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ORIGINAL ARTICLE

Cross-sectional comparison of risk factors associated with mental illness and learning difficulties in kindergarten and elementary, middle, and high school children in the United States: a socio-ecological resilience framework

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Abstract

Aim Mental illness and learning difficulties in children can be explained using the socio-ecological resilience (SER) model, which states that personal characteristics and an individual's social relationships coupled with environmental factors of adverse life events influence mental health. We aimed to identify factors associated with anxiety, depression, and learning difficulties in kindergarten and elementary, middle, and high school children.

Subject and methods This study utilized data collected from the 2019 National Health Interview Survey (NHIS) questionnaire administered across the United States. Children aged 4 to 17 were included. Risk factors were categorized into personal characteristics, lack of peer support, adverse family events, and socioeconomic status (SES). Logistic regression was used to estimate the risk for each risk factor and SER layers for anxiety, depression, and learning difficulties.

Results In relation to the SER model, factors from personal, relational, and structural layers all influenced the likelihood of anxiety, depression, and learning difficulties in children across all ages. Negative personal characteristics of emotional dysregulation were the most significant risk factor associated with anxiety and depression. For children in kindergarten, relational factors of poor peer relations were more significant in influencing learning difficulties, while behavioural dysregulation measured by hyperactivity had a greater influence on learning difficulties for older children in elementary, middle, and high school. Having experienced adverse family events was significantly associated with worse mental health, while low SES was associated with worse depression and learning difficulties.

Conclusion Comprehensive interventions that strengthen personal characteristics, peer interactions, and environmental stressors are needed to address mental illness in children.

Keywords Child mental health · Learning difficulties · Socioemotional problems · Resilience

Introduction

Mental illness affects around 15% of children and adolescents worldwide, while self-harm and suicide are one of the leading causes of death amongst children aged 5 to 19 (Liu et al. 2022). Childhood and adolescence are critical periods of social and emotional development. Up to 50% of lifetime mental illness develops during early adolescence (Kessler et al. 2007). Thus, identifying and understanding risk factors for mental illness in children is critical to developing strategies to improve mental health.

School has a significant role in cognitive, language, emotional, and social development, as school is where children and adolescents spend a large proportion of their time.

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Children and adolescents with mental illness often have greater difficulties in coping with the learning and social demands at school, leading to poor academic success and learning difficulties (Schulte-Körne 2016). Those with learning difficulties are also at greater risk of anxiety and depression due to increased psychological stress from feelings of inadequacy, shame, and low self-esteem as a result of negative school feedback (Ihbour et al. 2021). In order to develop interventions to improve child and adolescent mental health and learning difficulties, associated modifiable risk factors must be first identified.

Mental health in children and adolescents can be explained by the socio-ecological resilience (SER) model, which proposes that emotional and behavioural development are influenced by both personal characteristics of emotional and behavioural self-regulation, and interactions with the environment (Vaughn and DeJonckheere 2021). SER is divided into four layers—(1) personal, (2) relational, (3) structural, and (4) spiritual or cultural—with the personal layer at the centre of the model (Vaughn and DeJonckheere 2021).

On each layer, different protective and risk factors exist. While positive protective factors improve resilience to mental illness, negative risk factors increase psychological stress and contribute to worse mental health. Personal characteristics reflect a child's ability to regulate emotions and behaviour, influenced by their temperament, self-esteem, and motivation (Zalewski et al. 2011; Deutz et al. 2018). The relational layer refers to one's supportive social network of friends, peers, parents, family, and other community members, while the structural layer is the non-relational aspect of one's community (Vaughn and DeJonckheere 2021). Examples of factors within the structural layer include neighbourhood safety, availability of social and healthcare services, and accessibility of financial support (Vaughn and DeJonckheere 2021). Lastly, the spiritual and cultural layer of the SER model relates to one's morals, ethics, values, and worldview, acting as the contextual aspect of the model that influences how a person forms their personal characteristics, while contributing to how they interact on the relational and structural layers. Figure 1, adapted by the authors based on the SER model, illustrates the different factors that make up each layer of SER (Vaughn and DeJonckheere 2021).

