CHILDHOOD ADVERSITY AND LIFE-COURSE CONSEQUENCES

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PUBLISHED IN: Frontiers in Psychology

frontiers Research Topics

frontiers

ISSN 1664-8714
ISBN 978-2-88976-727-4
DOI 10.3389/978-2-88976-727-4

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CHILDHOOD ADVERSITY AND LIFE-COURSE CONSEQUENCES

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Citation: Zlotnick, C., Cui, N., Golfenshtein, N., Li, Y., eds. (2022). Childhood Adversity and Life-course Consequences. Lausanne: Frontiers Media SA.
doi: 10.3389/978-2-88976-727-4

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frontiers | Frontiers in Psychology

EDITORIAL
published: 11 July 2022
doi: 10.3389/fpsyg.2022.967180

Editorial: Childhood Adversity and Life-Course Consequences

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Keywords: childhood adversity, stress, education, mental health, parenting

Editorial on the Research Topic

Childhood Adversity and Life-Course Consequences

Childhood adversity is common in different sociocultural contexts and related to adverse outcomes throughout the life course (Caspi et al., 2017; Hughes et al., 2017, 2021; Bellis et al., 2019). Research in the past several decades has increased our understanding about the behavioral, psychological, and physical health outcomes, and the socio-economic burden related to childhood adversity. More precise and consistent measurements of childhood adversity, as well as the use of mixed-methods and longitudinal studies, and recently developed approaches such as epigenetics have further expanded the field. Nine original research articles were collected in the present Research Topic. All attempted to disentangle the effects of heterogeneous forms of childhood adversities, and examine the possible underlying mechanisms that result in negative outcomes.

Five of the nine research articles focused on relatively healthy children in school settings. They assessed heterogeneous forms of childhood adversity, including daily stress, psychological abuse and neglect, physical abuse, school bullying, and other environmental and personal encounters.

Xue et al. assessed the prevalence and risk factors of school bullying among a large sample of Chinese children and adolescents and found that 17.3% of the participants reported school bullying against their peers, and ∼7.8% reported cyberbullying. Parental involvement and high self-control were protective against bullying, whereas experiencing interparental conflict and risk behaviors were associated with more bullying behavior.

Based on the process model of stress and coping, Wu et al.'s study examined the relationship between daily stress (i.e., bullying, examination failure, study load, financial problems in the family, family conflict, and chronic physical illness in a family member) and behavioral problems among primary school students. Their findings showed that high levels of daily stress were associated with more behavioral problems; however, this relationship was buffered by high-quality family functioning and good class environment.

Li et al. used longitudinal data from 271 primary school children and found that psychological abuse and neglect predicted low academic achievement 6 months later through low learning engagement. In addition, they reported that family socioeconomic status (SES) moderated the relationship between learning engagement and academic achievement, so that this relationship was stronger among children with low SES.

Similarly, Shen used data from 15-year longitudinal dataset of 9–12 years old children at the baseline in China and found that cumulative childhood adversity was associated with low educational attainment that was further linked to poor mental health in later adulthood. Interestingly, this study constructed cumulative adversity using a different set of adversities, including socioeconomic hardship, family disruption, children's physical issues (chronic disease, insufficient breakfast, or myopia), and academic setbacks. This study also examined the specific

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Edited and reviewed by:
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Specialty section:
This article was submitted to Developmental Psychology, a section of the journal Frontiers in Psychology

Received: *12 June 2022*
Accepted: *23 June 2022*
Published: *11 July 2022*

Citation:
Cui N, Zlotnick C, Li Y and Golfenshtein N (2022) Editorial: Childhood Adversity and Life-Course Consequences. Front. Psychol. 13:967180. doi: 10.3389/fpsyg.2022.967180

effects of different types of adversity on mental health across different life stages and assessed potential gender effects.

Cui et al. analyzed the potential role of P300, a proxy indicator of the allocation of neural resources and neurocognitive processing capability, in the relationship between physical abuse and externalizing behavior among a sample of school children. They reported that physical abuse by mothers was associated with more child externalizing behaviors through the mechanism of allocating more attentional resources to novel cues, which was indicated by enhanced P300 amplitude to novelty cues in an auditory oddball task.

Similarly, Moreno-Manso et al. reported significant cognitive impairment among 61 youths who were receiving protective services due to child maltreatment, poor family function, and others, and found that cognitive impairment was associated with more emotional and behavioral problems. The two studies together elucidate the possible neurocognitive mechanism underpinning the relationship between childhood adversity, and emotional and behavioral consequences.

