changed dramatically, as economic, political and legislative problems led to many Czechs experiencing disillusionment with the social situation, and their optimism decreased considerably (Macek and Marková, 2004; Linek, 2010).

The 2000's could be metaphorically described as "entering adulthood" of the Czech society. Unrealistic optimism and naive confidence in the future were replaced by a more realistic view of the future (Linek, 2010). Adolescents raised in a democratic society take individual freedom for granted; and their possibilities for self-development were greatly expanded. However, the pressure for independent decision-making and the associated uncertainty have also increased. These adolescents are more individualistic than before, recognizing the value of education, success, social prestige, leisure, and entertainment. They are very tolerant and liberal in relation to drugs and sex, less dependent on parents and teachers (Macek et al., 2013).

All these characteristics can apply to the life of adolescents in the 2010s. A new element has been the massive expansion of social networking, still mainly through personal computers, laptops, and tablets. Thus, life on social networking sites was still separate from other activities of adolescents (Subrahmanyam and Šmahel, 2011). The globalization of adolescent culture and socialization through media has progressed quickly.

The last cohort, born in the new millennium, grew up with mobile smartphones becoming the main means of communication and the platform for adolescents' long-term and often permanent participation in social networks. Twenge (2017) called them the iGeneration of adolescents, for whom social media and communication through text and picture messaging have partially replaced normal face-to-face social interactions and other activities. They spend less time with peers than previous generations, and despite spending more time at home, often in the presence of parents, their communication with parents is limited. In the virtual social world, they face unrealistic expectations, aggressiveness, and inadequate benchmarks for their self-assessment. This may be why they are more likely to experience anxiety, depressive symptoms, and loneliness. They are very tolerant but impatient and indecisive (Twenge, 2017). However, as prior research showed, the effects of technology use and new modes of communication on adolescents' well-being can be both positive and negative because of a complex interplay of different factors (Bedrošová et al., 2018; Dedkova et al., 2022).

The present study

This study offers a unique opportunity to analyze well-being data from four cohorts (1992, 2001, 2011, and 2019). The primary goal was to describe the distribution of self-reported life satisfaction and daily hassles across saliently different macrosocial situations. Based on previous research, we assumed life satisfaction should remain stable. The daily hassles are more likely to be different now than in the past because they reflect the different macrosocial contexts.

The second goal of the study is to assess whether self-reported daily hassles are related to self-reported life satisfaction and whether this relationship differs across cohorts. Since self-esteem affects the assessment of life satisfaction, we assessed this relationship separately while controlling for self-esteem.

Methods

Participants and procedure

Four cohorts of Czech adolescents were sampled about 10 years apart in 1992, 2001, 2011, and 2019. All are quota samples reflecting the population of the Czech Republic with respect to the type of lower and higher secondary schools attended; whole classrooms were sampled. The samples covered two grade cohorts, specifically, grade 8 students around age 14 (age 13, $p = 4.3\%$, 14, $p = 22.4\%$, 15, $p = 22.4\%$) and grade 10 students around age 16 (age 16, $p = 27.4\%$, 17, $p = 16.1\%$, over 17, $p = 7.3\%$).

The 1992 sample was collected in the Euronet Pilot Study (Alsaker and Flammer, 1999; $N = 257$, 44% female). The participants directly experienced the socialist regime and the start of the transformation in 1989. The 2001 and subsequent data were

collected to replicate the 1992 study. Participants in the 2001 sample ($N = 310$, 51% female) grew up in the transformation turmoil following the 1989 revolution. The 2011 sample ($N = 371$, 47% female) was computer-administered in classrooms. Participants in this sample were born during the transformation period, grew up in a consolidated EU-member country, and had Internet services as a part of their everyday life. The 2019 sample ($N = 3{,}206$, 56% female) was mostly administered in classrooms using pen-and-paper format (2,484, 77.5%), while some were administered on school computers (722, 22.5%). This generation grew up in a society increasingly influenced by online media and social networks.

The total effective sample size was $N = 4{,}005$ ($n_{1992} = 255$, $n_{2001} = 305$, $n_{2011} = 363$, and $n_{2019} = 3{,}082$).

The informed consent procedures reflected the contemporary local standards. In 1992 and 2001, schools used their authority to administer the questionnaire as a part of curriculum. Parental informed consent was sought in 2011 and 2019. The 2019 survey was approved by the Research Ethics Committee of Masaryk University (Ref. No. EKV-2018-026).

Measures

Well-being

A total of 13 items addressing adolescents' subjective well-being were selected from the Berne Questionnaire on Adolescents' Well-Being (BSW-Y; Grob et al., 1991). They represent two factors, namely life satisfaction and self-esteem. The BSW-Y has been shown to have satisfactory psychometric properties (Grob et al., 1991; Grob, 1995). The items use a 4-point response scale from 1 (totally false) to 4 (very true). The 8-items of *life satisfaction* (LS) scale fit a unidimensional model (ordinal CFA robust CFI = 0.967, SRMR = 0.043), with all items loading well on the factor of life satisfaction, resulting in sufficient internal consistency (McDonald's omega = 0.75). The 5-item scale of self-esteem also fit a simple unidimensional model (ordinal CFA robust CFI = 0.945, SRMR = 0.056), with all items loading well on the single factor, resulting in sufficient internal consistency (McDonald's omega = 0.75).

Daily hassles (DH)

The inventory developed in the Euronet Pilot Study (Alsaker et al., 1999) uses 11 items asking about the extent to which selected life domains (for the list see Table 2) presented obstacles or difficulties to the respondent over the previous 6 months. The items use a 4-point response scale from 1 (not at all difficult) to 4 (very difficult). Responses were summed to indicate the overall level of perceived daily hassles. This sum is not intended as a reflective measurement of a construct but as a formative index of the total amount of perceived hassles in the 11 domains. The polychoric correlations among items range from 0.05 to 0.39 suggesting (1) no strong latent variable is producing the perceived hassles (2) there are no compensatory relationships between the domains of hassles in which perceiving problems in one domain would prevent or reduce perceiving hassles in another. With only cross-sectional data we can estimate reliability with McDonald's omega total = 0.77 estimating the proportion of all systematic variance in an unweighted composite score (Revelle and Condon, 2019).

Analysis

Linear models were estimated in IBM SPSS 28 using the GENLIN procedure with robust standard errors. Models with individual hassles were run on 10 multiple-imputed datasets to overcome the missing responses in hassles with boy/girlfriend. The pooled values of parameters reported below did not meaningfully differ from the parameters found in the unimputed data.

Validity checks on the well-being scale and hassles items included number of valid responses, too fast responses, and strings of identical responses. This excluded 2, 5, 8, and 124 respondents from the respective cohorts.

Measurement models were estimated in R (R Core Team, 2021) with the lavaan package (Rosseel, 2012) and omega total was estimated with package psych (Revelle, 2022).

Results

Descriptive statistics

Life satisfaction scores were slightly negatively skewed across the four cohorts. Its means and standard deviations (Table 1) changed very little over time [Welch's $F(3, 598.4) = 5.99$, $p < 0.001$, $\omega^2 = 0.003$]. The gender effect was small, with males reporting slightly higher life satisfaction [Welch's $F(1, 3{,}913) = 34.2$, $p < 0.001$, $\omega^2 = 0.008$].

Self-esteem showed similar distribution with minimal cohort differences [Welch's $F(3, 607.0) = 11.9$, $p < 0.001$, $\omega^2 = 0.007$]. The gender effect was small, with males reporting slightly higher self-esteem [Welch's $F(1, 3{,}862) = 182.1$, $p < 0.001$, $\omega^2 = 0.044$]. Life satisfaction and self-esteem were positively correlated across cohorts (r's = 0.48, 0.56, 0.61, and 0.63, respectively).

Descriptive statistics of individual daily hassles treated as a continuous variable are presented in Table 2 separately by cohort. The means were all below 3, corresponding to "somewhat bothersome," although most values were below 2, indicating "not very bothersome." Table 1 reports the descriptive statistics of the total daily hassles (the mean of individual hassles). The cohort differences in means of DH were minimal [Welch's $F(3, 603.9) = 8.9$, $p < 0.001$, $\omega^2 = 0.006$]. Gender differences in mean DH differed across cohorts. In 2019, females reported higher level of DH (Cohen $d = 0.40$), whereas the difference between earlier

TABLE 1 Descriptive statistic of life satisfaction, self-esteem, and total daily hassles scores by cohort.

	N	*M*	*SD*	Minimum (1)	Maximum (4)	Skewness	Kurtosis
Life satisfaction							
1992	254	2.87	0.42	1.38	3.88	−0.43	0.63
2001	305	2.95	0.43	1.63	4.00	−0.34	0.09
2011	362	2.92	0.49	1.38	4.00	−0.57	0.34
2019	3,063	2.98	0.46	1.00	4.00	−0.64	0.48
Self-esteem							
1992	255	2.87	0.50	1.40	4.00	−0.17	−0.35
2001	303	2.92	0.53	1.40	4.00	−0.35	−0.11
2011	362	2.90	0.59	1.20	4.00	−0.31	−0.41
2019	3,054	2.77	0.62	1.00	4.00	−0.39	−0.30
Daily hassles total							
1992	255	1.90	0.37	1.00	2.91	0.35	−0.19
2001	301	1.93	0.35	1.00	3.18	0.28	−0.09
2011	363	2.02	0.44	1.00	4.00	0.79	1.87
2019	3,062	1.90	0.44	1.00	4.00	0.50	0.29

TABLE 2 Descriptive statistics of individual daily hassles domains by cohort.

	Cohort									
	1992		2001		2011		2019			
	M	SD	M	SD	M	SD	M	SD	Welch *p*	ω^2
School	2.64	0.82	2.63	0.70	2.75	0.85	2.60	0.85	0.010	0.002
Money	2.36	0.91	2.36	0.89	2.33	0.89	1.91	0.83	<0.001	0.045
Boy/girlfriend	2.10	0.98	2.18	1.03	2.29	1.11	2.09	1.15	0.009	0.002
Friends & peers	1.57	0.72	1.54	0.66	1.79	0.85	1.93	0.89	<0.001	0.022
Active sports	1.78	0.92	1.92	0.99	2.01	0.99	1.99	0.97	0.004	0.003
Parents and family	1.91	0.91	2.05	0.89	2.20	1.03	1.98	0.97	<0.001	0.004
Home and neighbors	1.54	0.80	1.54	0.81	1.63	0.88	1.46	0.76	0.002	0.004
Health	1.73	0.84	1.74	0.78	1.84	0.82	1.81	0.87	0.179	<0.001
Leisure time	1.67	0.88	1.66	0.82	1.69	0.84	1.77	0.88	0.024	0.002
Public information access	1.77	0.74	1.85	0.81	1.83	0.78	1.71	0.73	0.002	0.003
Own room	1.82	1.07	1.80	0.97	1.88	1.05	1.64	0.92	<0.001	0.007

The theoretical range was 1–4. Higher values represent a higher perceived level of hassles. Welch *p* is the *p*-value of the F-test with 3 and 570–614 degrees of freedom with Welch's correction.

cohorts were close to zero [interaction $F(3, 707.1) = 12.8$, $p < 0.001$, $\omega^2 = 0.009$].

Linear models predicting life satisfaction

The primary aim of the analysis was to see whether self-reported daily hassles in life are related to self-reported LS and whether this relationship differs across cohorts. We used standardized LS as the outcome in a linear model and gender (the male was the reference category), cohort (2019 was the reference category), and standardized self-esteem as predictors. In separate models, DH entered either as individual predictors or as a single variable representing the overall level of hassles.

The models reported in Table 3 included interactions between gender and DH, cohort and DH, and cohort and gender. We also estimated a model with a three-way interaction between gender, cohort, and DH, but this interaction did not contribute to the explained variance while using many degrees of freedom.

The model with individual daily hassles (M1a and M1b in Table 3). The cohorts did not differ significantly in life satisfaction when DH were zero [Wald $\chi^2(3) = 4.97$, $p = 0.174$]. Gender

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TABLE 3 Parameters of the linear models predicting life satisfaction.

Parameter	M1a	M1b	M2a	M2b
	B (*SE*)	*B* (*SE*)	*B* (*SE*)	*B* (*SE*)
(Intercept)	0.97 (0.06)	0.39 (0.05)	0.93 (0.05)	0.36 (0.05)
Cohort				
1992	−0.20 (0.17)	−0.09 (0.15)	**−0.38 (0.15)**	**−0.28 (0.13)**
2001	−0.08 (0.19)	−0.04 (0.16)	0.05 (0.16)	0.07 (0.13)
2011	0.05 (0.16)	0.06 (0.13)	−0.05 (0.14)	−0.04 (0.13)
Gender = female	0.12 (0.08)	**0.22 (0.06)**	0.14 (0.07)	0.25 (0.06)
Cohort X gender = female				
1992	**−0.34 (0.12)**	−0.26 (0.11)	**−0.40 (0.12)**	**−0.24 (0.10)**
2001	−0.13 (0.11)	−0.16 (0.09)	−0.13 (0.11)	−0.13 (0.09)
2011	−0.26 (0.11)	**−0.24 (0.09)**	−0.30 (0.11)	−0.22 (0.09)
Self-esteem (standardized)		**0.53 (0.02)**		
Daily hassles (semi-standardized)			**−0.43 (0.03)**	**−0.18 (0.02)**
School	**−0.09 (0.03)**	−0.06 (0.03)		
Money	**−0.15 (0.03)**	**−0.12 (0.03)**		
Boy/girlfriend	**−0.10 (0.02)**	−0.02 (0.02)		
Friends and peers	**−0.09 (0.03)**	0.06 (0.03)		
Active sports	−0.06 (0.02)	−0.03 (0.02)		
Parents and family	**−0.14 (0.03)**	**−0.07 (0.03)**		
Home and neighbors	−0.01 (0.03)	0.01 (0.03)		
Health	**−0.09 (0.03)**	−0.05 (0.03)		
Leisure time	**−0.10 (0.03)**	−0.05 (0.03)		
Public information access	**−0.14 (0.03)**	**−0.10 (0.03)**		
Own room	−0.02 (0.03)	−0.01 (0.03)		
Cohort X daily hassles			0.16 (0.06)	0.04 (0.06)
1992				
2001			−0.01 (0.07)	−0.08 (0.05)
2011			0.08 (0.06)	−0.01 (0.05)
School * 1992	**−0.19 (0.07)**	**−0.20 (0.06)**		
2001	0.10 (0.09)	0.08 (0.07)		
2011	−0.14 (0.06)	−0.11 (0.05)		
Money * 1992	0.13 (0.07)	0.08 (0.06)		
2001	0.02 (0.06)	−0.02 (0.05)		
2011	0.05 (0.07)	0.05 (0.06)		
Boy/girlfriend * 1992	0.08 (0.06)	0.07 (0.06)		
2001	−0.01 (0.06)	−0.02 (0.05)		
2011	−0.04 (0.05)	−0.03 (0.04)		
Friends and peers * 1992	−0.03 (0.10)	−0.06 (0.08)		
2001	0.03 (0.08)	0.05 (0.07)		
2011	0.03 (0.07)	0.03 (0.06)		
Active sports * 1992	0.04 (0.06)	0.00 (0.06)		
2001	−0.05 (0.06)	−0.06 (0.05)		
2011	0.07 (0.06)	0.03 (0.05)		
Parents and family * 1992	0.01 (0.07)	0.01 (0.06)		
2001	0.04 (0.06)	−0.03 (0.05)		
2011	−0.06 (0.06)	−0.07 (0.05)		
Home and neighbors * 1992	0.02 (0.06)	−0.05 (0.06)		
2001	0.00 (0.07)	0.03 (0.06)		
2011	0.02 (0.06)	−0.04 (0.05)		
Health * 1992	0.05 (0.07)	0.03 (0.06)		

(Continued)

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TABLE 3 Continued

Parameter	M1a	M1b	M2a	M2b
	B (*SE*)	*B* (*SE*)	*B* (*SE*)	*B* (*SE*)
2001	0.02 (0.08)	0.07 (0.06)		
2011	0.08 (0.07)	0.08 (0.07)		
Leisure time * 1992	0.01 (0.07)	−0.01 (0.07)		
2001	−0.09 (0.07)	−0.09 (0.06)		
2011	0.06 (0.08)	0.03 (0.07)		
Public information access * 1992	0.13 (0.09)	0.19 (0.08)		
2001	0.01 (0.07)	0.04 (0.06)		
2011	**0.20 (0.07)**	0.05 (0.06)		
Own room * 1992	0.02 (0.06)	−0.01 (0.05)		
2001	−0.02 (0.06)	−0.09 (0.05)		
2011	0.00 (0.06)	0.01 (0.05)		
Gender = female X daily hassles			−0.07 (0.03)	−0.06 (0.03)
Female * school	−0.02 (0.04)	0.00 (0.03)		
Female * money	0.05 (0.04)	0.08 (0.03)		
Female * boy/girlfriend	0.00 (0.03)	−0.03 (0.02)		
Female * friends and peers	0.03 (0.04)	−0.04 (0.03)		
Female * active sports	0.02 (0.03)	0.00 (0.03)		
Female * parents and family	**−0.13 (0.04)**	**−0.10 (0.03)**		
Female * home and neighbors	−0.09 (0.04)	−0.08 (0.03)		
Female * health	0.01 (0.04)	0.02 (0.04)		
Female * leisure time	0.00 (0.04)	0.00 (0.03)		
Female * public information access	0.00 (0.04)	0.05 (0.04)		
Female * own room	−0.02 (0.04)	0.00 (0.03)		
R^2	0.239	0.440	0.209	0.417

Effects in bold, $p < 0.01$. Reference categories are 2019 and male. Life satisfaction and self-esteem in the model are standardized—B's can be interpreted as betas or Cohen *d*'s. Daily hassles were recoded to a scale from 0 (not at all difficult) to 3 (very difficult) and the overall daily hassles score has been divided by its standard deviation so that it expresses the amount of hassles as a multiple of SDs from zero hassles.

differences in LS were small, ranging from Cohen *d* of 0.22 in favor of males in 1992 to $d = 0.12$ in favor of females in 2019; still, gender difference across cohorts was significant [Wald $\chi^2(3) = 12.8$, $p = 0.005$].

The effect of DH was in the expected direction. For most categories of hassles, their unique effects were small but statistically significant. The difference in mean LS between no reported hassles (coded 0) and "very difficult" hassles (coded 3) was around 0.3 standard deviation of LS in the latest (reference) cohort. The categories with the greatest effect were hassles related to money, parents and family, and access to public information. On the other hand, hassles related to sports, neighbors, or having their own room did not have a unique effect on LS. The unique effects of hassles did not differ much between cohorts. Only hassles related to school appeared to have a more pronounced effect in 1992 and 2011.

Conversely, hassles related to money had a much smaller effect in 1992. In 1992 and 2011, the effect of hassles related to public information access was much smaller. Apart from hassles related to parents and family, where the effect was almost double for females, and to a lesser extent hassles related to neighbors, the hassles effects were independent of gender.

Adding self-esteem to the model decreased most of the effects due to collinearity, as expected. The effect of self-esteem was understandably large ($B = 0.53$, $p < 0.001$). The inclusion of standardized self-esteem as another predictor changed the effects, as they now represented the unique effects of hassles on the part of LS variance not affected by or related to self-esteem. The effects of hassles related to money and parents/family were the least affected by the inclusion of self-esteem and remained statistically significant. The effect of hassles related to public information access was independent of self-esteem. The effect of hassles related to parents and family was still much higher in females.

The model with total daily hassles (M2a and M2b in Table 3). The effect of total DH on LS was medium and significant ($B = -0.43$, $p < 0.001$). In 1992, the effect was smaller than in the later cohorts. When self-esteem was controlled, the effect of total DH decreased to less than half but remained significant. The effect of DH was slightly but non-significantly higher in females than in males.

Here, the interaction between gender and cohort was clearer. In all the earlier cohorts, gender differences in mean life satisfaction were minimal, whereas, in the 2019 cohort, females reported higher satisfaction than males by about a third of standard deviation, especially when controlling for self-esteem.

Discussion

The present study aimed to describe changes in life satisfaction of Czech adolescents over the past three decades of social change. Our general assumption was that social processes and changes in Czech society affect adolescents' everyday lives and lived experiences and consequently life satisfaction, which was the focus of our analyses. Although we could not assess the direct influence of social changes, we can put our findings in the context of other studies that investigated life satisfaction around the time of our study.

According to the European Values Study, Czech adults experienced an increase in LS in the first decade following the regime change (1990–1999). Since 2008, no significant increase in LS has been observed (Večerník and Mysíková, 2014). A similar result was found in the HBSC study, which tracked the LS of Czech adolescents from 2002 to 2014. The adolescents in our study seemed to follow this general trend. The raw means of LS did not differ much across cohorts, but when we accounted for gender and DHs, life satisfaction in the 1992 cohort was much lower than in the later cohorts. Since this effect differed when we included individual hassles in the model, the cohort differences in the structure DHs likely obscured cohort differences in raw life satisfaction.

Regarding gender differences, boys usually report as slightly more satisfied than girls (Hodačová et al., 2017). When accounting for hassles, the females reported higher life satisfaction, except for 1992, when males scored higher on life satisfaction. Hence, the male life satisfaction advantage appears to be due to fewer perceived hassles. We found support for the assumption that self-esteem is a stable predictor of adolescents' LS (e.g., Diener and Diener, 2009; Moksnes and Espnes, 2013). We observed minimal gender differences, except in 2019 when girls reported higher life satisfaction after controlling for self-esteem, which is consistent with Zeigler-Hill and Myers (2012). Self-esteem is usually more stable compared to life satisfaction (Diener and Diener, 2009; Anusic and Schimmack, 2016). Our results are consistent with these findings, with the four cohorts of adolescents differing only minimally in the self-esteem means.

The perceived volume of daily hassles was found to be highly predictive of LS. Even when controlling for demographic variables, LS quickly decreased with daily hassles. The association appeared stable over time, although the link was weaker in 1992. This finding can be interpreted based on a macrosocial view of adolescents' lives: the euphoria after the fall of communism and new opportunities led to an unusually high level of life optimism among most young Czechs in the first half of the 1990s. Everyday difficulties were more often viewed as necessary but only temporary consequences of the rapid social change moderating their negative effect on life satisfaction. In the following years, economic conditions declined along with the level of optimism in the Czech population (Linek, 2010). Czechs became more skeptical of their life expectations, and their life satisfaction was more linked to their everyday experience. Therefore, the link between perceptions of daily hassles and life satisfaction was stronger for other cohorts as well.

While all the domains of daily hassles contribute to the decrease in LS, their unique effects differ. Problems experienced by adolescents at school were the biggest contributors to decreased LS, because they were also the most frequent domain of hassles (*cf.* Barrett and Heubeck, 2000; Booth and Anthony, 2015). School difficulties differed from other difficulties in that they had a higher effect on LS in 1992. Schools' social influence in the communist era was still high in 1992, leading to the school difficulties being experienced as more serious. Although fears related to school are the most frequent in Czech adolescents (Michalčáková et al., 2013), we found that influence of daily hassles related to the school on life satisfaction slightly declined later. It may be related to the fact that students could in this period perceive problems at school as less severe or important in the overall context of their life in which adolescents started to be newly partially influenced by social media (Twenge, 2019).

Problems with money were very frequent across cohorts except the last one. For adolescents, this is primarily a parental support issue (Lavee and Ben-Ari, 2008; Suarez-Morales and Lopez, 2009) so the significant reduction in the incidence of money problems in the last cohort may be due to the recent increase in the standard of living of Czech families (Kuchařová et al., 2019).

All our findings must be considered in light of the fact that there were uncontrolled sampling differences between the individual years. Although the sampling procedure was the same, schools' motivations to participate, particularly parents' willingness to provide informed consent, have changed over the three decades. In 1992, the schools exercised the authority to administer surveys as a part of the curriculum without explicit consent from parents. This has gradually changed, and in 2011 and 2019, individual parental consent needed to be secured, with considerable proportions of students not participating in the survey.

The list of daily hassle domains has not changed since the first cohort in 1992. The relevance of individual domains of hassles may have changed and new relevant domains may have emerged. This presents a challenge for the formative index of the total daily hassles because formative indicators are not interchangeable and because the assumption of the constancy of (unit) weights may not hold. That questions the validity of the model using total hassles. However, the model with individual hassles shows that apart from school-related and public-information-access-related hassles the magnitude of association with life satisfaction does not change significantly.

Despite its limitations, our study sends a positive message about the well-being of Czech adolescents. The data show that

their subjective well-being, both in the form of life satisfaction and self-esteem, has been stable over the past three decades despite the macrosocial changes the Czech society has undergone over the period. Although the frequency of daily problems has changed slightly over these years, their impact on their life satisfaction has not changed much.

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 2019 research project was approved by the Research Ethics Committee of Masaryk University (Ref. No. EKV-2018-026). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

PM and SJ contributed to the conception and design of the study. LL organized the database. SJ performed the statistical analysis. PM wrote the first draft of the manuscript. PM, SJ, and LL wrote sections of the manuscript. 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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Superlatives, clickbaits, appeals to authority, poor grammar, or boldface: Is editorial style related to the credibility of online health messages?

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Adolescents, as active online searchers, have easy access to health information. Much health information they encounter online is of poor quality and even contains potentially harmful health information. The ability to identify the quality of health messages disseminated *via* online technologies is needed in terms of health attitudes and behaviors. This study aims to understand how different ways of editing health-related messages affect their credibility among adolescents and what impact this may have on the content or format of health information. The sample consisted of 300 secondary school students (M_{age} = 17.26; SD_{age} = 1.04; 66.3% female). To examine the effects of manipulating editorial elements, we used seven short messages about the health-promoting effects of different fruits and vegetables. Participants were then asked to rate the message's trustworthiness with a single question. We calculated second-order variable sensitivity as the derivative of the trustworthiness of a fake message from the trustworthiness of a true neutral message. We also controlled for participants' scientific reasoning, cognitive reflection, and media literacy. Adolescents were able to distinguish overtly fake health messages from true health messages. True messages with and without editorial elements were perceived as equally trustworthy, except for news with clickbait headlines, which were less trustworthy than other true messages. The results were also the same when scientific reasoning, analytical reasoning, and media literacy were considered. Adolescents should be well trained to recognize online health messages with editorial elements characteristic of low-quality content. They should also be trained on how to evaluate these messages.

KEYWORDS

message credibility, adolescents, scientific reasoning, analytical thinking, media literacy

Introduction

In today's digital world we are faced with vast amounts of information generated by social networks and the internet at large, in addition to traditional outlets. "The era of fake news" (Albright, 2017: 87) and the "information pandemic" challenge us in several ways and it has become quite hard to navigate in the realm of news and information.

Extremely easy access to health advice (such as social media for information on nutrition, Poínhos et al., 2017) is not a guarantee that the information encountered is valid and helpful. Indeed, recent research has confirmed that online health messages are mostly unsatisfactory, incomplete, and inaccurate, and/or have misleading content or even potentially harmful health information (e.g., Dutta et al., 2020, on COVID-19 and severe acute respiratory syndrome coronavirus 2; Goobie et al., 2019, on idiopathic pulmonary fibrosis; Loeb et al., 2020, on urological health issues; Mueller et al., 2019, on psoriasis; Mueller et al., 2020, on atopic eczema). Consequently, trusting health messages of an unsatisfactory quality can result in poor health choices that are ineffective at best and lethal at worst. For instance, conspiracy beliefs can have a real effect on general health. Recently published research showed that belief in conspiracy relates to negative attitudes toward vaccination (Jolley and Douglas, 2017: 459; Hornsey et al., 2018: 310–311). Thus, trustworthiness of online messages has become an issue of utmost importance (Flanagin and Metzger, 2008).

Trusting in a message or message credibility could be defined as "an individual's judgment of the veracity of the content of communication" (Appelman and Sundar, 2016: 63). Hence it refers to the perceived credibility and trustworthiness of the information, not the measure of the actual quality of the information (Freeman and Spyridakis, 2004: 240). Message credibility is also distinct from media or source credibility (e.g., Flanagin and Metzger, 2007; Appelman and Sundar, 2016; Sungur et al., 2016), however, it could be complicated to separate one from the other when evaluating message (Brante and Strømsø, 2018: 794). Often, judging source credibility is a pre-step in further assessing message credibility (Flanagin and Metzger, 2008).

Message credibility can be evaluated by describing its accuracy, authenticity, and believability (Appelman and Sundar, 2016: 73). The last one is considered to be the overarching characteristic of message credibility (Flanagin and Metzger, 2008) and, therefore, we wanted to examine this characteristic of health messages and decided to focus on the perceived persuasive intent of messages, which is one of the five heuristics people use when assessing online messages (Metzger et al., 2010: 434–435). The message itself can possess some features that contribute to higher perceived credibility, such as statistics and references (Hong, 2006: 551).

Prior work on message credibility has been interdisciplinary, such as information research or social psychology (Brante and Strømsø, 2018: 774–778). Typical research focuses on distinguishing fake and true information and on the different cognitive processes involved in the evaluation (e.g., Pennycook et al., 2020). Other branches of research deal with factors influencing message credibility, such as content or format features. For example, research shows that the strength of arguments is the main factor in message assessment (Li and Suh, 2015: 323). But this path of research is usually overlapping with source credibility research.

Since most of the research on credibility messages involves adult samples (e.g., Newman and Fletcher, 2017; Sterrett et al., 2018), this research focuses on adolescents as being "digital natives" (e.g., Bennett and Maton, 2010). However, a recent systematic analysis expresses concern about little research in this area and its possible impact on adolescents' health and life (Freeman et al., 2020: 215). Youth is an especially sensitive period for the development of good health practices, and it seems particularly salient to support healthy lifestyle preferences in this period (Kelly et al., 2011: 220–221). For instance, recent research has shown that risky behavior in youth is promoted by positive portrayals in the media, such as exposure to pro-smoking portrayals in movies (Sargent et al., 2005: 1185–1186) or to pro-alcohol portrayals (Hanewinkel et al., 2012: 712–714). Information obtained from interpersonal, online, or media sources changes how one approaches health and illness (Bell, 2014: 514). Online health information supports information provided by practitioners and participants report positive effect on health-related decisions, such as lifestyle changes, self-care, treatment compliance (Thapa et al., 2021: 780–781).

We cannot expect the media to provide healthier content or to drop unhealthier messages, it is up to the readers how they approach the messages (Brown, 2006: 459). They usually evaluate online information based on website appearance, website domain, and website language (Freeman et al., 2020: 219–220), meaning that they look at their structural features (Rains and Karmikel, 2009: 549–551). Website messages that use business-like language, authoritative organizations, or trusted brands are more trusted (Freeman et al., 2020: 219–220). Based on adolescents' reports in focus groups, they are also sensitive to editing elements (superlatives, clickbait, grammar mistakes, authority appeal, and bold typeface). Erroneous or insufficient editing influenced the distinction between the credibility and the untrustworthiness of messages (Vorelová and Masaryk, 2019).

Even though adolescents use online health information immensely, adolescents' strategies to appraise the information are not sophisticated (Freeman et al., 2020: 219). Adolescents search less systematically (Bilal and Kirby, 2002: 661–663; Hansen et al., 2003: 7), their search is superficial, and they seldom consider the source of the information

(Hansen et al., 2003: 7; Wallace et al., 2000: 93–94). It seems that adolescents' skills are rather inadequate and insufficient (Marttunen et al., 2021: 300–301). When evaluating sources, their assessments are focused more on relevance or accessibility (non-epistemic justification) than reliability or credibility (epistemic justification) (Coiro et al., 2015: 294; List et al., 2016: 47). And even if they find the proper information, secondary school students cannot reliably distinguish sponsored content in the text from the original editorial content (Wineburg et al., 2016). They usually believe what they encounter online, regardless of the marketing practices (Kim et al., 2011: 195). Therefore, it is very important to understand which health messages encountered online are trustworthy, and relevant, without commercial backgrounds such as advertising, promotion, or sponsorship (Kim et al., 2011: 188).

Most of the research on credibility messages involves adult samples (e.g., Newman and Fletcher, 2017; Sterrett et al., 2018). However, adolescents are active users and searchers for online health information. The relevance and quality of this information are questionable, we need to examine which information they perceive as credible. Although previous research has explored the strategies for judging online information, most of the research does not separate message credibility from media credibility, and little is known about message credibility and its prominent part-believability (Appelman and Sundar, 2016: 59–60). Since most of the studies concerning media trust are cross-sectional (Strömbäck et al., 2020: 146–147), we wanted to understand how manipulations with health messages affect their trustworthiness. Previous research has also suggested that both format and content of online messages might be important in perceiving messages as trustworthy (Metzger et al., 2003: 302–304). This study aims to understand how manipulations with short health messages affect their trustworthiness in adolescents and what implications this may have on content or format of health information. Moreover, this study builds on the previous study with high school students (Vorelová and Masaryk, 2019), in which the authors qualitatively explored message trustworthiness and identified five editing elements that deduced perceived message credibility. Accordingly, we wanted to experimentally verify the effect of content and format manipulations of short health messages (fake health messages, true health neutral messages, and true health messages with editing elements) on trust in messages. We hypothesized that adolescents perceive true messages as more trustworthy than fake messages (RH1). We also wanted to know how well the participants discern between true neutral messages and fake messages. Therefore, we explored their sensitivity to these messages, inspired by bullshit sensitivity (Pennycook et al., 2015). Sensitivity was calculated as deduction of the fake message score from the true neutral message score. Our second hypothesis thus stated that our participants are more sensitive to true neutral messages than to fake messages (RH2). We also hypothesized that true neutral messages will be more trusted than messages with editing elements (RH3) Lastly, we hypothesized that messages with editing elements are more trusted than fake messages (RH4).

However, the perception of message credibility can depend on previous knowledge and skills of participants. For example, previous research has shown that analytical thinking, scientific reasoning, and media literacy might help high school students to discern between trustworthy and untrustworthy messages. Analytical thinking is considered to be a broader cognitive ability, while scientific reasoning is a narrower ability. Analytical thinking in the dual-process theory (Kahneman, 2019) or Type 2 processing in the tripartite model of the mind (Stanovich et al., 2011: 374) are defined as conscious, effortful, slow, logical, and systematic. It is usually compared to intuitive thinking or System 1, which is described as fast, effortless, uncontrolled, and emotional. When a problem is simple, intuitive thinking helps us to come to quick decisions, gives us important cognitive shortcuts, and thus reduces endeavor and time. Analytical thinking is best suited for complex and complicated problems. Several recent studies (e.g., Pennycook and Rand, 2019; Pennycook et al., 2020) showed that people with better analytical thinking are usually better at discerning fake news from the real news, regardless of their political orientation. These studies examined mainly political fake news and used adult samples; therefore, we aim to examine the protective role of analytical thinking against manipulation of the messages in high school students (RQ1).

However, recent studies showed that besides analytical thinking, scientific reasoning is important in credibility issues as well (e.g., Čavojová and Ersoy, 2020). Scientific reasoning is defined as an ability to understand and apply principles of sciences, such as understanding hypotheses and theories, gathering data, and examining the evidence (Dunbar and Klahr, 2012). Research shows that scientific reasoning is related to distrust of alternative treatments and pseudoscientific health practices (Čavojová and Ersoy, 2020: e244). Scientific reasoning also predicted endorsement of general as well as health specific (related to COVID-19) unwarranted beliefs over and above analytical thinking (Čavojová et al., 2019: 5–7; Čavojová et al., 2020: 543–544). Therefore, to examine its effect on the manipulation of the messages we included scientific reasoning in our study (RQ2). Since domain-specific knowledge is bound to concrete problems that can be easier handled for adolescents (Bašnáková and Čavojová, 2019), we applied concrete scientific reasoning in the study.

Lastly, not everybody is motivated or able to reason analytically and scientifically, thus the focus is shifted more and more toward second-order scientific reasoning, such as media literacy. For instance, it helps in reducing current smoking and susceptibility to future smoking (Primack et al., 2006: 469) as well as to reduce the consumption of sugar-sweetened-beverages (Chen et al., 2017: 7). Furthermore, media literacy interventions decrease deviant behavior such as alcohol intake, smoking, body dissatisfaction, and eating disorders (Xie et al., 2019:153). The current study, therefore, explored whether media-savvy adolescents would be affected by manipulation of the messages in information trust (RQ3).

Materials and methods

Research design

We used the experiment with an incomplete within-subject repeated design with 1 factor (message) in 7 levels (fake message, true neutral message, true message with editing elements- superlatives, clickbait, grammar mistakes, authority appeal, bold typeface). Each participant randomly received every level of the independent variable (fake message, true neutral message, true messages with editing elements-superlatives, clickbait, grammar mistakes, authority appeal, bold typeface). We also ensured that each level of the independent variable (except fake message) was displayed with different content (different fruit or vegetable). The randomization of the independent variable was ensured by the Qualtrics program. There were three covariates to control the effect of the manipulation on the trustworthiness. No blinding was involved in this study.

Participants

The G*power 3.1 (RRID:SCR_013726) with the defined parameters calculated the required sample size to be 282. In the experiment, the target sample size was 300 including participants who might fail to pass the attention check question. The data collection agency stopped when $N = 300$ was reached.

The online research was opened by 721 participants, out of which 279 withdrew at some point, 98 finished the experiment before getting to the attention check question, 32 were excluded based on the results of the control question, and 12 did not finish the experiment after the control question. In total, 300 participants successfully finished the experiment. Participants that responded incorrectly to attention check question were excluded. There were no incomplete or missing data. We set up items in the program as obligatory. Only full answers were analyzed.

The sample consisted of respondents who attend secondary school in Slovakia aged 16–19 years. Respondents were informed of the intention and rules of the research through informed consent. Respondents were recruited *via* a research agency. The agency addressed respondents who met the following conditions: high school students aged 16–19, even distribution of men/women, and coverage from all regions of Slovakia. All respondents who required it were recruited by the agency through their legal representatives, who gave their consent for them to participate in the research. The research agency used an online panel to address respondents or their legal representatives.

The sample consisted of 66.3% of women, M_{age} = 17.26 (SD = 1.04). In total, 36.7% of students attended secondary grammar school, and 63.3% of students attended various specialized types of high school.

Materials

The research battery consisted of the presentation of short health messages, and the evaluation of their trustworthiness, followed by a single attention check question (out of 4 possibilities participants were asked to tick one). This was followed by three instruments measuring scientific reasoning, analytical thinking, and media literacy, respectively.

Experimental manipulation of the editing elements in short health messages

Health messages

To study the effect of manipulation of editing elements, we used six short messages (up to 35 words) about the beneficial health effects of various fruits and vegetables. The messages were based on real research findings and the example of the structure was: *"Natural source of pectin (Title). Carrot has a positive effect on cholesterol. It is because carrots contain pectin, which helps with decreasing cholesterol levels. Pectin enables exclusion of toxic substances from the body."* (The exact wordings of all used messages).[1] The six messages were chosen based on the results of the pilot study (see text footnote 1) to reflect the same level of trustworthiness.

Five new (manipulated) versions of each message were then created: (1) including 3 superlatives in the text of the message, (2) using clickbait title (3) including 3 small grammar mistakes in the text of the message, (4) adding a fictional source of the message[2], and (5) using 3 boldfaces to emphasize several words

1 https://osf.io/7vjxd/

2 http://healthydiet.com/effectofgooseberries

TABLE 1 Sensitivity between true neutral and fake messages.

	−4	−3	−2	−1	0	1	2	3	4	Total
Frequency	1	2	4	26	122	76	32	24	13	300
Percent	0.3	0.7	1.3	8.7	40.7	25.3	10.7	8.0	4.3	100

TABLE 2 Paired *t*-test comparing trustworthiness between true neutral/fake health message and health messages with editing elements.

			Comparison with the true neutral health message			Comparison with the fake health message		
	M	SD	*t*	*p*	*d*	*t*	*p*	*d*
True neutral health message	3.52	1.13	–	–	–	9.43	<0.001	0.77
Superlatives	3.42	1.14	1.43	0.154	0.12	−7.82	<0.001	0.64
Clickbait	3.26	1.15	3.43	0.001	0.28	−6.11	<0.001	0.50
Authority appeal	3.60	1.11	−0.98	0.327	−0.08	−9.87	<0.001	0.81
Grammar mistakes	3.45	1.08	0.95	0.346	0.08	−8.91	<0.001	0.73
Bold typeface	3.45	1.11	0.87	0.385	0.07	−8.12	<0.001	0.66
Fake health message	2.79	1.21	9.43	<0.001	0.77	–	–	–

in the message. This created a pool of 36 messages (six messages in six versions, available at (see text footnote 1).

To examine the ability to distinguish between true and fake health messages, we also included one fake message in the same format as true neutral health messages: *"Natural source of iqmerctin (Title). Beans have a positive effect on intelligence. They contain a substance called iqmerctin, which helps to increase intelligence. Iqmerctin is one of the active ingredients supporting brain development."* We used a made-up substance called "iqmerctin." The word is an amalgamation of the abbreviation IQ and word ivermectin which at the time of data collection was considered controversial in relation to treating COVID-19. The antiparasitic drug was initially considered to be a COVID-19 miracle cure but later research did not support the claim (Popp et al., 2021).

Dependent variable

Trustworthiness

Participants were asked to assess the trustworthiness of the messages by answering the question "*To what extent do you believe this message*?" on a Likert scale ranging from 1 (*not at all trustworthy*) to 5 (*totally trustworthy*). A single score was used for each message (theoretical range from 1 to 5) with higher numbers indicating higher trust in the message.

As a secondary variable, we also calculated the ability to recognize true and fake messages. Second-order variable sensitivity was calculated as a deduction of trustworthiness in fake messages from the trustworthiness of true neutral messages. The theoretical range is from −5 to +5. Positive numbers indicated higher trust in true neutral messages than fake messages, negative numbers the opposite. This allowed us to see the level of trust participants placed in each message and also their sensitivity to fake messages.

Covariates

Scientific reasoning

We used the Scientific Reasoning Scale (Drummond and Fischhoff, 2017) adapted by Bašnáková et al. (2021). It contains six items (available at https://osf.io/7vjxd/); for example, the "causation vs correlation" item was about increasing the birth rate: "*A researcher wants to find out how to increase natality. He asks for statistical information and sees that there are more children born in cities that have more hospitals. This finding implies that building new hospitals will increase the birth rate of a population. Agree/Disagree*." Each correct answer was assigned 1 point and we calculated the total score as the sum of all correct answers (theoretical range from 1 to 6), thus a higher number indicates better scientific reasoning. The mean score for the whole sample was 3.93 (SD = 1.45). Cronbach's α was 0.44 and ω = 0.45. We calculated average correct answers as the ratio of mean score and number of items. In total, 65.5% of items were answered correctly.

Analytical thinking

We used four items from the cognitive reflection test – two items from the numerical version (Frederick, 2005) and two items from the verbal version (Sirota et al., 2020). For example: "*If you were running a race, and you passed the person in 2nd place, what place would you be in now?*" (correct answer: 2nd, intuitive answer: 1st). The test is presented in full at https://osf.io/7vjxd/. The Sum of total correct answers (theoretical range from 0 to 4) reflects participants' analytical thinking with higher scores indicating better analytical thinking. The mean

score for the whole sample was 1.52 (SD = 1.04), Cronbach's α was 0.38 and ω = 0.41. We also calculated average correct answers as in the previous instrument and 38% of items were answered correctly.

Media literacy

We will use the Critical Thinking about Media Messages scale (Scull et al., 2010) to assess media literacy. The six items of the scale (for example "*I think about what the people who made the media message want me to believe,*" presented in full at https://osf.io/7vjxd/) are evaluated on a 6-point scale from 1 (*never*) to 6 (*always*). A total score (theoretical range from 6 to 36) was calculated as the sum of all item responses. Higher scores indicate a greater frequency of critical thinking about media messages. The mean score for the whole sample was 21.65 (SD = 6.22) and both α and ω were 0.85.

Ethical considerations

All the study's participants provided informed consent, and the study design was approved by the appropriate ethics review board. All procedures performed in the study followed the ethical standards of the 1964 Helsinki declaration and its later amendments and the Internal Institutional Regulation 5/2014. A local ethics committee at Comenius University, Faculty of Social and Economic Sciences, upon the Regulation 5/2014 ruled that no formal ethics approval was required in this particular case.

Data analysis

The data were analyzed using the IBM SPSS Statistics 20 (IBM SPSS Statistics, RRID:SCR_016479) and JASP software (0.12.2, RRID:SCR_015823). Descriptive analysis, Cronbach's alpha, McDonald's omega, paired *t*-tests, and repeated measures ANCOVA with *post-hoc* test were used to analyze the data. A *p*-value <0.05 was used as a criterion to determine the statistical significance of all analyses conducted in this study. Effect size *Cohen's d* was interpreted based on Cohen's suggestion (Cohen, 1992). Raw data are stored at osf.io/7vjxd.

Results

Sensitivity to messages

We used frequency analysis to explore the sensitivity between true neutral and fake messages (RH1, **Table 1**). In total, 40.7% of participants did not differentiate between fake and true health articles. The second-largest frequency (25.3%) refers to one point difference between the trustworthiness of a true health article and a fake article, which means a true health article was assessed by participants as only one point more trustworthy than a fake health article. When we add up the frequency of negative numbers of sensitivity, we see that 11% of participants trusted more fake messages than true messages. On the other hand, 48.3% of the participants trusted more health messages than fake messages. Mean of the sensitivity is close to one (M = 0.73; SD = 1.35). Sensitivity did not correlate with media literacy, $r_{(292)}$ = 0.05, p = 0.409. However, it weakly correlated with scientific reasoning $r_{(292)}$ = 0.17, p = 0.003, and analytical thinking $r_{(292)}$ = 0.12, p = 0.032.

Examining the effect of manipulation

Descriptive statistics for the different versions of the messages are displayed in **Table 2**. Based on measures of central tendency, variability, and distribution we concluded that the variables are normally distributed. To examine the effect of our manipulations on the trustworthiness of messages (RH1, RH3, RH4) we performed a series of paired samples *t*-test (**Table 2**).

The results showed that there was a significant difference in trustworthiness between neutral health message and fake health message, $t_{(299,1)}$ = −9.428, p < 0.001 with Cohen's d = 0.77 (medium effect size). It seems that our participants were able to successfully distinguish between the true neutral and blatantly false messages. This finding was corroborated also by the results from the comparison of the trustworthiness of the fake health message with the true messages, but with editorial elements aimed to manipulate their trustworthiness. The results showed significant differences in trustworthiness between fake health messages and all other health messages with editing elements (see **Table 2**) with Cohen's d number at least 0.50.

On the other hand, when we examined the differences in trustworthiness between true neutral messages and messages with editing elements, we found only one significant difference between true neutral health messages and health messages with clickbait, $t_{(299,1)}$ = 3.429 p = 0.001 with Cohen's d = 0.28 (small effect size). There were no other significant differences (**Table 2**).

Examining relationships with scientific reasoning, analytical thinking, and media literacy

To examine the effect of covariates (scientific reasoning, analytical thinking, and media literacy) on the trustworthiness and untrustworthiness of messages (RQ1, RQ2, RQ3) we performed a series of repeated measures ANCOVA tests.

There was not a significant effect of health messages on their trustworthiness after controlling for either scientific reasoning, $F_{(1,298)} = 3.278$, $p = 0.053$ or media literacy $F_{(1,298)} = 0.054$, $p = 0.817$; but there was a significant effect of type of health message on trustworthiness of the message after controlling for analytical thinking, $F_{(1,298)} = 5.041$, $p = 0.017$. However, Bonferroni's multiple comparisons indicated that there was a statistically significant difference in means between fake messages and both true health messages and true health messages with editing elements when controlling for scientific reasoning ($p < 0.001$), analytical thinking ($p < 0.001$), and media literacy ($p < 0.001$). There was also a statistically significant difference in means between true neutral messages and messages with clickbait when controlling for scientific reasoning ($p = 0.014$), analytical thinking ($p = 0.013$), and media literacy ($p = 0.014$).

Discussion

Interpretation of the results

Although adolescents search for health information online besides using other sources (such as doctors, parents, and peers), little is known about which online information they perceive as credible. Especially nowadays, in the times of not only fake news but also news that is insufficient, questionable, and potentially hazardous to health, skills and knowledge of assessing the credibility of online health messages are essential and necessary. To avoid the drawbacks of cross-sectional research and to have more insight into credibility itself, this study experimentally examined the effects of manipulation with content and format of health online messages on their trustworthiness in an adolescent sample.