At the centre of the model, one's personal characteristics influence how they interact with the environment on the relational and structural layers of SER, including distal and proximal support systems such as family, school, peers, and the broader community (Zhou et al. 2022). Negative

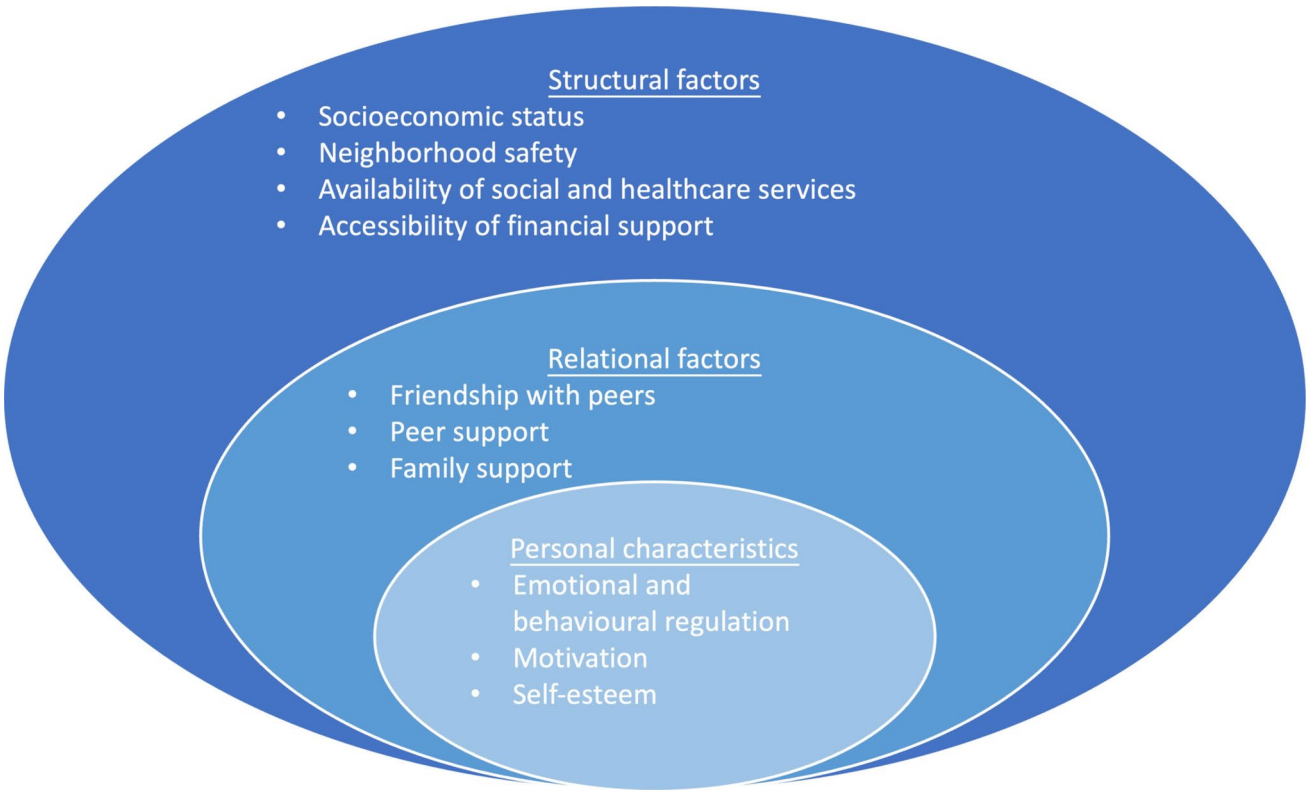

Fig. 1 SER model used for the study. At the centre of the model, personal characteristics guide how an individual interacts with factors in the relational and structural layers of SER. Together, each layer contributes to a child's resilience against psychological stress and influences their mental health

personal characteristics can be measured by emotional and behavioural dysregulation. Difficulties with emotional regulation hinder a child's ability to utilize effective and flexible coping strategies in challenging situations, as they are unable to monitor, evaluate, and adjust emotional experiences appropriately (Gross 2013), while behavioural dysregulation of destructive tantrums and severe outbursts of temper limit a child's ability to engage in social and learning opportunities (Ogundele 2018). Independent of personal characteristics, peer support acts as a positive moderator for personal characteristics. Peer support can serve as a valuable emotional asset, providing protection against risk behaviours and mental illness through positive interactions in supportive and collaborative relationships (Stewart and Sun 2004). However, negative peer and family relationships such as peer victimization or domestic violence can increase the risk of mental illness (Holmes et al. 2016).

Socioeconomic status (SES) is another important social determinant of health linked to all layers of the SER, influencing children's exposure to risk factors. Children born into low SES households are more likely to have poor food security and limited access to educational opportunities and healthcare, as well as residing in a more dangerous neighbourhood (Reiss et al. 2019). Thus, children of low SES households are at greater risk of experiencing adverse home and life events that contribute to poor cognitive, social, and emotional development, predisposing them to poor mental health (Reiss et al. 2019).

To the best of the authors' knowledge, previous studies have largely focused on the relational layer of the SER model of mental health. However, the extent of the influence of each layer of the SER model on mental health and learning difficulties in children has not been examined previously. Furthermore, comparisons of risk factors associated with each layer across children of different age groups have not been established. The current study aims to compare the influence of risk factors in three layers of SER (personal, relational, and structural) on mental illness and learning difficulties in children across age groups from kindergarten to high school, to better understand how these risks associated with mental illness and learning difficulties differ among age groups.