The study by Mey et al. focused on male drug addicts under mandatory drug rehabilitation in Malaysia and revealed that more childhood maltreatment experiences were related to low treatment motivation. They also found that forgiveness and self-efficacy were possible psychological pathways through which childhood maltreatment mitigated treatment motivation.

Zhang et al. examined the joint and independent effects of different forms of childhood abuse (emotional, sexual, and physical) on different outcomes among pregnant women. Using data from 1,825 pregnant women, they reported that a high cumulative score of childhood abuse was associated with severe prospective and retrospective memory impairment. Among pregnant women exposed to only one form of child abuse, only women with emotional abuse experience demonstrated significant memory impairment, signifying the importance of assessing childhood abuse during prenatal care.

Finally, the COVID-19 pandemic has increased the risk of parenting stress. Parents with childhood adversity may be predisposed to vulnerability during this stressful period. Supporting this notion, Clemens et al. collected data from an online survey during the first lockdown due to the COVID-19 pandemic and found that parents with more adverse childhood experiences (ACEs) were more likely to exhibit harmful parenting behaviors.

In view of the findings of this Research Topic, it seems clear that regardless of the age-group, type of population, or exposure to a single or multiple type of adversities, people who were exposed to childhood adversity were at high risk of academic, emotional, behavioral, and cognitive problems. Although preventions and interventions have been emphasized to address the issues of adverse childhood experiences, the implementation and enforcement of these measures seem unsatisfying as a significant proportion of the participants involved in the included studies still suffered from such experiences. In this sense, it is still necessary to raise awareness of the harmful consequences of childhood adversity and apply prevention and intervention measures. In addition, future advances in differentiating positive, tolerable, and toxic stress, revealing the complex mechanism of how childhood adversity gets under the skin and produces life-long consequences, and therefore, designating and implementing preventive and therapeutic early interventions is warranted.

AUTHOR CONTRIBUTIONS

NC drafted the editorial. CZ, YL, and NG checked against results, edited, and refined the materials within this editorial. All authors contributed to the article and approved the submitted version.

FUNDING

This research is part of the grant of the National Social Science Fund (18CSH061) and the Seed Fund for Candidates for Qilu Outstanding Scholars by Shandong University (2018WLJH46).

ACKNOWLEDGMENTS

The authors would like to thank all the contributing authors for their engagement with the Research Topic and all the Frontiers staff for their support of the Research Topic.

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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.

frontiers in Psychology

ORIGINAL RESEARCH
published: 19 August 2021
doi: 10.3389/fpsyg.2021.716489

Executive Processes and Emotional and Behavioural Problems in Youths Under Protective Measures

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This research studies the executive processes of youths under protective measures between 13 and 18 years of age, as well as the emotional problems they have and the presence of behavioural problems, such as difficulties to control and direct attention, to control one's own behaviour and inhibit inadequate or ineffective responses (hyperactivity-impulsiveness) and problems related to emotional regulation. In addition, we study the presence of significant differences according to the sex of the youths. We also analyse to what extent the difficulties in the executive processes are related to and can predict the emotional and behavioural problems. The instruments used were Stroop's Colour and Word Test (Stroop), the Paths Test (TESen), and the System of Evaluation for Children and Adolescents (SENA). The results indicated that the youths had difficulties in such executive processes as execution, speed, and accuracy in carrying out tasks. Furthermore, they had emotion problems, amongst which the symptoms of anxiety are worthy of note; whilst attention deficit, hyperactivity-impulsiveness, and problems related to emotional regulation could also be observed. The data indicated greater difficulties in the executive processes for males than for females. There was a greater emotional symptomatology in the females, whilst there were greater deficits in attention and hyperactivity/impulsiveness in the males. Similarly, the deficits in the executive processes were related to and predicted emotional and behavioural problems. This research suggests the design of a structured programme focused on systematic training in real, daily situations, recommending the use of restorative techniques to work on the affected cognitive skills and techniques aimed at improving the youths' emotion regulation.