Adolescents in our sample were able to discern between fake health messages and health messages whether true or slightly changed with editing elements. However, this result regarding the ability to discern the messages that are on the opposite truth scale (fake vs. true) is more complex. We examined the sensitivity to distinguish between blatant fake health messages and true health messages. It was computed as the deduction of scores on the trustworthiness of fake health messages from true health messages. The mean was low and around zero ($M = 0.73$, SD = 1.35). From deeper frequent analysis, we found that 48% of participants trusted the true neutral health messages more than the fake ones. However, 41% of participants considered fake and true neutral messages equally trustworthy and 11% considered true neutral health messages less trustworthy than fake health messages. This result is not insignificant. Putting trust in messages requires identification of fake vs. true content. Fake content could also have the form of lies and deception, and relevant research confirms difficulties in discerning lies from true statements (e.g., Hartwig and Bond, 2014). Chances of identifying lies are close to random distribution (from 50 up to 70%), regardless of whether the setting is laboratory or real-life situations, regardless of whether participants are lay people or professional lie catchers (Aamodt and Custer, 2006: 9; Bond and DePaulo, 2006: 226; Hartwig and Bond, 2014, par: Alternative metrics). Furthermore, fake or lie identification could be medium bounded. Online communication is asynchronous, detached, non-interactive, low in richness, therefore there are less informational cues present which might impede a reader to decide on truthfulness (Carlson et al., 2004: 11–13; Burgoon et al., 2005: 2). Identification of untruth content is rather a difficult process than a simple one, and various cues (verbal linguistic and verbal content, non-verbal, contextual) or meta-cues (interactions between cues) help in true vs lie decision (Carlson et al., 2004: 7–10).

In the case of health messages that seem plausible, reasonable, and probable enough, adolescents could not tell the difference between true neutral health messages and health messages with editorial elements. The results were the same when we controlled for individual differences (scientific reasoning, analytical thinking, and media literacy). It suggests that adolescents perceive these messages as trustworthy regardless of the various content and format manipulations (superlatives, appeal to authority, boldface, grammatical errors), regardless of their reasoning skills and media literacy. The only health message with an editorial element that was significantly less trusted compared to a true health message was a clickbait headline message.

It seems that in the case of health messages that seem possibly true and believable, adolescents do not either notice or decide on their trustworthiness based on editing cues (except clickbait). These editing cues (superlatives, authority appeal, bold type, and grammar mistakes) were identified by focus groups (Vorelová and Masaryk, 2019) as being the ones that are spotted in text and decrease the credibility of the message. They are rather easily noticed cues compared to other cues that need content-demanding skills or other assessment skills that adolescents might not possess. The participants rather ticked their answers without prior deeper consideration of the content or the format cues. Only clickbait seems to be "popular" enough that adolescents were able to recognize it. Clickbait headlines seem to discourage readers and may lower message credibility (e.g., Molyneux and Coddington, 2020; Kaushal and Vemuri, 2021; Molina et al., 2021).

All four factors—source, message, media, and readers—might influence overall perceived trustworthiness (Hocevar et al., 2017). In this research, messages were stripped of source and media factors. Thus, the participants could not rely on cognitive heuristics that are frequently used to assess online messages (e.g., Metzger et al., 2010; Freeman et al., 2020). For example, messages were not displayed on the websites and therefore adolescents had to search for other features and cues besides source credibility, website

appearance, or logo (e.g., Metzger et al., 2010; Strömbäck et al., 2020). Nor could adolescents rely on endorsement by other people (e.g., Metzger et al., 2010). Moreover, the participants could not check the content of the message and compare the information with other sources as to its accuracy, fairness, or bias (e.g., Brante and Strømsø, 2018; Strömbäck et al., 2020). Therefore, adolescents could only rely on themselves and the information in the provided messages.

One possible explanation of participants' failure to notice the editing cues comes from the tripartite model of mind proposed by Stanovich et al. (2011: 373–378). In this model, the mind is divided into the autonomous (fast-thinking, intuitive), the algorithmic (slow thinking, rational), and the reflective mind. The latter embraces general knowledge and beliefs. According to this model, individual differences in rational thinking dispositions are shown in a reflective mind because this type of mind refers to goals and beliefs relevant to the goals. Both algorithmic and reflective minds contribute to so-called mindware that encompasses declarative knowledge and procedural skills. Mindware helps to initiate detection processes followed by inhibitory processes that override System 1 (Stanovich, 2018: 432–433). From this point of view, there are two types of judgment errors relating to mindware that can happen: error of comprehension (or knowledge error) and error of application (or process error) (Stanovich et al., 2011: 366; Stanovich, 2018: 433).

The participants might have both judgmenterrors. They either do not have the necessary knowledge or do not know how to use this knowledge. Stanovich et al. (2011: 369) highlight that mindware is a very special subset of several skills and knowledge, such as probability, scientific reasoning, formal and informal reasoning, evaluation skills, examining possibilities, and avoiding myside thinking. The autonomous set of systems, on the contrary, includes behavioral regulation by emotions, implicit learning, and overlearned associations. It seems that adolescents only have the autonomous set present and available. In the case of mindware, they have not created it yet or they might have inadequately learned it (Stanovich, 2018: 440).

In both scenarios, the implication should be focused on learning declarative knowledge or correcting inadequately learned mindware. This is a very important step in prevention or intervention because the availability of mindware is the very key parameter that stands out in the concept of individual differences in heuristics and biases tasks (Stanovich et al., 2011: 379–380). We could see it as the first phase in a 3-stepped model of applying mindware into action. Without knowledge of mindware, one cannot apply this knowledge to practice. And we could start by clarifying the concepts connected to credibility because as Hilligoss and Rieh (2008: 1468–1469) reported that there are at least 5 distinct conceptualizations of credibility by people: truthfulness, believability, trustworthiness, objectivity, and reliability. Then we might introduce cues for online assessment, such as content cues (refers to content itself), peripheral source cues (such as institution, reputation, affiliation), and peripheral information object cues (such as appearance and presentation of the information) (e.g., Hilligoss and Rieh, 2008; Brante and Strømsø, 2018; Park and Kwon, 2018; Strömbäck et al., 2020). Our research also confirms how important different cues are for the adequate assessment of health online messages. Context- and social-free messages are hard to evaluate because a great number of cues are missing. When we help adolescents to become sensitive to cues, they will direct their attention to these cues, as prominence-interpretation theory states (Fogg, 2002: 722–723). Thanks to this attention-grabbing process they can proceed then to evaluate the credibility. The basic tenant in the prominence-interpretation theory says that both these processes are important to judge online information and if one is missing, the users will not be able to evaluate the credibility. Spotting editing cues could later become adequate cognitive heuristics that could help to appraise online health messages effectively, accurately, and correctly (Metzger et al., 2010: 433; Freeman et al., 2020: 219).

The second error regarding mindware relates to errors of process (Stanovich et al., 2011: 366; Stanovich, 2018: 433). Stanovich et al. (2011: 374–375) distinguish between Type 1 processing (heuristics) and Type 2 processing (analytic and reflective). Heuristics are defined as autonomic since they are carried out autonomously and without deliberate cognitive effort, similar to Kahneman (2019). The main function of Type 2 processing is to deactivate heuristics processing and to become engaged in higher cognitive processes. This could be the second reason why the adolescents in this research were not so successful in distinguishing health messages. Type 2 processing was not successful in switching off automatic heuristics processing, Type 2 did not override Type 1 processing. Thus, even if the adolescents had relevant mindware, they used superficial and unsophisticated strategies, such as intuition or other heuristics, in giving their trust to the presented health information; this has previously been confirmed in research (e.g., Freeman et al., 2020). Moreover, based on the credibility assessment model, it is very important what kind of heuristics people have developed or possess because these are then widely used across different sources and contexts (Hilligoss and Rieh, 2008: 1479–1480).

We did not ask participants whether they had any knowledge about trustworthiness or message credibility, nor were they asked to explicitly name the processes used during the evaluation of the trustworthiness of online health messages. However, in recent research (e.g., Gray et al., 2005; McGrew et al., 2018; Tamboer et al., 2022) adolescents admitted that they evaluate online health messages based on the trial-and-error method and they were aware of the need for improving their health literacy skills. It seems that adolescents might be

aware of their limits in assessing the trustworthiness of online information and they also might have a need for cognition after all.

Other interesting results concern sensitivity which was computed as the trustworthiness of true messages minus the trustworthiness of fake messages. We found that sensitivity did not correlate with media literacy, but weakly correlated with concrete scientific reasoning and analytical thinking. These concepts were carefully chosen based on previous research, and we supposed that they would help in the evaluation process. However, media literacy as a widely accepted concept for media consumers did not meet our expectations. This could be a result of the used tool, which was a self-reported scale (compared to the other two instruments that were performance tests) and that it focuses on the analysis of media in general. Moreover, in this study, we used informative health messages on the positive effect of fruits and vegetables. In other research on media literacy and health behavior, media literacy was linked to the substance use behavior or risky behavior (Primack et al., 2006: 469; Xie et al., 2019: 153). This could be another explanation for not finding a relationship between sensitivity to health messages and media literacy. Media literacy seems more important in risky behavior and in deciding what to avoid rather than in promoting healthy behavior. Furthermore, informative health messages were not intentionally worded to help adolescents solve their possible health issues. Adolescents probably did not connect to the information as they did not need it.

Two other individual characteristics were related to cognitive abilities, namely analytical thinking and scientific reasoning. Both might contribute to better discerning online health messages (e.g., Čavojová and Ersoy, 2020; Pennycook et al., 2020). In this research, adolescents were poor analytical thinkers, because only 38% of items were answered correctly. However, they were better in scientific reasoning, with almost 65% of correctly answered items. This was corroborated by a stronger relationship of scientific reasoning to sensitivity compared to analytical thinking, even though both correlations were small as to effect size. Analytical thinking seems to help in evaluating both content and format of health messages (fake, true, and edited messages) when an individual needs to decompose the whole into parts in order to evaluate these parts as well as the whole, to find disrupting parts of the message. On the other hand, in discerning fake vs. true health messages scientific thinking helps to find evidence to evaluate these messages and to search for content evidence.

Nonetheless, the adolescents were not keen on using cognitive skills since applying heuristics enables them to spend less energy and sources. "Humans are cognitive misers because their basic tendency is to default to processing mechanisms of low computational expense" (Stanovich, 2018: 424). The second reason why people hinder themselves from applying cognitive abilities is that heuristics must be overruled by some other previously received information or previously learned rule, as was previously stated in the mindware section. If there is no other information or another rule, then obviously one cannot proceed with override.

There is another possible explanation for these results. According to a reflective mind, one needs to have goals and beliefs relevant to this goal. It means that people also need to be motivated and have the self-esteem to apply Type 2 processing and override Type 1 processing (e.g., Stanovich et al., 2011; Stanovich, 2018). Motivation is also mentioned in other models (such as the elaboration likelihood model by Petty and Cacioppo, 1986) or along with credibility assessment (e.g., Metzger et al., 2003; Freeman et al., 2020; Tamboer et al., 2022).

As adolescents are frequent users of the internet, we usually expect that they already know how to approach and appraise online information. The opposite is true, and it seems they have serious gaps in their knowledge. Based on the judgment errors relating to mindware (Stanovich et al., 2011: 366; Stanovich, 2018: 433), we suggest that adolescents should be well trained in procedural knowledge, which means adolescents should know about editorial elements that are characteristic of websites with low-quality content (e.g., Čavojová et al., 2016). On top of that, they should be trained in evaluating online messages (e.g., Petty and Cacioppo, 1986; Metzger et al., 2003; McPherson et al., 2004; Freeman et al., 2020), which means recognizing the cues for evaluation, both central and peripheral, evaluating online messages based on criteria, as well as recognizing problematic messages or misleading cues. This means increasing sensitivity toward cues and enhancing evaluation thinking.

Adolescents should also be trained in analytical thinking and scientific reasoning, as these skills seem to help distinguish false from true health messages. With increased and reinforced knowledge, adolescents can become successful thinkers. They will have two processes and two possible answers available. One that is intuitive and the other one that is a result of analytical thinking. They will better metanalyze their skills, better evaluate their skills and they will not fall for the Dunning–Kruger bias. This effect has been shown in reasoning with intuitive thinkers overestimating their knowledge and analytical thinkers having a more precise estimation of their knowledge (Kruger and Dunning, 1999: 44; Pennycook et al., 2017: 1782–1783). Those who are most biased are the ones that probably neither show propensity to think analytically nor have metacognitive skills to recognize their incompetence (Pennycook et al., 2017: 1782).

However, developing these cognitive advantages is a long-term and demanding process that should be part of the education system. In reality, it seems that the education system does not meet the need for assessment skills and falls short of the requirements of the modern world (Bašnáková et al., 2021: 14–15).

Limits of the study

This study has several limitations. The sample was limited to high school students, so the sample is biased regarding the proportion of adolescent school structure. Also, the participants had to have access to the internet and be reachable by the agency. There were also twice as many women in our sample as men.

The experiment itself has several drawbacks including ecological validity. In real-life situations, adolescents would probably not read seven health messages in a row to get the information they search for as previously noticed by other researchers (Hansen et al., 2003: e25; Freeman et al., 2020: 221).

Another limitation refers to the internal consistency of the two instruments, namely analytical thinking and scientific reasoning. The results of two different methods (Cronbach's alpha and McDonald's omega) were similar and low. This is not surprising since the two instruments are performance instruments that have right and wrong answers, and internal consistency is generally preferred for evaluating scale-based instruments. Other researchers have reported comparable levels of reliability measures for scientific reasoning in the localized version of this instrument (see Čavojová and Ersoy, 2020; Čavojová et al., 2020; Bašnáková et al., 2021). The analytical thinking instrument consisted of four items. In general, lower numbers of items contribute to lower internal consistency (Urbánek et al., 2011). It was also constructed as a combination of selected items from two versions of analytical thinking instruments, namely the numerical version created by Frederick (2005) and the verbal version developed by Sirota et al. (2020). This could contribute to lower internal consistency as well.

We used short health messages with selected vegetables/fruits based on a pilot study. The content of the messages was positive and supportive but might not have elicited enough interest in the adolescents to engage them in the topic. Some adolescents could have been more interested in the health issues and be also more educated in it. Credibility is often connected with the abilities and motivation of the receivers (e.g., Metzger et al., 2003; Freeman et al., 2020). Another potential direction of the future studies could include manipulations with messages on different health related topics.[3]

Health literacy might also prove to be a valuable concept in this regard. Defined as "the acquisition, understanding and application of context-specific knowledge," health literacy is usually measured on three levels, described as functional, interactive and critical health literacy (Nutbeam, 2009: 304). Higher level of health literacy suggests the greater the autonomy and personal empowerment in health-related issues (Nutbeam, 2009: 304). Moreover, people with lower or limited health literacy are likely to distrust specialist doctors and dentists, but they rely on and put trust in other sources (such as social media, blogs or celebrity webpages, and commercial/corporate sources) that might have dubious information (Chen et al., 2018: 730). The combination of health literacy and media literacy may prove to be the way to go. Some argue that media literacy is not only complementary to health literacy, but one of the factors to increase health literacy would be to increase media literacy (Akbarinejad et al., 2017: 5; Schulenkorf et al., 2021: 5).

As our research shows it is reasonable to explore secondary school students' perception of online health message credibility. Our results are both disturbing and encouraging at the same time. Adolescents did discern fake messages vis-a-vis true or edited messages. However, almost half of the sample could not differ true from fake messages which is an alarming number. But the hopeful news is that analytical thinking and scientific reasoning seem able to help secondary school students to better discern between fake messages and true messages. Moreover, only clickbait messages stood out among other messages with edited format and content when it came to distinguishing from true messages. Other content and format changes in online health messages (superlatives, authority appeal, bold type, and grammar mistakes) were overlooked by adolescents. These results suggest a way how secondary school students could be better equipped to handle messages in the era of information over-abundance.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found below: OSF https://osf.io/7vjxd.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee at Comenius University, Faculty of Social and Economic Sciences. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

KG: conceptualization, writing – original draft, data curation, data analysis, and writing – review and editing. RM and VČ: conceptualization, writing – review and editing, and funding acquisition. NS: conceptualization, development of design and methodology, and writing – review and editing. 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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The development and validation of an emotional vulnerability scale for university students

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This study developed an emotional vulnerability scale and examined its reliability and validity with a sample of university students. In health psychology, a measurement of emotional pain ("hurt feelings") can contribute to the prevention and improvement of physical and mental health problems in daily life. We collected data from 361 Japanese university students (186 men and 175 women; mean age=19.6±0.98years). From preliminary interviews with 20 participants, 42 semantic units were extracted. For scale development, a questionnaire survey was conducted using the 42 extracted categories, and exploratory and confirmatory factor analyses were performed. Four factors (16 items) emerged, which were both reliable and valid: (1) "vulnerability toward criticism or denial," (2) "vulnerability toward worsening relationships," (3) "vulnerability toward interpersonal discord," and (4) "vulnerability toward procrastination and emotional avoidance." This scale can be useful to understand vulnerability in everyday situations and grasp the vulnerable conditions experienced by individuals. This can help prevent stress responses (such as depression and sadness) and mental health problems, which are valuable contributions to health psychology.

KEYWORDS

vulnerability, mental health, university students, scale development, depression

Introduction

Emotional pain is part of the human experience, although its causes may vary. Characterized by Leary et al. (1998) as "hurt feelings," emotional pain is likely to be perceived as physical pain (Chen et al., 2008). People at a high risk of emotional pain are described as psychologically vulnerable (Jose, 2005). It is possible for some people to be more susceptible to emotional pain than others. The phenomenon of being at risk for psychological hurt is referred to as "vulnerability," which was proposed by Sinclair and Wallston (1999) as a psychological construct. They defined it as a "pattern of cognitive beliefs reflecting dependence on achievement or external sources of affirmation for one's sense of self-worth" (Sinclair and Wallston, 1999, p. 120). From their definition, external sources can indicate events in daily life and interpersonal relationships that may elicit

varying degrees of emotional pain, mediated by negative cognitive styles. How one responds to external sources of information depends on how one perceives events that occur in daily life and interpersonal relationships. Therefore, the more vulnerable people are, the more negative their perception of external sources, thus indicating how emotional pain is mediated by negative cognitive styles.

University students, who are the focus of this study, face many stressful life events, such as changes in their lifestyle, community, and relationships (Steptoe et al., 2007; Bayram and Bilgel, 2008; Ibrahim et al., 2013), thereby increasing their psychological vulnerability. Furthermore, maladaptive cognitive reactions to interpersonal events can affect coping behaviors, interpersonal relationships, and psychological and physical well-being (Nogueira et al., 2017). Thus, we developed an emotional vulnerability scale and examined its reliability and validity with a sample of university students.

Vulnerability

Hayashi (2002) defined vulnerability in the Japanese context as a susceptibility to psychological harm and a possible state of fragility or emotional hurt. It represents a cognitive belief or experience that renders a person susceptible to hurt feelings in response to everyday life events. Additionally, vulnerability has been defined as a "cognitive structure that makes individuals more fragile under stressful environments, assuming that some people are more affected by stressful events than others" (Sinclair and Wallston, 1999, 2010). These definitions indicate that vulnerability is a "cognitive belief" (Çutuk and Aydoğan, 2019) about oneself being easily hurt and is distinct from personality traits or states. Thus, some people may be vulnerable if they have strong cognitive beliefs about themselves as being weak or fragile. Vulnerability is negatively associated with positive emotions, life satisfaction, and optimism (Sinclair and Wallston, 1999). Furthermore, vulnerable individuals display a negative interpretation of life events only when they are confronted with certain stressors, which places them at high risk for depression and other diverse negative outcomes (Ingram and Luxton, 2005). Increased vulnerabilities also lead to poor mental health and lack of social support (Akın and Eker, 2011). The negative correlation between vulnerability and self-efficacy has an adverse effect on behavioral motivation (Kiamarsi and Abolghasemi, 2014), and higher levels of vulnerability are associated with higher levels of depressive symptoms (Yamaguchi et al., 2018, 2019). Notably, women are more vulnerable than men (Yamaguchi et al., 2019). Furthermore, studies of athletes report that when vulnerable athletes engage in stress coping, they may focus on resolving emotional hurt and negative feelings or seek help from a reliable person (Yamaguchi et al., 2022). From a psychopathological perspective, vulnerability is associated with depression and anxiety disorders. Several cognitive vulnerability–stress models propose that one's characteristic way of attending to, interpreting, and remembering negative events affects one's psychopathological vulnerability (Reardon and Williams, 2007). Therefore, severe vulnerability may lead to mental illness. These findings show that vulnerability is significantly associated with negative attitudes that impede mental recovery and that vulnerability affects not only human mental health, but also interpersonal relationships and behavior.

Measures of vulnerability

Several measures have been developed to assess vulnerability, some of which have been used by the studies previously mentioned. The psychological vulnerability scale (PVS) was developed by Sinclair and Wallston (1999) based on the emotional difficulties experienced by rheumatoid arthritis patients. According to Sinclair and Wallston (1999, 2), the PVS was designed to identify individuals with cognitive patterns that make them more susceptible to stress. Vulnerability in this study was defined according to the notion of "cognitive belief" mentioned earlier. Specific items include: "If I do not achieve my goals, I feel like a failure as a person," "I am frequently aware of feeling inferior to other people," and "I need approval from others to feel good about myself." From such items, it is possible to understand how effectively patients with rheumatoid arthritis have adapted to the pain and dysfunction associated with their condition. Using this scale, screening can be performed for cognitive vulnerability related to perceptions of dependency, perfectionism, negative attributions, and the need for external sources of approval. The athletic vulnerability scale (AVS) was developed by Yamaguchi et al. (2019) to determine athletes' susceptibility to emotional hurt in sports settings. This scale, which was developed in Japan, was based on the definition of Hayashi (2002), with reference to Sinclair and Wallston's PVS and related research. Specific items include: "I feel emotionally hurt when peers talk about me behind my back;" "During games, I feel depressed if I do not produce my usual performance;" and "I lose confidence if athletes of a lower level than me receive good evaluations." As these items show, terms specific to the target population are used, such as "match," "competition," and "athlete."

In addition, one factor of a 134-item self-descriptive inventory developed by Altman and Wittenborn (1980) listed items related to narcissistic vulnerability, such as "I cry immediately" and "I am very sensitive to being criticized." Although it is possible to assess the vulnerability of an individual as a personality trait, these items do not constitute scales, but represent a single factor assessed by the scale. Furthermore, it is possible that vulnerability connected with self-described dysphoria is different from the original state of vulnerability. In connection with the above Crowe et al. (2018), developed the Narcissistic Vulnerability Scale, a questionnaire that rates adjectives such as "Ashamed," "Ignored," "Underappreciated," and "Vengeful." We posit that these items are not related to vulnerability but are measures of psychiatric narcissism; therefore, it is difficult to determine whether they truly measure an individual's vulnerability. Thus, vulnerability measures

that have been developed to date are limited to specific groups of people or individual personality traits.

Schaufeli et al. (2002) pointed out the need to create measurement indicators that are tailored to the attributes and characteristics of the participants and to perform evidence-based analysis based on accurate psychological assessment. Therefore, Sinclair and Wallston (1999) and Yamaguchi et al. (2019) created measures of vulnerability specifically for patients with rheumatoid arthritis and university athletes, respectively, thereby addressing Schaufeli et al. (2002) point. However, using the above scales, it may be difficult to measure vulnerable conditions and emotional pain in interpersonal relationships, such as those experienced in daily life. For example, the AVS (Yamaguchi et al., 2019) cannot be used to measure the vulnerability of university students in daily life. In addition, a scale measuring the vulnerable conditions specifically experienced by patients with rheumatoid arthritis may not be suitable for measuring the experience of vulnerability in healthy participants who are responding to everyday difficulties in life and interpersonal relationships. To date, no indicators have been developed to measure the events and conditions related to vulnerability that people in general commonly experience in daily life. An emotional vulnerability scale that can be universally applied without limiting its scope to a target audience or specific situation is yet to be developed. In addition, it is unclear whether measuring vulnerability in relation to self-described dysphoria truly captures the concept of vulnerability. Therefore, it is difficult to measure an individual's vulnerability in everyday situations, which seems to be an issue common to all the scales mentioned above.

In sum, existing measures of vulnerability tend to focus on specific populations, such as athletes or people with rheumatoid arthritis. Thus, we developed an emotional vulnerability scale to establish the degree of vulnerability experienced by university students concerning everyday situations and events that may be applicable to even non-athletic students and healthy individuals. According to Leary et al. (1998) and Feeney (2005), "hurtful experiences" readily occur for many people on a daily basis, are memorable for a long period, and can have a significant impact on human cognition and behavior. In that context, university students interact and form close relationships with more people than junior high school and high school students and experience several life events related to their future prospects. Consequently, highly vulnerable people may respond with intense hurt feelings to specific events, which may impair their mental health. The specific conditions vary across individuals. Being able to measure and understand the vulnerability experiences and conditions of university students may elucidate their mental health.

Preliminary investigation

The purpose of the preliminary investigation was to conduct a survey using semi-structured interviews among university students, gather data regarding factors that characterize vulnerability in daily life, and create a draft scale based on the collected data.

Method of preliminary investigation

Participants

The participants for the preliminary study were 20 Japanese university students (10 men and 10 women; mean age = 21.1 ± 0.83 years). Included participants were active university students who had not taken a leave of absence owing to health-related, academic, or financial reasons in the past year. Students who had been medically diagnosed with mental disorders were excluded. Based on these inclusion and exclusion criteria, we used random sampling to recruit interview participants. To collect data on a wide range of vulnerability-inducing events that can be experienced in everyday situations, we assumed a required sample size of about 10 people. Twenty students volunteered to participate, none of whom were excluded.

Procedure

The survey was conducted from December 2020 to January 2021 using an online conference system. The interview consisted of three predetermined questions. Since physical pain was not the subject of this study, the questions were focused on experiences of emotional hurt. Shinmura (2018) states that vulnerability means feeling "fragile and weak." When conducting an interview survey, we observed some difficulty among the participants in answering the question "Have you ever felt vulnerable?" Therefore, the question was split into "Have you ever felt fragile" and "Have you ever felt weak?" and participants' responses were collected. The time required to complete each interview was approximately 30 min. The content of the interviews was recorded by an online conference system with the consent of the participants. As the survey was conducted online, we paid close attention to ensuring privacy; to do so, the first author and researchers used the conference room in the university, and the participants responded to the interview in a place that ensured privacy (e.g., home, alone in a room). Before interview commencement, we confirmed that the participants were alone.

We created the following questions for the semi-structured interview.

1. Have you ever experienced emotional hurt in your daily life? Can you explain more about it?
2. Have you ever felt "fragile" in your daily life? Specifically, what kind of event caused this feeling?
3. Have you ever felt "weak" in your daily life? Specifically, what kind of event caused this feeling?

Ethical considerations

Before the interview survey, participants were informed, in writing and verbally, about the purpose of the survey, that participation was voluntary, and that they would not be disadvantaged if they did not participate in the survey. In addition, they were informed that the recordings of the interviews would not be used for purposes other than that of this study.

Participation in the study was considered as consent. This study was conducted with the approval of the institutional review board of the institution to which the principal author is affiliated. The specific approval number was "2020–15."

Data analysis

The recorded interview data provided by the participants were transcribed. The data were sorted according to the Kawakita Jiro method (Kawakita, 1967). The vocabulary items were aggregated from similar expressions and categorized with labels indicating vulnerability in everyday situations, in accordance with Hayashi (2002, p. 1) definition of vulnerability as "a susceptibility to psychological harm, a possible state of brittle or emotional hurt." Based on these items, the appropriate question items were created in Japanese. Regarding the aggregated vocabulary, items having ambiguous content or unclear meanings, which significantly differed from the definition of vulnerability, were excluded from the analysis. A university faculty member specializing in health psychology, another member specializing in sports psychology, a graduate student specializing in sports psychology, and another specializing in mental health science participated in a discussion on item selection. The four experts agreed verbally after examining the printed data from the interviews, and any disagreements were resolved through appropriate discussion. This corresponds to the concept of "Showing Face Validity" mentioned by Wood and Boyce (2017), affirming people's views that the items are logical and relevant.

Preliminary survey results and discussion

From the analysis performed on the preliminary data, we identified seven major categories: remorse, diluted relationship, pressure, difficulty to refuse, procrastination, avoidance/escape, and susceptibility to critique. In addition, 42 subcategories were identified based on an evaluation of the aggregated vocabulary and Hayashi's definition of vulnerability (details of the categories and subcategories are presented in Supplementary Table 1).

Remorse

"Remorse" refers to content that expresses discouragement based on personal incompetence and the poor execution of an event. Answers regarding emotionally hurtful events that expressed remorse included "I feel inferior compared to others," "It will hurt if you show your feelings on your face," and "I will carry my mistakes around forever." Remorse was expressed when participants had experienced emotionally hurtful events that they blamed themselves for.

Diluted relationship

"Diluted relationship" refers to instances where participants expressed being emotionally hurt by interpersonal relationships. Answers included "I do not get on well with friends," "I feel like I am out of place," and "The other party's reply is slow." The obtained content clearly showed participants' vulnerability to psychological damage.

Pressure

"Pressure" refers to being emotionally hurt by tension and excessive anxiety. Responses such as, "I feel sick when I am responsible for something," "Speaking in front of many people makes me nervous," and "I am scared to fail," among others, showed that participants experienced emotional pain in tense situations.

Difficulty to refuse

"Difficulty to refuse" refers to having trouble in actively declining a request or invitation from others; it describes the emotional pain the participant experiences when refusing a request. The inability to explicitly refuse a request or invitation indicates weakness or fragility. Responses such as "I cannot argue/I cannot oppose," "I cannot refuse/I am pitiful if I cannot refuse," and "I do not want to be disliked/I cannot decline an invitation" clearly showed participants' susceptibility to interpersonal damage.

Regret over procrastination

"Regret over procrastination" refers to feelings of regret or remorse caused by the participant's negligence. Answers included "I do nothing when I am alone," "I am tired and cannot do that/I do not want to do it/I have to do it, but I do not," and "I do not want to do anything." The content expressed participants' feelings of disgust toward themselves, conveying a sense of hurt.

Avoidance/escape

"Avoidance/escape" refers to avoidance of emotional hurt by escaping an event. Responses such as "I want to run away/It is not convenient for me," "I will procrastinate/I give up," and "I cannot keep it going" showed that, rather than taking action and experiencing pain, the participants tried to minimize damage by escaping.

Susceptibility to critique

"Susceptibility to critique" described being emotionally hurt by the opinions and evaluations of others. Answers that showed participants' tendency to feel hurt by others' opinions included "I am directly told bad things about myself" and "my personality/existence/opinion was denied."

The main study

Purpose

We developed an emotional vulnerability scale based on the 42 semantic units obtained in the preliminary survey, determined the reliability and validity of the scale, and examined basic attributes using the scale.

Method

Participants

We collected data from 361 Japanese university students (186 men and 175 women; mean age = 19.6 ± 0.98 years). Survey participants' grades were as follows: first year (n = 40, 11.1%), second year (n = 192, 53.2%), third year (n = 102, 28.3%), and fourth year (n = 27, 7.5%). The participants were from the following university departments: sports and health sciences (n = 136), social welfare (n = 80), liberal arts (n = 51), literature (n = 35), economics (n = 17), commerce (n = 15), medicine (n = 11), engineering (n = 5), agriculture (n = 5), arts (n = 3), education (n = 1), and sociology (n = 1). Regarding membership status in university and off-campus clubs, the distribution was as follows: club activities (n = 175), circle activities (n = 45), extracurricular club teams (n = 13), and no club membership (n = 128). As with the preliminary survey, the exclusion criterion was the diagnosis of a mental disorder; no student fulfilled this criterion. All students fulfilled the inclusion criterion of being active university students who had not taken a leave of absence owing to health, academic, or financial reasons in the past year. The recruitment process was identical to that of the preliminary study.

Procedure

This study was conducted from June 2021 to July 2021, when classes were held online because of COVID-19-related restrictions. The survey was also conducted online, using Google Forms, and took approximately 10 min to complete. About 3 weeks after the first survey, 64 participants (32 men and 32 women; mean age = 20.0 ± 1.05 years) extracted from the original 361 participants by random sampling completed the emotional vulnerability scale again to assess test–retest reliability.

Ethical considerations

Before administering the questionnaires, the participants were fully informed, in writing and verbally, about the purpose of the survey, that participation was voluntary, and that they would not be disadvantaged if they did not participate in the survey. In addition, it was explained that the survey was anonymous, and the survey results would not be used for purposes other than that of this study. Participation in the survey was taken as consent. This study was approved by the institutional review board of the institution to which the first author is affiliated.

Measures

The questionnaire survey consisted of the following measures.

Sociodemographic questions

We collected data regarding the university students' sex, age, grade, undergraduate area of study, and club activities.

Draft of the emotional vulnerability scale

A draft of the emotional vulnerability scale was prepared using the 42 items obtained from the preliminary survey. The participants responded on a four-point scale, ranging from 1 = "I completely disagree" to 4 = "I completely agree." The total score was calculated by adding the average of each item. Higher scores indicated higher levels of vulnerability.

Scale for measuring depressive symptoms

The self-rating depression scale (SDS) developed by Zung (1965) was used. It consists of 20 items, with four possible responses ranging from 1 = "A little of the time" to 4 = "Most of the time." Higher scores indicated more severe depressive symptoms. Zung (1965) has reported a split-half reliability of 0.73 for the scale. In the present study, the scale showed good reliability, with a Cronbach's alpha value of 0.86.

Data analysis

In developing the scale, factor analysis was performed in this study based on Wood and Boyce's (2017) methodology. An exploratory factor analysis (maximum likelihood method/Promax rotation) was performed to determine the factor structure of the emotional vulnerability scale, after which confirmatory factor analysis was performed. Goodness-of-fit index (GFI), adjusted GFI (AGFI), comparative fit index (CFI), and root mean square error of approximation (RMSEA) were used for each GFI. The variance of each latent variable and each path from the error variable to the observed variable was constrained to 1. For reliability, the α coefficient was calculated to confirm the internal consistency, and the intraclass correlation coefficients (ICC) were calculated as a re-examination method at intervals of 3 weeks. Regarding validity, the correlation between vulnerability and depression was determined. Previous studies have reported a link between vulnerability and depressive symptoms (Yamaguchi et al., 2018, 2019). Therefore, this study also treated depressive symptoms as a component of validity. This corresponds to the notion of "Show Criterion Validity" mentioned by Wood and Boyce (2017). After ensuring reliability and validity, demographic data were analyzed using the emotional vulnerability scale. Specifically, we performed a t-test to determine sex differences. In the analysis, we decided to make a comprehensive judgment, including the index of effect size (η^2 and partial η^2), instead of examining only the *value of p* indicating the significance level. Regarding partial η^2, there is no clear standard for indicating the magnitude of the effect (Cohen, 1988), but when η^2 is used, it is affected by the number of independent variables and samples. After controlling for the influence of these factors, we also obtained the partial η^2 that calculates the effect size of the influence of one independent variable. IBM SPSS 27.0 and AMOS 27.0 were used for the analyses.

Results

To confirm the validity of the data for the 42 draft items, the Kaiser–Meyer–Olkin (KMO) and Bartlett Spherical Shape (BS) tests were performed. The KMO measure was.90, and the BS was 2584.050 ($p < 0.001$, $df = 120$).

TABLE 1 Results of the exploratory factor analysis.

Subscale	F1	F2	F3	F4	Communality
F1: Vulnerability toward criticism or denial ($\alpha = 0.72$)					
I get hurt when my opinion is criticized	0.870	0.055	0.010	−0.150	0.696
I get hurt when my thoughts are denied	0.796	0.060	−0.007	−0.054	0.637
I get hurt when someone criticizes me	0.705	−0.098	0.045	0.138	0.575
I get hurt when someone advises me	0.596	−0.043	0.046	0.186	0.511
F2: Vulnerability toward worsening relationships ($\alpha = 0.79$)					
I do not want to be hated, so I feel hurt if I cannot decline an invitation	−0.091	0.849	0.054	−0.026	0.650
I am afraid of being hated by people, and I feel weak and hurt for accepting requests	0.067	0.743	−0.024	0.088	0.691
I feel hurt if I cannot refuse what people have asked me to do	−0.043	0.681	0.020	0.000	0.443
I feel weak and hurt when I cannot oppose people's ideas	0.211	0.527	−0.058	0.030	0.437
F3: Vulnerability toward interpersonal discord ($\alpha = 0.80$)					
I get hurt when I am directly told bad things about myself	0.001	0.018	0.913	−0.061	0.802
I get hurt when I am indirectly told bad things about myself	0.062	0.057	0.801	−0.126	0.657
I get hurt when my relationship with my friends goes bad	−0.057	−0.057	0.575	0.235	0.420
I get hurt when someone I trust does not talk to me	0.095	−0.020	0.404	0.170	0.313
F4: Vulnerability toward procrastination and emotional avoidance ($\alpha = 0.79$)					
I feel vulnerable when I try to avoid things I do not like	0.076	−0.017	−0.074	0.710	0.504
I feel hurt avoiding things that cause inconvenience to me	−0.081	0.042	0.067	0.688	0.497
I feel regret and hurt when I turn my back toward a problem	−0.020	0.191	−0.026	0.674	0.615
I feel hurt when I put off things I do not like	0.012	−0.063	0.063	0.593	0.350
Cumulative contribution ratio (%)	36.8	45.3	50.6	55.0	

Exploratory factor analysis

For the exploratory factor analysis, the criteria for analysis were eigenvalues ≥1.0 and factor loadings ≤0.40. Consequently, 16 items from four factors were extracted. The four factors were "Vulnerability toward criticism or denial," "Vulnerability toward worsening relationships," "Vulnerability toward interpersonal discord," and "Vulnerability toward procrastination and emotional avoidance" (Table 1).

Reliability

The α coefficient of each factor was used to determine reliability. The values were as follows: for "Vulnerability toward criticism or denial," $\alpha = 0.85$; for "Vulnerability toward worsening relationships," $\alpha = 0.82$; for "Vulnerability toward interpersonal discord," $\alpha = 0.81$; and for "Vulnerability toward procrastination and emotional avoidance," $\alpha = 0.79$.

In addition, about 3 weeks after the first survey, a re-examination was performed with 64 participants (32 men and 32 women; mean 20.0 years old, $SD = 1.05$) extracted from the original 361 participants by random sampling. The ICC value for each factor ranged from $ri = 0.61$–0.68 ($p = 0.001$).

Confirmatory factor analysis

To investigate the validity of the factors extracted by the exploratory factor analysis, a confirmatory factor analysis was performed. The results showed that the paths from the assumed latent variables to the observed variables, and the path coefficients between the latent variables, were all significant at the 0.1% level, and the model's GFI was also good (GFI = 0.94, AGFI = 0.91, CFI = 0.96, RMSEA = 0.05).

Concurrent validity

Pearson's product–moment correlation coefficient was calculated for the relationship between depressive symptoms and vulnerability to analyze concurrent validity. A moderate positive correlation was found between depressive symptoms and total vulnerability score ($r = 0.43$, $p = 0.01$). The results showed a significant relationship between the four subscale scores of the emotional vulnerability scale and depressive symptoms ($rs = 0.25$–0.37, $p = 0.01$).

Analysis of demographic data

The basic demographic attributes of the participants were examined using the scale created in this study. Women had significantly higher scores than men on both the total emotional vulnerability scale and subscales other than "Vulnerability toward worsening relationships" (Table 2).

Discussion

This study developed an emotional vulnerability scale and examine its basic attributes. The emotional vulnerability scale developed in this study comprises four factors and 16 items and measures the vulnerability of university students in relation to

everyday situations and common experiences. In terms of reliability, the obtained coefficients were as follows: "Vulnerability toward criticism or denial," $\alpha = 0.85$; "Vulnerability toward worsening relationships," $\alpha = 0.82$; "Vulnerability toward interpersonal discord," $\alpha = 0.81$; and "Vulnerability toward procrastination and emotional avoidance," $\alpha = 0.79$. In addition, in the re-examination conducted with 64 participants approximately 3 weeks after the first survey, the ICC values were $ri = 0.68$, 0.61, 0.64, and.66 for the first, second, third, and fourth factors, respectively, all of which were significant at the 0.1% level. The ICC values of 0.61–0.80 are considered constant and 0.81–1.00 are considered almost perfect (Landis and Koch, 1977). In this study, *ri* values were.61–0.68; thus, they were substantial. The GFI of the model assessed using the confirmatory factor analysis was GFI = 0.94, AGFI = 0.91, CFI = 0.96, and RMSEA = 0.05. When the obtained values are applied to the criteria, a GFI of 0.90 or higher, a CFI of 0.95 or higher, an AGFI of 0.90 or higher, and an RMSEA of.05 or lower are regarded as an acceptable fit (Schermelleh-Engel et al., 2003). Therefore, all ICC and numerical values of the GFI of each model obtained in this study met the criteria. According to Wood and Boyce (2017), ideally, 450 participants are required for factor analysis (and at least 150 or more); this study involved 360 participants. The sample size is a little less than 100 short of the standard 450 people; however, the analysis shows that the reliability and validity are high. Thus, we think that this scale is reliable and effective.

The concept of vulnerability investigated in this study was proposed by Sinclair and Wallston (1999), and the measure of vulnerability developed by them, the PVS, has been often used in existing studies. Schaufeli et al. (2002) indicate the importance of creating a measure tailored to the characteristics (occupation, sex, etc.) of the participants and based on an accurate psychological assessment when preparing the questionnaire. Although the scale developed by Sinclair and Wallston (1999) has been used widely, this scale was created for patients with rheumatoid arthritis. Therefore, it is likely that the scale focuses on the difficulties in life experienced by patients with rheumatism, and it may not be possible to rule out the factors of vulnerability specific to this health condition.

We also used the developed scale to examine its association with depressive symptoms. A positive correlation was found between vulnerability and depressive symptoms. Since this result is consistent with previous research (Hayashi, 2002; Yamaguchi et al., 2018), we believe that the measure developed in this research reflects the construct of vulnerability. Therefore, if one is vulnerable to something happening in one's daily life, one may experience more depressive symptoms. Prior studies have shown the association of vulnerability with not only mental health (Hayashi, 2002; Yamaguchi et al., 2019) but also social connections (Dang, 2014). Specifically, a lack of social connections may lead to psychological vulnerability, which could contribute to poorer mental health outcomes (Dang, 2014). Moreover, psychological vulnerability is negatively correlated with resilience factors such as social support and self-efficacy (Kiamarsi and Abolghasemi, 2014; Satici et al., 2014; Gruebner et al., 2015). From these trends, we believe that the same results as those of the abovementioned studies can be obtained even with a scale that explores vulnerabilities among university students, and not just the PVS, which was developed for rheumatism patients. Additionally, Satici et al. (2016) revealed a negative relationship between psychological vulnerability and social safety and found social safety to be a significant negative predictor of psychological vulnerability. Additionally, similar to the findings of Yamaguchi et al. (2018, 2019), who studied the relationship between vulnerability and mental health, Demirci et al. (2019) reported that psychological vulnerability is an important factor for mental health and well-being. According to Yelpaze et al. (2021), empirical support for potential factors in the relationship between psychological vulnerability, social connectedness, and well-being is still lacking. This study does not explore any association with social ties or safety. However, vulnerable people may be unable to block relationships or use social support well to cope with their trauma. Hence, research on vulnerability requires further development. The subfactors of the scale developed in the current study are described below.

The first factor, "Vulnerability to criticism or denial," included items such as "I get hurt when my opinion is criticized" and "I get hurt when someone criticizes me." It comprises content that expresses excessive hurt as a result of reactions such as being criticized by others. Adolescents are more anxious about negative evaluations from others (Westenberg et al., 2004). According to Leary et al. (1998), "the perception that one is underestimated by others" is highlighted as a hurtful feeling in interpersonal relationships. Therefore, inattention, denial, and criticism by others are considered typical causes of emotional hurt. Such as, hurtful verbal communications are also cited as a factor that causes feelings of psychological hurt (Vangelisti, 1994). For example, verbal expressions such as "Going out with you was the biggest mistake of my life" and "You're such a hypocrite." Therefore, some people are expected to be overly pained by the remarks of others. Thus, a high score on "Vulnerability to criticism or denial" means that the person experiences excessive psychological hurt by the words and actions of other people.

The second factor, "Vulnerability toward worsening relationships," is related to interpersonal relationships. It includes items such as "I do not want to be hated, so I feel hurt if I cannot decline an invitation" and "I feel weak and hurt when I cannot oppose people's ideas." It involves attempts to delicately repair damage so that the relationship does not deteriorate and thus avoid the resultant pain. Rejection as a member of a group by others may reduce self-esteem (Leary et al., 1995) and increase self-damaging behavior (Williams et al., 2000). Therefore, it is conceivable that vulnerable individuals may experience increased hesitation to nurture relationships or increase their self-defeating behaviors and beliefs when rejection occurs. Additionally, unavoidable reactions to avoid rejections may exacerbate the issue. Thus, a high score on "Vulnerability toward worsening relationships" indicates being hurt by trying to build a relationship at the expense of one's own time and convenience.

TABLE 2 Sex differences in total vulnerability scores and subscale scores (*t*-test).

	Men ($n = 186$)		Women ($n = 175$)		*t*	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
Total score of vulnerability	2.6	0.56	2.8	0.53	3.84	0.001	0.40
Vulnerability toward criticism or denial	2.5	0.72	2.8	0.77	4.20	0.001	0.44
Vulnerability toward worsening relationships	2.2	0.71	2.2	0.70	1.10	0.273	0.11
Vulnerability toward interpersonal discord	3.0	0.73	3.3	0.60	4.18	0.001	0.45
Vulnerability toward procrastination and emotional avoidance	2.6	0.69	2.7	0.69	2.48	0.013	0.26

Cohen's *d*: small = 0.20, medium = 0.50, large = 0.80 (Cohen, 1988).

The third factor, "Vulnerability toward interpersonal discord," refers to the worsening of interpersonal relationships as expressed by items such as "I get hurt when I am directly told bad things about myself" and "I get hurt when someone I trust does not talk to me." Slander from a person is an example of this factor. Backbiting can be regarded as bullying, although the person who engages in it may think that it is a "joke." Insults, name-calling, derogatory or humiliating comments, embarrassment, exclusion from the group, backbiting, and events that disrupt friendship are considered "emotional bullying" (Arslan Özdinçer and Savaşer, 2008). Therefore, those who are vulnerable will take such jokes at face value, and it is expected that they will be further hurt, similar to the feeling of being bullied. As explained in the discussion of the second factor, vulnerable people tend to care about the views of others. Exclusion from the group in interpersonal relationships is an attack on the relationship, which reportedly increases anxiety, loneliness, and depression and seriously damages the relationship (Gazelle and Ladd, 2003). Thus, "Vulnerability toward interpersonal discord" refers to a state of being hurt when someone speaks badly of oneself, when the relationship with the other becomes unsatisfactory.

The fourth factor, "Vulnerability toward procrastination and emotional avoidance," includes items such as "I feel vulnerable when I try to avoid things I do not like" and "I feel hurt when I put off things I do not like." It comprises content that indicates someone is hurt excessively when there is a problem but suppresses the degree of hurt by escaping the event or problem and running away, which results in them being hurt. Escapist coping strategies have been shown to increase burnout when something goes wrong (Leiter, 1991). Therefore, if one faces a problem and tries to deal with it, one will be hurt, however, avoidance could carry the same risk. In addition, those who are vulnerable will be hurt by both actions, by either dealing with or avoiding the problem; moreover, if they avoid or escape the situation, they will blame themselves for being in the situation in the first place.

Leary et al. (1998) asked college students to freely describe vulnerable events. "Active separation," "blame," "betrayal," "teasing," "not cherished," and "disregarded" were expressed as hurtful events. According to Vangelisti (1994), "evaluation," "blame," "instruction," "joke," "threat," and "doubt" are listed as factors and situations that caused pain. Based on these facts, the contents of each factor extracted in this study generally support the vulnerable events extracted in past studies, and the scale developed in this study covers vulnerable events in daily life.

Next, sex differences were investigated. We found that women scored significantly higher in terms of vulnerability than men. Women were more vulnerable than men. This result is similar to that of previous studies (Hayashi, 2002; Yamaguchi et al., 2019), suggesting that the scale developed in the present study yields an accurate assessment of vulnerability. However, when examining each factor, the only factor in which sex differences were not confirmed was "Vulnerability toward worsening relationships." The university students surveyed were in the same peer group and therefore in the same stage of psychological development. Peer groups are considered to be a group in which members share each other's values and ideals, recognize each other's differences, and respect each other as independent individuals. Among these groups, same-sex friendships significantly support adolescents (Bagwell et al., 2005); in adolescence, these relationships are extremely intimate and may involve friends of the same age (Sullivan, 2013). Not comparing themselves to others and believing that each person has their own place in the world may help college students refuse unwelcome invitations and requests. However, this was not observed in the present study; moreover, it is conceivable that vulnerable individuals will accept any invitation or request out of fear of damaging interpersonal relationships, or they may experience a conflict between not wanting to get hurt and not wanting to hurt others. No sex differences were observed regarding this factor. Furthermore, when peer groups discuss various life situations, sharing positive experiences with each other improves psychological well-being (Demir et al., 2013). However, interpersonal conflicts and others' negative behavior toward an individual can lead to poor mental health. For example, a study of college athletes (Yamaguchi et al., 2019) found that people with higher vulnerability were more likely to develop depressive symptoms. Although the effect of vulnerability on depressive symptoms has not been investigated in this study, it could be an important research topic to be considered in future studies.