Method

Data source

This cross-sectional study utilized freely available data collected from the National Health Interview Survey (NHIS) questionnaire conducted in the United States in 2019 (Blewett et al. 2019). The NHIS is an annual and ongoing national health survey conducted by the National Center for Health Statistics (NCHS) in the United States, aimed at monitoring the health of the non-institutionalized US population through analysis of data on a range of health topics. For data collection, households are randomly selected from all addresses in the United States. One sample adult aged 18 years or older and one sample child aged 17 or younger are randomly selected from each household. Information regarding the child is collected from a parent or an adult knowledgeable and responsible for the healthcare of the child sampled. The survey is conducted in the form of an in-person interview by highly trained and skilled interviewers from the United States Census Bureau, and serves as the gold-standard health survey in the United States. Computer-assisted personal interviewing (CAPI) is used by the interviewers to help facilitate the interview.

Core questions regarding demographic characteristics, health insurance, healthcare access and use, health conditions, tobacco use and functioning, and disability are collected annually. Rotating core questions are repeated every other year. In 2019, mental health assessment was conducted for children and adolescents using questions from the Strengths and Difficulties Questionnaire (SDQ). Information regarding the child's experiences of stressful life events was also collected.

In this study, 6706 children were included for analysis. Only data for children between the ages 4 and 17 who completed the SDQ portion of the questionnaire were analysed. Included children were divided into kindergarten (aged 4 years) and elementary (5–10 years), middle (11–13 years), and high school (14–17 years) based on their age.

Socio-ecological resilience model

Three layers of SER were assessed—personal, relational, and structural. Personal and relational layers of SER were measured by the SDQ, used to assess mental health and behaviours in children and adolescents over the prior 6 months (Goodman 1997). The SDQ includes five components—emotional difficulties, conduct problems, hyperactivity, peer problems, and prosocial behaviour.

Personal characteristics were assessed based on the emotional difficulties, conduct, and hyperactivity subscales of the SDQ (Goodman 1997; Vaughn and DeJonckheere 2021). Together, these three subscales with a total of 15 questions have been identified as the Dysregulation Profile (SDQ-DP) and have been used to investigate concurrent emotional, affective, and behavioural dysregulation in children (Deutz et al. 2018). Previous studies have indicated that the SDQ-DP has high reliability, with Cronbach's alpha ranging from 0.70 to 0.80 (mean = 0.74) (Deutz et al. 2018).

The relational layer of SER was assessed using the peer problems and prosocial behaviour subscales of the SDQ (Goodman 1997). The structural layer of SER was assessed

based on exposure to adverse family events and SES through evaluation of each child's accessibility to healthcare, household income in relation to the poverty line, and food security. Accessibility to healthcare was assessed using eight items measuring whether any delays to healthcare occurred in the past 12 months due to cost and affordability. Food security was assessed using six items measuring whether any meals were reduced in size or skipped due to cost and whether children received free or reduced-cost meals at school in the past 12 months. Exposure to adverse family events was assessed with four items: (1) ever been victim of or witnessed violence in neighbourhood, (2) ever lived with a parent who was incarcerated, (3) ever lived with anyone who experienced mental illness or severe depression, and (4) ever lived with anyone with an alcohol or drug problem. Questions sampled regarding adverse family events were adapted from a set of eight questions on stressful life events used in the National Survey of Children's Health. The reliability of all subscales was adequate, with Cronbach's α of 0.683 for exposure to adverse family events, 0.649 for accessibility to healthcare, 0.589 for food security, and 0.622 for total SES. To determine SDQ scores, the parent respondent version of the SDQ was completed by parents or adults responsible for the child's health on behalf of the child sampled (Goodman 1997).

Outcomes: depression, anxiety, and learning difficulties

Depression and anxiety were assessed across children in elementary, middle, and high school. Both outcomes were measured based on frequency of feelings of depression or anxiousness. Children reporting daily to weekly feelings of depression or anxiousness were reported. Learning difficulties were classified based on the item "ever told had learning disability".

Statistical analysis

Reliability analyses were first conducted based on Cronbach's α levels, with > 0.70 indicating good reliability on subscales created to assess SES, food security, and accessibility to healthcare. Chi-square analysis was conducted to assess differences in incidence of mental illness and learning difficulties across kindergarten and elementary, middle, and high school children. To identify risk factors in each layer of SER associated with depression, anxiety, and learning difficulties, logistic regression was conducted in children and adolescents across all school layers. Chi-square analyses were also conducted to compare the differences in risk factors in children with anxiety, depression, and learning difficulties across age groups. Cases with missing SDQ scores were excluded.