Keywords: executive functions, emotional problems, executive processes, behavioural problems, psychopathology, residential care

OPEN ACCESS

Edited by:
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Specialty section:
This article was submitted to Developmental Psychology, a section of the journal Frontiers in Psychology

Received: *01 June 2021*
Accepted: *28 July 2021*
Published: *19 August 2021*

Citation:
Moreno-Manso JM, García-Baamonde ME, Guerrero-Barona E, Godoy-Merino MJ, Guerrero-Molina M and Barbosa-Torres C (2021) Executive Processes and Emotional and Behavioural Problems in Youths Under Protective Measures. Front. Psychol. 12:716489. doi: 10.3389/fpsyg.2021.716489

INTRODUCTION

Residential care is a protective measure aimed at those youths who, due to the especially vulnerable situation, cannot remain in the family homes. These youths are in a situation of abuse or serious risk of suffering abuse, either because the families do not or cannot adequately attend to the basic needs, or because they are victims of abuse. It is thus necessary to provide

them with a temporary place of residence that can guarantee them the necessary protection, education and emotional, cognitive, behavioural, and social development.

Many of these youths may present negative psychological consequences because of their situation of abuse and/or their adverse family life (D'Andrea et al., 2012; Jennissen et al., 2016; Jozefiak et al., 2016). Green et al. (2010), Cicchetti and Toth (2016), and Jaffee (2017) point out that child abuse explains the risk of suffering a psychopathology in a very high percentage of cases. Teicher and Samson (2013), Hodgdon et al. (2018), Karatekin et al. (2018), and Racine et al. (2020) point out that the victims of abuse have greater possibilities of developing such psychological symptoms and disorders as depression, anxiety, post-traumatic stress, psychosomatic disorders, attention deficit hyperactivity disorder (ADHD), behavioural disorders, personality disorders, psychosis, substance abuse, or suicidal tendencies, amongst others. Sege et al. (2017) and Docherty et al. (2018) point to the most frequent emotional and behavioural manifestations in victims of abuse as being attention deficits, oppositional defiant disorders, an inability to regulate emotional states, problems with the peers, and unruly behaviour at school.

Psychosocial adversities suffered at an early age such as the child abuse, may be prejudicial for the neurobiological systems, perturbing the development of the neuronal circuits and interfering in the brain's development (De Bellis et al., 2013; Rock et al., 2018), thus increasing one's vulnerability to mental health problems (Kim and Cicchetti, 2010; De Bellis and Zisk, 2014; Greger et al., 2015). Similarly, it has been observed that youths with psychopathology symptomatology, caused by situations of psychosocial stress, present structural alterations in certain regions of the brain such as the amygdala, the prefrontal cortex, and the hippocampus (Grant et al., 2014; Kavanaugh et al., 2017; Quinlan et al., 2017). Carrión et al. (2010) and Tottenham et al. (2011) showed that youths who have suffered traumatic experiences present a lower activity in the prefrontal cortex. These works concluded that there were neuronal losses in the medial prefrontal cortex, a region involved in the executive functions. Davis et al. (2015) and Cromer and Villodas (2017) demonstrated that alterations in the prefrontal regions occasioned by such traumatic experiences as abuse have emotional and behavioural consequences for the victims.

Concerning the differences between the genders, one of the limitations of studies is the use of samples of only one gender. However, some studies have found a greater effect in females related to cognition and emotional regulation; whilst in males, worse control over one's impulses has been found (Edmiston et al., 2011; Tung et al., 2012). Camuñas et al. (2020) observed more emotional problems in females than in males. Teicher et al. (2004), Shea et al. (2005), and Burghy et al. (2012) found a greater probability of internalising problems (anxiety, depression, post-traumatic stress…) in females and of externalising problems in males (attention deficits and hyperactivity).

In this context, the objectives of the research were: to analyse the executive processes of youths under protective measures, together with the emotional problems they may present, and the presence of behavioural problems, such as difficulties in controlling and directing attention, in controlling one's own behaviour and inhibiting inadequate or ineffective responses (hyperactivity-impulsiveness) and problems related to emotional regulation; to verify the presence of significant differences due to gender in the youths' executive processes, emotional and behavioural problems; to analyse the relationship between the executive processes, emotional difficulties, and the behavioural problems; and to determine the extent to which the executive processes can predict emotional problems and the behavioural problems. Based on the theoretical review carried out, we expected the youths to show deficits in the executive processes, emotional problems, and the behavioural problems (hypothesis 1). Furthermore, we expected significant differences in the executive processes, emotional problems, and the behavioural problems according to gender (hypothesis 2). We also expected difficulties in the executive processes to be related to the emotional problems and the behavioural problems (hypothesis 3). Finally, we expected the deficits in the executive processes would be able to act as predictors of the emotional difficulties and the behavioural problems (hypothesis 4).