From the above discussion, using the emotional vulnerability scale developed in this study, it is possible to understand participants' vulnerability in interpersonal relationships and

events in daily life. In addition, using this scale can help determine a person's level of vulnerability and predict possible mental health disorders, as vulnerability is expected to be a precursor to depressive symptoms (Yamaguchi et al., 2018, 2019). In fact, if adolescents experience hurt as threatening, they recall it repeatedly, which leads to increased stress (Joseph and Williams, 2005). Therefore, it can also serve as an important assessment tool in clinical situations. Therefore, it is suggested that understanding individuals' vulnerabilities will help prevent mental health issues, which is a significant contribution to related efforts in the health psychology field.

Limitations and further developments

This study has some limitations. A questionnaire survey was used to measure participants' "emotional hurt." Participants may have provided false responses to conform to socially acceptable values, avoid criticism, or gain social approval (Huang et al., 1998; King and Brunner 2000). It is conceivable that the evaluation of concepts that can be measured by questionnaire surveys, including one's "vulnerable state" that can be measured in this research, may change depending on participants' subjective responses. For example, when measuring "vulnerability," we believe that measuring social desirability (Van de Mortel, 2008) concurrently can reduce the distortion of the measurement. In fact, according to Van de Mortel (2008), the tendency for people to present a favorable image of themselves on questionnaires is called "socially desirable responding." Consequently, some people may underestimate the "emotional hurt" and try not to show weakness. Therefore, future researchers should include measures of social desirability.

Second, the SDS scale, used for concurrent validity, assessed only depressive symptoms. While vulnerability is associated with mental health and other stress responses (Yamaguchi et al., 2022), it is also associated with negative personality traits and social desirability. Future research should examine the associations with these concepts, as well.

Third, as this study only involved university students, it is possible that the obtained verbal data and questionnaire items reflect the vulnerability factors experienced only during university. There may be factors unique to each generation in the vulnerabilities of everyday situations that different populations can experience. Presently, the scale created in this study is intended for university students, based on our study's target group; its applicability, however, is not limited to athletes and rheumatism patients, as is the case with other existing standardized scales, and can be used among the general public. When using this scale with other age groups, it will be necessary to evaluate its reliability and validity. This time, we focused on university students, furthermore, it will be necessary to assess different populations, such as elementary, junior high, and high school students, as well as adults with different attributes, to generalize the results.

Lastly, as this study was a one-point cross-sectional survey, a causal relationship between vulnerability and depression could not be determined. As the impact of COVID-19 has been of great concern and a source of stress for the targeted university students, it will be necessary to conduct longitudinal surveys to determine a causal relationship between vulnerability and stress responses.

Conclusion

We developed an emotional vulnerability scale, confirmed its reliability and validity, and examined differences among participating university students based on demographic data. A four-factor structure scale was developed, and reliability and validity were assessed. This scale can be used to evaluate the vulnerable emotions and conditions experienced by individuals that cause them pain. Women were more vulnerable than men. The results suggest that the scale can be used to determine the vulnerability level of an individual and that it is effective as an assessment tool for mental health issues. From the viewpoint of health psychology, we believe that the scale could inform efforts toward regulating stress responses and reducing depressive symptoms and could provide opportunities to minimize painful feelings experienced as part of daily life.

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 Juntendo University. Written informed consent for participation was not required for this study in accordance with the national legislation and institutional requirements.

Author contributions

SY designed the study, collected all the data, performed the statistical analysis, and prepared the manuscript. YK supported the study design and data collection processes. YM and TO provided expert comments for the scale development process according to their specialties. YM contributed to sports medicine. TO contributed to psychiatry. All authors read and approved the final 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.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.941250/full#supplementary-material

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Unsettling experiences: A qualitative inquiry into young peoples' narratives of diagnosis for common skin conditions in the United Kingdom

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Skin conditions such as eczema and psoriasis are relatively prevalent health concerns in children, adolescents and young adults. Experiences of these dermatology diagnoses in adolescence have hitherto not been the focus of research, perhaps owing to assumptions that these diagnoses are not particularly impactful or intricate processes, events or labels. We draw on a thematic secondary analysis of in-depth interviews with 42 adolescents and young people living in the United Kingdom and, influenced by the sociologies of diagnosis and time, highlight the psychological, emotional, social and temporal complexities involved in their diagnosis experiences. Firstly, we describe how participants remembered, re- and co-constructed their diagnosis experiences during the interview. Secondly, we explore the pace and rhythm of diagnosis, including mis-diagnoses, highlighting the jarring potential for adolescents on being diagnosed, even for conditions typically deemed minor. Thirdly, we consider the ways in which these diagnoses have the capacity to reformulate notions of past, present and future, including projecting into imagined futures and reinterpreting past bodily sensations. Finally, we examine how memories about and the meaning of diagnosis are revisited, revised and potentially replaced as a child or adolescent grows older, and increases their management of their condition and encounters with healthcare professionals. In unsettling an assumption that diagnosis experiences for adolescents of common skin conditions is unproblematic or straightforward, our qualitative analysis critically engages with and contribute to tenets of health research that are of interest to quantitative and qualitative researchers, clinicians and patients.

KEYWORDS

adolescence, health, qualitative, diagnosis, experiences

Introduction

Common skin conditions and adolescence

Eczema and psoriasis are relatively common skin conditions, with a significant proportion of patients being children, adolescents and young people (Bronckers et al., 2015; Nutten, 2015). Both dermatological conditions are typically associated with a discoloured or otherwise rash-like appearance on the skin and itchiness, although there are important differences in terms of additional symptoms, the underlying causes and mechanisms of the conditions, treatments and management implications, and wider health considerations. Although there are age-related patterns of typical onset and duration, both eczema and psoriasis can affect anyone at any point in their lives and can be long-term (albeit episodic) conditions (Abuabara et al., 2018). Eczema, for example, often affects babies and young children, and there is a commonplace belief that people 'grow out of' it when they get older. Psoriasis, on the other hand, often has onset during adolescence and young adulthood; whilst young children can be symptomatic, it is relatively rare.

For people of any age living with skin conditions such as eczema and psoriasis, there can be profound personal and wellbeing impacts (Absolon et al., 1997; Gupta and Gupta, 1998; Carroll et al., 2005; Lewis-Jones, 2006; Basra and Finlay, 2007). There has been a growth in interest in the experiences of affected children, adolescents and young adults as a subgroup (e.g., Fox et al., 2007; Golics et al., 2009; Griffiths et al., 2011; Magin, 2013; van Geel et al., 2016; Ghio et al., 2019, 2020; de Vere Hunt et al., 2020, 2021). This consideration is in recognition that adolescence entails a range of physiological (including neurological), psychological and social changes. Many aspects of life can be affected by developing or continuing to have a skin condition, for example by negatively compounding and complicating adolescents' experiences with self-esteem and body image, the significance and influence of peer relationships, sexuality and sexual relationships, changes in the dynamics of the family, and independence in domains of life (including health management). Health and illness experiences at this age may subsequently play an important and formative role in shaping future health help-seeking behaviours and outcomes (Angold et al., 1998; Patel et al., 2007; Sawyer et al., 2012; Viner et al., 2012), with different views about the mechanisms through which this may occur (Raphael, 2013).

There has been growing recognition of the specific informational and support needs of adolescents with health conditions, including common skin conditions, with much of the research focus on addressing these needs in the context of individuals having a condition and the ongoing impact (Stinson et al., 2013; Kirk and Milnes, 2016). Where focus has been on the role and impact of diagnosis, these usually involve conditions in which absent or delayed diagnosis and subsequent treatment has significant morbidity and mortality risks, including around newborn screening (Berg et al., 2014; Gambling and Long, 2019; Ke et al., 2019). In contrast, research on common skin conditions has largely focused on experiences of *living with* the condition and the impact on quality of life – with diagnosis seemingly a prerequisite but otherwise unimportant event of the past (Fox et al., 2007; Ablett and Thompson, 2016). This may stem from assumptions that the diagnostic process is clinically straightforward for eczema and psoriasis diagnoses, and that, as common 'minor' conditions, the impact of diagnosis is not one of shock or surprise (Green, 2010; Schofield et al., 2011).

Diagnoses, as processes and products, in illness narratives

From a clinical and pragmatic perspective, diagnosis serves a purpose of naming and making sense of a constellation of symptoms, signs and markers, and can be an important component in laying a map for management and treatment options. A diagnosis can be made through a range of human (professional) and technological forms of assessment, and marks a high degree of certainty about symptoms and markers – even if the underpinning evidence-base contains questions regarding the nature and mechanism of a condition, the best courses of treatments, and accurate prognosis. In the sociology of diagnosis literature (e.g., Jutel, 2011, 2014; Jutel and Dew, 2014), further consideration is given to the socially constructed nature of organising bodily experiences into a medical framework, and the myriad of psychological, emotional and social meanings and consequences that this can have for patients. Diagnosis is unpacked to consider both the process (of diagnosing) and the product (a diagnostic label), and that these two related but not synonymous aspects can have intentional and unintentional impacts beyond having a simple clinical purpose.

One of the things that diagnosis can 'do' is to structure accounts of time with regards to a health condition or event. A linear narrative, although variable for different types of health conditions and events as well as structures of health services, might typically begin with the development of symptoms, move to consulting a health professional and having investigations, then receiving a diagnosis, and beginning a course of treatment or management (Brossard and Carpentier, 2016). Illness accounts may therefore feature diagnosis as part of the backstory to the present and identify diagnosis (as a process, event and/or label) to be a 'turning point' in the biographical construction (Undeland and Malterud, 2007; Germeni et al., 2018). Implicit within this is the recognition that diagnosis is not necessarily a neutral event or action; receiving and having a diagnostic label can shape an individual's orientation to and activities within their lives, potentially invoking re-evaluation and revision (for example, of expectations for the future). Bury's (1982) concept of 'biographical disruption', although not solely concerned with diagnosis, implies that *becoming ill* marks a distinction in the life of a person/patient: the way they think and feel about their life has changed in an

unexpected manner. Whilst symptoms and the experience of *becoming* or *being* ill can go unnamed and undiagnosed (officially or otherwise), the process of seeking a diagnosis and the label of having a diagnosis are cornerstones in much of modern medicine.

The literature capturing illness experiences in terms of the onset, diagnosis, and continuation of illness has expanded, with exploration of a range of different health conditions/events and patient groups. The concept of 'biographical disruption' (Bury, 1982) has been challenged and nuanced through the lens of particular health conditions and experiences, with the emergence of concepts such as biographical- 'repair', 'continuation', and 'abruption'. Locock et al. (2009) outline biographical repair as seeking to "restore normality and control" (p. 1050), and biographical continuation, drawing on Williams (2000), as when illness or ill health events are "absorbed and accepted within one's existing trajectory as biographically anticipated" (p. 1045). With their focus on terminal illness, Locock et al. (2009) offer the concept of biographical abruption as embodying a sense of "a 'death sentence', that life was in effect already over" (p. 1047). In addition there is recognition that having a diagnosed condition (symptoms and a diagnostic label) may have little to no impact for a person, particularly if symptoms are deemed relatively insignificant, 'normal' in their social circle, as 'always' having been there, or contextualised with experiencing other hardships (Pound et al., 1998; Faircloth et al., 2004; Harris, 2009; Monaghan and Gabe, 2015). The biographical impact of a (diagnosed) condition has been explored in the context of Motor Neurone Disease (Locock et al., 2009), hepatitis C (Harris, 2009) and various cancers (Schaepe, 2011); with the exception of skin cancer (Winterbottom and Harcourt, 2004), dermatological conditions have been largely absent to date. Following critiques that earlier literature focused only on adult experiences, subsequent consideration has attended to the experiences of children, teenagers and young adults (e.g., Williams, 2000; Williams et al., 2009; Bray et al., 2014; Monaghan and Gabe, 2015).

Our qualitative paper adds to understandings of the impact of skin conditions, adolescent health, and the sociologies of diagnosis, time/temporality and illness, by exploring how young people with eczema and psoriasis describe and account for their experiences of diagnosis – as processes and labels, with psychological, emotional, social and temporal impacts.

Materials and methods

A secondary analysis was undertaken of in-depth interviews with 42 young people aged between 16 and 24 years from England, who shared their experiences of having eczema or psoriasis. The original qualitative study was conducted with the aim of exploring the information and support needs of young people with common skin conditions. A total of 88 participants with acne, eczema, psoriasis and/or alopecia were interviewed. Participants were living in England and ranged in age from 14 to 24 years. The interviews were conducted between October 2014 and December 2015. The original study was approved by Berkshire National Research Ethics Service Committee (South Central) and was funded by National Institute for Health Research under its Research for Patient Benefit scheme (PB-PG-0213-30006).

The authors of this paper (AM, SR) are two of the original researchers, and the impetus for the secondary analysis was in part influenced by the first author's interest in diagnosis as informed by their work on another health condition from a different vantage [the role of diagnostic processes and labels for endometriosis from the perspective of NHS General Practitioners (Dixon et al., 2021)]. The question our secondary analysis addressed was 'how do young people experience and make sense of diagnoses in the context of eczema and psoriasis?' Secondary analysis involves analysing data generated for a different process (Heaton, 2004). While there is some contention over the meaning of secondary as opposed to primary analysis, and the extent to which the two approaches may differ (see, for example, Hammersley, 2010), we have asked a different question of a self-collected dataset (Heaton, 2008) and this has involved undertaking a distinct analysis. As researchers on the original study, we also bring to this secondary analysis a detailed understanding of the design and delivery of the study, including additional context regarding the dataset to aid interpretation, whilst also capitalising on the ability of a secondary analysis to explore previously under-considered topics and new perspectives. Our secondary analysis focuses on two of the four dermatological conditions in the data set (eczema, psoriasis), totaling 42 interviews, and excluded the data from participants whose interviews were solely about experiences of acne or alopecia.[1]

The original study had a 'maximum variation sample' design (Coyne, 1997) to include a range of demographic factors and contexts which might impact on young people's experiences of skin conditions. In addition to the type of dermatological condition, these factors included: age, gender, ethnicity, social class, geographic location and study/employment status (see Table 1 for an overview of key demographic characteristics). Participants were recruited through healthcare settings (via posters and fliers in waiting rooms, recruitment packs distributed

1 The dominant symptoms that participants had and consulted healthcare professionals about were deemed important in underpinning their diagnostic experiences, and it was felt that a focused secondary analysis on eczema and psoriasis would be most insightful. Whilst there are important differences in the symptoms of psoriasis and eczema, participants described some similarities – including a discoloured or otherwise rash-like appearance on the skin and itch – compared to the dominant symptoms described for acne (spots/pustules) and alopecia (hair loss). Other study findings from the acne and alopecia datasets have previously been published (McNiven, 2019; de Vere Hunt et al., 2020) which, to varying degrees, highlight aspects of diagnostic experiences for these dermatological conditions in the age group of adolescents and young people. For example, participants with acne often reported 'knowing' they had acne (or 'spots') without the need for suggestion or confirmation by medical professionals (McNiven, 2019).

TABLE 1 Demographic characteristics of the secondary analysis sample (n.42).

	Eczema	Psoriasis	Total
Number of participants	24	18	42
Age (years)			
14–17	3	6	9
18–21	13	5	18
22–24	8	7	15
Gender			
Female	17	11	28
Male	7	7	14
Ethnicity			
White British	13	15	28
Asian or British Asian	8	3	11
White European	1	0	1
Black Caribbean and White British	1	0	1
Arab and White British	1	0	1

by health professionals in primary and secondary care), support organisations (charities, mailing lists, discussion forums, social media), universities, colleges and schools, and through social media platforms such as Facebook and Twitter. Detailed information sheets were provided and participants were given opportunities to discuss their participation throughout the study. Participants gave written consent and, for those under the age of 16, parental or guardian consent was also required.

All but one interview were conducted by the first author (AM) in participants' homes or, if they preferred, in alternative meeting spaces such as community centres. Participants could choose to be interviewed on their own or with others present, including parents, guardians or a friend. Of the 42 participants included in the secondary analysis, only one chose to have a companion present throughout the interview; however, as will be highlighted later, family and friends sometimes joined the interview fleetingly. AM remained reflexive about her position as a (then) young, white, female researcher with a personal history of skin conditions (mild eczema, facial acne) sometimes evident, and SR provided supervision and support throughout the study.

The interviews were semi-structured, with an opening question inviting participants to talk freely about their experiences of a skin condition. Follow-up questions based on a topic guide ensured that areas not yet mentioned but present in existing literature or highlighted in previous interviews in the study were raised for discussion. Topics covered included symptoms, seeing healthcare professionals, using treatments, impacts on emotions and identity, impacts on friendships and relationships, financial costs, experiences across the duration of having the condition (including different contexts, e.g., at school, college, university, jobs) through to the present day, and looking ahead to the future. Interviewing continued until data saturation was reached, as marked by the point when the research team felt that no new perspectives or differences of opinion were presented in subsequent interviews, with the dataset concluding at 88 interviews (Hennink and Kaiser, 2021).

The original dataset was coded by first author AM. The first few transcripts were independently coded by second author SR. The coding was compared, inconsistencies discussed and resolved. A working coding framework was developed for the remaining data. For the secondary analysis, NVivo software was again used to organise the two subsets from the original dataset. Data were re-coded by first author AM using a coding framework based on interview content and relevant literature.This was refined throughout the process in discussion with SR as our analysis focused on the meaning the diagnosis held for participants and the ways in which they made sense of it. Thematic coding reports were then analysed more conceptually for links and connections across the data as well as the identification of outlier examples. Repeated questions were asked of the findings with discussion between both authors to ensure a robust and iterative engagement with the data. All participant names featured in the paper are pseudonyms.

Results

Reconstructing and co-constructing diagnosis experiences

Some participants could remember firsthand their experiences of developing symptoms, consulting for support, and getting a diagnosis for their eczema or psoriasis. Whilst some could not recall the in-depth detail and content, or step-by-step process, of *how* they came to be diagnosed and the information that accompanied the diagnosis, their emotional responses were often vivid in their memories. Lara (age 16, female) was 7 years old when she was referred to a dermatologist and diagnosed with psoriasis during an appointment:

> *I didn't even want to go to the hospital, I just wanted to go to school. And then I sat there and I remember my mum trying to explain to me. I knew that it was something to do with my skin but I didn't know what it was.*

The emotional responses to diagnosis – which could include confusion, shock, surprise, indifference or relief to have a medical label – could be exacerbated if the circumstances of diagnosis were unexpected and outside of the typical pattern of consulting healthcare professionals about particular dermatological symptoms. Anthony (age 17, male) was unexpectedly diagnosed when he was 10 years old and hospitalised with a serious blood infection. Although Anthony had itchy and dry skin for some time, he had not seen this as a problem or indicative of a skin condition until an emergency care doctor "*said, 'This [infection] is due to your eczema,' and I was-, obviously-, I didn't know I had eczema at that time until the doctor said*." The diagnosis was unexpected and the seriousness of his infection added to his sense

of shock. Anthony said he *"didn't know how to feel"* at the time but with hindsight, and from the vantage point of the interview, the diagnosis marked a change in his life and perception of himself: "*I used to be a really healthy kid.*"

Not all participants could remember their symptom onset or being diagnosed, often because they were young infants at the time. As such, some felt that there had not been a time in their lives 'before' they had a skin condition: "*it's always been part of me. I've never experienced having no eczema, so for me this is normal*" (Jo, age 17, female). In this formulation of always having had eczema, there is not an illness narrative of disruption with onset. However, whilst participants may view themselves and the presence of their condition as always existing simultaneously, implicit in the naming of the condition and speaking of management/treatments is that a diagnosis has taken place at some point. Again, often as very young infants, this was not something participants could necessarily speak to from their firsthand experience – yet they drew upon various ways to reconstruct the process of seeking and receiving diagnosis, namely through their parents/guardians and other family members' memories.

There were different ways that participants reconstructed the order of events that preceded their memory, including experiences of diagnosis. Some had heard about the processes from their parents or wider family, and absorbed this history into their telling of events. For others, the forthcoming interview was itself a prompt to ask family members for information about the timings and processes, such as when and how their skin condition had first been suspected and named. Some participants contacted the researcher in the hours, days or weeks after the interview to fill in some 'gaps', based on conversations they subsequently had with their parents and wider family. Additionally, parents were sometimes present, brought into or invited themselves into the interviews to give information at key points, highlighting the co-constructed nature of qualitative research encounters and data production.

These forms of parental/guardian contributions participated in the production of the participant's narrative in the interviews and afterwards, providing additional context for sense-making of the data. During the interview, for example, Bethany (age 22, female) described her earliest memory of eczema as going to nursery when she was a few years old and becoming "*aware of others [peers] and what they do and what they can eat*," including memories of being prohibited from activities related to her triggers (e.g., petting animals). After the interview, Bethany asked her parents to tell her more about the earlier experiences, moving a step further back into her history beyond what she herself could recall. She explained that the 'start' of her eczema was when she was a few months old, at the point of weaning ("*[my] parents knew when I started on solids and started to get rashes in reaction to certain foods*"), and from there her parents consulted healthcare professionals, she was diagnosed, and treatment and management ensued. This part of Bethany's history – including the occurrence and significance of diagnosis – was not part of her firsthand memory but re-and co-constructed via her parents participating in the production of research data.

The pace and rhythm of diagnosis

In addition to the variation in terms of age at diagnosis, the process of seeking and receiving a diagnosis took different amounts of time and was experienced in different ways by the children, adolescents and young adults in the study. Sometimes diagnosis was rapid in pace and with minimal investigation: a person has some symptoms, they promptly attend an appointment with their GP, they describe and/or show the symptoms, and a diagnosis is made. This type of swift process was most often described about eczema and diagnosis was made in primary care. For others, whilst the process of being diagnosed once inside the consultation room may take just seconds or minutes, the lead-up to deciding to see a health professional and book an appointment may have taken much longer (months, weeks, even years). There were a variety of ways that diagnosis was experienced in terms of pace and rhythm; the 'standard model' of diagnosis (Brossard and Carpentier, 2016) – whereby symptoms are noticed, an appointment is attended, and a diagnostic label is ascribed – was not universal, as noted earlier in Anthony's abrupt diagnosis in an acute situation of infection after years of itchy skin which was not (yet) deemed to be a symptom.

For some participants, particularly those with psoriasis, the process of seeking a diagnosis was neither quick nor contained, and could involve multiple investigations and tests, referrals to secondary care, and long periods of time where symptoms were not yet explicitly or formally named. Whilst these diagnoses spanned longer periods of time, there were different perceptions of pace and rhythm in these experiences. Participants described how they sometimes waited for periods of time with little to no contact with healthcare professionals and services, whilst other times the time period included multiple consultations, tests, and conversations in quick or otherwise intense succession, including discussions about possible or speculative diagnoses without definitive conclusion. Medical tests were sometimes undertaken to eliminate alternative explanations for the symptoms, with time spent not only attending for tests but also arranging them and waiting for the results. The content of these experiences of seeking a diagnosis contributed to perceptions of pace, in terms of whether the time spent 'waiting' for diagnosis moved slowly and felt empty, or conversely felt intensely busy and full of activity.

Based on their age, some children and young people felt that their healthcare professionals were initially hesitant to give them particular diagnoses and focused on eliminating all other options first, which also added to the length of time that these individuals felt 'in limbo' about their health situations and management options. This was most often described in relation to psoriasis, whereby it had been diagnosed and managed as something else initially, including as eczema. As noted earlier, there are age-related trends for the onset of psoriasis; for

children displaying symptoms consistent with the diagnosis, other explanations were usually considered first and explored with trials of treatment. Lara felt that she was not diagnosed with having psoriasis sooner or quicker because "*it's really rare for children under the age of 12 to get it, so I got treated as an allergic reaction, and then eczema, and then another allergic reaction*." As well as being related to age, other aspects deemed medically unusual or unfamiliar to some healthcare professionals could lead to first considering alternative diagnoses. For example, Louise (age 20, female) saw different GPs about her symptoms of an "*itchy vagina*" and it was repeatedly implied that her symptoms were likely to be a sexually transmitted infection, despite multiple tests with negative results. Louise took to looking online and was surprised how quickly she saw references to 'vulval eczema' – a diagnosis which, several months later, was confirmed by a specialist.

There were also practical challenges for participants in using healthcare services, stemming from uncertain or revised diagnoses. For example, Daniel (age 15, male) has psoriasis but was initially told he had a fungal skin infection and prescribed topical antifungals by his GP. Although his symptoms did not clear up, it took a while for him to be able to return to his GP as it required him to take time out of school and for his parent to take time off work to attend another appointment. The cost of prescriptions (for young adults eligible to pay) and over-the-counter treatments for an undefined or misdiagnosed condition could add to a sense that the process had been a waste of money as well as of their time. As such, uncertain, revised and misdiagnoses presented challenges for children and some adolescents and young adults, as well as their families, stemming from dependence on parents or guardians to transport and accompany them to see healthcare professionals, and having little or no financial independence to draw on in their healthcare management.

Young people sometimes described feeling 'let down' when healthcare professionals did not or were unable to conclusively provide a diagnosis, or when an earlier diagnosis was revised. Frustration was described by Gemma (age 23, female) who saw her GP many times over several weeks and months before being referred to a dermatologist who quickly diagnosed her with psoriasis in the appointment: "*it took 30 seconds*." However, because of the delays involved in seeking the diagnosis, Gemma had widespread and extremely itchy, cracked and flaky skin at a severity which meant corticosteroid topical treatments would not be suitable and she would have to wait a further 6 weeks before phototherapy commenced, compounding her disappointment that the diagnosis process had been quick in the dermatology appointment but drawn out across months because of other aspects of the healthcare services. The implications of hindsight for young people, including Lara, was a sense that diagnosis could and should have been quicker, and, from the vantage point of having a diagnosis, young people also evaluated their past and future in other ways too.

The impacts of receiving a diagnosis on perceptions of time

Participant narratives highlighted how diagnosis – as processes, events and labels – could shape views about past, present and future. As such, for some young people, diagnosis marked a biographical disruption in terms of their thoughts and feelings about themselves, and expectations about how other people (especially peers and potential partners) might think about and behave towards them in the future. James (age 22, male) summed this up when he described receiving a diagnosis of psoriasis aged 17, as the point when "*bang, it's all changed*." Daniel also described how upsetting diagnosis could be ("*like a dagger in the heart*") and especially when accompanied with information such as the "*possibility that I could have it for the rest of my life*." Returning to the emotional impacts of diagnosis for Lara, she recalled how:

> *I just kind of sat there [in the appointment], like this is going to entail on my whole life, I could have it for the rest of it, and people are going to think it's ugly and horrible, and I'm going to lose so many people because of it.*

The concerns that Lara described having at the point of diagnosis, however, cannot be easily separated from her experiences in the following months and years which did include friendships ending and being bullied about her psoriasis. From the vantage of the interview, the fact she had indeed experienced social, emotional and psychological losses reinforced diagnosis as a significant (negative) turning point, again highlighting the complexity of qualitative research and narrative interviewing as retrospective.

However, this sense of biographical disruption was not felt by all participants. Some did not describe receiving a diagnosis as important in terms of affecting how they thought or felt about themselves. As mentioned earlier, some young people who had eczema since they were a baby or toddler deemed that their skin condition had 'always' been there and part of them. There were also some participants who developed their condition at a later age but for whom it was not considered particularly significant or impactful in their lives. When asked about experiences of 'diagnosis' in his interview, Matt (age 20, male) thought it was "*quite a strong word*" and not fitting in his case of having "*a touch of psoriasis, only in certain places*," rather than "*a serious, horrible illness*." As such, the symptoms of the condition, and the process and label of diagnosis, were both relatively insignificant for Matt.

Asides from the personal, emotional and psychological impacts on individuals from a diagnosis – including the potential, or not, for biographical disruption – young people often found that a diagnostic label had a useful social function in the present. Being able to give a medical name for a condition could help young people explain their symptoms and reassure, or minimise unwanted comments from, friends and family as well as wider peers, strangers and/or colleagues. John (age 21, male) found

having the label 'psoriasis' helpful to explain his "*red, angry, blotchy*" skin to friends and family who had often asked questions or made comments:

> *Once I knew it was psoriasis, I could say, 'Oh, got this, don't know how long it'll be there for, hopefully it'll go away' […] [rather than] 'I don't know what it is, it's just something that's there'.*

For some participants, having a diagnostic label helped distance them from adverse and stigmatising connotations that might otherwise be associated with their visible symptoms, certain behaviours and sensorial aspects of treatments (including the smell and feel of topical treatments). This included others' concerns about contagion and questions over the person's hygiene, which might underpin upsetting comments and behaviors which, as Lara experienced, included bullying and friendships ending. At a stage in their lives where the approval of peers and potentially relationships are paramount, a diagnostic label could be a welcome tool for adolescents in trying to avoid various types of social exclusion and rejection.

In addition to the ways that views about the present and imagined futures were affected following diagnosis, some young people also described looking back at the past in a new light. This included (re)interpreting bodily sensations that had previously been contained as unimportant or otherwise temporary, including itchy skin for Anthony which, through naming as eczema, became symptoms of a condition he had, has and is likely to continue having in the future. As such, whilst receiving a diagnosis could cause individuals to revisit their thinking about their experiences, in the fourth and final theme, we explore how this is an ongoing process over time.

Growing independence and re-diagnosis

Memories about and the meaning of diagnosis can change as time passes and a child or teenager grows older, has increased independence, learns more about their health, and takes on a larger share of responsibilty for the management of their skin condition or health and life in general. This was especially pertinent to those whose diagnoses had taken place when they were babies or young infants and who had been managing a skin condition for many years, but who could not recall firsthand the experience of being diagnosed. In addition to the information given at the point of diagnosis, parents or guardians had usually been the primary recipient of information from healthcare professionals about the skin condition across many years – as well as having the overarching responsibility for management and treatments. This was the case for Zoe (age 20, female), who had eczema since she was an infant but "*don't really understand what was wrong with my skin*" and "*just lived through it without any information*." The point at which the parental-doctor dynamic becomes less appropriate and necessary, and a transition takes place, should be informed by the ability of the child or adolescent to understand information and take on (greater) responsibility for treatments. However, for some young people, the dynamic was difficult to disrupt and could be enduring even into early adulthood.

As the young people grew older, the feeling of being a bystander in their own medical care could leave them feeling marginalised, confused and frustrated – including lacking information that might have been delivered alongside diagnosis and in additional consultations. In Zoe's experience, healthcare professionals, including GPs, "*don't retell you the things they expect you to know*" and "*just believe that as a child you understood and you've carried on*." Zoe thought that health professionals perhaps assume that parents relay information about the diagnosis, in addition to ongoing treatment regimens, on to the child as they grew up, but cautioned that this does not always happen or it could consist of partial and sometimes inaccurate information. As such, children, adolescents and some young adults felt that they lacked information about the causes and triggers for their condition, or how treatments worked, as they grew up. For some, participating in the interview led them to realise that they had gaps in their current knowledge and unanswered questions which no-one (healthcare professional or parent) had hitherto explained or done so in a way that they understood.

Other young people had acquired information which would normally accompany diagnosis or early consultations when they started having more independence with their health and attended medical appointments without their parents or guardians. This was the case for Natalie (age 19, female) who had had eczema since she was a baby; after moving away to university, she struggled with disrupted sleep because of the itchiness of her skin and so she booked an appointment. Here, the practice nurse drew a diagram of the skin and the mechanisms of eczema: "*It's the first time anyone's ever explained why I have eczema, what causes eczema and the best ways to treat it […] It took 19 years, but someone finally explained.*" Such an example highlights how young people's encounters with healthcare professionals at an older age could be experiences of revisiting, revising and potentially replacing or filling in gaps of their former understandings of the diagnostic label, constituting a type of re-diagnosis.

Just as some young people found it distressing to receive a diagnosis, those who had types of re-diagnosis could also feel shocked or surprised and experience it as a biographic disruption which affected their perception of the past, present and future. Indeed for some young people, having lived with and managed a diagnosed condition for years could make it even more surprising to learn something that they felt they should have known all along. Kirsty (age 17, female) felt that the information her parents had been given when she was diagnosed with psoriasis as a child was lacking and, as a result, they were left "*to find out a lot for ourselves*," for example through online research. At a recent appointment with her doctor, she was shocked to hear about the increased risks of cardiovascular disease and for it to be raised

flippantly, implying that she should already know or would otherwise not find it frightening to hear:

> *I remember the doctor saying, "Oh when you're 40, let your GP know that you have got psoriasis." I was a bit shocked by that. […] I found it quite crude. She was like "Oh let them know." She kind of said it as a joke and I was like, "Hang on a second, I did not realise- [that psoriasis could affect heart health]."*

Rather than diagnosis being a static and completed event from the past, young people grappled with these kinds of 're-diagnosis' as reverberations when they grew older and information emerged in medical appointments and/or through online research. As such, whilst the original medical diagnosis may not have been experienced as a turning point, including for infants who have no firsthand memory of the process and event, these types of events in later years and with increased health responsibility could add to, revise or replace previous experiences, meanings and knowledge associated with diagnosis.

Discussion

A substantial body of medical sociology literature has considered the onset of a health condition or event as having the capacity to shape a person's approach to their life and health, including in terms of their perspective on the future, with diagnosis often an implicit apriori component (Bury, 1991; Faircloth et al., 2004; Demain et al., 2015). For example, diagnosis sometimes features as a 'turning point' in people's stories of health and illness as a mechanism for distinguishing time in particular ways, such as 'before' and 'since then'. Our paper argues for viewing diagnoses, as processes and products, as experiences worthy of academic consideration; in other words, approaching diagnosis as a topic in its own right and not only the 'start' of stories about living with a condition (Jutel and Nettleton, 2011). We reiterate how diagnoses can mark important changes in how people view themselves and their futures, and how they interact with others (Jutel and Dew, 2014), but not always and in all cases for the same condition. By considering young people with common skin conditions, the paper expands the contexts in which illness experiences (and diagnoses specifically) have been considered in the academic literature, and argues that being diagnosed with a common skin condition, contrary to popular beliefs that these are not 'serious' illnesses, can be upsetting and confusing for young people.

The distress described by some in response to the processes and product of diagnosis suggests that childhood and adolescence can be a fragile time to develop, be labelled with, and manage a skin condition such as eczema or psoriasis. These conditions are not typically deemed to be life-threatening, though we note complications such as Anthony's experience of a blood infection can be, yet they are life-impacting. Existing literature highlights the impact on aspects such as self-esteem and mental health more broadly (Yeo and Sawyer, 2005; Shaw et al., 2019). In addition to the impact of the condition itself, our data suggest there are a range of ways that young people can be affected by the processes, events and labels of these diagnoses. However, not all participants described the processes of seeking and receiving diagnosis as significant to them, nor as constituting a disruption to their lives – either previously, currently or in their imagined futures. In some cases, a sense of biographical continuity and endurance—of always having had the condition or minimal disruption—meant that it was deemed part-and-parcel of their lives, and not remarkable. For some, being very young and having little direct memory of the diagnosis meant that the occurrence had little temporal potency in delineating 'before' and 'after'. As such, this paper contributes to challenging the ways in which, as Brossard and Carpentier (2016, p. 2) have written in the context of dementia, "diagnosis continues to be treated as a self-evident turning point" in patient and/or research participant lives, when in fact these may not always be.

As Goodwin and McConnell (2014) argue, diagnosis is often not simply a 'moment' but a process which extends over time, and our analysis has further explored the ways in which time and temporality can be involved in young peoples' experiences. This has included exploring the pace, rhythm and reverberations of diagnosis, as well as considering chronological age at various stages of reconstructing, remembering, and revising diagnosis over time and growing older. The length of time before a diagnosis was given following onset of symptoms and/or first consultation with a health professional could take days, weeks and months – for some, seeking a diagnosis became a burdensome task and could feel simultaneously protracted and yet, when faced with a given diagnostic label, abrupt and shocking. For some participants, there was a sense that the diagnosis *could* and *should* be quicker, and therefore that their experience of diagnosis had been slower than necessary. The lack of immediacy of diagnosis, or at least a sense that these were often not made in a timely enough manner, left some young people feeling unsupported and frustrated.

Receiving a diagnosis could then end a period of uncertainty for the young person about the meaning of their symptoms, potentially offering reassurance about the next steps of management and treatment. Having a medical name for their condition could be a useful label for explaining visible symptoms and potentially mitigate against stigma that, for example, they had a potentially contagious disease or were 'dirty'. However, some participants—such as Lara—described having an immediate sense on receiving a diagnostic label that their peers would nonetheless stigmatise and alienate them. For some young people, the experience of 'gaining' a diagnosis subsequently figured more as a personal, emotional, psychological and social injury in some ways, as Daniel's reference to diagnosis being "*a dagger in the heart*" strikingly conveyed. Biographical disruption was expressed about receiving (as well as having) a diagnosis, when young people anticipated there subsequently being unwanted changes and various types of losses in their future pertaining to their skin condition.

We suggest that part of the distress felt by some young people on receiving a diagnosis for eczema or psoriasis pertains to the way in which their actual experiences did not marry up with their socialised understandings of expectations about medical professionals and medical processes. For some, this was their first experience of consulting for a health concern, with varying degrees of parental/guardian involvement, and diagnosis was part of their expectations meeting reality; their expectations about how a diagnosis would be made, how quickly, and what would happen next sometimes jarred with the reality they encountered. One area where there were added complications to expectations and realities of diagnosis for young people concerned misdiagnoses. These experiences could be unsettling or even shocking for children, adolescents and young adults, challenging a naivety that they had previously held about the certainty of healthcare professionals, processes, systems, services and knowledge. Not only could experiences of uncertainty and/or misdiagnosis undermine children and adolescents' beliefs about and confidence in medical processes, professionals and services, but it could also have tangible impacts for them in terms of feeling they had 'wasted' time before more appropriate treatment could be started and symptoms better managed.

Partial or unclear communication of information by healthcare professionals and misunderstanding on the part of the patient is a concern across all groups, but our data suggest it may be particularly relevant for children and adolescents in the context of diagnosis owing to their circumstances. The parents of those who were diagnosed when they were very young were primarily the recipients of information, but this content is not necessarily shared clearly with the child as they grow up and may not be repeated by health professionals subsequently seen. Even for those who had reasonable capacity to comprehend the diagnosis at the time, information and explanations may not be directed towards them or communicated in an age-appropriate way. This also highlights the risk of informed healthcare falling between the gaps when a parent or guardian is a proxy holder of the condition-specific information. Some young people diagnosed when very young had experiences of seeing health professionals when they had become more independent in managing their condition, for example when attending appointments without their parents, and being helped to understand the background to their condition. We suggest these experiences constitute a type of re-diagnosis, as time folds back in a sense to allow them to comprehend that which they could not or did not at the time of the official diagnosis. The learning of new information, which could invoke surprise and worry, could add to a sense of disruption for those who felt the diagnosed condition marked (or now marked) a significant change in their lives.

Conclusion

The focus of this secondary analysis has highlighted some of the complexities surrounding the diagnosis of two common skin conditions – eczema and psoriasis – for children, adolescents and young people, and the ways in which they make sense of this diagnosis in the context of time and over time. Various aspects of time and temporality have been drawn out of the accounts given by young people regarding their diagnoses, highlighting different features deemed important, including: the age circumstances of when diagnosis takes place and their ability to remember or reconstruct it, the pace and rhythm of seeking a diagnosis, feelings on receiving a diagnosis and having a diagnostic label, the impact of diagnosis on perceptions of past, present and future, and the way diagnosis can be revisited and revised as the young person grows older and more independent. Our analysis has also highlighted the interactional layers involved in young peoples' diagnosis experiences, as well as in the processes of recalling and narrating experiences in the setting of a qualitative interview. We hope our paper will showcase the depth and rich insight that a qualitative exploration can yield on a topic – diagnoses – that is of interest to both quantitative and qualitative researchers, as well as patients and clinicians.

Our findings are in the context of recognition that early encounters with healthcare professionals, particularly those involving growing degrees of independence for health management with age and maturity, can impact future approaches and expectations towards help-seeking and health management. We suggest though that the temporal context is important for understanding why a diagnosis of eczema or psoriasis might be upsetting for children and adolescents, given that these are not widely regarded as particularly serious or shocking diagnoses nor conditions. This includes the fact that it may be the individual's first or most significant to date reason to engage with healthcare professionals and services, and that their expectations about medical processes and the operations of the healthcare system (in this context, the NHS) may jar with the realities they encounter – including that diagnosis may be slower and more complicated than expected. In addition, it may also be the first time they have had been told they have a long-term health condition, rather than an acute medical event such as the flu or a broken bone, and reconciling the meaning of this in the context of their lives where aspects such as the importance of peer opinions, appearance concerns and growing independence are increasing with the transition of adolescence.

Late childhood, adolescence and young adulthood often constitute periods of significant change, including growing independence around health condition management and help-seeking. The present paper contributes to medical sociological literature and to evidence demonstrating the impacts of skin conditions on young people, recognising them as an important group with particular information and support needs. Looking through a lens of time and temporality has also highlighted possible relevant areas for improvement in health care, such as the need for professionals to manage young peoples' expectations about the likely duration, pace and rhythm of seeking diagnoses when these conditions are a possibility.

Study implications

It is important that healthcare professionals, including psychologists, consider that diagnosis experiences for typically regarded minor conditions like eczema and psoriasis can be distressing and troubling, particularly for children and adolescents for whom there are additional confounding factors. We also suggest it may be pertinent to revisit information that would have accompanied diagnosis with adolescents, as they reach various stages of independence in their lives and in their approach to healthcare, in recognition that there may be gaps in understanding.

Strengths and limitations

A strength of this paper is the use of concepts of time and temporality – including chronological age, as well as qualities like rhythms, pace and reverberations – which offer a productive lens through which to explore narratives of young people with two common skin conditions, eczema and psoriasis. The original study considered a wide range of young people's experiences, with a large sample size for a qualitative study which offered rich data for our secondary analysis. Nonetheless, a limitation is that other important differences may exist that were not adequately articulated in the data set and therefore not drawn out in our analysis, and our paper has not been able to explore all angles.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. The datasets used in the secondary analysis are available from the corresponding author on reasonable request.

Ethics statement

As a secondary analysis, ethic review and approval was not required for the study on human participant in accordance with the local legislation and institutional requirement. Written informed consent from the participants' legal guardian/next of kin was not required for the secondary analysis study in accordance with the national legislation and the institutional requirement.

Author contributions

AM conducted the interviews in the original study. SR provided supervision and support throughout the original study. 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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The influence of academic pressure on adolescents' problem behavior: Chain mediating effects of self-control, parent–child conflict, and subjective well-being

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As a negative social issue, teenagers' problem behavior not only affects individuals' physical and mental health and social function development but is also not conducive to social harmony and stability. This study mainly discusses the influence of academic pressure on adolescents' problem behavior, and the potential relationship between these and academic pressure, examining issues such as self-control, parent–child conflict, and subjective well-being. The data were collected from the fifth wave of the China Family Panel Studies (2017–2018). The data of 2,465 teenagers aged 10–15 were analyzed by LISREL8.8 software. The results show that academic pressure positively affects adolescents' deviant behavior. The mediation model finds that parent–child conflict and self-control play a direct mediating role between academic pressure and adolescents' behavioral problems. Parent–child conflict, self-control, and subjective well-being have important chain mediation effects between academic pressure and adolescents' problem behavior. Therefore, in order to reduce the risk of such problems, it is necessary to further strengthen individuals' ability to maintain self-control, promote or cultivate adolescents' character strengths, create a harmonious family atmosphere, reduce the probability of parent–child conflict, and increase the subjective well-being of teenagers.

KEYWORDS

teenagers, academic pressure, problem behavior, self-control, parent–child conflict, subjective well-being, chain mediation

Introduction

Adolescents' problem behavior refers to behavior that deviates from the normal standard of society expected while adolescents are growing up (Markova and Nikitskaya, 2014). As a negative social behavior, it is usually used to measure adolescents' physical and mental health and social function development (Kenneth et al., 2003). The specific

manifestations of adolescents' problem behavior include an inappropriate learning attitude, poor interpersonal relationships, and bad living habits (Kremer et al., 2016). Relevant research shows that adolescents' problem behavior is persistent, which can significantly affect adult drinking, violence, and even committing crimes (Pol et al., 2012; Evans et al., 2020). This not only affects adolescents' behavioral health, but also is not conducive to the harmonious and stable development of society. It has been found that adolescents' problem behavior is mainly influenced by individuals, families, schools, and society, and the disharmonious parent–child relationship, school violence, and social order are all important factors that lead to it (Reaves et al., 2018). This study seeks to verify the formation mechanism and path of influence of adolescent problem behaviors from the four levels of individual, family, school, and society, starting from the external environment and internal performance, through to structural equation modeling, in order to find ways reduce adolescent problem behavior and promote the development of positive social functions.

Given the background of China's nine-year compulsory education system, teenagers are not able to live without learning during their long growth stage. Academic pressure may have an important impact on teenagers' physical and mental health, family relations, and happiness, which has been confirmed by many studies (Sun et al., 2011; Zhang et al., 2016). Academic pressure refers to the tension, discomfort, and other emotions caused by the pressure from school, family, and society in the learning process (Luo et al., 2020). Studies have shown that teachers and parents have higher learning expectations of teenagers with good academic performance, resulting in greater academic pressure. When academic performance does not match expectations, this can create negative emotions, which will lead to deviant behaviors (Ma et al., 2018; Çelik, 2019). Teenagers with poor academic performance are vulnerable to peer pressure in the campus environment, and they are prone to feelings of inferiority, anxiety, and fear in their studies. At the same time, their academic failures also make them vulnerable to peer investigation and rejection. This leads to rebellious psychological issues, showing problem behavior such as hyperactivity and aggression, and even crimes (McEvoy and Welker, 2000). Therefore, it is particularly important to study the path of influence of academic pressure on adolescents' problem behavior.

Parent–child relationships, teacher–student relationships, and peer relationships are the most important social relationships of teenagers. They play an important role in the development of their social functions (Buist, 2004). The parent–child relationship is a type of interpersonal relationship that unites a natural relationship and a social relationship. It is bound by blood relationship and has the particularity of stability, permanence, intimacy, and an appropriate relationship. It has an extremely important influence on the physical and mental development of teenagers (Kerri et al., 2009). It has been found that parents' psychological aggression and corporal punishment can easily lead to more deviant behaviors, such as aggression, violation of discipline, and anxiety. Parent–child conflict has a long-term and persistent negative impact on adolescents' behavioral problems (Bradford et al., 2007). Some studies have found that parent–child conflict has a moderating effect on academic pressure and adolescent behavioral deviation (Kuang, 2011). In addition, a number of studies have also found that academic pressure may affect adolescents' problem behavior through parent–child conflict. Academic pressure includes the pressure placed on adolescents by parents. When academic performance fails to satisfy parents, it will affect family relations, resulting in parent–child conflict, which may lead to an increase in adolescents' problem behavior (Huan et al., 2008). The way parent–child conflict affects the relationship between academic pressure and adolescents' problem behavior needs further verification.

Self-control is one of the most important factors that affect an individual's internal development. According to changes in the external environment, a person can adjust their thoughts, emotions, and behaviors in time to achieve established goals (Casey and Caudle, 2013). Relevant research proves that teenagers with high self-control have greater happiness, excellent academic performance, good interpersonal relationships, less mental illness and problem behavior, and, at the same time, they can better regulate negative personal emotions (Pokhrel et al., 2017). A study found that academic pressure can regulate adolescents' problem behavior through individual self-control. Strong self-control ability can also relieve academic pressure and reduce negative emotions (Xu et al., 2018). In addition, the parent–child relationship can also influence adolescents' self-control and then their problem behavior. For example, self-control theory points out that a negative parent–child relationship will reduce the development of adolescents' self-control ability. However, the lack of self-control ability can easily lead to individual bad behavior (Bunch et al., 2017). A general theory of crime also shows that parent–child conflict is an important factor restricting the development of adolescents' self-control ability, and adolescents with low self-control ability are at high risk of violating discipline or committing crimes (Hirschi and Gottfffredson, 1993). Therefore, the direct and indirect effects of academic pressure, parent–child relationship, and self-control on adolescents' problem behavior still need to be further explored.

Subjective well-being is an indicator of an individual's life state ascertained by examining certain standards, mainly emotional state and life satisfaction (Diener and Fujita, 1995). Subjective well-being, as a psychological characteristic of teenagers, can effectively measure their social adaptation state, and it is also an important index to evaluate their psychological adaptability (Eryılmaz, 2011). Studies have found that subjective well-being can not only effectively predict adolescents' mental health, but also predict their tendency to display problem behavior (Rask et al., 2002). Teenagers with low subjective well-being often show anxiety, loneliness, depression, etc. They often deal with social

Abbreviations: AP, Academic pressure; SC, Self-control; PCC, Parent–child conflict; SWB, Subjective well-being; PB, Problem behavior; CFA, Confirmatory factor analysis; SD, Standard deviation; SEM, Structural equation modeling.

relations with a negative attitude, and their social adaptation is low, which is more likely to lead to problem behavior (Arslan and Renshaw, 2017). Subjective well-being can also affect teenagers' problem behavior through academic pressure, the parent–child relationship, and self-control. The greater the academic pressure, the worse the parent–child relationship, and the lower the self-control ability; children's subjective well-being is often low, thus increasing the risk of problem behavior (Qutaiba et al., 2012; Bücker et al., 2018). Therefore, it is particularly important to explore the influence mechanism of subjective well-being on adolescents' problem behavior.