Ethics

Data from this study were collected from the 2019 NHIS questionnaire. The Research Ethics Review Board (ERB) of the National Centre for Health Statistics reviews survey content and methods each year to protect participants of the survey. An advance letter is mailed to all selected participants prior to the interview, and verbal consent is obtained from each participant prior to the interview (National Center for Health Statistics 2002).

Results

The distribution of depression, anxiety, and learning difficulties from kindergarten to high school children is displayed in Supplementary Table I. A greater proportion of high school children (aged 14–17 years) reported having learning difficulties, depression, and anxiety than children of other age groups.

Personal (SDQ-DP), relational, and structural factors associated with anxiety, depression, and learning difficulties

Logistic regressions were used to assess the likelihood of mental illness and learning difficulties across kindergarten to high school students as presented in Table 1. Overall, personal characteristics and factors on a relational layer appeared to be the most significant factors influencing all outcomes measured. Emotional difficulties was the most significant factor associated with anxiety and depression across children and adolescents in elementary (OR = 16.196, 8.066), middle (OR = 18.708, 18.210), and high school (OR = 20.978, 17.021). Hyperactivity was also significantly associated with a greater likelihood of depression and anxiety across all age groups except for children in middle school. Conduct problems were associated with a greater likelihood of depression across children of all age groups. Hyperactivity was the most significant factor associated with learning problems in elementary (OR = 10.139), middle (OR = 6.441), and high school (OR = 5.318) students.

On a relational layer, peer problems were significantly associated with anxiety, depression, and learning difficulties across children of all ages. Compared to older adolescents, younger children in kindergarten with peer problems were 20.548 times as likely to have learning difficulties, while younger children with hyperactivity were 1.427 times as likely to have learning difficulties. Although the association of peer problems with the likelihood of learning difficulties decreased at older ages, having peer problems was still associated with a greater likelihood of having learning difficulties across elementary (OR = 2.594), middle (OR = 2.962),

Table 1 Factors associated with anxiety, depression, and learning difficulties across children of different school age groups

	Anxiety				Depression				Learning difficulty				
	Elementary school	Middle school	High school	All age groups	Elementary school	Middle school	High school	All age groups	Kindergarten	Elementary school	Middle school	High school	All age groups
Personal characteristic	3.867***	5.059***	5.250***	4.321***	3.199***	3.682***	4.433***	3.341***	2.260*	3.516***	1.960***	1.924***	2.326***
Emotion	16.196***	18.708***	20.978***	19.708***	8.066***	18.210***	17.021***	15.366***	1.229	2.708***	1.784	2.066***	2.317***
Conduct	1.795*	1.560	1.450	1.605**	2.959***	3.622***	1.927*	2.503***	0.986	1.702*	1.167	1.836*	1.634**
Hyperactivity	3.704***	4.074***	3.709***	3.562***	3.112***	1.835	2.741***	2.163***	1.427**	10.139***	6.441***	5.318***	6.310***
Peer support	1.552**	1.132	1.766***	1.651***	1.512	1.862*	1.311	1.600***	5.301***	1.858***	2.045**	1.931***	2.081***
Prosocial behaviour	0.689	1.509	1.764*	2.054***	1.947	1.665	1.560	1.694*	0.951	0.644	1.180	1.714	1.942***
Peer problems	4.104***	4.762***	5.081***	4.797***	6.393***	8.790***	5.209***	6.443***	20.548***	5.168***	5.795***	4.263***	5.307***
Adverse family event	1.148	1.191	1.297***	1.257***	1.145	1.182	1.254**	1.269***	0.676	0.855	0.988	1.160	1.042
Neighbourhood violence	1.316	2.358***	2.339***	2.069***	1.174	3.394***	2.192***	2.181***	0.000	1.992*	1.221	1.237	1.414*
Parents incarcerated	0.654	0.649	1.106	0.813	2.152*	0.272*	1.339	1.086	0.000	1.075	0.577	3.225***	1.651**
Family member mentally ill or severely depressed	3.291***	2.372***	2.441***	2.664***	2.239*	4.121***	3.327***	3.148***	2.021	1.527	2.155**	1.848**	1.846***
Family member with an alcohol or drug problem	1.312	1.597	1.290	1.364*	1.350	1.885	1.035	1.319	1.207	1.143	1.559	0.772	1.013
SES	0.951	0.950	0.983	0.954	1.172**	1.140*	1.130**	1.124***	0.513	1.090	1.208***	1.134**	1.119***
Poverty	0.826	0.840	0.936	0.864	1.366	1.504	1.231	1.291	0.605	1.552*	1.914**	1.998***	1.714***
Healthcare access	1.385***	1.173	1.401***	1.365***	1.302*	1.128	1.522***	1.410***	0.000	1.066	1.039	1.176	1.111
Food security	1.115*	1.244***	1.161***	1.156***	1.367***	1.420***	1.269***	1.315***	1.012	1.220**	1.321***	1.187**	1.227***

* P< 0.05; **P<0.01; *** P< 0.001

and high school (OR = 2.679) children. Peer problems was also significantly associated with anxiety and depression for children across all ages.