MATERIALS AND METHODS

Participants

The sample consisted of 61 youths between 13 and 18 years of age (*Mean* = 14.98; *SD* = 1.21) in residential care with protective measures. About 47.5% of the participants were female ($n = 29$) and 52.5% were male ($n = 32$). The participants made up the total number of youths within this age range in public residential care and in privately managed tutored flats in the Region of Extremadura (Spain) in 2019. The sample size was adequate, given that the number of participants is representative of the population in residential care in Spain (Observatorio de la Infancia, 2019). The average period of time spent in residential care centres was 38 months.

The reason for the protective measures and the corresponding admittance to a residential care centre was the legal situation of vulnerability. A total of 33 youths (54.1%) had been separated from the family due to child abuse. As for the type of abuse, 21.5% of the participants had suffered physical neglect, followed by physical and emotional neglect (14.3%), physical abuse (9.8%), physical and emotional abuse (7%), and sexual abuse (1.5%). In the remaining 45.9% of youths ($n = 28$), the protective measure was for other reasons, such as the impossibility of the parents or legal tutors to carry out the obligations towards them (alcoholism, drug consumption, prison, mental illness, prostitution, or domestic violence; 25.2%), the abandonment/express renunciation on the part of the parents/tutors (3%) or due to an inability on the parents' part to control the youth's behaviour (17.7%).

As for the youths' educational situation, it should be pointed out that 73.7% were in obligatory secondary education, 3.3% were in baccalaureate, 9.7% were in vocational training, and 13.3% were not studying at all.

No youths receiving therapeutic attention following a diagnosis of neurodevelopmental disorders, such as intellectual disability, disorders of the autistic spectrum, ADHD, or specific learning disorders, took part in the research, thus avoiding the bias that the inclusion would have supposed for the objectives of the study.

The information concerning diagnoses of the youths' physical or mental health was obtained from the personal files of the Social Services of the Region of Extremadura (Spain). The youths who participated in the research presented no relevant physical or mental health problems and no mention was made in the files of the presence of intellectual disability.

Instruments

Colour and Word Test (Stroop)

This is one of the most widely used tests to detect neuropsychological problems or brain damage and to evaluate interference (Golden, 2007). The test consists of three tasks: reading words, naming colours, and a final task of interference. A comparison of the scores obtained in the three tasks allows the effects of interference in the subjects and the attention control to be evaluated. The test involves the ability to select relevant information in a flexible way and adapt to new circumstances, to face cognitive stress and process complex information, inhibitory control, the speed of processing, the ability to plan and execute strategies aimed at achieving a goal, working memory, and cognitive flexibility. The test is applied individually and is sensitive to lesions in the frontal lobe. The tasks involve focusing on a particular stimulus (selective attention) and ignoring distractions (irrelevant stimuli; inhibitory control). As for the normative data, the average scores are between 40 and 60. With respect to the reliability data, Cronbach's Alpha in the three sheets is, respectively, $\alpha = 0.85$, $\alpha = 0.81$, and $\alpha = 0.69$; whilst in interference it is $\alpha = 0.70$.

The Paths Test (TESen)

The Paths Test (TESen; Portellano and Martínez, 2014) is a screening test aimed at detecting alterations in the executive functioning. The instrument consists of carrying out a planning task of hand-eye coordination. The test is applied individually and consists of four parts (paths) of increasing difficulty. The tasks that must be carried out in each part involve, progressively, attention and executive processes of varying complexity. The test provides us with scores concerning speed (the ability to resolve tasks that require increasing amounts of attention and executive control), accuracy (successes and errors committed), and execution (efficiency with which the task is carried out). As for the normative data, the average scores are between 40 and 60; whilst for the reliability data, Cronbach's Alpha in speed is $\alpha = 0.93$, in accuracy $\alpha = 0.89$ and in execution $\alpha = 0.88$.