What is the relationship between group academic pressure and the behavioral problems of teenagers? Do self-control, parent–child conflict, and subjective well-being have mediating effects between academic pressure and adolescents' problem behavior? Based on the existing theoretical basis and literature, the research hypotheses are shown in Figure 1: (H1) academic pressure is positively correlated with adolescents' problem behavior; (H2) parent–child conflict has a mediating effect on the relationship between academic pressure and adolescents' problem behavior; (H3) parent–child conflict and subjective well-being have chain mediation between academic pressure and adolescents' problem behavior; (H4) self-control has a potential mediating effect in the relationship between academic pressure and adolescents' problem behavior; (H5) self-control and subjective well-being have chain mediation between academic pressure and adolescents' problem behavior; (H6) parent–child conflict, self-control, and subjective well-being have complex chain mediation between academic pressure and adolescents' problem behavior; and (H7) subjective well-being plays an intermediary role in academic pressure and adolescents' problem behavior.

Materials and methods

Participants

The data were collected from the China Family Panel Studies (CFPS) in 2018. This is a nationwide, large-scale, multi-disciplinary social follow-up survey project, focusing on the

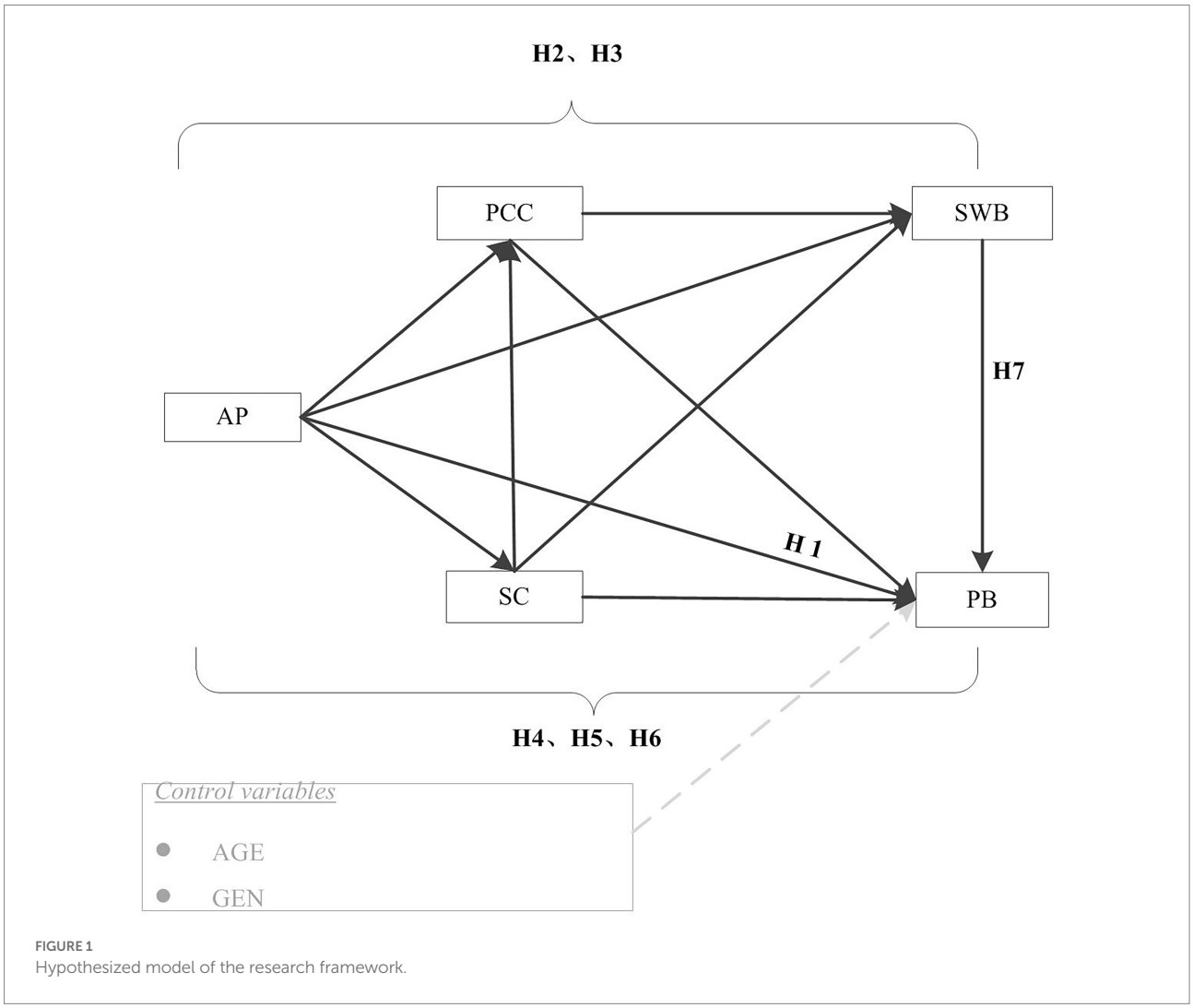

FIGURE 1
Hypothesized model of the research framework.

economic activities, educational achievements, family relations and family dynamics, health, and other topics of Chinese residents. A baseline survey was officially carried out in 25 provinces, cities, and autonomous regions in China in which 14,960 households and 42,590 individuals were interviewed. The permanent tracking objects of the CFPS survey are visited every 2 years. First, a total of 37,354 people participated in the fifth wave survey. According to the characteristics of the research subjects, 34,747 people were selected. Then, 142 non-school and blank questionnaires were excluded. The final sample comprised 2,465 people. The CFPS project has been approved by Peking University Biomedical Ethics Committee (IRB00001052-14010). All the participants signed an informed consent form.

Measures

Academic pressure

Academic pressure was mainly measured by the degree of stress experienced by the participants during their own studies. This was measured by asking the following question: "How much do you think your academic pressure is?" The answer was based on five grades (no pressure to great pressure, with a score of 1–5). The higher the score, the greater the academic pressure on teenagers.

Parent–child conflict

This indicator was measured by asking the respondents how many times they had quarreled with their parents in the last month. The answers were defined as five grades (1 = 0 times, 2 = 1–2 times; 3 = 3–4 times, 4 = 5–6 times, 5 = 7 times and above).

Self-control

The CFPS has investigated the self-control ability of teenagers aged 10 to 15 since 2012. This scale mainly consists of 12 items, which are used to evaluate the self-control state of daily behavior. It includes the following 12 statements: (1) I am always well prepared, (2) I pay attention to details, (3) I like to be organized, (4) I will do things according to my own schedule, (5) I am very careful in my study, (6) I always put things at random, (7) I always mess things up, (8) I always forget to restore things, (9) I do things carefully and thoroughly, (10) I do my homework first and then play, (11) I'll start my homework assignment right after, and (12) I'll clean up when things get messy. Questions six (I always put things at random), seven (I always mess things up), and eight (I always forget to restore things) are reverse questions. Their answers were scored in reverse before the analysis in this study. Each item was rated from 1 to 5, where 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = quite agree. The higher the score, the stronger the self-control ability.

Subjective well-being

Subjective well-being was mainly measured by asking whether participants thought they were happy or not. It was measured by asking the participants, "Do you think you are happy?" Their responses included 11 grades (0–10). The higher the score, the higher the happiness index.

Problem behavior

In the CFPS 2018 Personal Questionnaire, information was collected about adolescent respondents aged 10 to 15 for the first time, including internalizing and externalizing problem behavior. In 2018, the CFPS adopted a more concise version (Myers et al., 1994) from the Early Childhood Liberal Study in the United States, which contains 14 questions, including eight internalized questions and six externalized questions. Internalized questions related to the following: angry, exam, loneliness, sadness, performance, worry about homework, playmates, and shame; externalization included: quarreling, paying attention, being distracted, finishing homework, being talkative, and fighting. Each entry was rated from 1 to 5, where 1 = totally non-conforming, 2 = non-conforming, 3 = fair, 4 = relatively consistent, and 5 = completely consistent. The higher the score, the greater the probability of adolescent deviant behavior.

Data analysis

In this study, SPSS22 was used to analyze the correlation between variables and the frequency, mean, and standard deviation of each index. The Cronbach's alpha coefficient was obtained by factor analysis to evaluate the internal consistency of the scale. LISREL8.80 software was used to construct the chain structure equation, and the intermediary effect was verified. The moderating variables were parent–child conflict, self-control, and subjective happiness, and the independent variable was academic pressure. The dependent variable was problem behavior (Figure 1). To explore the fitting effect of the structural equation model, the values of the comparative fitting index (CFI), non-normalized fitting index (NNFI), incremental fitting index (IFI), and modified goodness-of-fit index (AGFI) were limited to be higher than 0.90 (Bentler, 1990; Hu and Bentler, 1999). The approximate root mean error (RMSEA) value was <0.05 (Steiger, 1990; Browne and Cudeck, 1992). The critical value (CN) of Hoelter was greater than 200 (Bollen, 1986).

Results

Descriptive data

Table 1 shows the main demographic characteristics of the teenagers investigated, in which the average age is 12.40 ($SD = 1.66$) years old. There is little difference between the number of boys and girls in the survey. Those who have never quarreled with their parents in the past month account for 73.24% of the total number, and only 3.76% of teenagers have quarreled with their parents five times or more in the past month. The average score of adolescents'

academic pressure is 2.89 ($SD = 1.14$), the average score of self-control is 42.28 ($SD = 6.76$), the average score of subjective well-being is 8.15 ($SD = 2.09$), and the average score of problem behavior is 31.83 ($SD = 8.16$).

Mediation analyses

LISREL 8.8 software was used to perform confirmative factor analysis of the measurement indicators. The analysis results are shown in the following table. The RMSEA values of self-control and behavioral deviation are all less than 0.08, the values of NNFI, CFI, IFI, and AGFI are all greater than 0.9, the Cronbach's alpha values are all greater than 0.7, and the reliability and validity of the scale are within the acceptable range (Table 2).

According to the value of t ($t < 1.96$), in order to obtain the final model (Figure 2), the insignificant path was eliminated by using the structural equation model. The model has a good fitting degree, RMSEA = 0.043, NNFI = 0.90, CFI = 0.93, IFI = 0.93, AGFI = 0.98, CN = 470.35 (Table 3). The results show that the total effect was 0.082 (95% CI 0.64–0.102), the total indirect effect was 0.008 (95% CI 0.03–0.014), the direct effect was 0.074 (95% CI 0.56–0.092), all $p < 0.01$, and the model was some intermediaries (Table 4). In addition, academic pressure, parent–child conflict, and adolescent deviation have significant positive effects, while self-control and subjective well-being have significant negative effects on adolescent deviation. Academic pressure is negatively correlated with self-control, positively correlated with parent–child conflict, and has no direct impact on subjective well-being. Self-control, parent–child relationship, and subjective well-being play a significant chain-mediated role in academic pressure and adolescent deviant behavior.

Table 5 shows the path of influence between academic pressure and adolescents' problem behavior. The study found that academic pressure has a significant influence on adolescents' problem behavior, with a total effect of 0.19 ($p < 0.001$) and a direct effect of 0.14 ($p < 0.001$). Hypothesis 1 is supported by the data. Academic pressure has a positive impact on parent–child conflict ($\beta = 0.09$, $p < 0.001$), and parent–child conflict also has a direct impact on adolescents' problem behavior ($\beta = 0.10$, $p < 0.01$). It has a significant negative effect on subjective well-being ($\beta = -0.07$, $p < 0.001$), and subjective well-being can directly affect adolescents' problem behavior ($\beta = -0.11$, $p < 0.001$). Therefore, academic pressure can positively affect adolescents' problem behavior through parent–child conflict, and it can also affect adolescents' problem behavioral through parent–child conflict and subjective well-being. Hypotheses 2, 3, and 7 are supported to some extent. In addition, academic pressure negatively affects self-control ($\beta = -0.09$, $p < 0.001$), while self-control directly affects adolescents' parent–child conflict, subjective well-being, and problem behavior, with direct effects of −0.18, 0.37, and −0.32, respectively ($p < 0.001$). Therefore, academic pressure can affect adolescents' problem behavior through self-control. The deviant behavior of teenagers can be influenced through self-control and parent–child conflict, but also through self-control, parent–child conflict, and subjective well-being. Therefore, hypotheses 4, 5, and 6 are supported to some extent.

TABLE 1 Descriptive statistics variables of the sample (n=2,465).

Variable	$n^{\#}$	%	Mean	SD
Control variable				
Age [10–15]			12.40	1.66
Sex				
Male	1,305	52.94		
Female	1,160	47.06		
Independent variables				
Academic pressure [1–5]			2.89	1.14
Mediating variables				
Parent–child conflict				
Number of quarrels with parents				
never	1,697	73.24		
1–2 times	415	17.91		
3–4 times	118	5.09		
5–6 times	44	1.90		
≥7 times	43	1.86		
Self-control [12–60]			42.28	6.76
Subjective well-being [1–10]			8.15	2.09
Dependent variable				
Problem behavior [6–30]			31.83	8.16

Note: Total number < n = 2,465 due to missing data.
[], The range of a single item.

Discussion

From the four levels of individual, family, school, and society, this study took the external environment and internal performance as the starting point to explore the formation mechanism and path of influence of adolescent problem behavior, so as to improve the references for reducing such behavior and promoting the development of positive social functions. Using a structural equation model, this study verified the path of influence of

TABLE 2 Scale reliability and validity tests.

Variables	RMSEA	NNFI	CFI	IFI	AGFI	CN	Cronbach's alpha
Self-control	0.063	0.93	0.95	0.95	0.97	330.83	0.874
Problem behavior	0.069	0.90	0.93	0.93	0.96	271.42	0.854

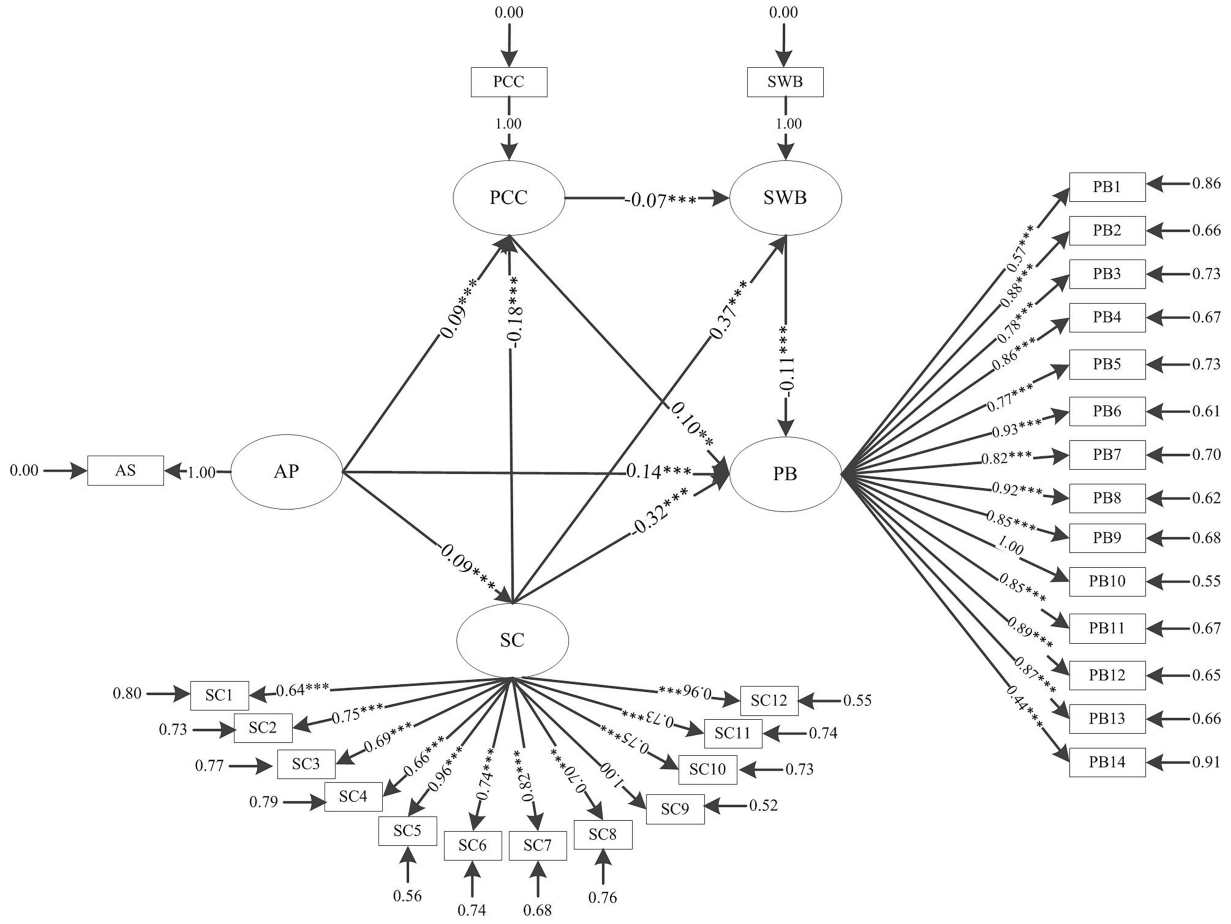

FIGURE 2
Structural equation modeling results. *Note*: AP, academic pressure (the influence of academic pressure on adolescent problem behavior); SC, self-control; PCC, parent–child conflict; SWB, subjective well-being; PB, problem behavior; **p<0.01, ***p<0.001.

TABLE 3 Measures of goodness-of-fit for academic pressure and problem behavior model of the adolescents.

Model	Chi-square	*df*	RMSEA	NNFI	CFI	IFI	AGFI	CN
Initial model	1688.49	418	0.043	0.90	0.93	0.93	0.98	469.39
Delete AGE → PCC	1690.77	419	0.043	0.90	0.93	0.93	0.98	469.79
Delete AP → SWB	1692.92	420	0.043	0.90	0.93	0.93	0.98	470.79
Delete AGE → PB	1693.77	421	0.043	0.90	0.93	0.93	0.98	471.03
Delete GEN → PCC	1694.02	422	0.043	0.90	0.93	0.93	0.98	471.99
Delete GEN → SWB	1707.41	423	0.043	0.90	0.93	0.93	0.98	469.32
Delete AGE → SWB #	1707.41	424	0.043	0.90	0.93	0.93	0.98	470.35

IA, internet addiction; PB, problem behavior; GEN, gender; SC, self-control; DP18, depression in 2017–2018.#Goodness-of-fit of the final model.

academic pressure on adolescent problem behavior. It has shown that academic pressure positively influenced adolescents' problem behavior. The mediation model found that parent–child conflict and self-control play a direct mediating role between academic pressure and adolescents' problem behavior. In addition, this study also found that parent–child conflict, self-control, and subjective well-being have important chain mediating effects between academic pressure and adolescents' problem behavior.

Academic pressure is an important factor affecting adolescent problem behavior

The study proved that academic pressure has a significant influence on adolescents' problem behavior. That is, the greater the academic pressure, the higher the risk of adolescents' problem behavior. At present, China's education model is still exam-oriented education (Hu and West, 2015). Teenagers are constantly facing

TABLE 4 Analysis and comparison of specific direct and indirect effects.

	Point estimate	Product of coefficients			BOOTSTRAP1000 TIMES 95% CI			
					Bias corrected		Percentile	
	Estimate	S.E.	Est./S.E.	*p*-Value	Lower	Upper	Lower	Upper
Total effect	0.082	0.010	8.207	***	0.063	0.099	0.064	0.102
Total indirect effect	0.008	0.003	2.986	**	0.003	0.015	0.003	0.014
Direct effect	0.074	0.009	7.906	***	0.057	0.093	0.056	0.092

TABLE 5 Direct and indirect effects of academic pressure and problem behavior in adolescents.

Variables	Problem behavior		
	Direct effect	Indirect effect	Total effect
Independent variables			
Academic pressure	0.14	0.05	0.19
Mediation variables			
Parent–child conflict	0.10	0.01	0.11
Self-control	-0.32	−0.06	−0.38
Subjective well-being	−0.11	-	−0.11

various examinations in order to enter better schools. In this process, they bear pressure from all sides, including learning tasks, learning expectations, and interpersonal relationships. Excessive academic pressure is bound to lead to emotional changes in teenagers, which will easily lead to mental illness such as depression in the long run (Anyan and Hjemdal, 2016). Problem behavior is generally the excessive behavior undertaken by teenagers after they bear great psychological pressure. Serious problem behavior includes acts such as suicide and murder (DiCataldo and Everett, 2007), which are not only detrimental to the physical and mental health and social function development of teenagers, but also brings indelible harm to families, schools, and even society. It is particularly important to alleviate the academic pressure on teenagers. To facilitate this, China has adopted a "double reduction" policy. However, at the early stage of the policy's implementation, there are still many problems. For example, test scores are still an important factor for students to go to higher schools, and the service quality of teachers is inconsistent (Li, 2021). Therefore, it is necessary to continuously strengthen the reform of the education system, take the coordinated development of teenagers' morality, intelligence, physique, and beauty as guidance, and improve their psychological resilience.

Parent–child conflict increases the risk of problem behavior in adolescents

The results of the study found that parent–child conflict was an important factor affecting adolescent problem behavior. There was a mediating effect in the association between academic pressure and problem behavior. Family is the primary environment for individual growth, and the influence of family environment on adolescents is very important. Parent–child conflict, as a negative event, can directly affect adolescents' emotional behavior and increase the risk of problem behavior (Bradford et al., 2007). Academic pressure mainly comes from school, family, and peers, while adolescents' dependence on family makes them bear more pressure from family. Increasing numbers of parent–child conflicts are rooted in children's academic performance. Such conflicts will also increase adolescents' psychological trauma and increase the risk of problem behavior (Rex et al., 1986). Adolescents are a special group whose physical and mental development is not sufficiently sound. A good family environment is particularly important for the formation of their values. Therefore, parents should aim for the healthy growth of their children, attach importance to family relationships, reduce parent–child conflicts, and create a harmonious family ambience.

Self-control can effectively alleviate adolescent problem behaviors

The study also proved that self-control can directly affect the problem behavior of adolescents and, as a mediating factor, it can alleviate the effect of academic pressure on their problem behavior. One study found that the stronger the self-control ability, the higher an individual's ability to manage stress and regulate emotions, and the lower the probability of negative behavior to a certain extent (Glenn and Cunningham, 2000; Finning et al., 2017). At the same time, self-control also has a moderating effect, including reducing external environmental factors such as family conflict and poor academic performance (Perrone et al., 2004). Having good self-control can improve adolescents' academic performance, reduce negative emotions, and resolve academic pressure, thereby reducing the probability of occurrences of problem behavior (Yu, 2010). Therefore, it is necessary to focus on improving the self-control and stress-management ability of young people, channeling negative emotions, and providing better potential conditions for the development of young people's mental health and social function.

Improving adolescent subjective well-being can effectively prevent problem behavior

According to the textual content analysis, we found that subjective well-being can effectively alleviate adolescent problem

behavior. Subjective well-being, as an important indicator to measure the psychological characteristics of adolescents, is affected by factors such as interpersonal relationships, social support, and social trust. Our study also confirms this view (Renshaw, 2016). The area of adolescents' activity is mainly between school and home. Family relationships, teacher–student relationships, and classmate relationships constitute adolescents' interpersonal networks. Negative interpersonal networks will reduce life satisfaction and subjective well-being, and eventually lead to problem behavior (Bücker et al., 2018). This study also partially confirmed this conclusion. Therefore, by strengthening social support and combining family and school, the subjective well-being of adolescents can be jointly improved to reduce the occurrence of bad behavior.

The complex chain mediating effect of parent–child conflict, self-control, and subjective well-being

Finally, it is worth mentioning that the results of that parent–child conflict, self-control, and subjective well-being play significant chain mediating roles between academic pressure and adolescents' problem behavior, mainly following three paths. First, academic pressure increases the risk of parent–child conflict, thus reducing subjective happiness, and then increases the risk of adolescents' problem behavior. Second, academic pressure can reduce self-control, thereby reducing the subjective well-being of individuals and increasing the probability of adolescents' problem behavior. Third, academic pressure leads to the decline of self-control ability, increases the probability of parent–child conflict, and reduces the subjective well-being of teenagers, leading to problem behavior. Self-control and parent–child conflict affect subjective well-being to a certain extent, thereby affecting adolescents' problem behaviors. Therefore, there is a need to focus on how to improve the subjective well-being of teenagers. For example, schools can offer psychological courses, strengthen the psychological education of teenagers, and promote or cultivate their character strengths. At the same time, mental education could be integrated into daily teaching, actively guiding the healthy development of young people's minds and shaping their strong personality traits. In addition, the family relationship is an important part of teenagers' happiness, so parents should pay more attention to this while educating their children. When parents have a good relationship with their children, they should control their emotions, reduce the frequency of parent–child conflicts, and create a harmonious and happy family relationship.

Limitations

Some limitations to this study warrant consideration. First, academic pressure, self-control, parent–child conflict, subjective well-being, and problem behavior are cross-sectional in the study and can be further validated using longitudinal data in the future. Second, since the information was gathered from the participants in the study, self-report/recall bias may have existed. However, it is not easy to achieve continued participation among cohorts of adolescents in a cohort study, and the sample size should not be ignored. As a result, our findings with regard to acceptable goodness-of-fit indices deserve to be given more attention.

Conclusion

The problem behavior of teenagers should be given continuous attention. Academic pressure has a direct positive impact on adolescents' problem behavior, and parent–child conflict and self-control have a direct mediating effect between academic pressure and adolescents' problem behavior. In addition, parent–child conflict, self-control, and subjective well-being have important chain mediation effects between academic pressure and adolescents' problem behavior. The results of this study emphasize that it is necessary to start from the four levels of individual, family, school and society, and combine the external environment and internal performance to strengthen the psychological characteristics of adolescents and reduce problem behavior. For example, schools can offer psychological courses, strengthen the psychological education of teenagers, and promote or cultivate their character strengths. Parents should pay attention to controlling their emotions when they interact with their children, reduce the frequency of parent–child conflicts, and create a harmonious and happy family relationship. Teenagers should also strengthen their cultivation of self-control and reduce problem behavior. In addition, these measures can increase social support and enhance the subjective well-being of adolescents.

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. This study was approved by the Ethical Review Committee of Peking University Biomedical (IRB00001052-14010), and all participants signed informed consent. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

M-mJ and KG designed the study, analyzed results, drafted, revised the manuscript, and acquisition of funding. M-mJ and

Z-yW drafted and revised the manuscript. KG and P-pG analyzed results, and revised the manuscript. 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.

Publisher's note

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Perceived stress of adolescents during the COVID-19 lockdown: Bayesian multilevel modeling of the Czech HBSC lockdown survey

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Objective: Long-term isolation, including lockdowns and quarantines, may have a distressing effect on anyone experiencing it. Adolescent brain architecture is very sensitive to environmental adversities, and the mental health development of adolescents may be particularly vulnerable during the pandemic era. In order to better understand the triggers for perceived adolescent stress (PSS) during the COVID-19 lockdown, the present study aimed to assess the effects of social well-being and changes in time use during the lockdown, as well as the family COVID experience of adolescents.

Methods: The sample for this study comprised n=3,440 adolescents (54.2% girls; mean age=13.5±1.6years). Bayesian correlations between PSS, health and well-being variables were assessed. PSS was then modeled as an outcome variable in a series of nested Bayesian multilevel regression models.

Results: The negative impact of the COVID-19 lockdown was more apparent in girls. PSS was moderately correlated with adolescent health and well-being. The strongest predictor of higher level of PSS was frequent feeling of loneliness. On the contrary, lower level of PSS was most associated with having someone to talk to.

Conclusion: Long-term social isolation of adolescents could be harmful to their mental health. Psychological coping strategies to prevent the consequences of social isolation and development of mental health problems should be promoted on the individual, family, and even community level.

KEYWORDS

perceived stress, COVID-19 lockdown, HBSC, adolescent, Bayesian multilevel regression

Introduction

In March 2020, the World Health Organization (WHO) declared a pandemic to contain the spread of COVID-19 (Mahase, 2020). Subsequently, countries around the world adopted lockdowns, social distancing, and school closures complemented with online education. Restrictive measures were gradually implemented to prevent gatherings of people and reduce the incidence of the infection (Panchal et al., 2021). Thus, the pandemic became a risk not only for physical health, it started affecting mental health, as well (Pfefferbaum and North, 2020). Indeed, long-term isolation, including lockdowns and quarantines, may have a distressing effect (Brooks et al., 2020; Racine et al., 2022). For adolescents in particular, the adverse effects of pandemic lockdowns on mental health are substantial (Kiss et al., 2022). According to some authors, the psychological consequences of the pandemic may even outlast its physical impact (Brooks et al., 2020).

Adolescent brain architecture is very sensitive to environmental adversities (Eiland and Romeo, 2013; Fuhrmann et al., 2015), and the mental health development of adolescents may be particularly vulnerable in the pandemic era (Panchal et al., 2021). During the lockdown, adolescents were exposed to chronic stress conditions, such as forced isolation from peers due to school closures, social distancing, restrictions in leisure-time activities, loss of a sense of security and safety, and fears about the future (Gruber et al., 2021; Panchal et al., 2021). Frequently reported psychosocial outcomes of the COVID-19 lockdowns on adolescents were sleep disruption, loneliness, anger, irritability, or a worsening of preexisting psychiatric symptoms (Panchal et al., 2021; Porter et al., 2021). Globally, adolescents have been reporting higher rates of depression, anxiety, and overall mental health deterioration due to the pandemic (Panchal et al., 2021; Kiss et al., 2022). The adolescent suicide rate has also been increasing (Hoekstra, 2020; Mayne et al., 2021). Girls (Magson et al., 2021; Kiss et al., 2022) and older adolescents (Chen et al., 2020; Panchal et al., 2021) were reported to be at higher risk of poor mental health during the COVID-19 pandemic. Even before the pandemic, adolescent girls were shown to suffer from a greater psychological distress accompanied with higher level of physical and mental health complaints than boys (Eiser et al., 1995; Wade et al., 2002). A steady trend of increased gender differences in health complaints with higher adolescent age has been indicated in many Western countries (Torsheim et al., 2006). The excess reporting of psychosomatic symptoms in female adolescents tends to be related to self-esteem and body image (Sweeting et al., 2007), as well as differing rates of biological development, societal expectations, lifestyle, and behaviors (Sweeting, 1995).

According to previous studies, decrease in physical activity and increase in time spent being sedentary, especially in front of a screen and using technology/social media belong among the most common changes found in the behavior of adolescents during periods of lockdown (Jones E. et al., 2021; Panchal et al., 2021). All the above have previously been identified as risk factors for developing mental health problems (Hoare et al., 2016). Prior research has also shown that poor mental health in adolescents was influenced by distress, frustration or even anger in their parents, which could have resulted in overreactions and increased family violence (Cluver et al., 2020; Achterberg et al., 2021). External stressors thus elicit family tension, which leads to a decline in well-being in both parents and children (Achterberg et al., 2021). However, all types of routine, social support, family communication and appropriate leisure-time activities seem to have had a positive impact on adolescent mental health during the pandemic (Donker et al., 2021; Panchal et al., 2021). On the other hand, the decrease in social and school obligations may have reduced the pressure on both children and parents; thus, some families could have experienced the pandemic as a form of relief (Hoekstra, 2020; Bruining et al., 2021).

The level of perceived stress characterizes the extent to which a person views his/her life as being unpredictable, uncontrollable, and stressful (Cohen et al., 1983). It is seen as a psychological risk factor with an impact on the outbreak and development of mental disorders among adolescents (Lindholdt et al., 2021). Half of the mental disorders, including depression, anxiety disorders, suicidality, etc., emerge or worsen during adolescence (Paus et al., 2008; Gruber et al., 2021), and their consequences persist into adulthood (Aneshensel, 1992). Psychological stress during adolescence has also been identified as a risk factor for alcohol and drug use, with the consequent perils of developing addiction (Aseltine and Gore, 2000; Sinha, 2008). Further, adolescent stress is associated with obesity and abnormalities in immune, metabolic and cardiovascular functions, with greater risk for subclinical atherosclerosis in adulthood (De Vriendt et al., 2009; Low et al., 2009; Pervanidou and Chrousos, 2012). Increased levels of psychological stress during adolescence may be especially harmful given that coping skills, psychosocial and physiological stress response systems develop during this period (Repetti et al., 2002; Low et al., 2009; Gavin et al., 2020). The perceived stress of adolescents thus deserves attention in COVID-19 research, due to its enduring impact on physical and mental health, as well as on overall well-being (Jones E. et al., 2021).

The severity of pandemic preventive measures varied per countries, just as the outcomes may vary. The challenges of the pandemic, however, have been scattered around the world, and its consequences need to be monitored. During the first national lockdown in the spring of 2020, the Czech Republic was among the very strict countries in terms of preventive measures relative to the number of infections (Stringency Index, 2020). There is, however, still little known about its effect on Czech adolescents' perceived level of stress and their well-being. This study aims to (1) assess gender differences in the COVID-19 lockdown experience of Czech adolescents, (2) evaluate the correlations between adolescents' perceived level of stress and their well-being, and (3) estimate the associations between potential pandemic stressors and the perceived level of stress among adolescents during the spring 2020 lockdown.

Materials and methods

Data and participants

Data for this study is connected to the Health Behavior in School-aged Children (HBSC) study,[1] which is an international cross-sectional survey on adolescent health. There is a standardized international protocol for the data collection process among 11-, 13- and 15-year-old school children (Inchley et al., 2018). During the first Czech COVID-19 lockdown in the spring of 2020, schools were asked to participate in an unscheduled round of data collection with the HBSC survey questionnaire adapted to capture the impact of the lockdown on the adolescent health (Cosma et al., 2021). Out of 234 randomly selected schools from all 14 Czech administrative regions, 144 schools were willing to participate in the survey. Data was collected online during June 2020. The final sample for this study contains $n = 3{,}440$ participants from the 5th, 7th, and 9th grades (54.2% girls, mean age = 13.5 ± 1.6 years). Participation in the survey was voluntary and anonymous, with informed consent from the participants' parents. The participants were not paid and no other incentives were provided for their participation. The research was conducted according to the guidelines of the Declaration of Helsinki and was approved by the ethics committee of the Faculty of Physical Culture, Palacky University Olomouc (No. 65/2020).

Missing data

Missing data on item level totaled 0% to 6.4% (1.8% missing values on average). We assumed that the data is MCAR (Missing Completely At Random) and performed all the analyses twice; first, with complete cases only (with case-wise deletion of missing values), and second, with all missing data imputed using a Bayesian imputation process in the Rethinking package in R software (McElreath, 2020). As the results with complete cases were analogous to those from the imputed data, in this study we report the results based on the imputed dataset only. In Bayesian imputation, the measured values provide priors for the missing values. The priors are then updated by the relationship between the predictors and the outcome used in the imputation. Each missing value is then replaced by the maximum *a posteriori* probability (MAP) estimate.

Variables and measures

Sociodemographic variables

The respondents reported their age, gender (boy–girl) and the region where they go to school (one of the 14 Czech administrative regions).

Health and well-being

The short form of the *Perceived Stress Scale* (PSS) was used to assess the respondents' level of perceived stress. The instrument is a brief 4-item scale measuring stress perception during the last month (Cohen, 1988). Responses are assigned on a five-point Likert scale (0 – never, to 4 – very often), with the items summed to provide a total PSS score ranging from 0 – least stressed, to 16 – most stressed. In international validation studies, the internal consistency of the PSS-4 scale ranged from $\alpha = 0.55$ (Lee et al., 2015) to $\alpha = 0.77$ (Warttig et al., 2013). In a Czech adult sample, the internal consistency of the PSS-4 was $\alpha = 0.83$, $\omega = 0.80$ (Figalova and Charvat, 2021). *Life satisfaction* captured how adolescents felt about their life at present. It was measured using the Cantril ladder, which is a visual scale with 11 possible values ranging from 0 – worst possible life, to 10 – best possible life (Levin and Currie, 2014). The ladder was shown to be understood by adolescents and being reliable and valid measure in this age group (Levin and Currie, 2014). *Psychological and somatic complaints* were assessed using the HBSC Symptom Checklist (Haugland and Wold, 2001). Respondents reported the frequency of psychological symptoms (i.e., feeling low, irritable or in a bad mood, nervous and having difficulties falling asleep) and somatic symptoms (i.e., headache, stomachache, backache, and feeling dizzy) during the past month. A five-point scale is used for rating the two subscales, from 0 – about every day, to 4 – rarely or never. A summary score with values from 0 to 16 in each subscale is assessed, with higher scores representing more frequent complaints ($\alpha = 0.61$ and 0.77 for somatic and psychological subscale, respectively, in the present sample). The checklist was shown to have good discriminant and internal validity (Gariepy et al., 2016) and test–retest reliability (Haugland and Wold, 2001). *Self-rated health* was reported on a four-point scale from 1 – poor, to 4 – excellent using a question adapted from the study of Kaplan and Camacho (1983). It was described as a valid measure for large-scale population-based surveys in adolescents and young adults by Allen et al. (2016), who found it was an equivalent construct across various population groups.

Social well-being during the COVID-19 lockdown

The respondents were asked to report how often during the spring 2020 lockdown they felt (1) lonely, (2) felt being part of a group of friends, and (3) had people they could talk to about important things. The responses ranged from 1 – never, to 5 – very often, to each question. The items were adapted for adolescent use from the original R-UCLA scale (Hughes et al., 2004).

Changes in time use during the COVID-19 lockdown (compared to pre-lockdown)

The adolescents were asked to report whether they spent less or more time on several activities during the spring 2020 lockdown than before the lockdown. The compared activities were (1) schoolwork, (2) leisure time, (3) sleep on weekdays, and (4) sleep on weekends. The responses ranged from 1 – definitely less,

1 http://www.hbsc.org

to 5 – definitely more, to each question. The questions were developed *ad hoc* to study the perceptions of changes during the first wave of lockdown. The adolescents were also asked "Over the past 7 days, on how many days were you physically active for a total of at least 60 min per day?" The answers ranged from 0 to 7 days. The question was developed by Prochaska et al. (2001), validated against accelerometers, and manifested good test–retest reliability.

Family COVID-19 experience

The Perceived Impact of the 2008/09 Economic Crisis Scale (Due et al., 2019) was adapted for the lockdown situation to assess household disruptions due to the COVID-19 pandemic. There were two items assessing economic disruptions – one or both parents losing their jobs, having less money in the household; three items assessing psychosocial disruptions – felt cramped in the house, more family disputes, more parental stress; two items assessing opportunities – learn new things, more time to engage in joint activities with family that they all enjoyed. The responses were coded 1 – yes, 0 – do not know, and-1 – no. The respondents were also asked whether they or their family members were diagnosed with COVID-19. There were only 21 positively diagnosed respondents in the sample (0.6%), and 47 positively diagnosed members of their families (1.4%). These numbers were so negligible that we did not include the variables in the analyses.

Statistical analyses

All analyses were performed using the R 4.1.2 statistical software. Bayesian methods for all statistical analyses were used. Highest density intervals (HDIs) are presented together with the posterior probability distribution estimates. HDIs summarize the most credible values of the posterior distributions. Their span in this study was set to 95%.

For a comparison of the descriptive characteristics between males and females, the Bayesian *t*-test and Bayesian proportion test was used, implementing the Bayesian First Aid package (Baath, 2014). The Bayesian First Aid package was also used for assessing the Bayesian correlations between the PSS, health and well-being variables. Weakly informative and uninformative default priors, as described in Kruschke (2013), were used for these analyses: normal prior distributions with a large standard deviation for the population means, uniform priors for standard deviations and a shifted-exponential prior for the normality parameter. The Bayesian Monte Carlo Markov Chain (MCMC) process in JAGS was used for estimating the posterior probability distributions (Plummer, 2003).

Three nested varying-intercepts multilevel regression models were then fitted using the administrative regions of the Czech Republic as the higher level and individual respondents as the lower level. Model 1 estimated the effect of social well-being during the COVID-19 lockdown. In Model 2, the effect of social well-being and changes in time-use during the COVID-19 lockdown was assessed, while the full model (Model 3) further evaluated the effect of the family COVID-19 experience in the respondents' families. All three models were adjusted for gender and age of the respondents. In the regression models, standardized variables (*z*-scores) were used to allow for a comparison of the variables of different scales. Only the variables representing the family COVID-19 experience of the respondents did not have to be standardized, given their natural categorization (−1, 0, 1 values). Weakly informative priors were used to regularize the estimates. Hyperparameters $\alpha \sim$ Normal (0,1) and $\sigma \sim$ Cauchy (0,2.5) were used for estimating the random effects with the hyperprior Normal (α, σ). Given the standardization of the variables, the Normal (0,1) prior was employed for estimating the fixed effects in the regression models. Using the Normal (0,1) prior states it is likely for the estimates to have a majority of the values within one standard deviation from the mean. The Rethinking package (McElreath, 2020) was used for multilevel regression modeling. The MCMC sampling was performed with the Stan sampler (RStan, 2021), using 10,000 iterations in 4 chains. The performance of the models was compared using the Watanabe–Akaike information criterion (WAIC), which evaluates the predictive accuracy for the fitted Bayesian models (Gelman et al., 2013). A lower value of the WAIC suggests a better fit. The analytical script for the R software is available as a Supplementary File.

Results

Descriptive characteristics

Descriptive characteristics of the dataset ($n = 3{,}440$; mean age = 13.45 years, SD = 1.62) are presented in Table 1. There were 1,866 girls (54.2%) and 1,574 boys (45.8%). In general, girls reported higher levels of perceived stress, lower life satisfaction and poorer self-rated health, including higher levels of psychological and somatic complaints. Girls also felt more lonely. No meaningful difference was found between boys and girls in the frequency of feeling to be a part of a group of friends or having the opportunity to talk to someone (the HDI intervals contain 0). Also, no gender differences were found in the majority of time-use variables during the lockdown, i.e., changes in sleep time, time spent doing schoolwork or amount of leisure time. However, girls reported being more physically active during the lockdown than boys; on average, girls were physically active for at least 60 min per day more than 4 days during their past week. The proportion of girls reporting negative family disruptions due to COVID-19 was higher than that of boys (25% of girls felt cramped at home; almost 25% of girls reported higher frequency of disputes at home, compared with the rates for boys – 14% and 17%, respectively). Over 40% of the adolescents (both genders) reported their parents being more worried than before. On the other hand, the majority of the adolescents saw the lockdown as an opportunity to learn new things (68% of girls and 60% of boys) and had more time for enjoyable joint family activities (56% of girls and 62% of boys).

TABLE 1 Descriptive characteristics of the sample.

Variable	Total $n = 3,440$	Girls $n = 1866$	Boys $n = 1,574$	Mean posterior group difference[a]	95% HDI credible interval
	Mean (SD)	Mean (SD)	Mean (SD)		
Age	13.45 (1.62)	13.48 (1.62)	13.41 (1.63)	−0.07	−0.18, 0.04
Health and well-being					
Perceived stress (score 0–16)	6.31 (2.78)	6.65 (2.90)	5.90 (2.57)	−0.74	−0.92, −0.55
Life satisfaction (score 1–10)	7.73 (1.78)	7.53 (1.86)	7.97 (1.65)	0.44	0.33, 0.56
Psychological complaints (score 0–16)	4.57 (3.88)	5.11 (4.05)	3.93 (3.57)	−1.20	−1.46, −0.95
Somatic complaints (score 0–16)	1.96 (2.44)	2.31 (2.64)	1.54 (2.12)	−0.65	−0.77, −0.53
Self-rated health (score 1–4)	3.27 (0.66)	3.22 (0.66)	3.33 (0.65)	0.11	0.06, 0.15
Social well-being during COVID-19 lockdown					
Lonely (score 1–5)	2.18 (1.19)	2.42 (1.22)	1.90 (1.09)	−0.52	−0.60, −0.45
Part of group of friends (score 1–5)	2.95 (1.28)	2.92 (1.23)	3.00 (1.33)	0.08	−0.01, 0.17
Could talk to someone (score 1–5)	3.59 (1.22)	3.61 (1.20)	3.56 (1.25)	−0.05	−0.13, 0.04
Changes in time use during COVID-19 lockdown[b]					
Sleep time weekends (score 1–5)	3.50 (0.99)	3.50 (0.97)	3.50 (1.01)	0.00	−0.07, 0.07
Sleep time schooldays (score 1–5)	3.80 (1.06)	3.80 (1.05)	3.80 (1.08)	0.01	−0.07, 0.08
School work (score 1–5)	3.46 (1.29)	3.50 (1.26)	3.43 (1.32)	−0.07	−0.16, 0.02
Leisure time (score 1–5)	3.85 (1.15)	3.82 (1.13)	3.89 (1.18)	0.08	0.00, 0.16
Physical activity during past week (0–7 days)	3.95 (2.11)	4.08 (2.05)	3.80 (2.18)	−0.29	−0.43, −0.14
Family COVID-19 experience[c]					
It felt cramped in my house	681 (19.80)	467 (25.03)	214 (13.60)	−0.12	−0.15, −0.10
More disputes at home than before	725 (21.08)	454 (24.33)	271 (17.22)	−0.08	−0.11, −0.05
There was less money at home	495 (14.39)	270 (14.47)	225 (14.29)	0.00	−0.03, 0.02
One or both parents lost their job	286 (8.31)	177 (9.49)	109 (6.93)	−0.03	−0.05, −0.01
My parents worried more than before	1,398 (40.64)	753 (40.35)	645 (40.98)	0.00	−0.03, 0.04
Opportunity to learn new things	2,212 (64.30)	1,866 (68.01)	943 (59.91)	−0.09	−0.12, −0.05
More time for enjoyable joint activities	2,023 (58.81)	1,047 (56.11)	976 (62.01)	0.06	0.02, 0.09

Results of the Bayesian *t*-test and the Bayesian test of proportions comparing girls and boys.
[a]Boys vs. girls; SD = standard deviation.
[b]Changes in time use compared to pre-lockdown, and physical activity.
[c]Proportion of positive ("yes") responses to each question.

Correlates and predictors of the level of perceived stress

The level of perceived stress of adolescents was moderately correlated with their well-being during the lockdown: The PSS was positively correlated with psychological and somatic complaints (median posterior $r = 0.51$, 95% HDI [0.48, 0.53]; median posterior $r = 0.33$, 95% HDI [0.29, 0.36], respectively) and negatively correlated with self-rated health (median posterior $r = -0.32$, 95% HDI [−0.35, −0.29] and life satisfaction (median posterior $r = -0.46$, 95% HDI [−0.49, −0.43]).

The results of standardized multilevel regression analyses predicting the level of adolescent perceived stress are summarized in Table 2. All three models have been adjusted for gender and age. In Model 1, the effect of social well-being during the COVID-19 lockdown on stress was analyzed. The analysis showed loneliness was associated with a higher level of stress (posterior mean $\beta = 0.31$, 95% HDI [0.28, 0.34]), while being a part of a group of friends or having someone to talk to was associated with a lower level of perceived stress (posterior mean $\beta = -0.07$, 95% HDI [−0.10, −0.04]; posterior mean $\beta = -0.19$, 95% HDI [−0.23, −0.16], respectively).

In Model 2, the effect of social well-being and changes in time use during the COVID-19 lockdown on the stress level was analyzed. The effect of social well-being remained almost the same as in Model 1. In addition to that, a higher level of perceived stress was associated with more sleep on the weekends and less sleep on school days (posterior mean $\beta = 0.06$, 95% HDI [0.03, 0.09]; posterior mean $\beta = -0.06$, 95% HDI [−0.10, −0.03], respectively) compared to the time before the lockdown. On the other hand, more days spent with physical activity lowered the level of stress (posterior mean $\beta = -0.04$, 95% HDI [−0.07, −0.01]). There was no substantial effect of the perceived changes in the amount of schoolwork and leisure time during the period of school closures due to the lockdown.

In Model 3, the effect of social well-being and changes in time use, together with the COVID-19 experience in the family, was analyzed. The effect of social well-being and changes in time use were analogous to those in Model 2. The negative family disruptions due to COVID-19, i.e., feeling cramped at home,

TABLE 2 Bayesian multilevel regression analysis of covariates predicting the level of perceived stress in adolescents during the spring 2020 lockdown.