In addition to personal characteristics and relational factors, specific environmental factors assessing adverse family events and low SES were also significantly associated with poor mental health outcomes and a greater likelihood of having learning difficulties. Low SES increased the likelihood of having depression for students across all school layers (elementary OR = 1.238, middle school OR = 1.230, high school OR = 1.190). Poor food security and poverty increased the likelihood of having learning difficulties across children in elementary to high school. Children in elementary (OR = 3.291, 2.329), middle school (OR = 2.372, 4.121), and high school (OR = 2.441, 3.327) who had lived with people who experienced mental illness or severe depression were also more likely to have anxiety and depression.

Comparison of risk factors across children in kindergarten and elementary, middle, and high school

Chi-square analysis was used to compare the proportion of children with different risk factors with depression, anxiety, and learning difficulties across age groups, as presented in Tables 2, 3, and 4.

Significantly more depressed children in high school (57.1%) had emotional difficulties than those in elementary (40.4%) and middle school (56.6%). Similarly, for children with anxiety, a greater proportion of children in high school reported emotional difficulties as compared to children in elementary and middle school. In contrast, more children with depression and anxiety had hyperactivity difficulties in elementary school (41.4%, 30.9%) as compared to middle (36.8%, 30.7%) and high school (38.9%, 16.7%). Across age groups, we also identified significant differences in the proportion of anxious children with peer problems and structural risk factors of having experienced an adverse family environment.

In contrast to anxiety and depression, no significant differences in emotional difficulties were observed across age groups in children with learning difficulties. A greater proportion of children with learning difficulties had conduct problems in kindergarten (25.0%) as compared to children in elementary (24.8%), middle (13.2%), and high school (15.3%). Similarly, a greater proportion of younger children in elementary school (51.6%) and kindergarten (40.0%) had hyperactivity problems compared to those in middle (33.1%) and high school (22.7%). On a relational layer, the greatest proportion of children with learning difficulties had peer problems in kindergarten (60.0%).

Table 2 Factors associated with low versus high depression scores across children of different school age groups

	Elementary school		Middle school		High school		All age groups		*P*-value
	Low score	High score	Low score	High score	Low score	High score	Low score	High score	
Personal characteristic									
Emotional difficulties	59 (59.6)	40 (40.4)	33 (43.4)	43 (56.6)	88 (42.9)	117 (57.1)	180 (47.4)	200 (52.6)	0.018
Conduct problems	68 (68.7)	31 (31.3)	55 (72.4)	21 (27.6)	166 (80.6)	40 (19.4)	289 (75.9)	92 (24.1)	0.055
Hyperactivity	58 (58.6)	41 (41.4)	48 (63.2)	28 (36.8)	162 (78.6)	21.4 (38.9)	268 (70.3)	113 (29.7)	< 0.001
Peer support									
Prosocial behaviour	90 (90.9)	9 (9.1)	71 (93.4)	5 (6.6)	188 (91.7)	17 (8.3)	349 (91.8)	31 (8.2)	0.830
Peer problems	67 (67.7)	32 (32.3)	46 (60.5)	30 (39.5)	135 (65.5)	71 (34.5)	248 (65.1)	133 (34.9)	0.605
Adverse family environment									
Neighbourhood violence	84 (85.7)	14 (14.3)	57 (76.0)	18 (24.0)	155 (76.0)	49 (24.0)	296 (78.5)	81 (21.5)	0.131
Parents incarcerated	77 (80.2)	19 (19.8)	68 (90.7)	7 (9.3)	171 (83.0)	35 (17.0)	316 (83.8)	61 (16.2)	0.164
Family member mentally ill or severely depressed	73 (76.0)	23 (24.0)	49 (65.3)	26 (34.7)	137 (67.5)	66 (32.5)	259 (69.3)	115 (30.7)	0.233
Family member with an alcohol or drug problem	76 (79.2)	20 (20.8)	54 (72.0)	21 (28.0)	151 (73.7)	54 (26.3)	281 (74.7)	95 (25.3)	0.491
SES									
Poverty	74 (74.7)	25 (25.3)	54 (71.1)	22 (28.9)	165 (80.1)	41 (19.9)	293 (76.9)	88 (23.1)	0.234
Healthcare access	82 (82.8)	17 (17.2)	62 (81.6)	14 (18.4)	162 (78.6)	44 (21.4)	306 (80.3)	75 (19.7)	0.658
Food security	36 (36.4)	63 (63.6)	31 (40.8)	45 (59.2)	102 (49.5)	104 (50.5)	169 (44.4)	212 (55.6)	0.075