Predictor	β (95% HDI)[a]		
	Model 1	Model 2	Model 3
Gender[b] (female vs. male)	0.13 (0.07, 0.19)	0.14 (0.08, 0.20)	0.13 (0.06, 0.18)
Age[b]	0.05 (0.02, 0.08)	0.05 (0.02, 0.08)	0.03 (0.00, 0.06)
Social well-being during COVID-19 lockdown[c]			
Lonely	0.31 (0.28, 0.34)	0.30 (0.27, 0.33)	0.24 (0.20, 0.27)
Part of group of friends	−0.07 (−0.10, −0.04)	−0.06 (−0.09, −0.03)	−0.05 (−0.08, −0.02)
Could talk to someone	−0.19 (−0.23, −0.16)	−0.19 (−0.22, −0.16)	−0.15 (−0.19, −0.12)
Changes in time use during COVID-19 lockdown[c]			
Sleep time weekends		0.06 (0.03, 0.09)	0.06 (0.02, 0.09)
School work		0.02 (−0.01, 0.05)	0.03 (0.00, 0.06)
Leisure time		−0.03 (−0.06, 0.00)	−0.01 (−0.04, 0.02)
Physical activity during past week		−0.04 (−0.07, −0.01)	−0.03 (−0.06, 0.00)
Sleep time schooldays		−0.06 (−0.10, −0.03)	−0.05 (−0.09, −0.02)
Family COVID-19 experience			
It felt cramped in my house			0.12 (0.08, 0.16)
More disputes at home than before			0.08 (0.05, 0.12)
There was less money at home			0.07 (0.03, 0.11)
One or both parents lost their job			0.06 (0.01, 0.12)
My parents worried more than before			0.02 (−0.01, 0.06)
Opportunity to learn new things			−0.07 (−0.10, −0.03)
More time for enjoyable joint activities			−0.07 (−0.10, −0.03)
Variance for region	0.07 (0.02, 0.13)	0.08 (0.03, 0.13)	0.17 (0.10, 0.25)
WAIC	8974.5	8951.0	8805.7

[a]Posterior distribution mean and its 95% credible interval.
[b]Gender and age are used as controlling variables in all models.
[c]Standardized variables (z-scores) were used.

having more disputes, parents losing jobs or less money at home, were associated with a higher level of perceived stress. The strongest effect of family disruptions was found in feeling cramped (posterior mean $\beta = 0.12$, 95% HDI [0.08, 0.16]). Both positive impacts of the lockdown, i.e., having the opportunity to learn new things and having more time for enjoyable joint family activities, lowered the level of perceived stress (posterior mean $\beta = -0.07$, 95% HDI [−0.10, −0.03]).

From the best fitting Model 3 (considering its WAIC value) it can be concluded that the social well-being of adolescents (i.e., loneliness and not having someone to talk to) remained the strongest set of predictors of higher level of perceived stress among adolescents even after controlling for the changes in time use, and their family COVID-19 experience. A graphical interpretation of the posterior estimates of Model 3 is available in Figure 1.

Discussion

This study aimed to assess gender differences in the COVID-19 lockdown experience of Czech adolescents, to evaluate the correlations between adolescent perceived level of stress and their well-being, and to find predictors of the perceived level of stress. The analyses suggest that the negative impact of the COVID-19 lockdown was more apparent in girls and the perceived level of stress was moderately correlated with adolescents' health and well-being. The strongest predictor of higher level of PSS was frequent feeling of loneliness. On the contrary, lower level of PSS was most associated with having someone to talk to.

Perceived stress, health, and well-being

Our findings support those of others, who found that perceived stress in adolescents was negatively related to health (Gruber et al., 2021; Panchal et al., 2021; Kiss et al., 2022), well-being and life satisfaction (Porter et al., 2021). Adolescence is a sensitive period in life, with extensive physical and cognitive changes and development in social and emotional areas (Steinberg, 2005). These changes involve transformation of emotional and social support from parents to friends, leading to a greater autonomy of the young person (Berndt, 2002). Moreover, the development of adolescents' personality and identity is directly connected to their coexistence with peers (Brechwald and

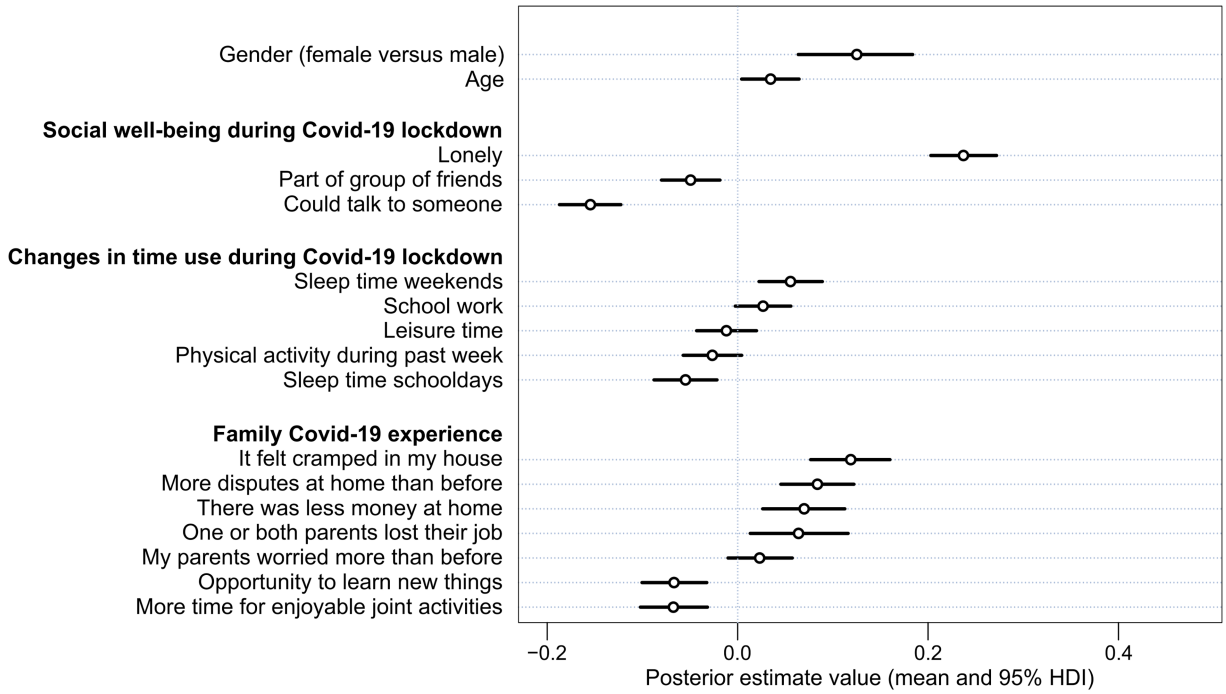

FIGURE 1
Posterior estimate mean values and uncertainty (95% HDI intervals) of stressors in adolescents during the spring 2020 lockdown (Model 3). Standardized variables (*z*-scores) were used.

Prinstein, 2011). The preventive measures adopted during the pandemic to stop the virus from spreading came rapidly and with the pronounced distress of the whole society. Young people are usually more flexible and compliant to accepting new situations and changes (Cheng et al., 2014). They can, however, also be more vulnerable to abrupt changes in their lives because of the lack of psychological capabilities of resilience and coping that have not yet had time to develop (Romeo, 2013). The mental health effects of the pandemic on adolescents have been previously reported, particularly in girls (Branje and Morris, 2021; Chawla et al., 2021; Magson et al., 2021), who are systematically reported to be at higher risk of emotional problems and subsequent mental health problems (Kuehner, 2017; Kiss et al., 2022). On the other hand, the reporting might be skewed by the differing social expectations, lifestyles, and behaviors for girls and boys (Gadin and Hammarstrom, 2005; Maclean et al., 2010). In European countries, boys are more often than girls reminded that they are supposed to be strong and in control, including their physical and mental health (Maclean et al., 2010). Before the pandemic, girls were systematically reported to be less physically active than boys (Slater and Tiggemann, 2011; Telford et al., 2016). Physical activity is considered one of the most important factors for maintaining health and well-being (Penedo and Dahn, 2005). During the pandemic, physical activity level of adolescents declined worldwide regardless of gender (Gobbi et al., 2020; Roe et al., 2021; Dana et al., 2022) and thus negatively affected their physical and mental health (Bates et al., 2020). Some studies have shown, however, that adolescent moderate and vigorous physical activities decreased while light physical activities remained the same (Sekulic et al., 2020; Tulchin-Francis et al., 2021). Pre-pandemic, boys were more engaged in organized sports and moderate-to-vigorous physical activities than girls (Nader et al., 2008; Sekulic et al., 2020). This may be connected to higher drop in boys' activity during the pandemic lockdown with girls becoming more active than boys because of proceeding with lighter physical activities (Sekulic et al., 2020). That could also be the case in the present study where girls reported more days spent with physical activity than boys. Several previous studies have found a connection between worse mental health and higher adolescent age (Chen et al., 2020; Panchal et al., 2021; Ren et al., 2021b). In the present study, the association between age and perceived stress was not strong.

Social well-being during COVID-19 lockdown

The social well-being of Czech adolescents (i.e., loneliness, being a part of a group of friends and having someone to talk to) was found to be the strongest set of predictors of the level of stress. Loneliness increased perceived stress, while being a part of a group of friends and having someone to talk to reduced the stress level. Loneliness is an unpleasant emotional experience when there is a contradiction between the desired and the available social contact (Loades et al., 2020). Experiencing it seems to be especially difficult for young people

(Heinrich and Gullone, 2006; Laursen and Hartl, 2013). This may be caused by the importance of being part of a peer group for forming the adolescent personality and identity as well as seeking support (Brechwald and Prinstein, 2011). The links between mental health and deficiency in social contacts were extensively explored before the COVID-19 pandemic (Wang et al., 2017); however, the full extent of the possible consequences of loneliness only came to the surface during the pandemic, with ordered lockdowns and distancing measures (Loades et al., 2020; Hoffart et al., 2022). Short-term loneliness has been previously shown to be less dangerous than long-term loneliness in terms of future mental health problems (Qualter et al., 2010; Loades et al., 2020). Any possible future lockdowns thus should not be extended beyond the necessary period. To some extent, the negative effects of the lockdowns might have been mitigated by the possibility of online connection through social media. However, the quality of online communication and relationships may not be the same as meeting face-to-face (Mesch and Talmud, 2006). Even though online interactions with friends can be a sound option for reducing loneliness during times of physical distancing (Branje and Morris, 2021), it is important to be mindful of the nature of adolescent interactions (Ellis et al., 2020). Adolescents reporting greater positive online social experiences (including emotional and informational support and belonging) endorsed lower levels of loneliness. In contrary, adolescents experiencing negative online experiences that engender such feelings as exclusion or rejection were reporting greater feelings of loneliness (Magis-Weinberg et al., 2021). Another negative effect can arise when adolescents co-ruminate on negative feelings (because of uncertainty and high levels of stress during pandemics) and thus unintentionally escalate negative feelings (Ellis et al., 2020). This paradoxical effect of increased notion of friendship quality and connection but simultaneously increased depression through co-rumination has been documented especially in girls (Rose et al., 2007).

Changes in time use during COVID-19 lockdown

During the lockdown, Czech adolescents perceived several changes in their daily routine. On average, they reported more time spent on schoolwork and on leisure activities, as well as longer sleep both on weekdays and on weekends than before the lockdown. In the present study, the only predictor of perceived stress with non-zero probability was the change in length of sleep. While longer sleep on weekdays reduced the level of stress, longer sleep on weekends conversely increased the level of stress. This result might seem ambiguous. However, the sleep patterns of adolescents on weekdays are directly connected to their sleep patterns on weekends (Crowley et al., 2014). During non-pandemic weekdays, adolescents often sacrifice sleep time to fulfill their school, extracurricular and social obligations, and thus need to catch up on the "social jet lag" and prolong their sleep on weekends (Wittmann et al., 2006). During the lockdown, remote learning allowed adolescents to sleep longer (Gruber et al., 2021; Kiss et al., 2022); there were no out-of-home extracurricular activities and no face-to-face social contacts available. These pandemic measures allowed adolescents to use their time differently and might have prevented the accumulation of sleep debt during the week (Kiss et al., 2022). Sleep problems have been previously shown to be predictors of psychological distress in adolescents (Lovato and Gradisar, 2014; Becker et al., 2021), and, conversely, healthy sleep patterns reduce their stress and the risk of future health problems (Blake and Allen, 2020). This is in line with our results; prolonging sleep duration on weekdays (and thus eliminating the social jet lag) was associated with a decrease in the level of stress. At the same time, unhealthy sleep patterns on weekdays might have led to prolonging sleep on weekends, which was then associated with an increase in the level of stress.

Family COVID-19 experience

Due to pandemic measures, families stayed at home for a longer time period than they are used to. In the present study, the factors elevating stress of adolescents were connected to psychosocial disruptions in families (feeling cramped and having more disputes at home than before) and to economic disruptions (one or both parents lost their jobs and having less money in the household). Family relationships have been previously reported to play an important role in the adjustment of adolescents during the pandemic (Bulow et al., 2021). Family can render support and comfort for its members. However, the pandemic has challenged the well-being of all family members, not only children, as the demands of the pandemic-related measures often seemed to surpass the parents' capacity (Weeland et al., 2021). Besides eliciting fear of the illness, the pandemic measures affected the everyday life of families through changes in their routines as well as changes in school and work obligations (Weeland et al., 2021). In response, parents more often changed their parenting strategies and behaviors towards authoritarian parenting, more often monitored their children's activities and decreased the autonomy of their children (Bulow et al., 2021; Cassinat et al., 2021; Ren et al., 2021a). Although these changes in parenting might be explained by the parents' effort to protect their children (Weeland et al., 2021), they could have led to more parent–child conflicts and thus increased the level of stress in both parents and children (Park and Walton-Moss, 2012). Stress and conflict potential in families can be further escalated by a cramped housing situation, especially in times when there are few opportunities to escape their homes (Lips, 2021). Additionally, economic distress caused by the pandemic dealt another blow to family functioning. Financial hardship is a well-known stressor affecting the well-being of families even before the pandemic (Wickrama et al., 2012; Budescu and Taylor, 2013). Thus, during times of crises (like pandemics), the necessary restrictions should be implemented with special care and considerations, especially in regions with low-income families where financial difficulties and household overcrowding could be more substantial.

Besides the negative impact of the pandemic, studies have also shown some positive effects, especially in increasing the resilience and stability of some individuals and families (Donker et al., 2021; Weeland et al., 2021), particularly those who were able to use the

unanticipated time spent at home to increase family bonding (Achterberg et al., 2021). Family functioning seems to have had a major impact on adolescents' coping with the effects of the pandemic. A supportive family environment protected adolescents from excessive distress (Magson et al., 2021), whereas problematic families with negative interactions before the pandemic had more difficulties adapting to the stressful lockdown situations (Weeland et al., 2021). The pandemic could have possibly further escalated pre-pandemic family conflicts (Achterberg et al., 2021).

In the present study, there were two factors decreasing adolescent stress levels. These were items assessing opportunities – the opportunity to learn new things and having more time to engage in joint activities with family that they all enjoyed. School closures and lack of out-of-home activities might have led to less academic and social pressure for some adolescents (Hoekstra, 2020) and given them more time to engage in new activities, on their own or with their family members. Fewer peer conflicts and bullying in a school environment may also have had a positive impact on decreasing the stress level and elevating the well-being of adolescents (Hoekstra, 2020; Bruining et al., 2021). There is a great sociodemographic and psychosocial variability of individuals and even greater variability in the way they response to the sudden changes the pandemic brought to their lives (Achterberg et al., 2021). It is important to comprehend which adolescents may rely on their resilience; they will be able to bounce back to normal, having learned and maybe even benefitted from the pandemic (Branje and Morris, 2021). On the other hand, those adolescents who are at risk of experiencing chronic negative consequences of pandemic stress should get support from their surroundings (Weeland et al., 2021). This is especially important with respect to the possible long-term impact on the adolescents' mental health (Weeland et al., 2021; Kiss et al., 2022).

International COVID-19 adolescent experience

The severity of pandemic preventive measures varied among countries, however, their negative consequences on mental health of adolescents have been reported across the world. In European countries such as Italy, Germany, Croatia, United Kingdom or Ireland, adolescents have experienced increase in their emotional problems, depression and anxiety connected to feelings of social isolation (Francisco et al., 2020; Forte et al., 2021; Hu and Qian, 2021; O'Sullivan et al., 2021; Ravens-Sieberer et al., 2022). In Italy, Croatia, and Romania, Forte et al. (2021) reported that lockdown significantly decreased quality of life, optimism and happiness, and increased perceived stress in adolescents. Moreover, those living in a small apartment without a prospect of going out experienced intensified feelings of sadness, anger and anxiety (Forte et al., 2021). That is in line with a study from Spain, Portugal, and Italy, where Francisco et al. (2020) found that a possibility of going outdoor (terrace or garden) decreased the level of psychological stress of adolescents. In the United Kingdom, Italy, Romania, and Croatia, boys were less likely than girls to experience emotional problems (Forte et al., 2021; Hu and Qian, 2021). The negative impact on mental health was apparent especially among adolescents in low-income, one-parent, and single-child households (Hu and Qian, 2021; Ravens-Sieberer et al., 2022). All these findings are comparable to the outcomes of the present study on a sample of Central European adolescents showing that unfavorable family conditions, stay at home orders and social distancing were related to elevated levels of stress.

Outside Europe, high rates of adolescent distress due to the pandemic disruptions of every-day life was reported in the United States (Hoffmann and Duffy, 2021) as well as in Canada (Thomson et al., 2021). These countries deal with similar post-lockdown problems in adolescents as the European countries. However, there are countries with socioeconomically disadvantaged regions (e.g., in India, Bangladesh, Jordan, Peru, Ethiopia, or Uganda), where school closures severely disrupted lives of young people in plentiful aspects beyond higher level of stress and mental health concerns (Patra and Patro, 2020; Jones N. et al., 2021; Favara et al., 2022; Nuwematsiko et al., 2022). After the schools were closed, numerous adolescents started working to provide for their families, with only a small chance of returning to school ever again (Patra and Patro, 2020; Jones N. et al., 2021; Favara et al., 2022; Nuwematsiko et al., 2022). The pandemic thus irreversibly changed their lives and their prospects of better future.

Limitations

There are several limitations of this study: First, its cross-sectional design does not allow us to reach conclusions on causality, and it has limited longitudinal evidence. As the national lockdowns came abruptly in the spring of 2020, the possibility of planning a longitudinal study design was limited. There was also no information about the mental health of the respondents before the pandemic in this study. Therefore, it is not possible to discern the direct effect of the pandemic from possible pre-existing mental health problems of the respondents. Further, the analyzed data originated during the first Czech national lockdown in the spring of 2020, at the time when the disease spread was well contained. The following waves of the pandemic were more severe for the Czech population (Our World in Data, 2022); thus, the findings of this study might not be applicable to the entire pandemic period. Another limitation would be that the data consists of self-reports of respondents, which can be influenced by social desirability, especially at the adolescent age (Camerini and Schulz, 2018). Owing to lower level of cognitive maturity (Mwamwenda, 1995), adolescents may over-report the socially desirable experiences and underreport the undesirable ones (Krumpal, 2013). In the present study, social desirability could have increased subjective positive evaluations of family relationships and decreased reporting of psychological symptoms describing bad mood or feeling low, especially in boys, who tend to deny the emotional distress and negative affect compared to girls (Koenig et al., 1994).

Conclusion

Long-term isolation, including lockdowns and quarantines, may have a distressing effect on anyone experiencing it. During the spring 2020 Czech lockdown, the negative impact was more apparent in girls. Adolescents' perceived level of stress was connected to their health and well-being. The strongest predictor of higher level of PSS was frequent feeling of loneliness. On the contrary, lower level of PSS was most associated with having someone to talk to. Such knowledge is important not only for the ongoing pandemic, but also for possible future disasters that could affect our everyday lives. As it is difficult to predict what effect protective pandemic measures will elicit on the mental health of adolescents in the long run, the impacts still need to be carefully monitored. Psychological coping strategies to prevent the consequences of social isolation and development of mental health problems should be promoted on individual, family and even community level. In the case of an ongoing pandemic situation, policymakers should be aware of the risks of social isolation for adolescents and not to prolong the duration of isolation beyond what is necessary. The restrictions should be implemented with special care and considerations, especially in regions with low-income families where financial difficulties and household overcrowding could be more substantial. The adolescents need help with developing healthy coping mechanisms to be resilient to the short-and long-term psychological effects of the pandemic. The authorities need to ensure that support services are widely accessible to young people and their families in order to prevent longer-term mental health impacts. Moreover, families and communities should be provided with specific measures which could help monitor adolescents' psychological well-being and health, and thus prevent the development of mental problems.

Data availability statement

Data are available on reasonable request from the last author of the study (petr.badura@upol.cz). Access to HBSC Lockdown 2020 study data corresponds with the international HBSC study rules and is more precisely described at: https://hbsc.cz/lockdown2020/ (in Czech).

Ethics statement

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

Author contributions

JF, RZ, PT, and PB: conceptualization. PB, JF, NK, and DS: methodology. NK, DS, and PB: validation. JF: formal analysis, software, and visualization. RZ, PT, and PB: resources and funding acquisition. PB and JF: data curation. JF, NK, and PB: writing – original draft preparation. JF, NK, DS, RZ, PT, and PB: writing – review and editing. NK and PB: supervision. All authors contributed to 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.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.964313/full#supplementary-material

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Maternal positive coparenting and adolescent peer attachment: Chain intermediary role of parental involvement and parent–child attachment

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This study investigated the relationship between maternal positive coparenting and adolescent peer attachment, and the intermediary role of parental involvement and parent–child attachment in 1,807 families using the maternal positive coparenting scale, the parental involvement scale, and the parent and peer attachment scale. The results showed that maternal positive coparenting behaviour, parental involvement, parent–child attachment, and peer attachment had significant positive relationships, and maternal positive coparenting had a positive correlation with adolescent peer attachment. Moreover, parental involvement and parent–child attachment played a significant mediating role between maternal positive coparenting behavior, including unity and consistent behavior, and adolescent peer attachment, respectively, which consisted of a sole intermediary role of parental involvement; a single intermediary role of parent–children attachment; and a chain intermediary role of parental involvement and parent–children attachment. Hence, maternal positive coparenting was positively associated with adolescent peer attachment, in which parental involvement and parent-child attachment served as a crucial bridge.

KEYWORDS

maternal positive coparenting, parental involvement, parent–child attachment, peer attachment, adolescents

Introduction

Peer attachment is the stable and lasting affective associations among peers, which includes trust, reliance, and sharing personal thoughts and emotions (Bowlby, 1979; Armsden and Greenberg, 1987; Xin et al., 2014). Adolescence is a critical period for developing individual peer attachment, which has an important impact on adolescents'

mental health and social adaptation (Armsden and Greenberg, 1987; Laible et al., 2000). Developing peer attachment affects inner traits and emotions, such as self-esteem, loneliness, depression (Liu et al., 2020), low mood (Lee and Park, 2017), academic self-efficacy and achievement (Llorca et al., 2017), and metal resilience (Oldfield et al., 2018), and predicts external problems and behaviours, such as internet addiction (Yang et al., 2016; Chen et al., 2018), bullying behaviours (Murphy et al., 2017), prosocial behaviour (Oldfield et al., 2016; Schoeps et al., 2020), and so on. Peer attachment is based on early bonding experiences with the parents during the transition to adolescence (Oldfield et al., 2016), which is affected by many family factors, especially interactions between children and parents (Meeus et al., 2002; Allen, 2008; Xiaoyan et al., 2011). Previous studies have examined the role of family influences in peer attachment. However, these studies did not focus on positive family factors. Therefore, it has great theoretical and practical significance to investigate positive family factors and their underlying mechanisms.

Recently, researchers have paid more attention to family systems theory, which divides family interactions as a whole into a marital binary system, a father-child, mother–child binary system, and a parent–child ternary system (Belsky et al., 1995), involving multiple levels of influence within families, such as interaction patterns with different caregivers (Cox and Paley, 1997). Beyond the father-child and mother–child system, family research is now focused on the more diversified ternary system and the interaction between different systems (Minuchin, 1985; Doherty and Beaton, 2004). The spillover hypothesis holds that emotions or behaviors generated in one subsystem (e.g., the parent–child ternary system) are similarly expressed in another (e.g., the parent–child subsystem; Erel and Burman, 1995). For example, the mother's positive coparenting may be reflected in the maternal involvement. The crossover hypothesis states that the emotions or behaviors of one of the interacting parties in a certain subsystem of the family (e.g., mother's positive coparenting) will affect those of other parties in other subsystems (e.g., paternal parenting involvement) (Bolger et al., 1989). In which coparenting is more important. Coparenting is a ternary relationship system composed of parents and children, which refers to an alliance formed by parents or caregivers in the process of child rearing, and includes the positive or negative attitudes of one parent towards the other (Feinberg and Hetherington, 2007; Chang and Xinchun, 2015). Positive coparenting and negative coparenting have different effects on family function, adolescent development, and adaptation. Positive coparenting behaviour occurs when one family member responds positively to the other's parenting behaviour and goals, while negative coparenting occurs when one party reacts negatively to the other's parenting behaviour and goals (McHale, 1997). Although coparenting behaviour has been examined in previous family studies, these studies focused on negative coparenting behaviour and the adverse effects of overall collaborative parenting behaviour on adolescents' psychological development (Zou and Wu, 2019; Riina et al., 2020). Although recent research has focused more on positive psychology perspectives, such as the influence of positive behaviour on human health development (Xi et al., 2019), the underlying mechanisms of how positive coparenting was associated with on adolescent psychological development are little known (Leary and Katz, 2004). Therefore, exploring the association of positive collaborative parenting behaviour with adolescents' peer attachment may promote both parental awareness practice of positive collaborative parenting behaviour and healthy adolescent peer attachment development, thereby playing an important role in developing more targeted practical interventions to improve the quality of family education (Goede et al., 2009; Lin et al., 2014).

As the main family caregiver, mothers have more frequent interactions with adolescents than fathers, and mothers' positive cooperative parenting behaviours have a larger influence on both adolescents and the entire family than fathers' (Barth et al., 2020). Therefore, this study mainly focused on mothers' positive collaborative parenting. Guided by family systems theory, mothers' positive cooperative parenting behaviour is a ternary subsystem of family interaction that affects the father-child and mother–child systems and whole family atmosphere. When mothers practice more positive collaborative parenting behaviour, the whole family forms a warm atmosphere, which promotes positive interactions among teenagers, promoting positive peer attachment development (Allen et al., 1996). Also, when mothers' and fathers' childrearing behaviours are consistent when interacting with teenagers, the teens acquire a belief that parents support and understand each other and are reliable. In turn, teens apply this belief to interpersonal communication with their peers, which promotes healthy peer attachments (Tian et al., 2014). Previous studies have shown that mothers' collaborative parenting has an important impact on adolescent peer attachment (Brown et al., 2010). Therefore, this study proposed Hypothesis 1: mothers' positive cooperative parenting behaviour was positively associated with adolescents' peer attachment.

Mediating effect of parenting involvement

Parental involvement is an important way for parents to interact with their children, and refers to parents' involvement in behavioral, emotional and cognitive aspects in the process of raising children (Lamb, 2004). According to the family systems theory spill over effect, emotional experiences formed in one family subsystem (or one aspect of a family subsystem) affect the emotional experiences of other family subsystems (or other aspects of a family subsystem; Erel and Burman, 1995). For example, mothers' positive collaborative parenting behaviour in the parent–child ternary system spills over and affects mothers' parenting behaviour in the binary system (Martin et al., 2017). Dykas and Cassidy (2011) found that fathers' parenting involvement behaviour was significantly affected by mothers' positive cooperative parenting behaviour.

Since parents are the main caregivers and psychological supporters of adolescents, their parenting input is an important source of adolescents' sense of security and trust (Main et al., 1985; Becker-Stoll et al., 2008). Previous studies have also shown that trust and security are important factors for predicting peer attachment development (Dykas and Cassidy, 2011). In their interactions with peers, adolescents with a sufficient sense of trust and security engage more positive interaction modes with others. Therefore, the quality of peer attachment has an important relationship with parents' ability to provide the parenting input their children need (Jones and Cassidy, 2014; Tu et al., 2014). Hypothesis 2 proposes that parenting involvement plays a mediating role between mothers' positive cooperative parenting behaviour and adolescents' peer attachment.

Mediating role of parent–child attachment

Parent–child attachment refers to the deep, stable and lasting emotional bond between parents and children. The parent–child system is clearly influenced by the parent subsystem—the parent–child system belongs to the parent subsystem, and parent–child attachment belongs to the parent–child system (Armsden and Greenberg, 1987). Spill over and crossover effects in Family systems theory assert that mothers' active cooperative parenting may affect both father-child attachment and mother–child attachment (Minuchin, 1985; Martin et al., 2017). When mothers and fathers are united in their parenting behaviours, the family atmosphere is warmer and more harmonious. In this atmosphere, teenagers have a more positive emotional experience regarding their parents, and are more likely to form healthy parent–child attachments. Previous studies have shown that active collaborative parenting has an important impact on the development of adolescent parent–child attachment (Zou et al., 2020). As individuals enter adolescence, they establish a more complete attachment experience psychological state (Main et al., 1985). Developing peer attachments is an important psychological task for adolescents. According to the internal working model of attachment, an individual will form a stable internal mechanism for responding to the outside world through interacting with parents in early stages. This mechanism will become the basis of interaction between individuals and others in the future and affect how individuals react to others (Simpson et al., 1992). Therefore, the internal working model established during parent–child attachment will be applied to the peer interactions, affecting adolescent peer attachment (Ma and Huebner, 2008). Previous studies have shown that the development of adolescent peer attachment is significantly affected by parent–child attachment (Wu and Wang, 2014; Murphy et al., 2017). Therefore, this study proposed Hypothesis 3: parent–child attachment plays a mediating role between mothers' active collaborative education and adolescent peer attachment.

Chain mediating effect of parenting involvement and parent–child attachment

According to the family system theory spill over hypothesis, the emotion and behaviour of one individual or party (or in one aspect) will spill over and affect the emotional experience and behaviour of an individual and another party (or another aspect) in the process of family interaction (Martin et al., 2017). Parenting involvement belongs to the dual parent–child system. Paternal attachment and maternal attachment reflect a bi-directional relationship between parents and children, which differ from the family function of parenting involvement, but is also a subsystem of the binary parent–child system. Therefore, although both parenting involvement and parent–child attachment belong to the family binary subsystem, parenting involvement is a one-way parent–child system from top to bottom, whereas parent–child attachment is a two-way emotional connection reaction system (Cassidy, 2008). According to the spill over hypothesis, mothers' emotional experience and behaviour formed by parenting will spill over to the mother–child attachment system to influence maternal attachment; and fathers' emotional experience and behaviour formed by parenting will spill over to the father-child attachment system to influence paternal attachment. Previous studies have shown that mother–child attachment is significantly affected by mothers' parenting involvement, and father-child attachment is significantly affected by fathers' parenting involvement (Hou et al., 2018). According to the internal working model of attachment, parent–child attachment affects peer attachment development. Considering the family system theory's crossover and spill over effects, mothers' positive coparenting behaviour affects parents' involvement in parenting, which affects parent–child attachment. Based on this, we proposed Hypothesis 4: parenting involvement and parent–child attachment are related to mothers' positive cooperative parenting behaviour and peer attachment and play a chain intermediary role.

Materials and methods

Setting and participants

A total of 1901 traditional two-parent families, including parents and adolescents, participated in the study, with 1,807 providing valid data, for an effective response rate of 95.06%. Adolescents' average age was 14.78 ± 1.90 years, with 928 boys (47.7%) and 879 girls (52.3%). Sixty-seven adolescents were only-children (3.7%) and 1,740 (96.3%) came from families with more than one child. The average subjective social economic status score (SSS) for the school and province were 5.28(SD = 1.75) and 5.41 (SD = 1.71; full range = 10), respectively. Fathers' average age was 45.62 (SD = 12.40) years and mothers' was 43.89 (SD = 6.15) years.

Procedure

Parents and adolescents were administered different questionnaires. Adolescents completed their questionnaires in school, and took the parent questionnaires home for their parents to complete, and then returned them to the school for unified collection. The returned questionnaires were screened and those with missing pages or missing responses for more than three items were excluded. The data were recorded into IBM SPSS Statistics, version 22.0 and analysed using descriptive statistics, correlation analysis, difference analysis, bootstrap tests, etc.

Measures

Mothers-reported mothers' positive collaborative parenting questionnaire

This questionnaire was compiled by McHale (1997) and revised in China by Chang et al. (2017). There are 29 questions in the questionnaire, including four dimensions: unity, consistency, conflict, and demeaning, only two dimensions (integrity, consistency) of positive co-parenting were selected in this study. The higher the scores, the more collaborative parenting behaviours. In the evaluation version of the parent collaborative parenting questionnaire, the adolescent language style was modified to reflect mothers' self-evaluation language. For example, the adolescent self-evaluation was changed from "when my father is restraining my behaviour, my mother supports his decision" to "when my husband is restraining my child's behaviour, I support his decision." The participants responded to the items on a 7-point Likert scale ranging from 1 (never) to 7 (always); higher scores indicate higher coparenting behavior. Confirmatory factor analysis indicated that this scale has good validity, with factor loading greater than 0.6(RMSEA = 0.061,CFI = 0.92,TLI = 0.92, SRMR = 0.047). The Cronbach's α coefficients of the two dimensions were 0.91 and 0.95, respectively.

Parent-reported parenting involvement

The parenting involvement questionnaire developed by Wu et al. (2015) has good reliability and validity. Fathers and mothers have the same parenting input structure, measured using the same structure questionnaire (Fagan et al., 2014). This questionnaire has been widely used to measure parenting involvement (Wu et al., 2018) and is divided into three dimensions: interactivity, which measures the interaction between parents and children; accessibility, which measures how much parents connect with their child's life; and responsibility, which measures the extent that parents are responsible for their children. The questionnaire has 56 items in the three dimensions, with scores on a five point scale from 0 to 4. Higher scores indicate higher levels of parenting involvement behaviour. In this study, the alpha coefficients for the three dimensions of parenting investment ranged from 0.94 to 0.97.

Adolescent-reported parent–child and peer attachment

This questionnaire was compiled by Armsden and Greenberg (1987) and translated and revised by Xiao and Chen (2009). It was completed by the adolescents and included three dimensions of parent and peer attachment: trust (e.g., understanding and respect), communication (e.g., communicating style), and alienation (e.g., anger and neglect). The questionnaire's 25 items were scored on a five-point scale (1 = strongly disagree, 5 = strongly agree). Higher scores of trust and communication and lower scores of alienation indicated higher levels of attachment qualities. The reported Cronbach's alphas of the three subscales were 0.80, 0.70, and 0.82, respectively.

Data analysis

Data were analysed using IBM SPSS version 22. We analysed control and inspection of common method deviation. Reverse scoring and different subjects were used to eliminate the influence of common method bias. The single factor test method recommended was used to test the common method deviation in the collected data and showed that the first factor explained 30.55% variance (e.g., less than 40% of the standard). Therefore, common method bias was not serious in this study. Then descriptive statistic and Chain Mediated Effect were conducted.

Results

Descriptive statistics and correlations

Presents the means and standard deviations of all study variables and the results of the correlation analyses. The correlation matrix indicated that adolescent age was positively related to maternal adult anxiety. Meanwhile, adolescent age was negatively related to paternal adult anxiety and paternal harsh parenting. Family SES was not related to other variables. Both paternal and maternal avoidance and anxiety were positively and significantly related to harsh parenting, that is, the higher the father's and mother's avoidance and anxiety, the harsher their parenting styles. Both father's and mothers' levels of avoidance and anxiety were negatively and significantly related to parent–adolescent attachments, indicating that the higher the levels, the worse the parent–adolescent attachment development. Harsh parenting by both fathers and mothers was negatively and significantly correlated with parent–adolescent attachments, indicating that the harsher the parenting style, the worse the parent–adolescent attachment development.

Descriptive analyses were conducted to examine the means and standard deviations and the relations between the variables of maternal coparenting integrity, maternal coparenting consistency, father involvement, mother involvement, paternal attachment,

maternal attachment, and peer attachment. Table 1 showed both maternal coparenting integrity and maternal coparenting consistency were positively and significantly related to peer attachment, which means the more positive behaviors of mothers, the higher level of peer attachment of children. And both mother's coparenting integrity and consistency and parental involvement were also significantly positively correlated. Father and mother involvement and peer attachment show positive relationship significantly still, that is, the more parental involvement, the higher level peer attachment of children. Moreover, the results indicated that the correlation between other variables is also significant.

The chain mediated effect of parental involvement and parent–child attachment

The SPSS macro process program compiled was used to produce 1,000 extractions. After controlling for gender, age, single child status, and subjective socio-economic status, we analysed the mediating effects of parent involvement and parent–child attachment on the relationships of mothers' positive cooperative parenting integrity and consistency with adolescent peer attachment. The results are shown in Table 2, and the chain mediated effect is shown in Figures 1, 2.

The results indicate that mothers' parenting involvement and mother–child attachment have a significant chain mediating effect on the relationship between maternal positive coparenting integrity and adolescent peer attachment (95% CI: 0.04, 0.10). Maternal positive coparenting integrity was indirectly related to adolescent peer attachment through mothers' parenting involvement (95% CI: 0.12, 0.23). Maternal positive coparenting integrity was indirectly related to adolescent peer attachment through mother–child attachment (95% CI: 0.05, 0.14).

The results also implicate that fathers' parenting involvement and father-child attachment have a significant chain mediating effect on the relationship between maternal positive coparenting integrity and adolescent peer attachment (95% CI: 0.04, 0.07). Maternal positive coparenting integrity was indirectly related to adolescent peer attachment through fathers' parenting involvement (95% CI: 0.11, 0.20). Maternal positive coparenting integrity was indirectly related to adolescent peer attachment through father-child attachment (95% CI: 0.04, 0.09).

The results indicate that mothers' parenting involvement and mother–child attachment have a significant chain mediating effect on the relationship between maternal positive coparenting consistency and adolescent peer attachment (95% CI: 0.04, 0.07). Maternal positive coparenting consistency was indirectly related to adolescent peer attachment through mothers' parenting involvement (95% CI: 0.07, 0.16). Maternal positive coparenting consistency was indirectly related to adolescent peer attachment through mother–child attachment (95% CI: 0.02, 0.08).

The results also show that fathers' parenting involvement and father-child attachment have a significant chain mediating effect on the relationship between maternal positive coparenting consistency and adolescent peer attachment (95% CI: 0.03, 0.05). Maternal positive coparenting consistency was indirectly related to adolescent peer attachment through fathers' parenting involvement (95% CI: 0.08, 0.13). Maternal positive coparenting consistency was indirectly related to adolescent peer attachment through father-child attachment (95% CI: 0.02, 0.06).

Discussion

Analysis

The present study aimed to investigate the relationship between positive coparenting and peer attachment in adolescents and the intermediary role of parental involvement and parent–child attachment based on family systems theory. The results showed that mothers' positive coparenting positively predicted adolescents' peer attachment, which was consistent with previous studies (Teubert and Pinquart, 2010; Zou et al., 2020). According to family systems theory, the maternal positive coparenting with the father can promote harmonious coexistence for the whole family, and provide teenagers with security through a harmonious, stable, and reliable family atmosphere, which is an important predictor of adolescents' peer attachment (Brown and Bakken, 2011; Zemp et al., 2018).

TABLE 1 Pearson correlations and descriptive statistics of the main study variables (N = 1807).

	1	2	3	4	5	6	7
1. Mother Coparenting Integrity	1						
2. Mother Coparenting Consistency	0.71**	1					
3. Father Involvement	0.50**	0.49**	1				
4. Mother Involvement	0.63**	0.62**	0.73**	1			
5. Paternal Attachment	0.31**	0.27**	0.36**	0.33**	1		
6. Maternal Attachment	0.23**	0.21**	0.10**	0.13**	0.28**	1	
7. Peer Attachment	0.30**	0.29**	0.29**	0.27**	0.34**	0.63**	1
M	29.26	46.13	3.24	3.39	81.14	73.64	77.56
SD	8.54	12.24	0.81	0.79	14.09	14.90	12.96

**$p < 0.01$.

When adolescents believe that their parents are stable and reliable, they are more likely to form stable and reliable beliefs towards others, which facilitate healthy interactions with others. Conversely, adolescents may experience interpersonal dilemmas if they believe that others are capricious and unpredictable (Lin et al., 2014; Wang and Cheng, 2014). Therefore, as the main family caregiver, mothers should consider whether their words and deeds are consistent with fathers' parenting behaviour goals when interacting with teenagers. Parents' consistent coparenting may provide a warm and harmonious family atmosphere for teenagers, facilitate better family function, and allow them to acquire a more positive interaction style, which will promote healthy adolescent peer attachments.

TABLE 2 Analysis of chain mediated effect (N=1807).

Indirect effect	B	R^2	95% CI
1→3→7	0.17	39%	[0.12, 0.23]
1→3→5→7	0.07	17%	[0.04, 0.10]
1→5→7	0.10	22%	[0.05, 0.14]
Total indirect effect	0.34	78%	[0.27, 0.41]
1→4→7	0.15	35%	[0.11, 0.20]
1→4→6→7	0.06	14%	[0.04, 0.07]
1→6→7	0.07	16%	[0.04, 0.09]
Total indirect effect	0.28	65%	[0.23, 0.34]
2→3→7	0.11	39%	[0.07, 0.16]
2→3→5→7	0.06	20%	[0.04, 0.08]
2→6→7	0.05	17%	[0.02, 0.08]
Total indirect effect	0.22	75%	[0.18, 0.28]
2→4→7	0.10	35%	[0.08, 0.13]
2→4→6→7	0.05	17%	[0.03, 0.05]
2→6→7	0.04	14%	[0.02, 0.06]
Total indirect effect	0.18	62%	[0.15, 0.22]

1, maternal positive coparenting integrity; 2, maternal positive coparenting consistency; 3, mother involvement; 4, father involvement; 5, maternal attachment; 6, paternal attachment; 7, peer attachment.

Second, based on the spillover and crossover effects in family systems theory which indicated that spill over and crossover effects, this study examined the relationships among parenting involvement, mothers' positive collaborative parenting, and peer attachment. Mothers' positive collaborative parenting behaviour positively predicted adolescent peer attachment, and predicted adolescent peer attachment through an indirect effect of parenting involvement, which is consistent with previous research findings (Lamb, 2000; Caldera, 2004; Li et al., 2012). The degree of parental involvement determines the extent of social psychological support adolescents receive (Updegraff et al., 2012). Higher levels of support provided adolescents with a sense of security and trust, which were important predictors of adolescent peer attachment (Becker-Stoll et al., 2008). Teenagers will feel more love and care for themselves during this period, allowing them to believe more firmly that they are worthy of being loved and cared for, and that others will interact with them in good faith, which will facilitate positive interactions with others and foster healthy peer attachments (Li et al., 2016).

Third, the results showed that mothers' positive cooperative parenting behaviour was indirectly related to peer attachment through parent–child attachment during adolescence. As a binary parent–child system, the parent attachment reflects an important parent–child relationship in accordance with family systems theory. Developing peer attachments is influenced by parent–child attachment, an important factor in the internal working model of attachment (Wang et al., 2005; Caldera and Lindsey, 2006), and parent–child attachment can positively affect peer attachment (Doyle et al., 2009). Previous research has also shown that mothers' positive coparenting can positively affect parent–child attachment (Barnett et al., 2011); when mothers hold a united and consistent attitude towards paternal behaviour, a supportive collaborative parenting situation develops, and teenagers will transfer this coparenting model to their interactions with teachers and peers, resulting in fewer conflicts that can lead to improved interaction styles in adolescents. This could, in turn, lead to

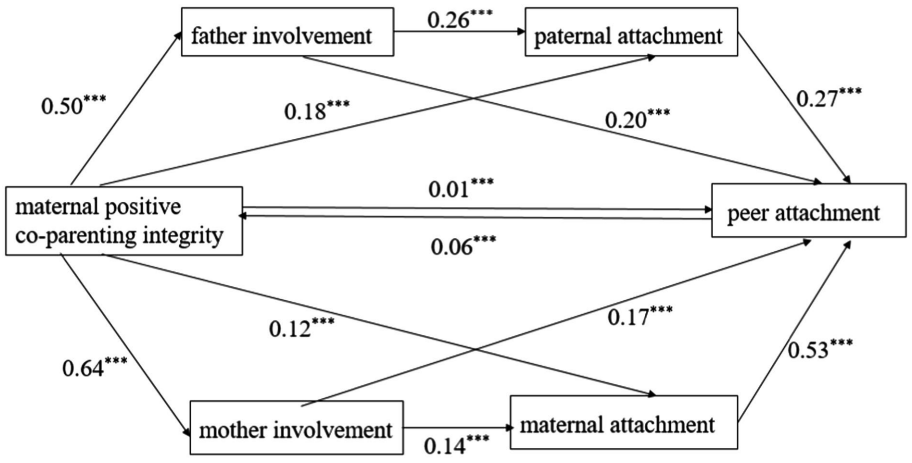

FIGURE 1
Chain mediating of parenting involvement and parent-child attachment between maternal positive co-parenting integrity and peer attachment. ***p<0.001.

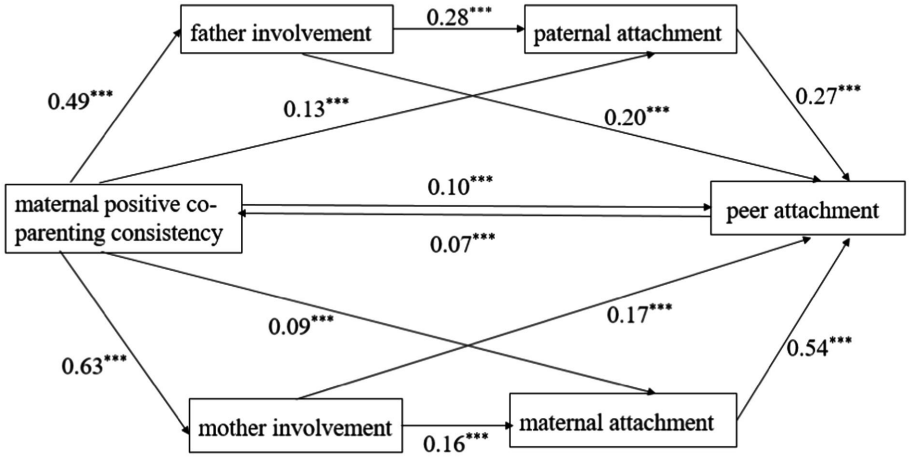

FIGURE 2
Chain mediating of parenting involvement and parent-child attachment between maternal positive co-parenting consistency and peer attachment. ***p<0.001.

improved communication with peers (Brown and Bakken, 2011). Early parent–child attachment relationships are crucial to forming subsequent attachment bonds outside of their family, including peer attachments (Gorrese and Ruggieri, 2012).

Fourth, this study indicated a chain intermediary effect of parental involvement and parent–child attachment on the relationship between maternal positive coparenting and peer attachment, which was consistent with the family systems theory. According to the spill over and crossover effects (Minuchin, 1985; Erel and Burman, 1995), maternal positive coparenting behaviour affects parental involvement, which affects parent–child attachment between adolescents and their parents (Zou et al., 2020). Furthermore, our findings supported the systematic view of family-peer linkages in adolescence (Brown and Bakken, 2011). The positive cooperative relationship between mother and father affect the outcomes of children, especially their friendship.

According to the internal working model of attachment, when adolescents can form a healthy attachment model with their parents, it promotes secure inner attachment that results in teenagers using a healthy model to interact with peers, facilitating healthy peer attachments (Liang and Wang, 2014). Therefore, parents need to pay more attention to mothers' positive coparenting behaviour. How mothers respond to fathers' behaviour not only was related to parent involvement and parent–child attachment, which, in turn, was related to adolescent peer attachment. A meta-analysis has shown that parental involvement is correlated with parent–child attachment, and plays an important role in developing parent attachment (De Wolff and Van Ijzendoorn, 1997).

Limitations and future directions

This section acknowledges several limitations of this study and shows directions for future research. First, this study employed a single self-report method, which should be integrated with interviews, experiments, and others' evaluation, so as to collect more objective and comprehensive information. Second, this study investigated families with good structure. Future research should examine more family types, especially left behind youth families in the process of urbanization, as a special family form. Moreover, the difference between one child family and more larger families should be given increasing amount of attention in future. Third, this study examined the effect of mothers' coparenting with fathers. Future studies could consider the role of fathers' coparenting with mothers, and then focus on how to promote parental positive coparenting behaviour through family education or counseling intervention to promote good communication and healthy growth of teenagers.

Research implications

Coparenting, involvement, and attachment are important for adolescent development, and consistent parenting behaviours affect parent–child attachment (Neppl et al., 2019). Moreover, previous researchers have found that the parental attachment construct plays a crucial role in peer attachment development (Armsden and Greenberg, 1987; Murphy et al., 2017). Parents' involvement affects adolescents' friendship quality and social competence with peers (Updegraff et al., 2001; Ladd and Pettit, 2002). Based on the family system theory, this study innovatively constructed a model including father, mother and adolescents to investigate relations among maternal positive coparenting, parent involvement, parent–child attachment, and peer attachment, comprehensively investigating the influence of mothers' active coparenting on adolescents, and exploring the ternary system effect of mothers' active collaborative parenting on the dual paternal and maternal system. Theoretically, the present study

extends the understanding of a family–peer system linkage and lays a foundation for future research on how parental positive co-parenting affects parenting involvement and parent–child and peer attachment. Practically, it expands knowledge of parenting behaviour, parent–child relationships, and peer relationships, and has substantial practical significance to family education and family counseling practice.

Conclusion

This study contributes to our understanding of the chain mediating processes in the association between maternal positive coparenting behaviour and adolescent peer attachment. Based on this exploratory approach, this study examined a mediation model emphasizing the role of mothers' involvement and parent–child attachment and found that parental involvement and parent–child attachment play a significant mediating role on the associations between mothers' positive coparenting behaviour and peer attachment through three specific paths: an independent mediating role of parental involvement, an independent mediating role of parent–child attachment, and a chain mediating role of parental investment and parent–child attachment.

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 Research Ethics Committee of the Institute of Psychology and Behavior, Henan University. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

WJ conceptualization, methodology, formal analysis, and writing—review and editing. YY data curation, and writing—original draft preparation. YH validation and investigation. XB supervision and formal analysis. YZ project administration. JL visualization and editing. 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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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.976982/full#supplementary-material

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Health behaviors of late adolescents in China: Scale development and preliminary validation

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Health behaviors influence health and well-being, improve quality of life, and provide economic benefits. It is important to take advantage of health-related opportunities during adolescence. Staying healthy during adolescence also promotes the future well-being of individuals and that of the next generation. We aimed to develop a reliable and valid scale based on the General Senior High School Physical Education and Health Curriculum Standards (2017 edition) to evaluate Chinese late adolescents' health behavior. The scale was to help physical education teachers measure the health behavior level of senior high school students, improve physical education and health teaching, and promote Chinese adolescent health. Participants were recruited by convenience sampling from September to October 2019. For the first survey, we recruited 526 senior high school students (318 boys, 208 girls; M_{age}=16.5), and the data were subjected to item analysis and exploratory factor analysis. For the second survey, we recruited 542 senior high school students (249 boys, 293 girls; M_{age}=15.5), and the data were subjected to confirmatory factor analysis and internal consistency reliability analysis. After exploratory factor analysis, we extracted four factors with 23 items: exercise awareness and habits (five items), mastering and applying healthy behavior knowledge (10 items), emotional regulation (four items), and environment adaptation (four items). The Cronbach's alpha values for these factors ranged from 0.863 to 0.937. After confirmatory factor analysis, we achieved a satisfactory goodness-of-fit model (CMIN/DF=2.92, RMR=0.03, GFI=0.93, CFI=0.91, TLI=0.92, RMSEA=0.06). Internal consistency, test–retest reliability, and construct validity were all satisfactory. These results suggest that the Chinese version of the Health Behavior Scale is a reliable and valid instrument for assessing the health behavior of senior high school students. The findings have important implications for increasing adolescents' health literacy, promoting adolescents' health, and enhancing the well-being of late adolescents.

KEYWORDS

health behavior, late adolescents, scale development, factor analysis, construct validity

Introduction

Health behaviors broadly refer to actions taken by individuals that affect health, disease, and mortality (Short and Mollborn, 2015; Rubinelli and Diviani, 2020). Healthy behavior such as physical activity, a reasonable diet, not smoking, and not being addicted to alcohol could decrease the risk of chronic diseases (i.e., obesity, cardiovascular disease, and cancer), improve quality of life, and provide substantial economic benefits (Crone et al., 2019; Bilal et al., 2020; Hecht et al., 2020; Stephanie et al., 2020). The adolescent years are a critical transitional period during which rapid physical, emotional, cognitive, and social development occurs (Shlafer et al., 2014; Inchley et al., 2020; Roberts et al., 2020). Health behavior in the early stages of life has an impact on health consequences in later life (Umberson et al., 2010; Akasaki et al., 2019). Studies have found that many of the major behavioral risk factors which lead to non-communicable diseases (smoking, drinking, and sedentary lifestyle) are mainly formed during adolescence and affect habit formation well into adulthood (Inchley et al., 2020).

Moreover, the latter phase of adolescent brain development (15–19 years) includes the continued development of executive and self-regulatory skills, leading to a greater future orientation and an increased ability to weigh the short-term and long-term implications of decisions (Patton et al., 2016). Therefore, it is particularly important to cultivate and evaluate late adolescent health behaviors. Previous research has indicated that many adult health behaviors are developed and established during late adolescence and early adulthood (Liu et al., 2019). Behaviors developed during adolescence frequently persist into late adulthood (Lien et al., 2002; Berge et al., 2015), which is a transitional period during which adolescents experience physical, mental, and social development transformations. Thus, it is an important period for social and cognitive development. These years also lay the groundwork for a successful transition into a healthy and independent lifestyle and employment, and provide support for life partnerships, marriage, and parenthood (World Bank, 2006; Patton et al., 2016).

Several international organizations such as Health Behaviour in School-aged Children (HBSC) and Global Action for Measurement of Adolescent health (GAMA) are dedicated to gaining insight into adolescent health by measuring health behavior to make effective, efficient, and accountable investments (Azzopardi et al., 2017). An important milestone of international health behavior research, the HBSC study, in collaboration with the WHO Regional Office for Europe, has been conducted every 4 years in 50 countries across Europe and North America since 1982, aiming to inform policy and practices to improve the lives of millions of young people (Health Behaviour in School-aged Children, 2001). GAMA, which defined a core set of adolescent health indicators, was established by the WHO and UN partner agencies in 2017 and aimed to unify efforts toward adolescent health measurement and reporting (World Health Organization, 2017). The Health Promotion Lifestyle Profile (HPLP), a well-known instrument measuring health promotion lifestyle behaviors, was originally developed by Walker in 1987 and revised as HPLP-II in 1995 (Walker et al., 1995). The HPLP includes 48 items on six subscales, and the HPLP-II includes 52 items on six subscales: health responsibility, physical activity, nutrition, interpersonal relations, spiritual growth, and stress management. The HPLP have been applied in many countries and different populations, with good reliability and validity. However, several shortcomings of the current approaches for evaluating adolescent health were identified: First, more qualitative research is needed regarding mental health, injury, and positive measures of adolescent health and well-being. Second, the link between global and national indicators, as well as between indicators and programming at national and subnational levels is often missing (Guthold et al., 2019). Third, most of the existing instruments for assessing behavioral outcomes, measure the duration, frequency, and time of occurrence of health behavior. Few studies have measured the adolescent's health behavior perceived ability, such as the acquisition and application of knowledge about health behaviors, especially after that the DeSeCo Projects conceptual framework for key competencies. In China, measurements of health behaviors include studies using the revised version of the internationally validated scales, as well as self-developed scales for specific behavior or disease. But the existing scales inability to assess the consciousness and ability of emotion regulation and environmental adaption and exercise. No comprehensive measurement tool for health behavior. There are few synthetic data sources on adolescent health behavior in this discipline. There are few synthetic data sources on adolescent health behavior in this discipline.

In China, the physical education and health curriculum is undergoing significant reform, and the definition of health behavior has also changed. Health behavior became one of the course objectives of the Chinese senior high school physical education and health curriculum, in 2018. The Ministry of Education of the People's Republic of China published the General Senior High School Physical Education and Health Curriculum Standards (2017 edition), which put forward the concept of core literacy in physical education and health (The Ministry of Education of the People's Republic of China, 2018). The national curriculum standard indicated sports ability, health behavior, and sports ethics as the main components of core literacy in the physical education and health discipline. The curriculum standard explicitly stated definitions, content, and classifications (Liu, 2018; Liu and Bing Shu, 2018). Exercise awareness and habits, mastering and applying healthy behavior knowledge, emotional regulation, and environment adaptation were the four major parts of health behavior. To the best of our knowledge, there is little research and almost no existing validated health behavior scales based on the standard curriculum (2017 edition), and few studies combined the health behavior traits. Therefore, the purpose of this study was to develop a reliable and valid scale to evaluate the health behaviors of senior high school students based on the viewpoint of health behavior proposed in the General Senior High School Physical

Education and Health Curriculum Standards (2017 edition). The Health Behavior Scale was to help physical education teachers measure the health behavior level of senior high school students, improve physical education and health teaching, and promote Chinese adolescent health and well-being.

Materials and methods

Original items for scale development

To evaluation of senior high school students' health behaviors, we first analyzed the documents and literature about health behavior and physical literacy before March 2019. Then developing the interview guide for the interview discussion (Appendix 1) and creating the original items pool through group discussion. Three group discussion sessions were conducted, with each lasting for an average of 90 min. The interviews were conducted utilizing both open- and closed-ended questions. The participants consisted of physical education subject specialists (N = 5) and physical education teachers (N = 5) in China. Analyze the interview results through group discussion, delete the repeated content, and add the new content to the item pool. In the group discussion sessions, participants shared their perception of health behavior based on the curriculum standard (2017 version), analyzed the structure of the scale, evaluated the item pool, and gave suggestions for revision (Appendix 2). The discussion sessions were audio-recorded and supplemented by hand-written notes.

The third revision of the scale, namely the preliminary scale, was then sent to a panel of four experts who were teaching and conducting research in the area of physical education and health education. They were invited to evaluate the face validity of the preliminary scale. The experts did not suggest the addition or deletion of any of the items, and the preliminary scale was well received and praised as useful.

Four sources were used for the evaluation of senior high school students' health behaviors. First, related items were compiled from the content of physical education and health textbooks for senior high school students approved by the Ministry of Education and physical education and fitness textbooks published by Shanghai Education Press. Second, items were searched for in literature related to health behaviors in senior high school students. Third, entries on the characteristics of senior high school students were compiled and combined with the current background. Fourth, other items referenced related to health behavior were also included.

Participants

We adopted convenience sampling, recruiting students from public schools that could provide a representative population for this study due to the school size being representative of most senior high schools. Calculation of the sample size was performed according to the criteria established by Kline which recommend a ratio of 5–10 subjects per item (Kline, 2010). Thus, the sizes of our samples in the process of item selection and reliability and validity analysis were decided based on this rule. Two surveys were conducted in Shanghai, China. The two surveys used two health behavior scales that covered four aspects of health behavior. The first survey is provided in Appendix 3, completed in September 2019. The second survey is provided in Appendix 4, completed in October 2019. Sample 1, on whom the preliminary scale was conducted, comprised 526 senior high school students (318 boys, 208 girls; $M_{age} = 16.5$) recruited from four public schools in Shanghai, located in the east of China. The data of Sample 1 were subjected to item analysis and exploratory factor analysis.

Sample 2, to whom the formal scale was administered, comprised 542 senior high school students (249 boys, 293 girls; $M_{age} = 15.5$) recruited from four public schools in Shanghai. The data from Sample 2 were subjected to internal consistency reliability analysis and confirmatory factor analysis.

All the participants were recruited *via* convenience sampling of the adolescent students attending schools, and parents or legal guardians provided written consent for their children to cooperate with our research. This study was approved by the ethics committee of East China Normal University (HR 095 in 2019). Written informed consent was obtained from all participants and their parents in China.

Items and scoring method

The Health Behavior Scale for senior high school students includes 54 items. Students are required to answer according to their actual situation. Each item is scored on a five-point scale from 1 to 5, each number on the scale corresponding to "completely disagree," "basically disagree," "somewhat agree," "basically agree," and "completely agree," respectively. In this study, all items were scored normally except the fifth and eighth items which used reverse scoring; these were summed up *via* coding.

Statistical analysis

SPSS 26.0 and AMOS 24.0 were used to analyze the data. The first step was a normality test. Means and standard deviations were calculated for all variables. The second step was item analysis, which was used to test the appropriateness or reliability of individual items in the scale. The results of item analysis (i.e., critical ratio and homogeneity testing) were used as a basis to filter or delete items. The third step was exploratory factor analysis (EFA), which is a common method used for scale development and includes reliability tests and validity tests. The fourth step was confirmatory factor analysis (CFA), enabling the structural equation model, discriminant validity, and convergent validity of the scale to be tested. The steps and judgments criteria taken for

psychometric assessments have been presented in the Supplementary materials.

Results

The response rate of Sample 1 was 100%, and the effective rate was 97%. For Sample 2, the response rate was 99% and the effective rate was 96%. All data were strictly screened to remove extreme responding (answering each question with the same answer, i.e., only 1 or 5) and pattern responding (following a certain artificial rule, such as "5, 4, 3, 2, 1, 5, 4, 3, 2, 1," or "1, 1, 1, 2, 2, 2, 3, 3, 3, 4, 4, 4, 5, 5, 5"). There were no missing data in either sample and no violations of normality in total score distributions were evident. Moreover, the skewness and kurtosis values for the items were within acceptable limits across the samples.

Item analysis

Item analysis was conducted on the preliminary 54 items. According to the results, Q8 ("I eat fast.") had four indicators [critical ratio > 3.0, item-total correlation ≥0.4 (Minglong, 2010a), communality ≥0.2 (Yong and Pearce, 2013), and factor loading ≥0.45 (Minglong, 2010b)] below the judgment criterion. Thus, this item (Q8) was deleted (see Table 1).

Exploratory factor analysis

Validity was tested *via* Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity. The KMO value was 0.973, greater than 0.60 (Beavers et al., 2013), while Bartlett's test of sphericity showed high significance ($\chi^2 = 230$, 05786.12, $df = 1{,}378$, $p < 0.01$), indicating the existence of common factors among variables which are very suitable for factor analysis.

In exploratory factor analysis (EFA), items with factor loads below 0.45 were removed in the next rotation; only one item was deleted at a time. Reanalysis was conducted with new data after each deletion and then the next EFA was conducted. Items with low factor loads were the first to be deleted (such as less than 0.45), followed by the item with the largest cross-factor load. Finally, items with less than three questions in the factors were deleted. A 23-item solution was achieved in 15 iterations and yielded a KMO measure of sampling adequacy of 0.957, and a good Bartlett's test of sphericity ($\chi^2 = 9105.670$, and $p < 0.00$). From the results of the principal component analysis using varimax rotation, four common factors with 23 items were extracted (Table 2). The four-factor structure was maintained perfectly regarding the item inclusion criteria, with sufficient loadings and no cross-loading. Commonalities of the variables ranged between 0.58 and 0.84. The first factor included 10 items and accounted for 26.6% of the variance; it was labeled "mastering and applying healthy behavior knowledge." The second factor included five items and accounted for 17.8% of the variance; it was labeled "exercise awareness and habits." The third factor included four items and accounted for 14.0% of the variance; it was labeled "environment adaptation." The fourth component included four items and accounted for 12.2% of the variance; it was labeled "emotional regulation." The details for each factor as well as the 23 items are shown in Table 2. The Cronbach's alpha values for each factor as well as for the overall scale were high, namely, 0.937 for Factor 1, 0.907 for Factor 2, 0.863 for Factor 3, 0.874 for Factor 4, and 0.958 for the overall scale.

Confirmatory factor analysis

Structural equation models

The 23-item four-factor EFA solution was then modeled using the AMOS program. A Maximum Likelihood CFA procedure executed on Sample 2 (N = 542) did not yield satisfactory fit indices. Therefore, using some of the suggested modification indices to reduce cross-loading, one item was removed (Q22), and to account for some within-factor non-zero correlations between unobserved error variances, some correlation arcs were added to the unobserved error measures. The final four-factor health behavior structure model had 22 items with the following fit statistics: RMSEA = 0.06 (<0.08; Browne and Cudeck, 1992; Hu and Bentler, 1999), CMIN/DF = 2.92 (<5; Bentler and Bonett, 1980; Marsh et al., 1988; Zhong Lin et al., 2004), RMR = 0.03 (<0.05; Minglong, 2010c), CFI = 0.93 (≥ 0.90), GFI = 0.91 (≥ 0.90), TLI = 0.92 (≥0.90; Mcdonald and Ho, 2002; Gundy et al., 2012). The model fitting index is shown in Table 3. These indices represent a good fit of the model based on the reported criteria. Since the CFA led to further elimination of items, an additional EFA was performed on Sample 1 to validate the final 22-item Health Behavior Scale (Figure 1). This EFA perfectly replicated the factor structure of the CFA. The solution explained 71% of the cumulative variance. Besides this, the factor loadings ranged between 0.53 and 0.88 and were significant, indicating a good relationship between the observed variable and latent variable (Ruan et al., 2019).

In summary, several rounds of exploratory and confirmatory factor analyses yielded a 22-item scale. The structure that emerged in our data comprised four distinct factors: the first, "mastering and applying healthy behavior knowledge" (10 items), included disease prevention and control, safety consciousness, basic health knowledge, rational nutrition, and a healthy lifestyle. The second, "exercise awareness and habits" (5 items), included exercise habits, exercise persistence, and emotions associated with the exercise of senior high school students. The third, "environment adaptation" (3 items), included social community ability, adaptability, and the ability to deal with the relationship between cooperation and competition. The fourth, "emotional regulation" (4 items), included the understanding of emotions and the identification of different emotions.

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TABLE 1 Item analysis summary.

Items	Critical ratio	Item-total correlation	Commonalities	Factor loading	Substandard index	Note
Q1	14.471	0.675**	0.462	0.68	0	retain
Q2	15.197	0.647**	0.397	0.63	0	retain
Q3	14.611	0.667**	0.44	0.663	0	retain
Q4	18.284	0.674**	0.431	0.657	0	retain
Q5	16.484	0.677**	0.449	0.67	0	retain
Q6	20.324	0.719**	0.485	0.696	0	retain
Q7	16.588	0.634**	0.369	0.607	0	retain
Q8	2.372	0.028	0.000	0.020	4	delete
Q9	19.498	0.694**	0.469	0.685	0	retain
Q10	14.354	0.678**	0.483	0.695	0	retain
Q11	13.769	0.673**	0.485	0.696	0	retain
Q12	17.451	0.642**	0.391	0.625	0	retain
Q13	17.382	0.622**	0.364	0.603	0	retain
Q14	15.877	0.703**	0.499	0.706	0	retain
Q15	20.901	0.780**	0.606	0.779	0	retain
Q16	15.048	0.645**	0.417	0.646	0	retain
Q17	13.71	0.636**	0.414	0.644	0	retain
Q18	18.059	0.647**	0.403	0.635	0	retain
Q19	19.124	0.747**	0.566	0.752	0	retain
Q20	18.998	0.723**	0.538	0.733	0	retain
Q21	15.765	0.704**	0.523	0.723	0	retain
Q22	13.434	0.678**	0.493	0.702	0	retain
Q23	17.915	0.729**	0.548	0.74	0	retain
Q24	16.836	0.695**	0.482	0.694	0	retain
Q25	16.053	0.705**	0.522	0.723	0	retain
Q26	14.57	0.708**	0.534	0.731	0	retain
Q27	15.845	0.718**	0.551	0.742	0	retain
Q28	19.844	0.767**	0.601	0.775	0	retain
Q29	19.354	0.732**	0.554	0.744	0	retain
Q30	18.972	0.692**	0.47	0.686	0	retain
Q31	21.143	0.739**	0.538	0.734	0	retain
Q32	19.58	0.698**	0.477	0.691	0	retain
Q33	20.848	0.722**	0.504	0.71	0	retain
Q34	22.557	0.730**	0.515	0.718	0	retain
Q35	21.568	0.751**	0.57	0.755	0	retain
Q36	24.894	0.800**	0.623	0.79	0	retain
Q37	20.409	0.761**	0.596	0.772	0	retain
Q38	16.939	0.699**	0.508	0.712	0	retain
Q39	18.083	0.733**	0.556	0.745	0	retain
Q40	19.92	0.780**	0.616	0.785	0	retain
Q41	16.93	0.739**	0.573	0.757	0	retain
Q42	19.087	0.731**	0.541	0.735	0	retain
Q43	18.462	0.725**	0.548	0.74	0	retain
Q44	14.275	0.650**	0.437	0.661	0	retain
Q45	21.102	0.758**	0.583	0.763	0	retain
Q46	23.211	0.713**	0.48	0.693	0	retain
Q47	21.854	0.735**	0.531	0.729	0	retain
Q48	16.096	0.646**	0.434	0.659	0	retain
Q49	19.611	0.664**	0.422	0.649	0	retain
Q50	16.354	0.673**	0.474	0.689	0	retain

(Continued)

TABLE 1 (Continued)

Items	Critical ratio	Item-total correlation	Commonalities	Factor loading	Substandard index	Note
Q51	17.8	0.691**	0.477	0.69	0	retain
Q52	18.835	0.673**	0.452	0.673	0	retain
Q53	20.228	0.656**	0.4	0.632	0	retain
Q54	18.6	0.704**	0.502	0.709	0	retain
Judgment criterion	≥3.00	≥0.400	≥0.200	≥0.450		

**$p < 0.01$.

TABLE 2 Results of exploratory factor analysis.

Item	Component				Commonalities
	Factor 1	Factor 2	Factor 3	Factor 4	
I will actively try my best to prevent all kinds of diseases.	0.796				0.743
I have the awareness and ability regarding security precautions.	0.789				0.749
I understand the harm, routes of transmission, and preventive measures of infectious disease.	0.784				0.723
I have a comprehensive grasp of methods of self-protection and mutual protection in exercise.	0.716				0.717
I never litter and I can sort garbage.	0.708				0.644
I understand the harm of malnutrition to health.	0.680				0.632
I know the characteristics and changing rules of psychological development during puberty.	0.656				0.623
I have good personal and public health habits.	0.626				0.580
I understand that different intensities of exercise require different nutritional needs.	0.611				0.606
I have a good sense of health and pay attention to developing a healthy and civilized lifestyle.	0.524				0.639
Even if there is no physical examination, I will still stick to physical exercise.		0.840			0.794
I have good physical exercise habits.		0.784			0.773
I can actively participate in or organize sports competitions in my class.		0.777			0.716
I know that physical exercise produces more positive emotions than negative emotions.		0.746			0.720
I can keep exercising for my favorite sports.		0.743			0.701
I can quickly adapt to a new learning and living environment.			0.805		0.796
I have good social communication abilities.			0.778		0.774
I will take the initiative to ask my classmates to do physical exercise together in a new class.			0.712		0.720
I know that a harmonious combination of competition and cooperation will make me progress faster.			0.564		0.620
I can distinguish between positive and negative emotions.				0.761	0.844
I know depression is a negative emotion.				0.707	0.703
I have a positive, optimistic, and cheerful attitude towards life.				0.598	0.723
I understand the harm of unhealthy emotions to health.				0.518	0.695
Eigenvalue	6.115	4.105	3.223	2.811	—
Explanatory variance	26.6%	17.8%	14.0%	12.2%	—
Cumulative % of explanatory variance	26.6%	44.4%	58.4%	70.7%	—

Factor 1: mastering and applying healthy behavior knowledge; Factor 2: exercise awareness and habits; Factor 3: environment adaptation; Factor 4: emotional regulation.

Convergent and discriminant validity

Three methods were used to assess convergent validity: factor loading, average variance extracted (AVE), and composite reliability (CR). The values of AVE and CR can be found in Table 4. The discriminant validity can be evaluated by the square root of AVE, which is shown in Table 5.

Test–retest reliability

Test–retest reliability was calculated for the health behavior scale using a sample of 60 senior high school students who completed the health behavior scale a second time after 2 weeks. The correlation coefficients for test–retest reliability ranged from 0.79 to 0.83. The intraclass correlation coefficients of the

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TABLE 3 Goodness-of-fit of the health behavior model.

	CMIN/DF	RMR	GFI	TLI	CFI	RMSEA
Initial structural model	4.07	0.04	0.86	0.87	0.88	0.08
Modified structural model	2.92	0.03	0.93	0.92	0.91	0.06
Recommended value	1–3	< 0.05	≥ 0.90	≥ 0.90	≥ 0.90	< 0.08

Initial structural model: the structural model before deleting Q22. Modified structural model: the structural model after deleting Q22, and modified model according to the modification indices.

four factors were 0.83, 0.82, 0.79, 0.80, and 0.83 for the overall scale.

Discussion

Result interpretation

We designed and validated an instrument to assess the health behaviors of senior high school students in Shanghai, China. To the best of our knowledge, this is one of the earliest studies to have developed and verified the Health Behavior Scale based on the Physical Education and Health Curriculum Standard (2017 edition).

Through factor analysis, we found that the scale has good reliability and validity. The EFA results (see Table 2) showed that the explanation rate of the cumulative variance after rotation was 70.7%, which was greater than 50%, indicating that the amount of information of the item can be effectively extracted. Meanwhile, the Cronbach's alpha values of each of the factors was close to or over 0.9, and the Cronbach's alpha value of the scale was 0.958, suggesting good reliability and high internal consistency for each factor and the scale as a whole (Gliem and Gliem, 2003). The Health Behavior Scale comprises four distinctive dimensions: mastering and applying healthy behavior knowledge, exercise awareness and habits, environment adaptation, and emotional regulation. This is consistent with the point of view put forward by the Physical Education and Health Curriculum Standard (2017 edition).

Regarding the goodness-of-fit of the health behavior model (see Table 3), the indices represent a relatively good fit of the model based on the reported criteria (Hu and Bentler, 1999). Bentler and Bonnet suggest the CMIN/DF as an appropriate measure of model fit, which should not exceed 5 (Bentler and Bonett, 1980). If the CMIN/DF is between 1 and 3, it means that the model fits well, while if the value is less than 5, it means the value in an acceptable range (Marsh et al., 1988). Besides this, the factor loadings ranged between 0.53 and 0.88 and were significant, indicating a good relationship between the observed variable and latent variable. Discriminant validity, along with convergent validity, is a subtype of construct validity (Cronbach and Meehl, 1955).

Discriminant validity shows that two measures that are not supposed to be related are unrelated. Convergent validity takes two measures that are supposed to be measuring the same construct and shows that they are related. In short, discriminant validity focuses on inter-factor correlations, while convergent validity focuses on inter-item correlations. The discriminant validity was established if the inter-test correlation was low, and the convergent validity was established if the inter-item correlation was high. The results of convergent validity (see Table 4) and discriminant validity (see Table 5) suggested that the construct validity of the scale was acceptable. Discriminant validity can be evaluated by comparing the correlation between the same constructs and the square root of AVE for any two constructs (Abdullah et al., 2013; Purnomo, 2017). The absolute values of the correlation coefficients were all less than 0.5, and less than the square root of the corresponding AVE, which indicated that there was a correlation between the latent variables and a certain degree of discrimination between them. This demonstrated that the discriminant validity of the scale was ideal. As can be seen in Table 5, the scale has adequate discriminant validity.

The general rule suggested for AVE is that it should be equal to or greater than 0.50, indicating adequate convergence (Richard and Youjae, 1988; Abdullah et al., 2013). According to Fornell and Larcker (1981), AVE should exceed 0.5 under ideal conditions, while 0.36–0.5 is acceptable (Zhang and Zheng, 2021). Coefficients of 0.5 for standardized factor loading, 0.7 for CR, and 0.36 for AVE are adequate limits for these measures. Hence, all items for convergent validity were met.

The intraclass correlation coefficient (ICC; Bartko, 1966) is one of the reliability coefficient indexes to measure test–retest reliability. The value of ICC lies between 0 and 1, with 0 indicating incredible. The value of ICC lies between 0 and 1, with 0 indicating not credible and 1 indicating completely credible. The ICC values ranging below 0.40 indicate poor reliability, values from 0.40 to 0.59 indicate fair reliability, values from 0.60 to 0.74 indicate good reliability, and values from 0.75 to 1.00 indicate excellent reliability (Portney and Watkins, 1993). The result of ICC demonstrated that the test–retest of the scale was ideal. Due to cultural differences, the concept of health behavior is different from the international interpretation of health behavior. According to the curriculum standard (2017 edition), health behavior is an aspect of the core literacy of the physical education and health discipline. Health behavior is a comprehensive manifestation of improving physical and mental health and actively adapting to the external environment, and it is the key to raising health awareness, improving health status, and gradually forming a healthy and civilized lifestyle. Health behavior includes developing a good exercise routine, rational diet, regular rest, good hygiene, controlling one's weight, avoiding bad hobbies, preventing exercise injuries and diseases, eliminating exercise fatigue, maintaining a good state of mind,

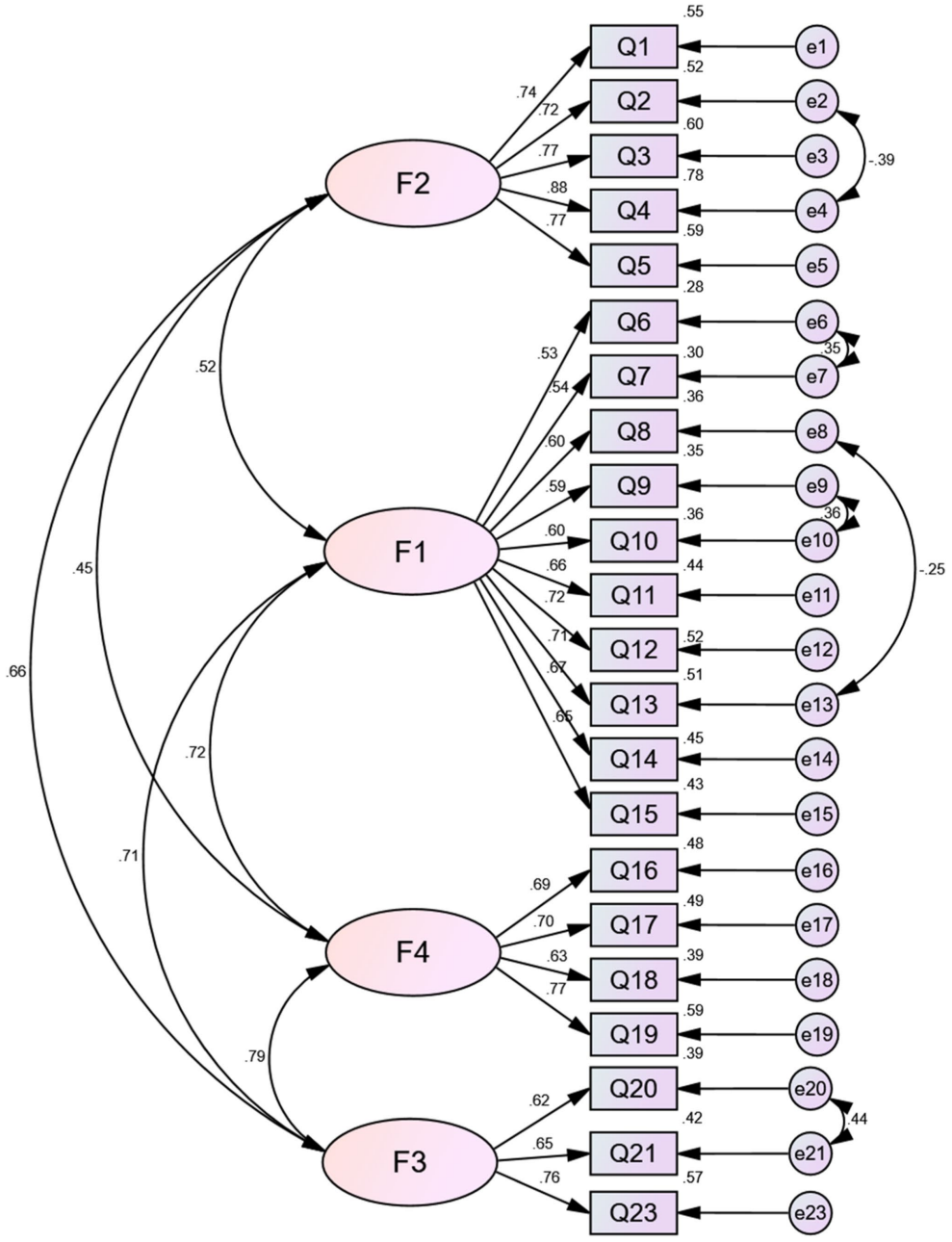

FIGURE 1
Structural equation model of health behavior.

and having the ability to adapt to the natural and social environment. In summary, health behavior refers to all health-related behaviors, not only including behaviors at the conscious level but also at the behavioral level. Internationally, health behaviors, sometimes called health-related behaviors, are considered to be actions taken by individuals that affect health or mortality. These actions may be intentional or unintentional and can promote or detract from the health of the individual or others (Short and Mollborn, 2015). Smoking, drinking, diet, physical activity, sleep, and drug abuse are all indicators of health behaviors. The international definition of health behavior interprets it at a specific behavior level, while the Chinese definition interprets it on an abstract level of consciousness containing more comprehensive content.

Different concepts lead to different measurement methods. International health behavior measurement research includes consideration of the time, frequency, and duration to perform the behaviors, such as the HBSC international research protocol, as well as the GSHS core questionnaire and expanded questionnaire (Health Behaviour in School-aged Children, 2017;

TABLE 4 Convergent validity of the Health Behavior Scale.

Path	Factor loading (> 0.5)	AVE (> 0.36)	CR (> 0.7)
Q1←F2	0.745	0.608	0.885
Q2←F2	0.724		
Q3←F2	0.773		
Q4←F2	0.881		
Q5←F2	0.766		
Q8←F1	0.604	0.399	0.868
Q9←F1	0.595		
Q10←F1	0.597		
Q11←F1	0.66		
Q12←F1	0.724		
Q13←F1	0.713		
Q6←F1	0.528		
Q7←F1	0.544		
Q15←F1	0.652		
Q14←F1	0.669		
Q16←F4	0.693	0.490	0.793
Q17←F4	0.703		
Q18←F4	0.628		
Q19←F4	0.768		
Q20←F3	0.621	0.460	0.717
Q21←F3	0.648		
Q23←F3	0.757		

AVE: Average Variance Extracted. CR: Composite Reliability.

TABLE 5 Discriminant validity of the Health Behavior Scale.

	F1	F2	F3	F4
F1	0.399			
F2	0.142***	0.608		
F3	0.135***	0.271***	0.460	
F4	0.12***	0.163***	0.199***	0.490
The square root of AVE	0.632	0.780	0.678	0.700

Significance level: *** $p < 0.001$.

World Health Organization, 2021). Compared with international research, the classification and measurement of Chinese health behaviors are not comprehensive. For example, emotional regulation of health behavior includes the cognition of emotions, recognition of different emotions, and the method of emotion regulation in the curriculum standard. It is not an assessment of the extent to which adolescents experience either depression or anxiety, but explores whether adolescents know that depression is a negative emotion and that negative emotions can impact health.

Cultural differences may partially explain the discrepancy, and another reason may be that China began its research on health behavior at a relatively late stage compared to international health behavior research. The measurement of various indicators of health behavior has not been combined with the time and frequency of specific behavior that occurred. The time and frequency of high school students' health behaviors are not mentioned in the curriculum standard (2017 edition), and nor are the specific indicators of health behaviors. Because health behavior is a macro concept that includes a variety of different indicators, indicators are constantly changing over time. For example, sedentary behavior, which might not have existed in the last century, has become very common in this era. Another reason may be discipline integration. In China, different health behaviors used to be classified in different disciplines. Physical education focuses on the prevention of and how to deal with sports injuries; medicine mainly concerns the treatment and prevention of diseases of the internal medical system, the surgical system, and infectious diseases, such as diabetes, hypertension, cancer, and acquired immunodeficiency syndrome; psychology mainly focuses on mental health problems or mental illness, e.g., anxiety or depression. A growing body of research suggests that exercise during the post-operative rehabilitation period is of importance. Exercise can also promote healthy behaviors and alleviate mental illness. The Health China 2030 plan, released by the State Council of China in 2016, clearly proposes to strengthen the integration of physical and medical interventions and non-medical health interventions. China is moving towards multi-disciplinary integration. Therefore, investigating health behavior in physical education and health involves considering the relevant knowledge from different disciplines, aiming at cultivating health consciousness and promoting the healthy behavior of adolescents.

In summary, this is the first preliminary validation to assess the health behaviors of senior high school students. We found the Health Behavior Scale to be reliable as a valid preliminary measure of health behaviors in this sample. It can also provide a good assessment of the health behaviors of late adolescents and serve as a basis for physical education teachers to better cultivate the core literacy of physical education subjects. Moreover, the scale is based on the national curriculum standards.

Limitations and areas of future research

There are several study limitations to address. First, although we had an adequate sample size, as confirmed by the KMO and Bartlett's test results, our sample was recruited from a single city, Shanghai. This may limit its generalizability to the national scale, particularly in the western rural area. And the definition of health behavior is based on the Chinese policy environment and cultural background. This could limit the applicability of this scale to other cultures and countries. Second, primary and middle school students and senior three students were excluded from this study. Future research is required that broadens the assessment of the scale's validity to

early adolescents and youth. Third, the health behavior scale showed consistent factor structure, high internal consistency, good validity, and high test–retest reliability. However, we did not assess criterion validity. Fourth, we only discussed and analyzed the interview results without coding the interview results and using a qualitative research approach to analyze them, which is a limitation. Seven physical education subject specialists and four senior high school physical education teachers only evaluated the content of the scale and did not fill in the expert questionnaire. There was no formal expert questionnaire data, so CVI and CVR could not be calculated. Fifth, we only measured the adolescent comprehension of health behavior (Q18: "I know depression is a negative emotion") and did not measure the actual health behavior problems experienced by adolescents. We did not evaluate the extent of depression and anxiety in adolescents. Future research will draw on international studies to investigate the health behavior of Chinese adolescents and research the time, frequency, and duration of health behaviors. At the same time, a longitudinal study will deeply analyze Chinese adolescents' health trends.

Although the scale has various limitations, it was developed to measure the health behaviors of senior high school students and involved the largest sample among studies conducted in China on this topic to date. Our scale could contribute to a further understanding of the situation among senior high school students.

Conclusion

Previous research on health behaviors focused on adults and the elderly, and few previous studies have comprehensively assessed trends in health behaviors among Chinese late adolescents. Using 1,068 senior high school students recruited from public schools in Shanghai, China, we developed a Health Behavior Scale for senior high school students. Our analysis identified four factors with 23 items: mastering and applying healthy behavior knowledge, exercise awareness habits, environment adaptation, and emotional regulation. Our study suggests that the Health Behavior Scale is a valid instrument for assessing senior high school students' health behaviors. This scale contributes to the Physical education teachers' better understanding of the level of health behavior of adolescents, improves the quality of teaching, and then increases adolescents' health literacy, promoting adolescents' health. These findings have important implications for enhancing the well-being of late adolescents.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary materials; 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 East China Normal University (HR 095 in 2019). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin. Written informed consent was obtained from the minor(s)' legal guardian/next of kin for the publication of any potentially identifiable images or data included in this article.

Author contributions

QQ, SD, and JY contributed to the conception and design of the study. SD and JY were involved in implementing the study and data collection. QQ undertook data analysis. QQ and SD wrote the first draft of the manuscript. QQ Polished and revised the draft. 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.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.1004364/full#supplementary-material

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COVID anxiety and its predictors among Slovak adolescents

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Introduction: The COVID-19 pandemic and its related restrictions, mainly social distancing, had an impact on the mental health of various groups, including adolescents.

Methods: The main goal of our study was to explore the impact of gender, age, resilience (measured using the Brief Resilience Scale), attachment anxiety, attachment avoidance (both measured using the Experiences in Close Relationships Revised Scale for adolescents), and mental and general health (measured using items of SF-8 Health Survey) on COVID anxiety (measured using the COVID Anxiety Scale) among a sample of Slovak adolescents (N=1,786, age 15 to 19, mean age=16.8, SD=1.2). The data were collected online between 13 April and 24 May 2021.

Results: Four nested linear regression models were fitted to the data and evaluated. The significant predictors that had a greater effect than our smallest effect size of interest (β=0.10) were gender (β=−0.26, p<0.001, where boys had lower scores in COVID anxiety), general and mental health (β=−0.13 and β=−0.14, respectively, both with p<0.001), resilience (β=−0.12, p<0.001), and attachment avoidance (β=−0.11, p<0.001). Similarly, age and attachment anxiety were significant predictors with a lower effect size (β=0.06, p=0.003, and β=0.09, p<0.001, respectively).

Discussion: Our results are in line with previous research findings highlighting the importance of prevention and interventions programs focused mainly on preventing loneliness and social disconnection, fostering secure attachment with parents and peers, and increasing the resilience of adolescents, especially in the stressful time of a pandemic, to promote their mental health.

KEYWORDS

COVID-19, adolescents, general health, COVID anxiety, attachment, resilience

Introduction

Over the last 2 years, the COVID-19 pandemic has significantly affected the lives of all people, including adolescents. The restrictions associated with the pandemic, which mainly involved social distancing, had a great impact on the functioning of the school system. In many countries, including Slovakia, students in primary, secondary and higher education

shifted, after sudden breaks, completely to distance learning, without the possibility of meeting their classmates and teachers. Besides education, young people also experienced other negative consequences of the pandemic, such as the financial and job instability of their families, the disruption of their general and family social relationships, acute and even chronic stress, and more.

In general, stress and stressful life events are significant predictors of mental health difficulties in adolescents (DuBois et al., 1992; Lindholdt et al., 2022). According to the systematic review from Bor et al. (2014), there has been in the 21st century an increase in the internalizing of problems (anxiety, depression), manifested mainly in girls, compared to the 20th century. Based on the meta-analytical results of Polanczyk et al. (2015), the prevalence of anxiety and depression among children and adolescents is 6.5% and 2.6%, respectively. In times of pandemic, there is even more risk of mental health problems, manifested in symptoms of depression, anxiety, or posttraumatic stress disorder (PTSD) (e.g., Douglas et al., 2009; Liu et al., 2020). According to a meta-analysis across 29 samples and 80,879 youth, the pooled prevalence of clinically elevated depression and anxiety symptoms during COVID-19 was 25.2% and 20.5%, respectively (Racine et al., 2021). According to a systematic review by Loades et al. (2020), there is a clear association between social isolation, loneliness and mental health problems arising during the pandemic among children and adolescents. Because socialization is very important for people in this age, the restrictions related to the pandemic may also play a significant role in mental health difficulties (e.g., Cohen et al., 2021). Adolescents with psychiatric history are an even more vulnerable group, possibly due to the disruption of psychiatric/psychological care, higher COVID-19-related anxiety, and possible difficulties in coping with lockdowns (e.g., Guessoum et al., 2020). Conversely, resilience, as an ability to cope with or bounce back from stressful events, may act as a protective factor against negative mental health outcomes (e.g., Hu et al., 2015; Anyan and Hjemdal, 2016; Li and Miller, 2017). According to Beames et al. (2021), higher resilience is related to decreased psychological distress and to increased positive outcomes. Their research pointed out that the most reported active coping strategies among Australian adolescent were socializing, engaging in hobbies, and exercise, which also highlight the importance of peer relationships for teenagers. This research also describes gender as an important factor related to resilience, where female gender was related to lower resilience. When comparing students based on age, younger students experienced significantly more distress associated with COVID-19 (e.g., Zhou et al., 2020).

Another important factor influencing the mental health of adolescents is attachment. While insecure attachment is linked with the development of internalizing problems, anxiety, and depression in adolescents (Brumariu and Kerns, 2010), more secure attachment to parents is associated with fewer depressive symptoms in this group (Kerstis et al., 2018). Attachment theorists emphasize the importance of sensitive and responsive interactions between parent and child for building trust towards oneself and others and for learning self-regulation strategies (Bowlby, 1969). The quality of early caregiving experiences and attachment style may affect stress responsivity: Securely attached adolescents may be more successful in self-regulating strategies and in adaptive coping responses (Howard and Medway, 2004). Anxiously (preoccupied) attached adolescents tend to engage in emotion-focused coping, such as rumination and self-blame, and to focus their attention on their own distress rather than focusing on solutions to current problems (Mikulincer et al., 2003). Avoidantly attached adolescents attempt to deal with distress and threats alone, using suppression and self-reliant strategies (Brenning et al., 2012). While relationships with caregivers/parents usually consist of the primary attachment bond, in adolescence, peer relationships begin to increasingly take on critical attachment functions (Allen and Tan, 2016).

Pandemics may be a challenging stressor that activates the attachment system. Individuals with higher attachment anxiety may be prone to experience more health anxiety, leading to maladaptive responses to the COVID outbreak (e.g., excessive hand washing, social isolation, extended fear from infection) (Asmundson and Taylor, 2020). In an Italian population sample, features of both secure and avoidant attachment style appeared to be protective for the risk of higher psychological burden during the COVID-19 outbreak compared to the anxious attachment style (e.g., Moccia et al., 2020).

Although a systematic review of longitudinal cohort studies showed that after an initial increase in mental health symptoms after the outbreak of COVID-19, there was decrease of problems comparable to pre-pandemic levels in mid-2020 among most population subgroups (e.g., Robinson et al., 2022). From a mental health prevention perspective, it may be important to also focus on younger age groups. Adolescents may be a particularly vulnerable group, as biopsychosocial stressors can have far-reaching consequences for future mental health, due to neuro-immuno-endocrinological changes induced by the stress of social isolation (de Figueiredo et al., 2021).

Based on the mentioned facts about potential risk and protective factors influencing psychological adjustment to the pandemic, the main goal of present paper was to examine COVID-19 anxiety and its association with sociodemographic characteristics, mental and physical health, resilience, attachment anxiety and avoidance among adolescents in Slovakia. We hypothesized that (1) girls will have higher COVID anxiety; (2) impaired mental and physical health will be associated with higher COVID anxiety; (3) adolescents with higher attachment anxiety will have higher score in COVID anxiety; and (4) less resilient adolescents will have higher score in COVID anxiety.

Materials and methods

Participants and data collection

Data was collected online from 13 April to 24 May 2021. In Slovakia, the state of emergency lasted from 1 October 2020 until

14 May 2021. Schools were in the distance learning regime, except the resumed full-time learning for the first class of primary and the last class of secondary school from 8 February 2021. Data from a total of 1786 adolescents were collected (age 15–19 years, mean age = 16.8, SD = 1.2). Two-thirds (66.3%) of the research sample were females (N = 1,184) and all the respondents were high-school students. The participants received a web link for the survey from their school management. Data collection was in line with the Declaration of Helsinki, and participation in the study was voluntary and anonymous. No incentives were offered for taking part in the survey. The study was reviewed and approved by the Scientific Ethics Committee of Palacky University Olomouc (NO 2021/11).

Measures

Demographics—participants were asked to report their gender (male, female), age (continuous) and type of school where they were studying.

COVID anxiety scale

The COVID Anxiety Scale (Silva et al., 2020) contains 7 items that can be answered on a 4-point Likert scale, where 0 = not applicable to me, 3 = very applicable to me. The reliability of the scale is ω_{total} = 0.92 (mean score = 6.25, SD = 5).

SF-8 health survey

The SF-8 Health Survey consists of 8 items, each of them representing a specific domain: (1) general health (GH), (2) physical functioning (PF), (3) role physical (RP), (4) bodily pain (BP), (5) vitality (VT), (6) social functioning (SF), (7) mental health (MH), and (8) role emotional (RE). The Slovak version of the questionnaire is similar to the Czech version (Bartuskova et al., 2018), where the participant is asked to evaluate subjective health in the last 4 weeks. Items 1–4 can be answered on a 6-point scale and items 5–8 on a 5-point scale. In the presented study, we worked only with item 1 (general health) and item 7 (mental health). For the purpose of this study, the scoring of these items was reversed so that a higher score corresponds to better health.

Brief resilience scale

The Brief resilience scale (BRS, Smith et al., 2008) consists of 6 items that can be answered on a 5-point Likert scale (1 = strongly disagree, to 5 = strongly agree). The BRS measures resilience as the ability to recover from a stressful experience. The Slovak version of the BRS shows good psychometric properties, reliability and validity (Furstova et al., 2021). The reliability of the scale on the research sample was ω_{total} = 0.86 (mean score = 2.98, SD = 0.9).

The experiences in close relationships-revised for adolescents

The ECR-R questionnaire for adolescents is a self-report measure consisting of 20 items, with 10 items representing (1) attachment anxiety and (2) attachment avoidance (Wilkinson, 2011). The items can be answered on a 7-point Likert scale (1 = strongly disagree, to 7 = strongly agree). The reliability of the attachment anxiety subscale was ω_{total} = 0.89 (mean score = 37.08, SD = 14.11), and of the attachment avoidance it was ω_{total} = 0.80 (mean score = 29.93, SD = 10.73).

Statistical analyses

First, the reliabilities of the measures were calculated using the total omega coefficient. For the main analysis, several nested linear regression models were estimated. The dependent variable was COVID anxiety, while gender, age, resilience and attachment anxiety and attachment avoidance were treated as predictors. The psychological variables were standardized. The predictors were divided into 3 blocks [(1) sociodemographics – age, gender, (2) sociodemographics, resilience, (3) sociodemographics, resilience, attachment avoidance, and (4) sociodemographics, resilience, attachment avoidance, and attachment anxiety]. Each one of the 4 blocks is presented as an individual model (see Table 1). The smallest effect size of interest (SESOI) for these models was set to β = 0.10 (based on Cohen, 1988).

Afterwards, the Pearson correlation coefficient was calculated to examine the relationship between general health, mental health (variables measured by the SF-8 Health Survey) and COVID anxiety level. All the statistical analyses were performed in the R software, version 4.6.1 (R Core Team, 2020).

Results

Background characteristics

The background characteristics of the Slovak adolescent sample are presented in Table 2. The data comprised 1,786 participants with the mean age of 16.8 years; 66.3% were female. A significantly higher level of COVID anxiety was reported by girls [$t(10.12) = p < 0.001$, Cohen's d = 0.51]. Students attending art schools (conservatories) also reported higher mean COVID anxiety than students attending other types of high school; however, the difference was not significant. There were no significant group differences found between the counties and size of municipality either. COVID anxiety was positively

TABLE 1 Results of linear regression models assessing the effect of background characteristics, health (SF-8), resilience (BRS) and attachment anxiety and avoidance (ECR-R) on the level of CAS.