Table 3 Factors associated with low versus high anxiety scores across children of different school age groups

	Elementary school		Middle school		High school		All age groups		*P*-value
	Low score	High score	Low score	High score	Low score	High score	Low score	High score	
Personal characteristic									
Emotional difficulties	219 (67.6)	105 (32.4)	114 (59.4)	78 (40.6)	230 (55.7)	183 (44.3)	563 (60.6)	366 (39.4)	< 0.004
Conduct problems	264 (81.5)	60 (18.5)	162 (84.4)	30 (15.6)	358 (86.5)	56 (13.5)	784 (84.3)	146 (15.7)	0.181
Hyperactivity	224 (69.1)	100 (30.9)	133 (69.3)	59 (30.7)	345 (83.3)	69 (16.7)	702 (75.5)	228 (24.5)	< 0.001
Peer support									
Prosocial behaviour	301 (92.9)	23 (7.1)	184 (95.8)	8 (4.2)	382 (92.5)	31 (7.5)	867 (93.3)	62 (6.7)	0.288
Peer problems	255 (78.7)	69 (21.3)	146 (76.0)	46 (24.0)	292 (70.5)	122 (29.5)	693 (74.5)	237 (25.5)	0.035
Adverse family environment									
Neighbourhood violence	290 (89.8)	33 (10.2)	159 (83.7)	31 (16.3)	328 (79.6)	84 (20.4)	777 (84.0)	148 (16.0)	< 0.001
Parents incarcerated	293 (91.6)	27 (8.4)	169 (88.9)	21 (11.1)	360 (87.2)	53 (12.8)	822 (89.1)	101 (10.9)	0.167
Family member mentally ill or severely depressed	255 (79.4)	66 (20.6)	146 (76.8)	44 (23.2)	307 (74.9)	103 (25.1)	708 (76.9)	213 (23.1)	0.349
Family member with an alcohol or drug problem	276 (86.3)	44 (13.8)	148 (77.9)	42 (22.1)	317 (77.1)	94 (22.9)	741 (80.5)	180 (19.5)	0.005
SES									
Poverty	279 (86.1)	45 (13.9)	161 (83.9)	31 (16.1)	356 (86.0)	58 (14.0)	796 (85.6)	134 (14.4)	0.743
Healthcare access	274 (84.6)	50 (15.4)	167 (87.0)	25 (13.0)	340 (82.1)	74 (17.9)	781 (84.0)	149 (16.0)	0.297
Food security	177 (54.8)	146 (45.2)	103 (53.6)	89 (46.4)	241 (58.4)	172 (41.6)	521 (56.1)	407 (43.9)	0.462

Discussion

Although the results were heterogeneous, personal characteristics, peer support, SES, and adverse home environment all had varying levels of influence on mental health and learning difficulties in children under 18 years of age. While personal characteristics of emotional and behavioural dysregulation were more significantly associated with anxiety and depression, peer support had a more significant influence on the risk of learning difficulties in children. Overall, the results suggested that strengthening personal characteristics of emotional regulation may help improve anxiety, depression, and learning difficulties in children. Improving peer relations and having better peer support may also improve mental health and reduce the risk of learning difficulties.

Across elementary, middle, and high school children, emotional difficulties were the most significant factor associated with anxiety and depression. The SDQ scale measures emotional difficulties through screening for emotional problems and symptoms associated with different neuropsychiatric disorders (Grasso et al. 2022). Furthermore, the emotional, conduct, and hyperactivity subscales of SDQ have been used together to indirectly assess emotional and behavioural dysregulation in children and adolescents in previous studies, emerging as a dysregulation profile (SDQ-DP) subscale in research (Deutz et al. 2018). Due to the compromised ability to monitor, evaluate, and modify emotional experiences, emotional dysregulation prevents children from utilizing effective and flexible coping strategies when faced with challenging situations (Gross 2013). Behavioural dysregulation often leads to aggression and severe conduct problems of destructive tantrums and severe outbursts of temper. Together, emotional and behavioural dysregulation impede learning and restrict access to normal activities and social opportunities, hindering a child's emotional and cognitive development and increasing the risk of mental illness and learning difficulties (Ogundele 2018).