Predictor	Model 1		Model 2		Model 3		Model 4	
	Beta	Std. error	Beta	Std. error	Beta	Std. error	Beta	Std. error
Background characteristics								
Gender (male vs. female)	−0.50***	0.05	−0.31***	0.05	−0.26***	0.05	−0.26***	0.05
Age (years)	0.05*	0.02	0.05*	0.02	0.05**	0.02	0.06**	0.02
School								
Art school (conservatory)	reference							
Grammar school	−0.36*	0.16	−0.27	0.15	−0.25	0.15	−0.25	0.15
Vocational school	−0.36*	0.15	−0.26	0.15	−0.25	0.15	−0.26	0.15
Apprenticeship	−0.36*	0.16	−0.27	0.16	−0.27	0.15	−0.28	0.15
Health (SF-8)								
General health			−0.14***	0.03	−0.12***	0.03	−0.13***	0.03
Mental health			−0.20***	0.03	−0.15***	0.03	−0.14***	0.03
Resilience (BRS)					−0.14***	0.03	−0.12***	0.03
Attachment (ECR-R)								
Anxiety							0.09***	0.03
Avoidance							−0.11***	0.02
R^2	0.061		0.140		0.154		0.167	
R^2 difference			0.079		0.014		0.013	

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

correlated significantly with attachment anxiety and significantly negatively correlated with general health, mental health, and resilience (see Table 3).

Predictors of adolescent COVID anxiety

The effect of the background characteristics of the participants, health, resilience and attachment anxiety and avoidance on the level of adolescent COVID anxiety was assessed using nested linear regression models. In Model 1, the background characteristics explained 6.1% of the total variance of the COVID anxiety. In this model, a higher level of the COVID anxiety was associated with female gender, higher age and students attending art schools (see Table 1). After adding health to the model (Model 2), the proportion of the explained variance increased by 7.9%. The effect of general and mental health was significant; a higher score in the health domains was associated with a lower level of COVID anxiety. In Model 3, after adding resilience to the model, the explained variance increased by another 1.4%. Resilience was found to significantly decrease the level of COVID anxiety. In Model 4, attachment anxiety and avoidance were added. Attachment anxiety increased the level of COVID anxiety, while attachment avoidance had a decreasing effect. The final explained variance reached 16.7%. In Models 2, 3, and 4, the type of school lost its significance. In the final model, the significant predictors with an acceptable effect size (above the smallest effect size of interest, SESOI, $\beta > 0.10$) were all associated with a decreased level of COVID anxiety: male gender, higher general and mental health score, and higher resilience and attachment avoidance scores.

Discussion

The main goal of this paper was to explore the relationships between COVID anxiety and its risk/protective factors. Negative predictors (protective factors) of COVID anxiety were being male, higher resilience and attachment avoidance. On the other hand, higher age, worsened general and mental health, and attachment anxiety were risk factors for COVID anxiety. The effect of other variables in the model were negligible (i.e., bellow our SESOI).

The effect of background characteristics

Mental health problems are in general more prevalent in females than in males (e.g., McLean et al., 2011; Baxter et al., 2014; Salk et al., 2017). Females are more vulnerable to developing psychological symptoms, such as anxiety, after a stressful or traumatic event (Tolin and Foa, 2008). The present findings corroborate girls experiencing higher level of COVID anxiety (e.g., Racine et al., 2021; Evren et al., 2022; Mora-Magaña et al., 2022). We also found that adolescents are more likely to be COVID anxious with increasing age. This is in line with other research that has observed higher mental health symptomatology in outcomes such as anxiety or depression in older adolescents (e.g., Nearchou et al., 2020). Regarding the type of school, higher mental health outcomes were observed in music and art students (e.g., Spahn et al., 2004; Vaag et al., 2021). Based on this fact, we used art school students as a reference group when comparing students in COVID anxiety levels; however, this difference was not significant.

The effect of health

In the context of the pandemic, much research has been done on both mental and physical health (e.g., Lakhan et al., 2020; Cui et al., 2022). Research findings based on longitudinal data have typically suggested that people's mental and physical health worsened during the pandemic. Nonetheless, pre-pandemic levels of mental health should also be taken into consideration (e.g., Cui et al., 2022). Several studies have confirmed that these baseline levels were a strong risk factor for mental health difficulties during the pandemic (Czeisler et al., 2020; McGinty et al., 2020; Fancourt et al., 2021; Shanahan et al., 2022). For instance, people who reported higher levels of anxiety even before the pandemic experienced a steeper decline in mental health during the pandemic (e.g., Morales et al., 2022). Even though we do not have the pre-pandemic data, our results suggest that general/mental health is a significant predictor of COVID anxiety. This is debatable, however, as general health could be both the cause and a consequence of perceived COVID related anxiety in adolescents.

TABLE 2 Descriptive characteristics of the data, comparison of COVID anxiety between sociodemographic groups.

Characteristic	*n* (%)	COVID anxiety scale (CAS)	
		Mean (SD)	Value of *p*
Total	1,786 (100)	6.23 (4.98)	
Gender			<0.001
Female	1,184 (66.3)	7.05 (5.03)	
Male	602 (33.7)	4.60 (4.46)	
School			0.082[a]
Art school (conservatory)	42 (2.4)	8.17 (5.69)	
Grammar school	406 (22.7)	6.26 (5.05)	
Vocational school	1,057 (59.2)	6.15 (4.90)	
Apprenticeship	281 (15.7)	6.15 (5.03)	
County			0.024[a]
Trenciansky	530 (29.7)	5.87 (5.00)	
Zilinsky	153 (8.6)	5.51 (4.25)	
Presovsky	372 (20.8)	6.93 (5.25)	
Banskobystricky	158 (8.8)	6.59 (4.81)	
Kosicky	204 (11.4)	6.38 (5.11)	
Bratislavsky	258 (14.4)	6.19 (4.98)	
Trnavsky	64 (3.6)	6.27 (5.11)	
Nitriansky	47 (2.6)	5.21 (4.09)	
Municipality size			0.55
Less than 1,000	290 (16.2)	6.03 (5.13)	
1,000 to 2,000	246 (13.8)	6.07 (4.57)	
2,000 to 5,000	319 (17.9)	6.54 (5.12)	
5,000 to 20,000	351 (19.7)	6.05 (4.89)	
20,000 to 50,000	229 (12.8)	6.21 (4.85)	
50,000 to 100,000	233 (13.0)	6.11 (5.06)	
More than 100,000	118 (6.6)	6.95 (5.41)	

Comparison of groups was performed with *t*-test and one way ANOVA.
[a]There were no significant group differences found with the post-hoc Sheffe test.

The effect of resilience

Resilience as the ability to bounce back from a stressful event is very important in coping with stress (Rutter, 2018), especially in pandemic times (e.g., Seaborn et al., 2022). In general, resilience plays a significant role in mental health. Based on current research, it might be a protective factor for anxiety related specifically to COVID-19 (e.g., Barzilay et al., 2020; Skalski et al., 2021), as well as general anxiety, which also applies during times of pandemic (e.g., Taao et al., 2022). Besides the importance of resilience during stressful times, it is also a relevant predictor of subsequent mental health. According to a Chinese study, a higher level of resilience before COVID-19 significantly predicted a decreased level of depression and anxiety after periods of lockdown (Shi et al., 2022). The protective model of resilience was supported by various researchers, who pointed out some factors that are specifically related to better mental health outcomes. According to Askeland et al. (2020), greater goal orientation, self-confidence, social competence, social support and family cohesion are important for maintaining mental health in adolescents. Similarly, a study on the risk and resilience of adolescents during COVID-19 showed that the most robust associations with teens' distress

TABLE 3 Correlation coefficients between the CAS, age, health (SF-8), resilience (BRS), and attachment anxiety and avoidance (ECR-R).

	Mean (SD)	Correlation coefficient with CAS	Value of *p*
Age	16.79 (1.15)	0.05	0.058
Health			
SF-8 General health	4.28 (1.23)	−0.27	<0.001
SF-8 Mental health	3.10 (1.30)	−0.32	<0.001
Resilience			
BRS sum score	2.97 (0.90)	−0.29	<0.001
Attachment			
ECR-R anxiety subscale	37.15 (14.10)	0.27	<0.001
ECR-R avoidance subscale	39.91 (10.70)	0.04	0.063

CAS, COVID Anxiety Scale; Pearson correlation coefficients are reported.

were with feelings of stress around parents and support received from them (Luthar et al., 2021). Similar results were obtained in a meta-analysis focusing on social support and its role in anxiety and other mental health variables in childhood and adolescence (Rueger et al., 2016; Heerde and Hemphill, 2018). Altogether the data suggest that interventions should attend not just to adolescents' mental health but also that of caregiving adults at home and school. There are strong associations between adolescents' reports of prosocial and health-protective behaviors, as well as significant pathways to COVID-19 prosocial health protective behaviors from parent–adolescent attachment security through adolescents' favorable mental health responses to the pandemic (Coulombe and Yates, 2022). Therefore, interventions aimed at boosting these potential protective factors would be beneficial for adolescents (not only) in pandemic times. Promote the well-being of adolescents (and others) during this difficult crisis should consider the quality of parent–adolescent relationships with fostering adolescent's felt security and safety with attachment-based interventions (review in Mikulincer and Shaver, 2007).

The effect of attachment anxiety and attachment avoidance

Based on our results, attachment anxiety is positively correlated to COVID anxiety. This result is in line with an Italian study, where the relationship between various attachment styles (secure attachment, fearful attachment, dismissing attachment and preoccupied attachment) and COVID anxiety was explored. Fearful and preoccupied attachment were significant positive predictors of COVID anxiety. This could be explained by the fact that people with higher attachment anxiety may tend to be more preoccupied about the pandemic and its related restrictions, which could lead to higher anxiety related to the COVID. In accordance with other research findings, attachment avoidance in our study was negatively correlated with the COVID anxiety (e.g., Moccia et al., 2020; Vismara et al., 2022). This relationship may be explained by the fact that avoidantly attached individuals, who tend to be self-directed and may exhibit less distress in social isolation, may have perceived the pandemic and restrictions as less stressful (in comparison with anxiously attached individuals). On the other hand, even in avoidantly attached people, social distancing and possible long-lasting loneliness related to pandemic restrictions might have an impact on mental health (e.g., Vismara et al., 2022). Based on available studies showing associations between attachment and the psychological impact of the pandemic (e.g., Moccia et al., 2020; Coulombe and Yates, 2022; Vismara et al., 2022), we can assume that secure attachment may play a key role in protection before the emergence of mental health disorders in challenging pandemics times. Securely attached people face stressful events relying on both others' support and their own self-confidence; they have the capacity to mitigate loneliness, which reduces potential anxiety and mental health problems.

Adolescence is an especially sensitive period for brain development (Fuhrmann et al., 2015). Bio-psycho-social stressors related to the pandemic may have an impact on mental health due to neuro-immuno-endocrinological changes induces by stress (de Figueiredo et al., 2021). Since socialization and relationships are in general very important for people in this age, the social isolation and potential long-term feeling of loneliness may be important sources of distress. The rapid systematic review of studies from various pandemics (Loades et al., 2020) showed that the length of loneliness due to pandemic restrictions in particular appears to be a predictor for future mental health. This could be taken into consideration when planning pandemic restriction rules for schools, and children and adolescents should be prevented from taking part in long periods of social distancing.

Based on fact that in adolescence peer relationships begin to increasingly take on critical attachment functions (Allen and Tan, 2016) and the security in peer attachment relationships is related to youths' feeling of connection (Parent et al., 2021), it is also important to focus on peer attachment relationships, because they can serve as an important source of social support, intimacy and strength and serve as a protective factor in situations of chronic stress during a pandemic. Simultaneously, it is important to aim to improve resilience, for example, by using a mindfulness training program (Yuan, 2021) or promoting active coping skills.

Limits and perspectives for future research

The present study has several limitations. The first regards the collected variables. The participants were not asked about any psychiatric diagnosis in their history or their mental health difficulties before the pandemic. They were also not asked if they are/were positive for COVID-19, which could have potentially affected their mental health. In both cases, the information could have helped us describe the anxiety related to COVID-19 more properly. Because our study design is cross sectional and we do not have pre-pandemic data from the same population, we cannot explore causality.

Conclusion

The pandemic had a significant impact on various domains of life, including mental health. Our study aimed to describe anxiety specifically related to COVID-19 and its association among Slovak adolescents. Based on our results, lower resilience, higher attachment anxiety, being a girl and having a higher age are predictors related to higher COVID anxiety. As resilience is a dynamic process and not a stable trait, interventions aimed at boosting resilience and preventing loneliness and social

disconnection might have significant meaning when working with adolescents (not only) in pandemic times. Moreover, fostering secure attachment with parents and peers might promote prosocial behavior and the mental health of adolescents.

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 Scientific Ethics Committee of Palacky University Olomouc. 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

The authors collectively conceived the main idea and design of the study. BJ and NK wrote the theoretical framework and discussion, with input from JH, GS, and JF. BJ performed the statistical analyses, with input from JF. JH, NK, and PT supervised the study. 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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Gender non-binary adolescents' somatic and mental health throughout 2020

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Background: Non-binary gender adolescents are particularly vulnerable and more likely to be exposed to several socio-psychological difficulties and disorders. It is vital to discover and act on the vulnerabilities they encounter. The present study aims to describe the somatic and mental health, affect state, frequency of risk behaviors, victimization and negative psychosocial factors, as well as the personality profiles of non-binary adolescents. In this study the concept of gender non-binary is used and captured respondents who selected "neither of these" as their gender from the possible options (female/male/neither of these).

Materials and methods: Data was collected between September 2020 and February 2021 in Sweden, Morocco, Serbia, Vietnam, and the United States. The cross-sectional, retrospective study utilized the electronic version of the Mental and Somatic Health without borders (MeSHe) survey. From the over 5,000 responses of 15–19-year-old adolescents, 58 respondents identified as being non-binary, and built our study population. Their data was analyzed with descriptive statistic methods.

Results: Close to a fourth of adolescents identifying as non-binary reported the existence of at least one somatic disease. The most prevalent somatic disease was allergies. Almost one-third had suffered from pain either often or all the time in the past 12months. The highest levels of perceived psychological distress were measured using obsessive–compulsive symptoms, depression, and interpersonal sensitivity. The average level of alcohol and drug use during the past 12months was low. About 40% of non-binary adolescents reported having experienced physical abuse, and half of them experienced psychological abuse at some point in their lives. Seventeen percent reported living with adults with alcohol-use problems. Non-binary adolescents' personalities were found to be dominated by high scores in Openness, Neuroticism, and Agreeableness.

Conclusion: This study presents a detailed biopsychosocial picture of a multinational sample of non-binary adolescents. Our study suggests that awareness and support are required from all fields of society, including family, school, healthcare, and educational institutions, for cis-normative culture to progress toward a greater understanding of and respect for gender diversity.

KEYWORDS

affect, adolescents, mental health, non-binary gender, personality, risk behaviors, somatic health, victimization

1. Introduction

People who identify as gender non-binary face significantly different life situations and well-being states compared to those who identify as gender binary. Current research agrees that non-binary gender individuals, especially adolescents and young adults, are particularly vulnerable and more likely to be exposed to several socio-psychological difficulties and disorders (Aparicio-García et al., 2018; de Graaf et al., 2021). Although non-binary gender identities are not new, general awareness of the group and its vulnerabilities has recently increased (Vijlbrief et al., 2020). During the last few decades, gender terminology and identities have diversified and become more visible in the public space (Richards et al., 2016). Consequently, the non-binary gender has become more widely accepted, although this varies across the world. The actual distinction and categorization of the group has a brief history in the public mind, and the same goes for the body of accumulated knowledge on the topic, although research has increased significantly in recent years. Healthcare professionals, especially in psychiatry, have the challenge and responsibility to deepen their understanding and knowledge about non-binary gender adolescents to be able to provide them with appropriate care.

Being familiar with diverse, evolving terminology and its meaning is a prerequisite for improved understanding. The non-binary gender is defined as a form of gender incongruence, which nowadays refers to the difference between the gender assigned at birth and perceived gender identity and expression (Andersen et al., 2020). The term is used as an umbrella concept and covers a spectrum of diverse gender identities, including bi-gender, gender fluid, a-gender, genderqueer, and others (Richards et al., 2016; Liszewski et al., 2018; Paz-Otero et al., 2021). As Richards et al. (2016) note, what unites them is the fact that they are distinct from the gender binary. The inability or unwillingness to identify as either a woman or a man, preferring to experience oneself as someone between the categories, as both, or as someone beyond the conventional gender matrix, means that they transgress and thus challenge established and normalized gender expectations of heteronormativity (Vijlbrief et al., 2020).

In the present study, the concept of gender non-binary was considered the most appropriate to describe those who chose the last option when asked about gender in the survey. The three options provided were "female," "male," and "neither of these." We do not know how the adolescents read the question, but regardless of whether they interpreted it as being biological or as social gender, they chose to stand outside of the established gender dichotomy.

Deviating from prevailing gender norms may have a negative impact on non-binary people's personal development and well-being, especially concerning their mental health, social relations, personal networks, and work possibilities. Besides worsened well-being, they have an increased risk of exposure to harassment and violence (Aparicio-García et al., 2018; Newcomb et al., 2020).

It is essential to discover and act on the vulnerabilities faced by individuals who identify as gender non-binary, especially during adolescence. Many of them must deal with more psychosocial problems than gender binary/cisgender youth, ranging from inequality, prejudice, social stigma, and discrimination to low self-esteem, mental health complaints, and suicide (Richards et al., 2016; Andersen et al., 2020). Although studies differ in their methodological allocations, samples, and reported figures, they largely show similar problematic results regarding non-binary people's social situations and health. For example, compared to gender binary/cisgender people, the levels of depression faced by gender non-binary individuals are disproportionately high (Newcomb et al., 2020; Moore et al., 2021). Recent studies indicate that non-binary adolescents also have an increased chance of being higher on the autism spectrum, having eating disorders, and facing weight manipulations, especially those who are assigned female at birth (Paz-Otero et al., 2021).

One aspect of complexity that characterizes the group is that non-binary people must constantly deal with contradictory processes of inclusion and exclusion (Vijlbrief et al., 2020). The elevated level of victimization of this group means that they are forced to constantly take social risks. For example, when it is impossible to predict how and in what contexts the environment will react to displayed gender identity, a constant readiness to be treated as deviant, as "the other," is forced on them. Gender non-binary youth can never take for granted that they will pass as "normal" and "understandable" in new or unknown contexts. They must constantly expose themselves to the risk of being rejected, excluded, or stigmatized. Living with such constant insecurity can be socially and mentally stressful and increase their level of perceived psychological distress. In addition, an increased prevalence of risk behavior among non-binary adolescents compared to gender binary/cisgender ones has been identified, such as increased drug use and sexual behaviors (Eisenberg et al., 2017). As part of the "coming out" process and attempting to find ways to understand and manage their own life situation, gender non-binary adolescents require extra social and psychological support.

Several studies also show that the types of problems affecting non-binary people have worsened, often significantly, during the

COVID-19 pandemic (Mirabella et al., 2021; Perl et al., 2021). In addition, the group's social support decreased during the pandemic, which can be attributed to the fact that non-binary people are more dependent on self-chosen families compared to other gender minorities. This can result in social isolation, leading to 29% increased mortality (Holt-Lunstad et al., 2015; López-Sáez and Platero, 2022).

To be able to complete previous research the present study aims to describe the somatic and mental health, affect state, frequency of risk behaviors, victimization and negative psychosocial factors, as well as the personality profiles of adolescents who identify as gender non-binary in a multinational study population. Our data carries information about how these adolescents felt, behaved and what type of experiences they had during the year 2020, which was the first year of the COVID-19 pandemic. Therefore, we show the COVID-19 pandemic's influence reported by adolescents on these variables. We also aim, to set the study's descriptive results in the context of knowledge from a dominantly gender binary-normative academic research and shed light on future challenges in the discussion. Our intention is to contribute to the research and knowledge in the field, especially for healthcare professionals, social workers, and teachers who interact with this vulnerable group of young people.

2. Materials and methods

2.1. Study design and procedure

This study has a cross-sectional design and is part of a large international project: the Mental and Somatic Health without borders (MeSHe) project.[1] The countries that are part of the MeSHe project are Sweden, Serbia, Morocco, Vietnam, and the United States. For data collection, self-report instruments on an electronic survey (eMeSHe) were used. They were available in five languages. The participants were secondary high school students, adolescents between the ages of 15 and 19, who were selected by convenient sampling using a non-probabilistic method. First (Fall 2020), we reached out in designated cities of participating countries to high school teachers and heads of schools to contact high school students. However, because of the different restrictions and approaches during the COVID-19 pandemic from some of the participating countries the response rate was very low. In these countries (Sweden, United States, and part of the data in Morocco) students were reached *via* Facebook and Instagram (Winter 2020).

The online survey consists of validated instruments, where adolescents rated their own physical and mental health, their aggressive, antisocial, and self-harm behaviors, their personality, the intensity and frequency of leisure-time physical activity, and their general affect state considering the past 12 months (retrospective). They also answered questions about the extent to which the COVID-19 pandemic changed their behavior, mood, psychosocial functioning, and victimization. The completion of the survey is estimated to take 35–45 min. The eMeSHe survey was open to answers between September 2020 and February 2021.

Participation was voluntary, and the survey was answered anonymously. Ethical permission to conduct the study has been given by each country's respective ethics board, ensuring that the study follows each country's law about not including minors (up to 15 years old) in the study. If the online survey gave rise to any questions or concerns of the participants, the end of the survey contained information and links to relevant support organizations in each participating country.

2.2. Study population

The study population is described in detail in Kerekes et al. (2021b). Briefly, respondents were recruited *via* their schools (in Vietnam and Serbia, part of the data in Morocco, and a minor part of the data in Sweden and the United States) and by social media (Sweden, the United States, and part of the data in Morocco). The national samples were not representative of the nation (see a more detailed description in Kerekes et al., 2021b).

During the study period (September 2020–February 2021), 5,341 complete responses were received on the eMeSHe survey from the five participating countries.

After exclusion of those under or over the approved age-span of the study, the final number of responses was 5,114 (1,534 from Vietnam, 1,108 from Serbia, 1,608 from Sweden, 541 from Morocco, and 323 from the United States), of which 37.0% were male, 61.8% were female, and 1.2% selected "neither of these" gender category. The mean age of the respondents was 16.69 (SD = 1.01).

For the present study, the data of those ($N = 58$) who selected "neither of these" as their gender from the possible options (female/male/neither of these), from here on referred to as gender non-binary adolescents, was utilized. We cannot be sure which gender category (female/male/neither of these) transgender adolescents chose, leaving the possibility that they are included in our non-binary category. We know that there were five adolescents from the 5,114 respondents, indicating in their psychiatric diagnosis transsexuality, and they have identified with male gender. The present study population (gender non-binary adolescents, $N = 58$) had a mean age of 16.48 years (Md = 16, SD = 0.99). The country of residence was distributed as follows, Sweden ($n = 15$, 26%), Morocco ($n = 4$, 7%), Serbia ($n = 7$, 12%), Vietnam ($n = 15$, 26%), and the United States ($n = 17$, 29%).

2.3. Measures

2.3.1. Background questions

The eMeSHe survey starts with some background questions, which include information about gender, age, country of

1 www.meshe.se

residence, the existence of medically diagnosed psychiatric disorders, physical disability, the existence of negative psychosocial factors (living with an adult with an alcohol use problem, living with an adult with a drug use problem, any experience of psychical abuse, or any experience of psychological abuse), and information about the frequency and intensity of generally experienced pain over the past year.

2.3.2. MeSHe health survey

The MeSHe health survey consists of questions through which adolescents report the existence of defined somatic diseases and complaints. It has been previously used in adolescent populations (Zouini et al., 2019a; Kerekes et al., 2021a), and its test–retest variability is proven to be acceptable (Zouini et al., 2019a).

2.3.3. The Godin–Shephard leisure-time physical activity questionnaire

In the Leisure-Time Exercise Questionnaire respondents indicate the frequency of "strenuous," "moderate," and "light," physical activities/exercises performed weekly. A total score is calculated by the following rule: strenuous/exhausting (9 METs × times/week) + moderate (5 METs × times/week) + light (3 METs × times/week; Godin and Shephard, 1985).

2.3.4. Brief symptom inventory

The Brief Symptom Inventory (BSI) is a measure of self-perceived mental or psychological distress (Derogatis and Melisaratos, 1983). It consists of 53 items divided into nine domains (primary symptoms scales). The sum of the responses builds up the General Severity Index (GSI). Each item measures the extent to which the adolescent experiences the given statement. The reliability of the BSI instrument was recently tested in a multinational sample, where it showed acceptable reliability for each primary domain, except that of Hostility (Nguyen et al., 2022). Therefore, in the present study, we report scores on eight of the primary domains (we do not report scores on Hostility). We report the GSI scores without the scores on Hostility as well.

2.3.5. Alcohol use disorder identification test

The World Health Organization (WHO) developed the Alcohol Use Disorder Identification Test (AUDIT) in 1993 (Saunders et al., 1993). It identifies early hazardous and harmful drinking. The instrument contains 10 items rated on a 4-point Likert scale, with a total score ranging from 0 to 40. There are three items that focus on alcohol use, four on dependence, and three about problems related to the alcohol habit. Alcohol problems were previously assessed among the general population (Aalto et al., 2009), the elderly (Aalto et al., 2011), and adolescents (Rumpf et al., 2013; Hasler et al., 2014). On the AUDIT scale there are previously validated gender (male/female) specific cut-offs to identify those with hazardous, harmful, or dependent drinking (Saunders et al., 1993). However, according to our knowledge no cut-off validated to other than male and female genders, and new studies point out that a range of AUDIT cut-off scores appear to be suitable based on cultural contexts, therefore we will not attempt to describe our study populations in this aspect, and we warn the readers to do that. Cronbach's alpha in the present study for AUDIT was 0.78.

2.3.6. Drug use disorder identification test

The Drug Use Disorder Identification Test (DUDIT) contains 11 questions that capture the frequency of drug use during the last year using self-reported data. Items from 1 to 9 are rated on a 5-point Likert scale, while items 10 and 11 are rated on a 3-point Likert scale. The DUDIT total score is calculated using the sum of all items; scores range between 0 and 44. DUDIT has been previously used in the adolescent population (Hillege et al., 2010; Hasler et al., 2014). On the DUDIT scale there are previously validated gender (male/female) and even culture specific cut-offs to identify those with drug use dependence in the different countries. However, no cut-off validated to other than male and female genders, and according to our knowledge no cross-cultural cut-off exist to us in our multinational sample. Therefore, we will not attempt to describe our study populations in this aspect, and we warn the readers to do that. Cronbach's alpha in the present study was 0.94.

2.3.7. Adolescent-adapted life history of aggression

The Adolescent-Adapted Life History of Aggression (AA-LHA) is a version of Coccaro's Life History of Aggression self-reported scale (Coccaro et al., 1997). It is adapted for a multinational, adolescent population (Stevanovic et al., 2022). It measures the occurrence of aggressive and antisocial behaviors from the age of 13. In a recent study, we analyzed cross-cultural validity and the optimal structure of the LHA, which resulted in the AA-LHA (Stevanovic et al., 2022). The AA-LHA contains nine questions that can be divided into two subscales, the Aggression subscale with five questions, and the Antisocial behaviors/Consequences subscale with four items.

2.3.8. COVID-19-related questions

The eMeSHe survey was completed with COVID-19-related questions at the end of 2020. These include items about changes caused by the COVID-19 pandemic in adolescents' risk behaviors, general well-being, and victimization. It also includes questions about the frequency of victimization in the respondents' whole lives. Detailed descriptions of the questions can be read at Kerekes et al. (2021b). In the present study, we use, from these questions, the description of risk behaviors (alcohol and drug use), norm-breaking behaviors (as a complement to the information gathered using other instruments, such as AUDIT, DUDIT, and AA-LHA), and the frequency of victimization during the COVID-19 pandemic and in the overall perspective of life.

2.3.9. Positive and negative affect schedule—Expanded form 30 items

The Positive and Negative Affect Schedule-Expanded form 30 items (PANAS-X30) (Watson et al., 1988) is an instrument that

allows participants to rate the degree to which they experienced the listed 30 feelings over the past year. The positive affect scale consists of 15 adjectives, 10 of which describe high-arousal experiences and five of which describe low-arousal experiences, such as feelings of energy, strength, inspiration or calmness and serenity. The negative affect scale, also consisting of 15 adjectives, 10 with high-arousal experiences and five with low-arousal experiences, describes undesirable inner experiences such as anger, irritability, guilt, shame, or nervousness.

2.3.10. Big five inventory

The Big Five Inventory (BFI) comprises of 44 short-phrase items that measure the degree of five scales. These are Extraversion (E; 8 items), Agreeableness (A; 9 items), Conscientiousness (C; 9 items), Neuroticism (N; 8 items), and Openness (O; 10 items). Participants were asked to express their degree of agreement or disagreement with each item presented on a 5-point Likert scale, ranging from disagree strongly to agree strongly. Examples of items from each of the scales are "Is talkative" (Extraversion), "Tends to find fault with others" (Agreeableness), "Does a thorough job" (Conscientiousness), "Is depressed, blue" (Neuroticism), and "Is original, comes up with new ideas" (Openness) (John and Srivastava, 1999).

2.4. Analyses

Descriptive statistics with minimum and maximum scores, mean (M), median (Md), standard deviation (SD), standard error (SE) and frequencies (%) with 95% confidence interval (CI) were used at both the scale and item levels. The Chi^2 test was used to determine the level of significance in the comparison of negative and positive affect levels within the non-binary adolescent group. The significance level was set at $p < 0.05$. All analyses were performed using SPSS version 28.

3. Results

3.1. Prevalence of somatic complaints and pain

In the multinational sample of adolescents identifying as gender non-binary, the most prevalent somatic complaints were allergies (31%), asthma (21%), and migraines (9%) (Table 1). Interestingly, the proportion of adolescents who indicated that they do not know if they have a specific disease or not was the highest in these three diseases and skin and celiac diseases (Table 1).

There were 38 adolescents (53.5% of the study population) who responded to each of the questions about somatic diseases with a yes or no. More than half of these (52.6%, $n = 20$) did not indicate any somatic complaints, 23.7% ($n = 9$) reported having one disease or complaint, 18.4% ($n = 7$) reported having two, 2.6% ($n = 1$) had three, and 2.6% ($n = 1$) had four coexisting somatic diseases.

Problems with diarrhea and constipation for a period longer than 14 days had a prevalence of 7% (CI = 2.2–19.2%) and 16% (CI = 8.6–31.4%), respectively, and in each category an additional 13.8% ($n = 8$, CI = 2.6–2.54%) indicated that they do not know.

Almost one third (28%, CI = 17–41%) of adolescents reported suffering from pain often or all the time, 53% (CI = 39–66%) reported pain sometimes and rarely, while only 19% (CI = 10–32%) indicated that they never experienced pain over the past 12 months. The average level of pain intensity in the sample was 3.98 (SD = 2.36, SE = 0.33, Md = 4.0). The different types of pain reported were, for example, headache, lower back pain, joint pain, and stomach pain.

Twelve percent ($n = 7$, CI = 5–23%) of the adolescents reported that they had a physical disability that prevented them from being physically active. The mean value of weekly leisure time activity was 33.1 (SD = 33.6, SE = 4.61, Md = 22, range from 0–136).

TABLE 1 Prevalence of somatic diseases in the multinational sample of gender non-binary adolescents (N=58).

	n	Yes (*n*)	95% CI	I do not know % (*n*)	95% CI
Cancer	58	0.0% (0)	0.0–6.2%	1.7% (1)	0.0–9.2%
Epilepsy	57	3.5% (2)	0.4–12.1%	0.0% (0)	0.0–6.3%
Migraine	57	8.8% (5)	2.9–19.3%	10.5% (6)	0.4–21.5%
Diabetes	57	1.8% (1)	0.0–9.4%	1.8% (1)	0.0–9.4%
Celiac disease	58	1.7% (1)	0.0–9.2%	6.9% (4)	1.9–16.7%
Thyroid disease	54	1.9% (1)	0.0–9.9%	1.9% (1)	0.0–9.9%
Rheumatological disease	58	0.0% (0)	0.0–6.2%	1.7% (1)	0.0–9.2%
Skin diseases	57	7.0% (4)	1.9–17.0%	10.5% (6)	4.0–21.5%
Tuberculous	57	0.0% (0)	0.0–6.3%	0.0% (0)	0.0–6.3%
Asthma	58	20.7% (12)	11.2–33.4%	6.9% (4)	1.9–16.7%
Allergies	58	31.0% (18)	19.5–44.5%	12.1% (7)	5.0–23.3%

CI, Confidence interval.

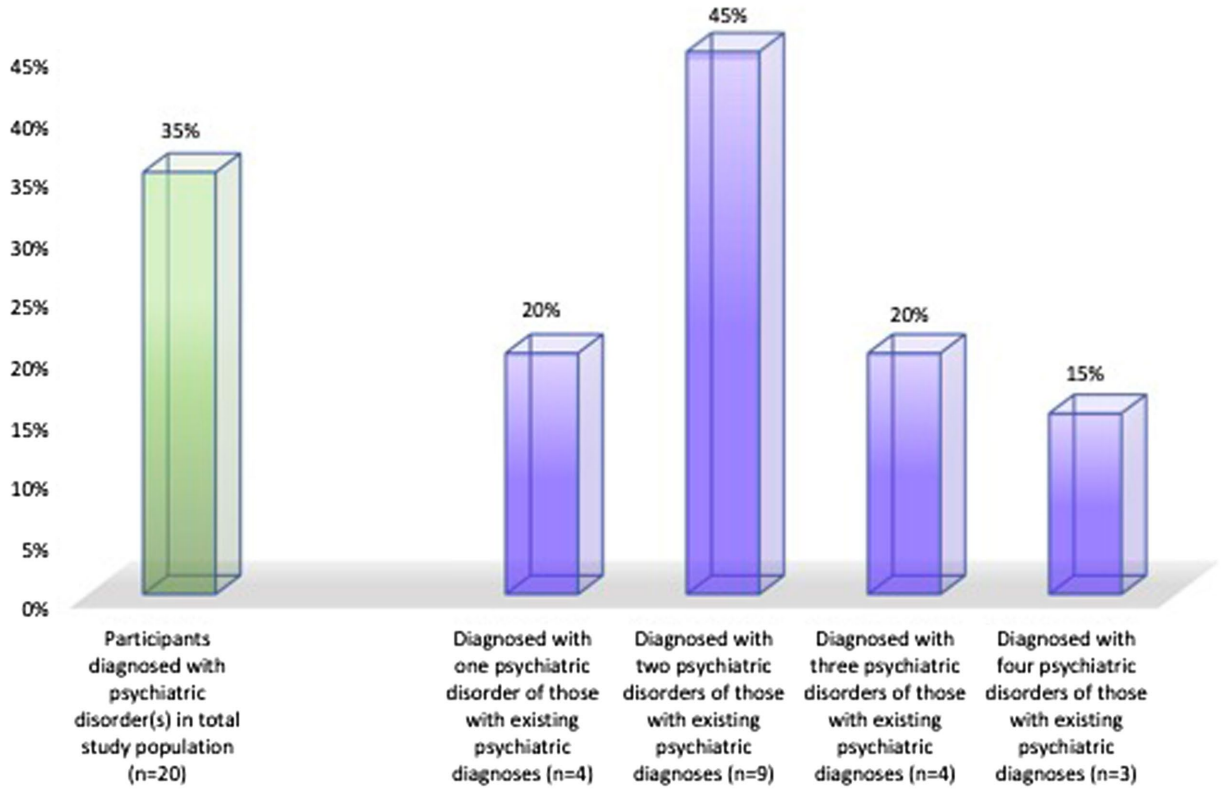

FIGURE 1
The prevalence of those with at least one psychiatric disorder (green column) in the whole study population (*n*=55), and the prevalence of one, two, three and four psychiatric diagnose (purple columns) within those with any psychiatric diagnosis (*n*=20).

TABLE 2 The level of psychological distress among non-binary adolescents (*N*=58).

Domain	*n*	*M* (SD/SE)
Somatization	54	1.30 (1.08/0.15)
Obsessive compulsive	54	2.11 (1.22/0.17)
Psychoticism	55	1.71 (1.13/0.15)
Depression	55	2.11 (1.17/0.16)
Interpersonal Sensitivity	55	1.94 (1.26/0.17)
Phobic anxiety	56	1.51 (1.14/0.15)
Anxiety	56	1.78 (1.17/0.16)
Paranoid Ideation	57	1.60 (1.22/0.16)
GSI (without Hostility)	46	1.60 (0.95/0.14)

M, Mean; SD, standard deviation; SE, standard error.

3.2. Prevalence of psychiatric disorders

Over half (65%, $n = 35$, CI =46–73%) of the adolescents had never been diagnosed with a psychiatric disorder. The remaining 35% ($n = 20$, CI = 27–54%) had been diagnosed with psychiatric disorder. These were most often anxiety disorders (80%, $n = 16$), depression (75%, $n = 15$), neurodevelopmental disorders such attention deficit hyperactivity disorder (ADHD) and/or autism spectrum disorder (ASD; 35%, $n = 7$), obsessive compulsive disorder (OCD; 20%, $n = 4$), post-traumatic stress disorder (10%, $n = 2$), and one adolescent each indicating self-harm and bipolar disorders. Of these adolescents, 80% ($n = 16$) had more than one coexisting psychiatric diagnosis (Figure 1).

The prevalence of adolescents currently taking prescribed (any, including those prescribed for somatic diseases) medication was 26% (CI = 16–40%).

3.3. The level of perceived psychological distress

The overall psychological distress level (GSI) was 1.60 (SD = 0.95, SE = 0.14, min–max: 0–4) in the study population. The highest level of distress was measured in the obsessive–compulsive symptoms of BSI (symptoms such as trouble remembering things, feeling blocked in getting things done, having to check and double check what you do, difficulty in making decisions, your mind going blank, trouble concentrating) and depression followed by interpersonal sensitivity domains. The lowest score was reached in the somatization domain (Table 2).

TABLE 3 Self-reported risk behaviors among non-binary adolescents (*N*=58).

	n	*M* (SD/SE)	Md	Min–max
AA-LHA Aggression	55	9.82 (6.49/0.87)	9	0–25
AA-LHA Antisocial behavior/ Consequences	57	1.25 (2.33/0.31)	0	0–9
AUDIT total	47	2.59 (4.33/0.63)	0	0–22
DUDIT total	50	1.08 (3.46/0.49)	0	0–21

AA-LHA, Adolescent Adjusted Life History of Aggression; AUDIT, Alcohol Use Disorder Identification Test; DUDIT, Drug Use Disorder Identification Test, *M*, Mean; Md, Median; SD, standard deviation; SE, standard error.

TABLE 4 Positive, negative, activated and deactivated affect among non-binary adolescents.

	Negative		Positive		Value of *p*
	n	*M* (SD/SE)	*n*	*M* (SD/SE)	
High arousal	52	26.63 (10.15/1.41)	54	24.94 (8.64/1.18)	0.43
Low arousal	54	16.68 (5.17/0.70)	55	12.33 (5.72/0.77)	<0.001
Total	50	43.38 (14.92/2.11)	54	37.24 (13.50/1.84)	0.05

M, Mean; SD, standard deviation; SE, standard error.

3.4. Risk behaviors

Over 60% (62.1%; $n = 36$ on the COVID-related questions and 61.8%; $n = 34$ on AUDIT) of adolescents indicated that they have never used alcohol. Twelve adolescents (20.7%) indicated that their usage did not change after the outbreak of the COVID-19 pandemic. Three (5.1%) indicated that their alcohol consumption decreased while seven (12.1%) indicated that their alcohol use increased. The majority (87.9%; $n = 51$ on the COVID-related questions, and 92%; $n = 52$ on the DUDIT) indicated that they have not used drugs during the past 12 months or ever. Two (5.2%) adolescents' illegal drug use did not change after the COVID-19 outbreak, while three (1.7%) reported greatly decreased use and while two (5.2%) reported greatly increased use.

The average level of the AUDIT score ($M = 2.59$, SD = 4.33, SE = 0.63, Md = 0) and DUDIT score ($M = 1.08$, SD = 3.46, SE = 0.49, Md = 0) was low (Table 3). The average frequency of aggressive behaviors since they turned 13 years of age (on the AA-LHA Aggression subscale) was 9.82 (SD = 6.49, SE = 0.87, Md = 9), and the frequency of antisocial behavior (on the AA-LHA Antisocial behaviors/Consequences subscale) was 1.25 (SD = 2.33, SE = 0.32, Md = 0; Table 3).

3.5. The presence of negative psychosocial factors and victimization

About 20% ($n = 11$) reported that someone had physically abused them at least once in the past 12 months. This included being hit, kicked, or subjected to other forms of violence that caused injuries without the need of hospitalization. 40% ($n = 23$) reported that they have experienced physical abuse (being pushed, kicked, beaten, slapped, etc.) in their life. A fourth (25%, $n = 16$) have been threatened and felt seriously afraid in the past 12 months, while half (50%, $n = 29$) indicated that they have experienced psychological abuse (have been threatened, forced to do something that felt wrong, been violated by humiliating and insulting words) at some point in their life. One fourth (25%, $n = 14$) of them reported that they had been grouped or touched in a sexual manner without their consent. A fourth (25%, $n = 14$) reported that someone had written offensive things about them online, and 16% ($n = 9$) reported that someone had uploaded pictures or videos about them without their consent on the internet.

Considering negative psychosocial factors in their micro-environment (family) 17% ($n = 10$, CI = 9–29%) reported living with adults with an alcohol use problem. Four of them (40%) also reported experiencing both physical and psychological abuse, and another 40% reported no experience of physical or psychological abuse. Two did not respond to the question about abuse. One adolescent reported living with an adult with a drug use problem. This adolescent also reported experiencing of physical and psychological abuse.

3.6. Prevalence of positive and negative affect

Adolescents reported a significantly higher level of negative than positive affect states ($p = 0.05$). The differences focused on low arousal emotions ($p < 0.001$) (Table 4).

3.7. Personality profiles

Non-binary adolescents had an average score on the Openness domain at 3.83 (SD = 0.72), the Conscientiousness domain at 2.94 (SD = 0.67), the Extraversion domain at 2.8 (SD = 0.84), the Agreeableness domain at 3.52 (SD = 0.55), and the Neuroticism domain at 3.6 (SD = 0.83). This was according to the Big Five Inventory (Figure 2).

4. Discussion

Most of the previous research studied the societal and mental health impacts being gender non-binary had on individuals (Richards et al., 2016; Eisenberg et al., 2017; Liszewski et al., 2018;

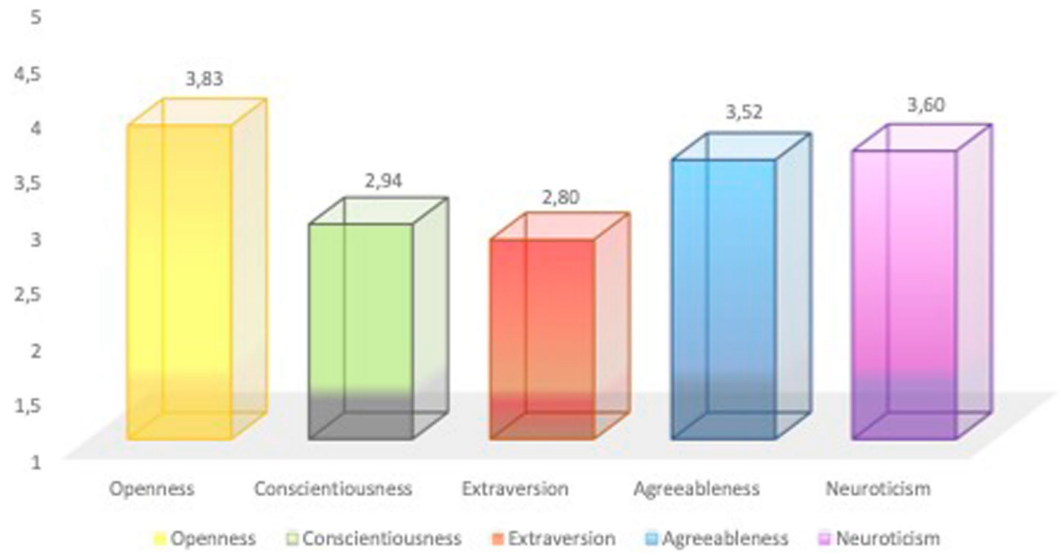

FIGURE 2
The levels of personality domains captured by the Big Five Inventory among gender non-binary adolescents (*N*=52).

Frost et al., 2019; Newcomb et al., 2020; Surace et al., 2021). According to our knowledge, we have yet to find a study that provides a more holistic picture of somatic and mental health, affect state, frequency of risk behaviors, the prevalence of negative psychosocial factors, and the level of victimization while capturing non-binary adolescents' personality profiles. The present study offers all these without claiming a complete description of the biopsychosocial characteristics of these adolescents. To be able to contribute to the field of knowledge at this stage, in the following discussion we problematize the findings in relation to previous research mainly based on gender binary data.

4.1. Somatic health and perceived pain

The present study's results showed that more than half of the adolescents did not indicate any somatic diseases, while about 25% indicated only one. The rest reporting having two or more coexisting somatic diseases. One third (31, 95% CI: 19.5–44.5%) of the adolescents reported having existing allergies and about one fifth (21, 95% CI: 11.2–33.4%) reported having asthma. In the interpretation of these results, we must point out that the confidence intervals were wide in our study, based on the considerable small study population, therefore future studies with higher sample size may find that the prevalence of these somatic diseases are closer to those found in binary adolescent population, but it may deviate even more drastically. A new study described the prevalence of asthma and allergies in a multinational sample of 15–19-year-old adolescents with over 4,800 male and female respondents (unpublished data from the MeSHe project). In that study, 24% of adolescents report having allergies and 10% report having asthma. These results indicate that possibly a higher proportion of gender non-binary adolescents suffer from these inflammatory conditions. Asthma and allergies, including food allergies, have increased over the past half decennium and became the most prevalent childhood chronic illnesses in developed countries (Locksley, 2010). While there is an element of genetic susceptibility behind these diseases, nobody questions the strong impact of the environment resulting in such increasing prevalence. Perceived stress due to several mechanisms can cause an imbalance in the immune system and lead to allergic reactions (Dave et al., 2011) or the exacerbation of asthma (Chen and Miller, 2007). It is also seen that allergies increase the odds of depression, anxiety, and personality and stress disorders in adult populations (Kelly et al., 2019). This is in concordance with our findings (discussed in detail in the next sections) that these psychiatric disorders are the most commonly reported in our study population.

When asking adolescents about how often they experienced pain during the past 12 months, 28% reported suffering from pain often or all the time. It most often consisted of headaches, lower back pain, joint pain, and stomach pain. This is comparable with a Norwegian study of 14–15-year-old adolescents that found that 29% suffered from prevalent, persistent pain (Mikkelsen et al., 2021). The median intensity of the pain in the Norwegian study was two (between 0 and 10), while in our study it was four (between 0 and 10). This suggests that while a similar proportion of adolescent report pain either often or all the time, those who identify as gender non-binary perceive greater intensity of pain. It was shown that adolescents who report persistent pain also have lower self-esteem, report higher level of perceived stress and loneliness, often complain about sleep problems, have more school absences, and overall experience a lower level of health-related quality of life as compared to adolescents with shorter pain

durations (Mikkelsen et al., 2021). Increased pain intensity may worsen all these problem areas. In our study, 19% of the adolescents reported no experience of pain. This is in contrast with the Norwegian study where 24% of adolescents reported no pain. To summarize, a greater proportion of gender non-binary adolescents report pain of higher intensity than cisgender adolescents. The increased intensity of pain in our study group could be explained by the prevalence of physical disabilities in the sample (12%). This was double the figure reported in 2003 in the United States (5.8%) (Merrick and Carmeli, 2003). Physical disabilities are generally coupled with chronic pain (de la Vega et al., 2018). Therefore, we hypothesize that non-binary adolescents who are in pain have a lower health-related quality of life. In our study, pain intensity positively correlated with the level of psychological distress and negatively correlated with the level of alcohol use, which could suggest that alcohol may be used as self-medication to alleviate pain and psychological distress symptoms. This can be related to previous research concerning psychological distress and alcohol use among adolescents who identify beyond gender dichotomy (Livingston et al., 2016). Alcohol may be used as a strategy to cope with the negative aspects of life such as the stress of being a minority (Mereish, 2019). However, the correlation between pain, psychological distress, and alcohol is an interesting area for further research.

4.2. Psychological distress, mental health

Research shows that gender non-binary adolescents suffer from poor mental health and challenging living conditions to a much greater extent than the general population does (e.g.: Eisenberg et al., 2017; Chew et al., 2020; Paz-Otero et al., 2021; Surace et al., 2021). In the present study, a third of the study population (35%) reported the existence of at least one psychiatric diagnosis. This seems to be much higher than in cisgender males and females in a sample of Swedish adolescents between 15 and 19 years of age. Of the 1,594 respondents, 312 (19.6%) reported that they have at least one psychiatric diagnosis (unpublished data from the MeSHe project). The most common disorders in non-binary adolescents were depression and anxiety disorders (75% and 80% of cases, respectively vs. 46% and 51% found in the general Swedish population), followed by neurodevelopmental disorders (35% vs. 41% found in the general Swedish population), obsessive–compulsive behavior (20% vs. 3.7% found in the general Swedish population), post-traumatic stress disorder (PTSD; 10% vs. 6.8% found in the general Swedish population), self-harm and bipolar disorder (5% and 5% vs. 0.7% and 1% found in the general Swedish population). This data suggests that the prevalence of obsessive–compulsive disorder is remarkably increased in gender non-binary adolescents, and they also exhibit an increased prevalence of depression, anxiety disorders, self-harm, PTSD, and bipolar disorders. On the other hand, the prevalence of neurodevelopmental disorders (ADHD and ASD) are somewhat lower than a Swedish general population sample of adolescents of the same age (unpublished data). When assessing information on the type and level of psychological distress in our study population, the results were in accordance with the findings about psychiatric diagnoses. Such as, the most prominent distress factors in the non-binary adolescent's life could be obsessive compulsive symptoms of BSI, depression, and interpersonal sensitivity. It is worth noting that BSI's primary domains are not based on the DSM criteria. Therefore, for example, obsessive compulsive symptoms include problems such as "trouble remembering things, your mind going blank, trouble concentrating, difficulty in making decisions," beside the more typical symptom of "having to check and double check what you do, difficulty in making decisions, your mind going blank." Impaired decision making has not only been detected in participants with OCD, but it has been suggested that it can be a core feature of OCD (da Rocha et al., 2011). There is also evidence toward neuropsychological deficits in pediatric OCD populations considering visual memory and spatial working memory (Andrés et al., 2007; Bernardes et al., 2020). While some people with OCD complain about having difficulties concentrating, there is no demonstrated neurobiological overlap between OCD and ADHD. The overlap may be as simple as it being very difficult (if possible) to give full attention to more than one thing at the same time. While there are an increasing number of studies showing the co-existence of ADHD and OCD in pediatric samples, these studies explain their coexistence based on the deficit in impulse inhibition (see Brem et al., 2014).

BSI has been used over the past years to assess the psychological distress level in adolescents in the general population in Morocco (Zouini et al., 2019c) and Sweden (Kerekes et al., 2021a). In both the Moroccan (data collected 2013) and Swedish studies (data collected 2018), it has been shown that adolescents scored the highest on the obsessive–compulsive domain, which was followed by anxiety and interpersonal sensitivity or paranoid ideations. While the pattern was similar in both the countries, the level of psychological distress differed. Mzadi et al. (2022) showed that during the COVID-19 pandemic, the level of psychological distress significantly increased in the paranoid ideation and depression domains in Moroccan adolescents. As our data collection happened ~1 year into the pandemic, these results should indicate that gender non-binary adolescents report a similar pattern, but possibly different level of psychological distress, as gender binary adolescents. A recently published study from the MeSHe project including gender binary, 15–19-year-olds from the same multinational population, reports that during the pandemic, adolescents in different nations reported the highest psychological distress in similar patterns. Each nation's sample scores demonstrated obsessive compulsive domains and interpersonal sensitivity within the three highest scores, followed by paranoid ideation and depression as nation-specific dominators (Sweden: depression, obsessive compulsive symptoms, interpersonal sensitivity; Morocco and Serbia: paranoid ideations, obsessive compulsive symptoms, interpersonal sensitivity; Vietnam: interpersonal sensitivity, obsessive compulsive symptoms, depression; and the United States:

obsessive compulsive symptoms, depression and interpersonal sensitivity). Most importantly, while the pattern is similar, the level of distress differed between samples (American and Moroccan adolescents reported significantly higher psychological distress levels than those from Serbia, Sweden, and Vietnam; Nguyen et al., 2022). Our study population reported higher distress levels in obsessive compulsive symptoms, depression, and interpersonal sensitivity and in the General Severity Index than each of the other countries' gender binary populations, except the United States. Generally, these results suggest that gender non-binary adolescents have similar stressors in their lives. They responded similarly to the COVID-19 pandemic as their gender binary counterparts, but with an increased level of distress.

4.3. Risk behaviors and aggression

In the present study, we assessed alcohol and drug use habits with two-two separate measures. Confirming the validity of each of the responses showed similar results. Over 60% of non-binary adolescents reported that they never used alcohol (on AUDIT and on COVID-related questions) and over 90% indicated that they have never used illegal drugs (on DUDIT and on COVID-related questions). These proportions are very similar to those found in a multinational sample of 15–19-year-old gender binary adolescents (Kerekes et al., 2021b). However, they differ from results obtained by Newcomb et al. (2020), who found high rates of risk behaviors such as substance use, in the population of $n = 214$ transgender and gender diverse adolescents in Chicago. The results of the present study showed fairly low levels of drug and alcohol use.

Importantly, in the present study, 12.1% indicated increased alcohol use and 5.2% indicated increased illegal drug use versus only 5.1% who indicated decreased alcohol consumption and 1.7% decreased their illegal drug use after the outbreak of the COVID-19 pandemic. Compared to the proportions in which these changes happened in gender binary adolescents, alcohol consumption: 10.2% increased and 13.3% decreased; illegal drug use: 3.2% increased and 2.1% decreased (Kerekes et al., 2021b), we can conclude that a greater proportion of non-binary adolescents who already used substances responded with increased use than decreased use. This was also higher compared to the proportion of gender binary adolescents who indicated increased substance use as a consequence of the pandemic. Risk behaviors such as using alcohol or drugs can be seen an example of coping with psychological distress. Hunt et al. (2021) found increased levels of psychological distress and lower psychological resilience among gender-diverse adolescents during the COVID-19 pandemic than their gender binary counterparts.

Beside substance use, we measured aggressive and antisocial behaviors demonstrated since the respondents turned 13 years old. The measure we used (AA-LHA), however, proved to not have cross-cultural validity, and researchers were warned not to use it for the comparison of aggressive and antisocial behaviors between genders (Stevanovic et al., 2022). Interestingly, the Hostility domain of the BSI was the only one that did not show validity in cross-cultural and cross-gender analyses (Nguyen et al., 2022). Therefore, we do not attempt to do any comparison with previous publications regarding non-binary adolescents' aggressive and antisocial behaviors.

4.4. Victimization and negative psychosocial factors

Information about victimization was also assessed with independent measures in our study. Adolescents completed questions about both the frequency of different types of victimization in their life and how it has changed during the pandemic (as part of the COVID-related questions), but they also were asked in the first section of the MeSHe survey to respond if they ever experienced physical or psychological abuse. Half of the respondents indicated that they had experienced psychological abuse and 40% of indicated that they had experienced physical abuse at some time in their life. The experience of physical and psychological abuse had previously been shown to vary between genders, cultures, and the time of assessment (Kerekes et al., 2021a). While Kerekes et al. explained the high proportion of female adolescents (47%) reporting experiences of psychological abuse with the social environment in Sweden of the time (the "me too" movement in 2018), we can conclude that the proportion of non-binary adolescents reporting physical and/or psychological abuse is higher than reportage from any culture, at any time, with any gender adolescents (Zouini et al., 2019c; Kerekes et al., 2021a). Previous studies confirm that gender non-binary adolescents are much more vulnerable to victimization, discrimination, and bullying than the general population (Richards et al., 2016; Eisenberg et al., 2017; Rimes et al., 2019; Newcomb et al., 2020).

During the pandemic, 20% reported that they were physically abused compared to 10.3% in the multinational sample of gender binary adolescents, 25% reported that they were grouped or touched in a sexual manner without their consent compared to 12.2% of the gender binary people surveyed, and the same amount, 25%, were threatened and felt seriously afraid compared to 11.5% of the gender binary population (Kerekes et al., 2021b). In cyberbullying, 25% reported that someone had written offensive things about them online compared to 12.5% in the gender binary population and 16% compared to 8.9% in gender binary (Kerekes et al., 2021b) reported that someone had uploaded pictures or videos about them without their consent on the internet. This data shows an at least doubled risk of being victimized as a gender non-binary adolescent. This can be related to Rimes et al. (2019), who concluded that gender non-binary and binary transgender adolescents experienced higher levels of domestic violence and childhood sexual abuse than the gender binary population. The prevalence of health risk behaviors among transgender and gender non-conforming youths was described in Eisenberg et al. (2017), where in addition to suicidal ideations,

they demonstrated greater risk of emotional stress and experiences of bullying with higher risk behaviors and lower protective factors compared to gender binary/cisgender youths.

While adolescence is a period of ontogenesis when individuals increase independency from their family/parents, the impact of the microenvironment (family) should be considered, especially during the COVID-19 pandemic when restrictions forced adolescents all over the world to stay home. In our study population, 17% reported living with adults with alcohol use problems, 40% also reported experiences of both physical and psychological abuse, while 40% reported experiencing neither physical nor psychological abuse. One adolescent reported living with an adult with a drug use problem and also reported experiencing of physical and psychological abuse. In previously published prevalence studies of parental alcohol and drug use problems, 0.4% of gender binary adolescents reported parental alcohol use problems in Sweden in 2018 (Kerekes et al., 2021a). 8.8% reported so in Morocco in 2013 (Zouini et al., 2019b,c). The results are thus dramatically higher in our study population. In terms of support from family and friends, the group of transgender and gender non-binary adolescents distinguished themselves from the cisgender population in terms of receiving less support from family and friends (Aparicio-García et al., 2018).

4.5. Affect states and personality profiles

Using the circumplex model of Watson and Clark (1994), we could detect that adolescents who identify as gender non-binary identity have a significantly higher level of negative than positive, mainly low-arousal, affect states. They indicated the dominance of feelings of sadness, guilt, and shame in their lives, which is in concordance with Aparicio-García's et al. (2018) study, where non-binary adolescents rated higher levels of being unhappy, feeling isolated, and having thoughts of suicide than adolescents who identify as transgender or cisgender. If high positive affects combined with low negative affects result in greater subjective well-being experiences (Jayawickreme et al., 2012), than we can conclude that our study population, with high negative affect in combination with low positive ones, may indicate unwellness in non-binary adolescents. The high level of negative affects reported in our study mirrored the high levels of self-rated depression and interpersonal sensitivity. The dominance of negative emotions in the adolescents' lives also mirrored their personality profiles. We found that non-binary adolescents can be described with the representative personality traits of Openness and Neuroticism, which are closely followed by Agreeableness. The previously presented results, high scores of negative emotions, dominance of obsessive compulsiveness, depression, and interpersonal sensitivity symptoms, often present diagnoses of anxiety, depression, OCD, PTSD, and self-harm disorders, high levels of victimization and high frequencies of familiar negative psychosocial factors. The high score on Neuroticism is thus the easiest to understand. People with high Neuroticism have high scores of anxiety, depression, anger, self-consciousness, and emotional lability (Duggan et al., 1990; Boyce et al., 1991). In the comprehensive study by Weisberg et al. (2011), it is pointed out that gender differences are difficult to notice in the primary domains of the Big Five, however they exist in Neuroticism, Agreeableness, and Extroversion (but not Openness) when comparing male and female genders. Gender differences decrease with increasing age for Neuroticism but increase for Agreeableness (Weisberg et al., 2011). This may suggest that our study population has a unique composition of personalities dominated by intellectual curiosity, creative imagination, and an appreciation of aesthetic experiences, in combination with anxious depressive personality traits and emotional lability, flavored with altruism, empathy, and kindness. This personality profile can be a productive and important part of society, and when protective instances are applied for everyday safety, can serve to increase the existing level of understanding and respect for adolescents who do not identify with the male or female genders.

5. Future challenges: Challenges for academic studies and challenges for care professionals, social workers, educators, and families

Multidisciplinary mental health professionals and teams are needed, as well as clinical guidelines and treatment protocols, to meet the complexity of non-binary people's situations and needs (Richards et al., 2016). The results and discussion of this study indicate the level, but not the pattern of psychiatric distress, and the prevalence, but not the type of psychiatric disorders that differ in non-binary and gender binary adolescents. A general adaptation, special development of care, and deeper and broader knowledge of non-binary adolescents are thus needed. More studies are required with an increased focus on a more diversified picture in terms of gender identification in collaboration with local and national organizations. Furthermore, the development of appropriate support measures in healthcare, education systems, authorities, as well as voluntary organizations are required. The results strengthen the increased demands that exist for faster adaptation and development of care and social support in accordance with non-binary individuals' experiences and needs (Moore et al., 2021). This also applies to their micro- and meso-environments, where the support of families and friends is important for adolescents' psychological health and resilience (Weinhardt et al., 2019).

In academic methodologies, the potential consequences of offering only two genders to choose from, when gender identity is requested in studies, should be considered. Even if the purpose of the study determines the design of alternative gender definitions, self-identification can be recommended. The existence of a gender category to identify with is essential for many people, at least if categorization processes are fundamental to the social organization and understanding of both individuals and society at large. Research processes establish social categorization, so not letting a respondent self-identify their gender signals that a growing number of people will be defined as non-existent and incomprehensible, which will be perceived as offensive (Butler, 1990, 1993). It also means that knowledge about gender variations will remain invisible. Furthermore, it might serve to stabilize, normalize, and reproduce the bi-gendered norms that still dominate society along with its negative effects.

6. Strengths and limitations

One of the greatest strengths of the present study is its study population. We focused solely on the group that actively defined themselves as neither male nor neither female gender (not those who did not respond to the question about gender) in a multinational sample of 15–19-year-old adolescents. The prevalence of adolescents identifying with genders other than strictly male, or female is increasingly recognized in today's societies (Richards et al., 2016). Since this group differs on several points from the other two gender groups, it is of essential importance to increase our knowledge about their well-being, vulnerability, and strength and potential in society. Kerekes et al. (2021b). However, the strength of the study population also contains a weakness, the weakness is the definition of the concept of non-binary gender. In this study, we have categorized those, who selected "neither of these" as their gender from the possible options (female/male/neither of these), as non-binary. Transgender or gender fluid categories could not be identified as specific categories based on the information we have collected, which is a limitation in the design of the study.

While the low number of participants could be considered as a limitation of the study, which is reflected in the high confidence intervals of the population proportions, it mirrors the actual prevalence of gender non-binary people from a multinational, general population sample of almost 6,000 adolescents. Therefore, the use of a multinational and general population sample is also a strength of the present study. In addition, the low prevalence of non-binary participants shows the importance of taking groups consisting of a few people seriously, since otherwise they risk being neglected by statistics and consequently excluded in research. The use of self-reported measures could be considered both a strength and a limitation. An undoubted limitation of the study is its cross-sectional design, which prevents analyses of causality between emerging aspects.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by each participating country's relevant national or institutional ethical board, which are: Sweden: National Review Board (Drn: 689-17 and 2020-03351); Serbia: The Ethics Committee of the Clinic for Neurology and Psychiatry for Children and Youth Belgrade; Morocco: Regional Directorate of the Ministry of National Education in Tetouan (authorization number 85); Vietnam: Review Board of Centre for Assisting and Consulting Psychology, University of Social Sciences and Humanities, Hanoi (RPSY-101); USA: Institutional Review Board for the Protection of Human Subjects, SUNY Upstate Medical University (1651637-32020-E). 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

The project was planned and led by NK, who is the principal investigator. KB has built the electronic survey and synchronized it for each language. KB and NK made the statistical analyses. CJ was responsible for the drafting of the manuscript. CJ, CK, and NK were responsible for developing the manuscript. Each co-author participated in finalizing the manuscript. 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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Technology supports me: Perceptions of the benefits of digital technology in adolescents

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Background: Technology plays a significant role in the lives of adolescents. Our knowledge is predominantly based on research exploring the risks associated with it, but adolescents also feel that technology supports their lives. This has received less consideration. Therefore, we aim to examine how adolescents perceive the benefits of digital technology.

Methods: We used qualitative data collected as part of the international Health Behaviour in School-Aged Children study. We conducted online, semi-structured interviews with 15 Slovak adolescents who came from three different types of secondary schools based on their graduation systems (mean age: 15.33; 20% boys). The data were analyzed using consensual qualitative research and thematic analysis.

Results: We identified five main themes based on the comments of adolescents: 1. *I know* (source of information, formal and non-formal education); 2. *I can* (smart device, helpful tool); 3. *I am connected/included* (social interactions); 4. *I have my comfortable place* (leisure time, creating my alternative world); and 5. *I work on my future* (self-development).

Conclusion: Adolescents perceived digital technology as mostly supportive and a helpful tool in their lives. The potential benefits of digital technology should be better reflected in public perception and policy, as the societal debate is mostly dominated by perceived disadvantages and risks.

KEYWORDS

qualitative study, digital technology, subjective perceptions, benefits, adolescents

1. Introduction

Technology is a very important element for young people, as it provides them with an alternative space where they can develop themselves and deal with different life challenges. Nowadays, the digital world is often perceived as a natural environment for

adolescents, as they are used to working with it from an early age (Mascheroni and Ólafsson, 2014). In that world, digital technology helps them apply ICT (information and communication technology) for various purposes (Digital Technologies Hub, 2014; Smahel et al., 2020). Moreover, they belong to the most connected age group in the world (UNICEF for Every Child, 2017). On the one hand, the digital world offers them many opportunities for their personal development, but on the other hand, it can also bring many negative experiences that they have to deal with (Subrahmanyam and Smahel, 2010; Kalmus et al., 2014; Smahel et al., 2020).

The attention and evidence on the risks of digital technology are quite extensive, with evidence showing that adolescents face different types of challenges while using it. Examples include exposure to inappropriate content (sexual or aggressive content) and inappropriate behavior (online harassment, online grooming, cyberbullying, hacking, or sharing personal information), and technical issues like poor Wi-Fi and other connections (Best et al., 2014; Machimbarrena et al., 2018; Smahel et al., 2020). Excessive Internet use is another problem linked to digital technology, which can also have a negative impact on adolescents' mental (depression, anxiety, stress, social isolation) and physical (headaches, backaches, dry eyes) health (Morrison and Gore, 2010; Koc, 2011; Best et al., 2014; Zheng et al., 2016; Guzel et al., 2018). However, digital technology can also be a very useful tool in the lives of adolescents if it is used appropriately. Their digital literacy, or ability to use digital technology for competent, autonomous, and safe communication, plays a crucial role in this process (Mascheroni and Ólafsson, 2014).

Based on theory and past research, digital technology seems to have several advantages for adolescents; however, evidence of their perspectives on this issue is lacking. First, the Co-construction model, proposed by Greenfields (1984) and adapted by Subrahmanyam and Smahel (2010), states that adolescents are no longer passive users of digital devices and virtual reality. On the contrary, in collaboration with other users, they participate in its co-construction, e.g., by creating and sharing norms that are in accordance with the properties of virtual space and by deciding the functions of applications or platforms (Greenfield and Yan, 2006). Regarding this, the boundaries between the online and offline worlds are disappearing for them. Moreover, the digital world serves as an extension of the offline world for adolescents. To be more specific, it allows them to address some offline issues or key developmental aspects related to their sexuality, identity, intimacy, or interpersonal relationships, for example by providing them with a vast amount of information that aids in their understanding of such offline experiences (Subrahmanyam and Smahel, 2010). In connection with this, findings of the Health Behaviour in School-Aged Children (HBSC) study showed that almost 20% of Slovak adolescents found it easier to talk about their feelings or worries online than face-to-face (Madarasova Geckova and Dankulincova, 2019).

Secondly, digital technology also plays a crucial role in an adolescent's process of self-construction or socialization (Schmitt et al., 2008; Guan and Subrahmanyam, 2009; Subrahmanyam and Smahel, 2010). Regarding social interactions, digital technology has been found to be a very beneficial tool for adolescents to strengthen their existing relationships (Subrahmanyam and Greenfield, 2008; Lee, 2009). Thanks to digital technology, adolescents can gain self-disclosure experience or positive feedback from other users, which can increase their self-esteem, self-acceptance, perceived social support, and social desirability (Best et al., 2014; Cipotella et al., 2020). In addition, research has shown that for specific groups of people, digital technology can be even more beneficial, e.g., it can empower youth in disadvantaged circumstances, such as hearing-impaired children (Barak and Sadovsky, 2008). However, further research is needed to identify other predisposing properties of adolescents who are more likely to benefit from digital technology.

Third, digital technology has a unique potential to help adolescents develop their knowledge, for example, by accessing huge amounts of information easily, sharing the information or allowing group work not only regarding education in school, but also in other life domains, e.g. health (health websites, Internet-based prevention programs) (Ybarara et al., 2008; Baheiraei et al., 2014; Costa et al., 2014). Moreover, technology allows adolescents to participate in virtual classrooms and online courses if they cannot attend classes in person for various reasons, such as distance, the Covid-19 pandemic, and so on (Rose et al., 2022). Using these functions of digital technology can improve adolescents' technical skills, which can also boost their self-confidence. Regarding health, research has shown that the use of digital technology to obtain health information is associated with positive youth development (Gómez-Baya et al., 2022). A key role is played by the parents of these adolescents, who are significant role models in the use of digital technology (Gulec et al., 2022). Research has also shown that technology can be a very useful tool in sharing health information between adolescents, by inviting pediatric influencers who spread health messages to their followers (Bozzola et al., 2021). The digital world is not only a place where adolescents gain something; it also allows them to talk openly with a doctor about sensitive topics related to their health (Harvey et al., 2008). Moreover, many adolescents find it useful to use digital devices, such as smartphones, watches, and apps, for monitoring their health (physical activity, menstruation), and for supporting some of its aspects (mood-enhancement and skill building; Pretorius et al., 2019; Rich et al., 2020). However, there is a need for further research on the ways digital technology can be even more effective in promoting education and health.

However, most research on digital technology has focused on its risks. Evidence is mostly lacking on the benefits, and only a very few studies have addressed adolescents' subjective experiences and perspectives regarding the benefits of digital technology in life domains other than interpersonal relationships. Therefore, our study aims to assess the perception of adolescents regarding the benefits of digital technology. Such evidence can be very useful in strengthening the confidence of people in the capacity of digital technology to develop or improve social connections, education, and even their health.

2. Methods

2.1. Design of the study

We conducted qualitative research embedded within the international HBSC study mapping health and health-related behavior with respect to the social context of adolescents. This qualitative study has been conducted using a combination of consensual qualitative research (CQR; Hill et al., 2005) and thematic analysis methodologies (Braun and Clarke, 2006).

The study protocol has been approved by the Ethics Committee of the Medical Faculty at Pavol Jozef Safarik University in Kosice (19 N/2020), and therefore the study has been conducted in accordance with the ethical standards outlined in the Declaration of General Assembly of the World Medical Association (2014) and the consolidated criteria for reporting qualitative research (COREQ; Tong et al., 2007).

2.2. Study setting, sampling, and participants

Our sample consisted of 15 students (mean age: 15.33 years; standard deviation: 0.62) who were attending the first year of secondary school. We performed the sampling for this qualitative study in multiple steps. Firstly, we contacted the school administrators to inform them about our study. After obtaining their consent for participation in the study, we contacted the parents of the potential participants and obtained their informed consent. If the parents agreed with their child's involvement, we got in touch with the adolescents. Participation in the study was fully voluntary and confidential, and all respondents were allowed to withdraw from it at any time.

2.3. Procedures and measures

First, we asked adolescents to fill out a questionnaire focused on sociodemographic characteristics (age, gender, and size of the place of residence). We then conducted nine semi-structured individual or group interviews that were based on a topic guide consisting of the following set of basic digital technology-related questions:

1. *When and why do you start using your mobile phone or tablet, connect to the Internet, or get online?*
2. *How does the Internet make your life easier? How does it help you?*
3. *In what way can the Internet be dangerous for people?*
4. *How do you know when time spent on your mobile phone, tablet, or online has become excessive?*
5. *How should mobile phones, tablets, or the Internet improve to serve you in the best possible way, becoming something that helps you, thanks to which you feel better, or that helps you to get closer to your goals?*

Each interview lasted 45–60 min. The interviews were conducted in the Slovak language and done via the online platform Zoom, as they were conducted during the second wave of Covid-19 pandemic in Slovakia (winter 2020/2021) and due to government measures Slovaks did not have a chance to meet with participants face-to-face. Each interview was conducted by a trained professional in psychology who had previous experience working with adolescents on an online counseling platform; all the interviews were video recorded. The rest of the research team consisted of researchers with a background in psychology, and all of them participated in the interviews as silent observers.

2.4. Data handling and analysis

Regarding data handling, we processed the obtained data by transcribing the interviews verbatim into the Slovak language. The transcriptions were checked to ensure their accuracy and then uploaded to MAXQDA, the standard platform used for data analysis. Next, we coded the data using the CQR methodology and thematic analysis. The team of coders consisted of a lead investigator (AMG), a senior (ZD, SC), and junior researchers (LBU), all of whom were trained in the CQR methodology. Individually, each team member watched the video recordings, read the transcripts, and created codes for the transcript segments. After that, all members met and shared their codes and interpretations with the aim of achieving consensus. In cases where members' opinions differed, the discussion continued until they reached a consensus regarding the codes.

In the analysis, we first described our study sample using the data from the questionnaires. We then went through the entire transcript using thematic analysis and identified the benefits of digital technology as perceived by adolescents. The codes produced during data handling were clustered into subthemes and themes. All team members first did this individually. They then met to share the created subthemes and themes and discussed these until they reached a consensus regarding the final thematic map.

3. Results

3.1. Description of the sample

Table 1 provides the background characteristics of the sample. We obtained responses from 15 adolescents, whose mean age was 15.3 years, and 20% of whom were boys. In terms of

TABLE 1 Descriptive characteristics of the sample.

Gender	
Boys	3
Girls	12
Type of school	
Grammar school	3
Secondary school (GCSE)	11
Secondary school (apprenticeship certificate)	1
Age (mean, SD)	15.33 (0.62)

GCSE, General Certificate of Secondary Education.

education, more than 70% of our respondents attended a secondary school with a General Certificate of Secondary Education (GCSE) graduation, and the rest of the sample attended a grammar school or secondary school without a GCSE.

3.2. Main themes

We identified five main themes regarding the different life domains in which digital technology can support and/or help adolescents, with each theme having several subthemes: 1. I know *(source of information, formal and non-formal education)*; 2. I can (*smart device, helpful tool*); 3. I am connected/I am included (*social interactions*); 4. I have my comfortable world (*leisure time, creating my alternative world*); and 5. I work on my future (*self-development*), see Figure 1. Table 2 provides quotes regarding the mentioned themes.

3.2.1. I know

The first theme, "I know," focused on the role of technology as a *source of information* and on *formal and non-formal education*. This was regarded as the most frequently mentioned benefit by adolescents and was associated with the knowledge they could gain *via* digital technologies or the Internet. Adolescents described the Internet as a *huge source of information* that offered them the opportunity to find everything they need, which they considered very helpful, including in their preparation for school. Moreover, knowing that they had access to such a source of information gave them a sense of freedom.

Furthermore, adolescents described digital technology as a tool that can be used to provide *online formal and non-formal education*, especially during the pandemic. They reported many previous experiences with different kinds of applications, online quizzes, and tests available on the Internet that helped them improve their knowledge in the subjects they studied at school, for example, language or chemistry. The internet can also be used as an educational aid by teachers in the classroom, so as to make learning more fun and interesting.

3.2.2. I can

Regarding the theme "I can," adolescents expressed some benefits linked to the features of digital technology. They described digital technology as a *smart device*, characterized by compactness or multi-functionality, that gave them the feeling of having everything they needed at their fingertips.

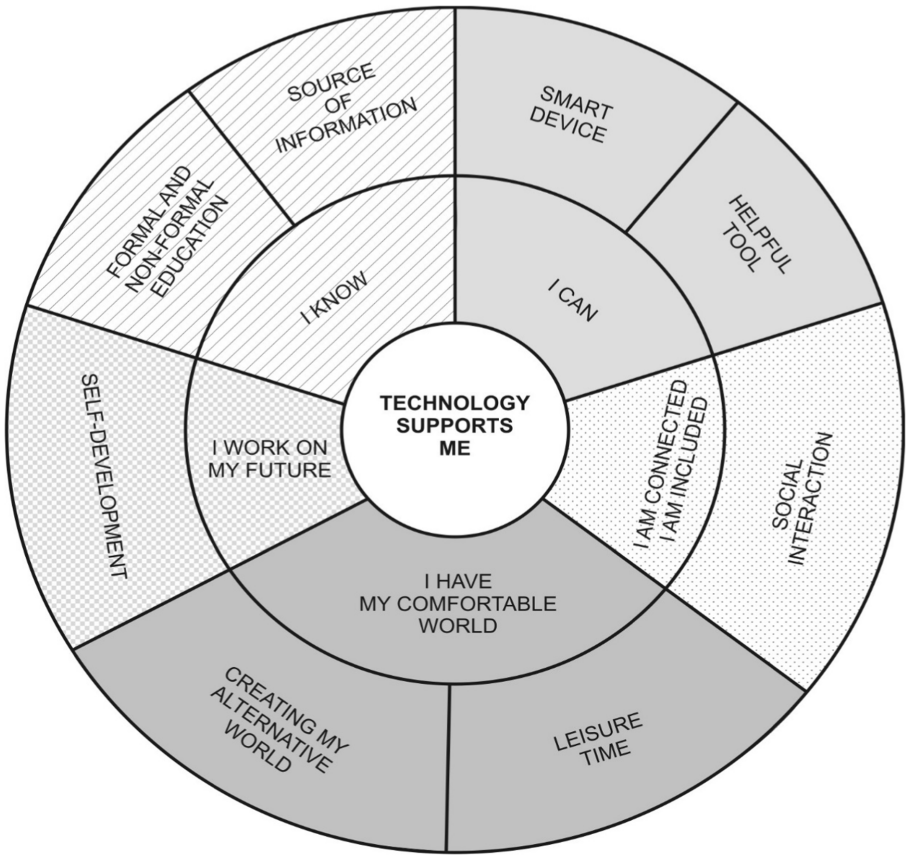

FIGURE 1
Model of themes and subthemes of perceived benefits of digital technology and Internet use by adolescents.

TABLE 2 Selected participant quotations for identified themes and subthemes on the benefits of digital technology for adolescents.

Themes/ Subthemes	Quotations
I know	
Source of information	*"… or if you want to search for something, you have it right in your pocket, so you can find it."*
	"… in fact, it also helps at school, for example, we do not have to look for some information in different books, or something like that, we just write it on Google, and in a few seconds, we will actually find it. "
Formal & non-formal education	*"For example, I play guitar, and I have watched a lot on the Internet about how I should learn to play some song or something, so it can help with many things…"*
	"For example, there would be no courses, but some online classes outside of school about something that we are interested in or that we probably want to do in the future, or some course at school, but outside of the school schedule. Some course that we could take to learn something more than what we have in school."
I can	
Smart device	*"I would probably miss the phone the most because you can make calls and I think you can do the most things on the phone. It is the handiest. You can just take it everywhere."*
	"Seeing what we have at school, what I should do, what I should send. It is easier for me if I have all the information on my phone, or the Internet student book if I have everything written there. It's easier than searching in a notebook, which we have to do for homework, which I should send to the teacher…"
Helpful tool	*"Or for example, you can put some reminders on the phone, so we do not forget some important dates or meetings."*
	"… Also, in practical terms, when people have some problem, many tips or tricks can be found on the Internet, nearly for everything. When something at home needs to be repaired, or bought, or has a lot of recipes for cooking."
I am connected/I am included	
Social interactions	*"… that actually those important things for school, or as we mentioned last time, that in the evening when we want to chat with friends or call or spend some time with friends, or family, so I think that this is the reason why many people actually use the phone. Or when we want to go out, I think that the majority of people arrange meetings through social media."*
	"No, but I do not mean that I'm dependent on social media or something, but mainly for communication with other people. For example, if I do not understand something, for example, at school, I'll write to someone to ask him/her if he/she can explain it to me. I know what is going on with that person; if I cannot be with him/her, the communication via phone tells me."
I have my comfortable world	
Creating my alternative world	*"For example, on Instagram or Facebook I have friends, or I follow people who motivate me in some way, or who are doing something similar that I would like to achieve, and I do not have people who demotivate me or who just talk about having a bad life and so on."*
	"It gives me a greater feeling of freedom, regarding information and communication, and I can see the benefits of it."
Leisure time	*"Usually now, when there is more work and there is nothing to do now, I always finish schoolwork in the evenings, and immediately I turn on something like 'Discord', so I can hear my friends and play something to switch off a little."*
	"Then, when I take some breaks during learning, I also use it as a form of relaxation, so I watch some videos or check new messages and respond to them or something like that. So, I use it as a form of entertainment as well."
I work on my future	
Self-development	*"So, if we see something on the Internet, for example, how other people work out, it can motivate us to do something, to do some exercise as well. So, I am not just watching other people do the activity, I am also doing it."*
	"Or you can create a lot of things right on the Internet. Many people have their own blogs. They also create some videos on YouTube or short funny videos on some type of social media, or they make funny pictures for social media. So, a lot of people also give something to the Internet, not only take it from it."

Furthermore, they found digital technology to be a very *helpful tool*, thanks, especially to all the applications that it provides. On the one hand, it helped them get oriented in time or space, thanks to calendars, watches, and maps. On the other hand, they reported that it can serve as a repository for their own thoughts, ideas, or important materials, which they can access at any time. Moreover, the Internet is not only considered useful in crises, as it offers quick access to the contact

information of different helplines, but also in the process of job-seeking.

3.2.3. I am connected/I am included

Most adolescents believe that thanks to digital technology they can "be connected or included," providing the title for this theme, which includes *social interactions* as another suggested benefit. The most frequently mentioned advantages by adolescents in this context included the ability to connect with others and the easy way to communicate or build/maintain their relationships. Digital technology can serve as a helpful tool in the development of their social interactions, as it facilitates communication or experience-sharing with friends or family members, especially those living abroad. It made those people more available to them. Moreover, adolescents admitted that the Internet helped them feed their need to be updated. Not only can technology play a crucial role by increasing the frequency of contacts, but it can also enhance the quality of existing relationships. Adolescents found technology extremely beneficial for making some relationships deeper, for example, with their teachers or people who do not prefer face-to-face communication. Another benefit suggested by adolescents was that technology provided a free and fast way to organize different kinds of formal and non-formal meetings.

3.2.4. I have my comfortable place

Adolescents described digital technology as being a place where "they have their comfortable world." They mentioned two benefits associated with this theme: *creating their alternative world* and engaging in *leisure activities*. Some adolescents perceived digital technology as a tool that helps them *create their own alternative world*, which they can tailor to their own needs or interests. It is a place where they can feel good or happy, as they have the opportunity to choose the things that will surround them in comparison to the offline world, by following the people who match their preferences and who can motivate them to engage in some activity or achieve their goals.

In addition, digital technology provides adolescents with an easy and fast way to find *leisure activities*. More specifically, they perceive the Internet as a place where they can unwind or just switch off for a bit. A dominant proportion of adolescents admitted to connecting to the Internet during school preparation breaks or just to fill idle time. They mentioned several activities that served them for this purpose, such as browsing social media, reading online books, watching movies, listening to music, or playing games, which supported their social lives.

3.2.5. I work on my future

Lastly, adolescents perceived *self-development* as an important benefit related to digital technology; this relates to our last theme, "I work on my future." The most frequently mentioned benefits by adolescents in this context were gaining motivation, self-improvement in existing hobbies, and sharing their skills. Adolescents believe that digital technology and the Internet offer them ideas or inspiration that can motivate them to start doing some kind of activity. They admitted that sometimes only watching people perform some activity could already work as stimulus. Furthermore, adolescents can find many tutorials or instructions shared by other users on the Internet that can help them develop or improve their hobbies. They also perceive the Internet as a place that gives them the opportunity to show off their talent or skills, for example, by writing blogs where they can share their thoughts or opinions or by publishing different kinds of videos on their YouTube channel. Moreover, they reported that the Internet can play a crucial role in promoting important topics or the activities of organizations for which it is very difficult to get help, such as "Homeless is more."

4. Discussion

Our study aimed to explore the benefits of digital technology based on adolescents' subjective perceptions and experiences. We identified five main themes in their statements: the adolescents perceived digital technology as a smart, helpful device *(I can)*; a source of information supporting their formal or non-formal education *(I know)*; a means of developing their social interactions *(I am connected/I am included)*; a means of participating in leisure time activities, creating their alternative world *(I have my comfortable world)*; and a means of working on their self-development *(I work on my future)*.

4.1. I know

We found that adolescents viewed digital technology as a very useful educational tool, not only in school settings but also because it provides a vast amount of information. This is in line with the findings of previous studies on this topic (Kibirige and DePalo, 2000; Dogruer et al., 2011; Baheiraei et al., 2014; Shonola et al., 2016). For example, Dogruer et al. (2011) showed that adolescents feel particularly at ease using search tools or social media, which can serve as a place for discussions about school subjects and help them clarify their uncertainties about topics. This finding can be explained as follows: today's adolescents prefer to use online resources for information, mostly because of their easy and fast accessibility (Lupton, 2021). More specifically, thanks to an Internet connection, they can obtain copious amounts of data or different perspectives on a topic in a relatively short time and without going anywhere. Moreover, thanks to this technology, they have easy access to online school materials shared by teachers, and this allows them to engage in learning activities even if they do not attend their classes. This can also be very useful in improving self-study flexibility (Shonola et al., 2016).

Additionally, research has shown that the context of video games often motivates adolescents to learn about different topics that they encounter at school; e.g., adolescents used information from a game – Minecraft (a survival-based game focused on discovering and gathering different resources, such as raw materials for craft tools to build the world and stay alive) – in physics or chemistry class. Many adolescents confirmed that playing video games helped them improve their language skills more than the English lessons at school (Pereira et al., 2019). Thanks to video games, they could meet players from different countries of the world, forcing them to use English if they wanted to talk, for instance, about game strategy. This can then highly supplement what they learn at school; language teachers' pay more attention to teaching their students about grammar than to developing their conversation skills. In addition, adolescents' responses confirmed the positive impact of computer games on their cognitive skills, too, such as reasoning or visual processing (Subrahmanyam et al., 2000; Pereira et al., 2019). Thus, we can conclude that digital technology and its applications give adolescents the possibility to gain knowledge or skills outside of formal education, allowing them to become independent learners who can choose what they want to study and how they want to study it (Sivalingam and Subbaiyan, 2018).

4.2. I can

From the perspective of adolescents, the instrumental features of digital technology can contribute to what they can do. Adolescents reported that digital technology is a smart and helpful device thanks to which they can get orientated in time or to a place. This finding is in line with the study conducted by Ling and Yttri (2002), which suggests that one of the most important functions of digital technology is that it supports micro-coordination, i.e., organizing the everyday lives of users, thanks to which they feel more flexible in terms of time and location.

Additionally, adolescents who participated in the study reported that digital technology can serve as a quick way to access different types of help. This finding is consistent with previous research showing that digital technology provides adolescents with a higher sense of security and plays a role in empowering them not only in emergencies but also in situations that some people may perceive as stressful, such as visiting public spaces (Pain et al., 2005; Tennakoon and Taras, 2012). It also aligns with the finding that many adolescents tend to turn to online counseling platforms or applications in crises, as they provide them with a space where they can feel emotionally safe and talk easier about their problems due to the distance between them and their counselors. This kind of service allows them to remain anonymous, maintain their privacy, avoid embarrassment when discussing their problems in person, and reduce the potential feeling of stigma (Pretorius et al., 2019; Wong et al., 2021). Another benefit of such help is that it is also accessible at times when formal services are not available, e.g., at night (Lásková, 2016; Pretorius et al., 2019). Moreover, the use of online help resources also helps meet users' desires to retain self-reliance. In the online setting, they still have a chance to decide if they will accept the proposed advice or deal with their problems by themselves. Finally, a study by O'Dea et al. (2020) showed that help apps can be very useful in supporting adolescents' intentions to seek help by showing them that their situation requires professional help, presenting them with coping strategies that could be effective for their problems, or reassuring them that it is normal to ask for help. Thus, giving a mobile phone to adolescents can also be perceived by parents as a way to keep their children safer and healthier (Williams and Williams, 2005). In such a situation, digital technology can be beneficial not only for adolescents but also for their parents.

4.3. I am included/connected

Next, the interviewed adolescents reported that digital technology can play a key role in the development of their social lives. Our findings are in line with research showing that although online communication led to a decrease in adolescents' face-to-face interaction with parents or friends, this did not affect the quality of those relationships (Lee, 2009). In addition, it strengthened their social ties with friends, which positively affected their well-being (Valkenburg and Peter, 2007; Lee, 2009). This can be explained by the higher level of controllability linked to online communication, which can encourage adolescents to open up to others, thus increasing the quality of their relationships (Joinson, 2001; Valkenburg and Peter, 2007). Moreover, digital technology can be very useful even for those adolescents with fewer social skills. Even introverted adolescents find it easier to self-disclose in the digital world, where they can choose what personal information to share (Peter et al., 2005). Digital technology also has a huge potential to include people who are disadvantaged due to reasons such as poverty, crisis, or disease. On the one hand, it allows them to get support from or connect with other people who are facing similar life conditions. On the other hand, it can link them to opportunities, such as online education and job offers, that are available to all people without discrimination (UNICEF for Every Child, 2017; Rideout and Fox, 2018). Thus, digital technology gives adolescents the possibility to feel more equal thanks to its capacity to connect people from different socioeconomic backgrounds, countries, or personalities.

4.4. I have my comfortable world

We found that, from the perspective of adolescents, digital technology gives them the option to create their own comfortable world, tailored to their needs and interests. They can choose the kind of content that will be presented to them when they go online in the digital world, for example, by following people who motivated them in doing some activity or achieve their goals. The theme of creating

an alternative world seems to be understudied, but some investigations have explored related topics (Djafarova and Rushworth, 2017; Croes and Bartels, 2021). They have shown that adolescents tend to follow social influencers to relax and have fun or to get information about products that are interesting to them (Djafarova and Rushworth, 2017; Croes and Bartels, 2021). Social influencers try to get closer to their fans by communicating with them. Therefore, adolescents can have the feeling that they are more accessible to them, just like their activities or achievements, which can ultimately motivate them in their own lives. This may be one reason why they chose them to be a part of their comfortable world.

Additionally, we found that many adolescents perceive online leisure activities as an important benefit of digital technology, as these allow them to switch off a bit. This is consistent with Khan's (2017) findings that adolescents often browse social media or watch videos passively because of a need to relax or be entertained. Furthermore, Cheah et al. (2021) suggested other motives that may lead to playing digital games, such as immersion/flow, gratification/affect, escapism, social interaction, identification, and goal orientation. The research of Helstrom et al. (2015) revealed that escape motives or playing to gain status in combination with excessive gaming time can lead to health problems such as depressive or musculoskeletal symptoms. Therefore, we can conclude that spending time in online activities can be beneficial for adolescents by providing them with a quick access to fun, relaxation, or friends, but it is very important to always consider the motives for this behavior, as these play a key role in determining its ultimate impact on adolescents' lives (Subrahmanyam et al., 2000).

4.5. I work on my future

We found that adolescents view digital technology as the place where they can work on their future. They suggested that it serves as a platform where not only they can learn something, but also display a part of themselves or their talent. This finding is in line with studies showing that public websites such as YouTube and MySpace, and even interests-driven online communities (such as writing groups) based on peer reciprocity can be very useful tools for the development of adolescents in the future (Iftikhar et al., 2019). On the one hand, this type of virtual place gives them the possibility to share their own experience or work/talent with a broader audience or with people who are important in their relevant field; thus, they can get constructive feedback that can help them improve (Ito et al., 2010; Iftikhar et al., 2019). On the other hand, they have the opportunity to view the experiences of others, which can provide them with inspiration or social support when engaging in a particular activity (Radovic et al., 2018). Specifically, if they are struggling in the beginning, seeing the path of others to success and everything that comes with it can make them feel they are not alone, which can encourage them to continue working on themselves. We can thus conclude that gaining a reputation, and fans, receiving constructive feedback on creative work, and seeing the experiences of others can also play a significant role in increasing adolescents' self-confidence, in addition to providing more motivation.

Strengths and limitations

A major strength of this study is its qualitative design, which allowed us to provide detailed insight into adolescents' subjective perceptions and experiences on the benefits of digital technology based on their own statements, which have been video-recorded, transcribed verbatim, and reviewed by all team members before we proceeded to the analysis. In addition, thanks to the consensual qualitative research methodology, we surpassed the subjective perspectives of the researchers, as all the coders had to reach a consensus regarding the codes used for the analyzed data. Lastly, our study presents adolescents' perceptions of the benefits of digital technology in all areas of life, whereas previous studies on this topic focused mainly on its risks or advantages in social life.

Our study is limited by the relatively small and not fully heterogeneous sample with respect to gender and secondary school type. This limitation may be attributable to the fact that our interviews were conducted during the second wave of the COVID-19 pandemic in Slovakia, and due to government measures, we did not have the chance to meet with participants in schools, which may have resulted in reduced participation in our study. However, we reached saturation during data collection based on this sample, i.e., no new themes emerged during the last interviews. A second limitation may be that, because of COVID-19, we conducted our study dedicated to the topic of digital technology *via* an online platform, which may have led to an information bias. We tried to reduce the likelihood of this bias by using open-ended questions that asked about adolescents´ personal experiences or subjective perspectives regarding digital technology.

Implications

Digital technology has been shown to have positive meaning for adolescents, as it facilitates their lives in many ways, for example, regarding their school environment (applications for the educational process, platforms useful for self-development). This implies a greater focus on the appropriate use of digital technology in school settings, which is also contingent upon the media literacy level of teachers. Therefore, educational policies should prioritize integrating continuous training plans for teachers in this area. In today's society, a negative perception of digital technology or the Internet is prevalent; however, these technologies are inevitable and therefore need to be used in an adequate manner in terms of time spent and user safety. A more positive perception of digital technology and its opportunities may lead to greater adoption in a variety of societal domains.

Our study is one of the first to confirm that digital technology can play a crucial supportive role in different life domains if it is used in an appropriate way. These findings should be confirmed by more studies on different age groups, and the benefits regarding areas other than social life. The exploration of needs met by adolescents through digital technology enables us to investigate aspects of the offline world that need to

be strengthened. In addition, further research should identify the groups of adolescents who are less likely to benefit from digital technology and how technology can be made more useful for them. This may provide important information not only for its future development but also for enhancing adolescents' adaptation to its demands. Moreover, future research can focus on the exploration of the effect of digital technology on the transition to adulthood and the adaptation to adult roles as part of mental and social health.

Conclusion

Our findings show that digital technology can support adolescents in various domains of their lives and that they are aware of the opportunities regarding its use. This demonstrates that putting adolescents and their opinions at the center of national and even global digital policies can be very helpful, not only in reducing their exposure to the risks associated with the technology but also in exploring how it can be useful in realizing their potential (UNICEF for Every Child, 2017). Moreover, our research suggests that digital technology can enable positive personal growth, self-perception, and mental well-being in adolescents. Although more research is focused on the risks of digital technology, adolescents' presence in the online world can also support positive adaptation to this developmental period, as well as their socialization as opposed to isolation.

Data availability statement

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

Ethics statement

The studies involving human participants were reviewed and approved by Ethics Committee of the Medical Faculty at the Pavol Jozef Safarik University in Kosice (19 N/2020). Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

LBU, AMG, ZDV, and SC participated in the design and coordination of the study and data collection. LBU conducted literature searches and provided summaries of previous research. LBU, AMG, ZDV, and SC worked on the analyses and interpretation of the data. LBU drafted the initial manuscript, and AMG, ZDV, SC, JH, JPD, and SAR provided supervision, contributed their comments to the manuscript, and approved its final version, as submitted. 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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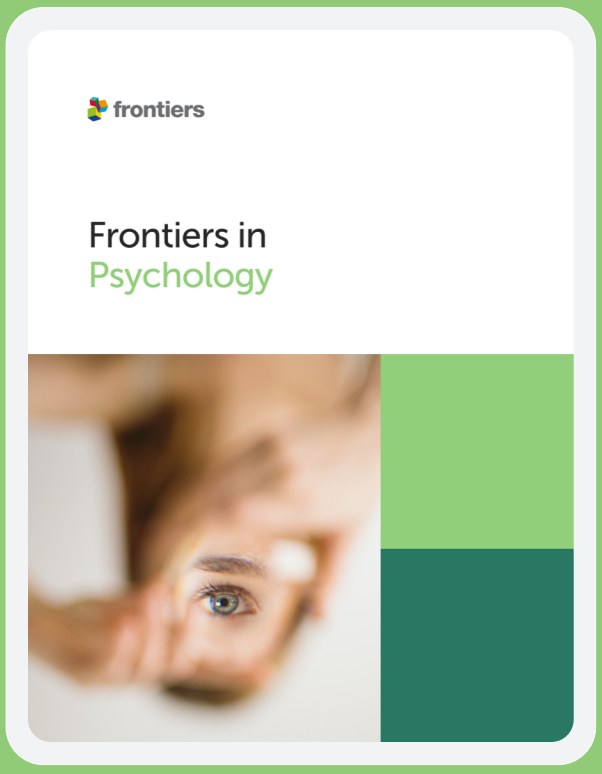

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