For these children, strategies such as mindfulness-based intervention, reducing escalation of emotions, and monitoring emotions can all help strengthen a child's resilience on a personal layer, providing them with effective skills to better manage their emotions and behaviour (Wyman et al. 2010; Bockmann and Yu 2023). In the current study, we found that the influence of emotional dysregulation on anxiety and depression increased with age. A greater proportion of depressed and anxious children had emotional difficulties in high school than in elementary school. In contrast, a significantly greater proportion of depressed and anxious children in elementary school had hyperactivity problems than those in high school. Since the influence of emotional and behavioural dysregulation on anxiety and depression differs across age groups, interventions should be adjusted and tailored across children of different school levels. The results indicated that interventions for older children in high school should be focused on strengthening emotional regulation, while strategies on both behavioural and emotional

Table 4 Factors associated with low versus high learning difficulties score across children of different school age groups

	Kindergarten		Elementary school		Middle school		High school		All age groups		*P*-value
	Low score	High score	Low score	High score	Low score	High score	Low score	High score	Low score	High score	
Personal characteristic											
Emotional difficulties	17 (85.0)	3 (15.0)	123 (76.4)	38 (23.6)	96 (79.3)	25 (20.7)	163 (75.8)	52 (24.2)	399 (77.2)	118 (22.8)	0.730
Conduct problems	15 (75.0)	5 (25.0)	121 (75.2)	40 (24.8)	105 (86.8)	16 (13.2)	183 (84.7)	33 (15.3)	424 (81.9)	94 (18.1)	0.034
Hyperactivity	12 (60.0)	8 (40.0)	78 (48.4)	83 (51.6)	81 (66.9)	40 (33.1)	167 (77.3)	49 (22.7)	338 (65.3)	180 (34.7)	<0.001
Peer support											
Prosocial behaviour	17 (85.0)	3 (15.0)	144 (89.4)	17 (10.6)	116 (95.9)	5 (4.1)	197 (91.6)	18 (8.4)	474 (91.7)	43 (8.3)	0.171
Peer problems	8 (40.0)	12 (60.0)	115 (71.4)	46 (28.6)	86 (71.1)	35 (28.9)	149 (69.0)	67 (31.0)	358 (69.1)	160 (30.9)	0.036
Adverse family environment											
Neighbourhood violence	18 (94.7)	1 (5.3)	139 (88.0)	19 (12.0)	106 (89.1)	13 (10.9)	178 (83.6)	35 (16.4)	441 (86.6)	68 (13.4)	0.300
Parents incarcerated	18 (94.7)	1 (5.3)	139 (90.3)	15 (9.7)	109 (91.6)	10 (8.4)	172 (80.0)	43 (20.0)	438 (86.4)	69 (13.6)	0.004
Family member mentally ill or severely depressed	16 (84.2)	3 (15.8)	133 (84.7)	24 (15.3)	94 (79.0)	25 (21.0)	163 (77.3)	48 (22.7)	406 (80.2)	100 (19.8)	0.324
Family member with an alcohol or drug problem	17 (94.4)	1 (5.6)	136 (87.2)	20 (12.8)	97 (80.8)	23 (19.2)	169 (79.7)	43 (20.3)	419 (82.8)	87 (17.2)	0.135
SES											
Poverty	18 (90.0)	2 (10.0)	123 (76.4)	38 (23.6)	85 (70.2)	36 (29.8)	162 (75.0)	54 (25.0)	388 (74.9)	130 (25.1)	0.260
Healthcare access	20 (100)	0 (0)	140 (87.0)	21 (13.0)	104 (86.0)	17 (14.0)	179 (82.9)	37 (17.1)	443 (85.5)	75 (14.5)	0.179
Food security	14 (70.0)	6 (30.0)	68 (42.2)	93 (57.8)	42 (34.7)	79 (65.3)	107 (50.0)	107 (50.0)	231 (44.8)	285 (55.2)	0.005

self-regulation are required in younger children to reduce the risk of anxiety and depression.

Improving behavioural and emotional self-regulation not only can equip children with tools to better cope with environmental and psychological stressors, but correcting dysfunctional behavioural and emotional profiles can enable children to better engage in social opportunities, allowing them to form friendships that provide positive peer support, acting as a protective factor against anxiety and depression (Butler et al. 2022). This aligns with findings from the current study that identified lack of peer support as an independent risk factor for anxiety and depression.

Learning difficulties were measured across children in kindergarten to high school. In kindergarten children, peer problems (OR = 20.548) on a relational layer acted as a more significant factor influencing learning difficulties as compared to emotional and behavioural dysregulation (OR = 2.260). For children in middle and high school, factors on a personal layer had a greater influence on the likelihood of having learning difficulties. Hyperactivity that is reflective of behavioural dysregulation was the most significant personal characteristic associated with increased likelihood of having learning difficulties across all age groups. The influence of hyperactivity on the likelihood of having learning difficulties decreased in older age groups. Differences in the influence of personal and relational factors on learning difficulties across age groups may be explained by the different learning objectives and demands required at different schooling stages.

In kindergarten, learning occurs through playing, reading, and singing via interactions with peers and responsive caregivers (UNICEF 2018). The main objective of learning for kindergarten children is to explore the world around them to develop language, social-emotional, and cognitive skills, with minimal focus on curriculum and academics (UNICEF 2018). Thus, peer problems such as being disliked by peers or having no friends can significantly impact a child's ability to engage in meaningful play, increasing the risk of having learning difficulties in kindergarten children. In elementary, middle, and high school, learning becomes more structured with a fixed curriculum assessed through assignments and exams, requiring higher levels of concentration to succeed in school. For children in elementary school and beyond, difficulties in concentration or task completion among children with hyperactivity issues may impact their ability to learn more significantly than peer problems (Krieger and Amador-Campos 2021).

In this study, structural and environmental factors of SER were assessed via questions on exposure to adverse family events and household SES. Negative environmental factors are linked to social adversity defined as exposure to hardships in social situations, such as maltreatment at home, poverty, and discrimination (Deirdre et al. 2019). In this study, only one factor of "having lived with someone who experienced mental illness or severe depression" uniformly increased the risk of either depression or anxiety.

Having caregivers who are mentally ill or severely depressed influences the likelihood of having anxiety and depression in children due to fewer positive parenting strategies and poor emotion regulation strategies, while being exposed to a volatile and stressful environment. Congruent with our study, previous studies found that 50% of children with depressed parents develop depression before adulthood (Goodman et al. 2011). At younger ages, responsive caregivers who can provide emotional support are critical for children to form secure attachments required for healthy emotional development to prevent anxiety and depression (Hammen et al. 2004). Depressed caregivers create unpredictable stressful environments by being emotionally and physically unavailable or being excessively intrusive and irritable (Hammen et al. 2004). However, a child's personal characteristics in emotional and behavioural regulation and strength of social support determine how a child responds to social adversities presented in adverse environments (Deirdre et al. 2019). Thus, not all children exposed to adverse environmental factors may develop anxiety or depression.

Low SES also increases the likelihood of having depression in elementary, middle, and high school children, often acting as an environmental stressor independent of personal characteristics and peer relationships (Reiss et al. 2019). Low SES is frequently associated with multiple adverse stressors including poor food security, severe financial crisis, and breach of law, while poor access to healthcare may deny children timely mental health support (Reiss et al. 2019). Low SES was also associated with increased likelihood of having learning difficulties in high school children. This may be explained by their lower readiness in cognitive, social, and emotional skills at the time of school entry due to worse learning opportunities at home and in the community (Edwards et al. 2009). In the community, children from low SES households often live in the poorest neighbourhoods without playgrounds, parks, and childcare and healthcare facilities (Edwards et al. 2009). At home, caregivers of low SES households are also often unable to provide their child with cognitively stimulating opportunities, nutritious food, high-quality childcare, stimulating toys, or additional academic support due to financial limitations (Edwards et al. 2009). Over time, the gaps between children from higher and lower SES may widen, leading to worse learning and academic performance in high school, as indicated in the current study.

One limitation of the study was the bidirectional relationship between risk factors and outcomes measured. While having peer problems can increase the risk for learning difficulties, having learning difficulties may also present as barriers that hinder the child's ability to make friends and thus

lead to peer problems. Similarly, while lack of peer support may act as an independent risk factor for depression and anxiety, a child with anxiety and depression is also more likely to be socially reserved and isolated, with increased risk for peer problems. The bidirectional nature reflects the complexity of interactions between environmental, personal, and relational factors within the SER model, supporting the idea that mental illnesses and learning difficulties are influenced by a sum of risk factors.

Conclusion

This study identified personal characteristics of emotional and behavioural dysregulation as the most significant risk factor associated with anxiety and depression amongst children in elementary, middle, and high school. Structural environmental factors including having experienced adverse family events and low SES also increased the risk of poor mental health outcomes. Thus, interventions to improve emotional and behavioural regulation should be targeted towards children in vulnerable communities, such as those residing within regions with poor demographic factors including poverty, low education, and high crime rate.

Mindfulness-based therapies such as mindfulness-based cognitive therapy and mindfulness-based stress reduction can be implemented. These therapies provide children with practical emotional and behavioural regulation strategies that can be exercised when they encounter psychosocial stressors, addressing emotional and behavioural dysregulation associated with greater depression and anxiety. Correcting dysfunctional behavioural and emotional profiles can further enable children to better engage in social opportunities, allowing them to form friendships that provide positive peer support, acting as a protective factor against anxiety and depression. Early implementation of mindfulness-based therapies and practices in schools of disadvantaged communities, starting from elementary school, can act as a protective strategy for vulnerable children against poor mental health outcomes, equipping them with adequate emotional and behavioural regulation strategies when faced with psychosocial distress.

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Availability of data and material The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics Data analysed in this study are from a freely available open-source NHIS dataset. Permission was granted to the principal supervisor and all collaborators for use.

Consent for publication Consent was obtained from each participant prior to the conduction of the interview over the phone by the United States Census Bureau. Permission to use the dataset was granted to all authors involved in this study.

Conflict of interest The authors report no potential for conflict of interest.

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