System of Evaluation for Children and Adolescents

This instrument provides very useful information for detecting psychological problems in children and adolescents (Fernández-Pinto et al., 2015). The test is aimed at evaluating emotional and behavioural problems, as well as contextual problems. However, considering the aims of our study, contextual problems were not evaluated. With respect to emotional problems, it evaluates depression, anxiety, social anxiety, somatic problems, post-traumatic symptomatology, and obsession-compulsion. As for the behavioural problems, it evaluates problems of attention, hyperactivity-impulsiveness, and emotion control. With respect to the normative data of this instrument, the average is 50 and the SD is 10. The instrument's reliability reflects adequate indices. The mean of Cronbach's Alpha is between $\alpha = 0.82$ and $\alpha = 0.85$ on the scales of samples from the general and clinical populations, respectively, and of $\alpha = 0.93$ in the global indices.

Procedure

The research was authorised by the institution responsible for the legal tutelage of the youths (Region of Extremadura, Spain). All procedures performed were in accordance with the ethical standards of Extremadura University (Ref.: 181/2020) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. All subjects gave the informed consent for inclusion before they participated in the study.

The evaluators received prior formation on applying the instruments so as to guarantee the validity and reliability of the data gathered. All the instruments were applied individually in the centres and homes where the youths resided. No difficulties arose, whilst the tests were being carried out.

Statistical Analyses

This is a descriptive study of a transversal nature. We first of all carried out a descriptive analysis of the youths' executive processes, the emotional problems, and the behavioural problems. Secondly, having confirmed the use of non-parametric tests, we then used the Mann-Whitney U test to analyse the presence of significant differences according to gender. Thirdly, we performed a Spearman's correlation analysis to analyse the relation between the executive processes, the emotional problems, and the behavioural problems; finally, we carried out a linear regression analysis to determine the extent to which the executive processes can predict emotional difficulties and behavioural problems.

The statistical package SPSS version 25 was used for the statistical treatment of the data.

RESULTS

Table 1 shows the descriptive data from the Stroop, TESen, and System of Evaluation for Children and Adolescents (SENA).

The data from Stroop test showed mean scores of below 50, which is indicative of a low resistance to interference and thus less inhibitory attention control. Several of the youths show difficulties to inhibit or control automatic responses. The low scores observed may indicate scarce cognitive flexibility and a low adaptation to cognitive stress required in new situations, as well as a lower capacity to take decisions and resolve problems.

Results from TESen test indicated that the global performance in the test is below of the normative group in execution, speed, and accuracy. The scores in speed were below the normal range,

TABLE 1 | Means and SDs of the Stroop, TESen, and System of Evaluation for Children and Adolescents (SENA).

	Mean	*SD*
Stroop		
Words	40.92	8.14
Colours	36.02	7.65
Words-colours	38.93	5.90
Interference	45.80	2.79
TESen		
Execution	29.51	4.35
Speed	27.87	5.28
Accuracy	24.67	4.06
SENA		
Global indices		
Index of emotional problems	63.62	2.72
Index of behavioural problems	64.48	2.07
Emotional problems		
Depression	52.31	4.29
Anxiety	63.90	2.56
Social anxiety	60.77	2.62
Somatic problems	61.77	5.29
Post-traumatic symptomatology	60.41	8.81
Obsessive–compulsive	58.16	7.15
Behavioural problems		
Attention problems	64.38	4.84
Hyperactivity-impulsiveness	64.46	6.58
Problems controlling emotions	63.08	5.81

indicating that there are significant differences in the speed of cognitive processing, in cognitive, attention, visuospatial, and psychomotor fluency. The scores in accuracy were the lowest. This indicates difficulties in planning and solving more difficult problems and is caused by insufficient mental flexibility (rigidity), inhibitory deficit (impulsiveness or low resistance to interference), or difficulties in working memory. This may be related to a deficient control of emotional regulation and impulses.

Results from SENA test indicated that the global indices the scores obtained were above average in both indices (emotional problems and behavioural problems). The highest score is in the index of behavioural problems, which is one of the most severe difficulties.

The data indicated scores higher than the normative group in such emotional problems as anxiety, social anxiety, somatic problems, and post-traumatic symptomatology. It is also worth mentioning the high scores in problems of attention, hyperactivity-impulsiveness, and problems with regulating emotions.

As for gender differences in the executive processes, in emotional problems and in behavioural problems, **Table 2** shows the data from the Mann-Whitney U test.

Results from Stroop test showed significant differences according to gender in words-colours and interference. The average score in the males was lower than that of the females.

The data from TESen test indicated significant differences according to gender in executive processes analysed (execution, speed, and accuracy). The scores were lower for the males than for the females. The males thus presented greater difficulties than the females.

Results from SENA test in the global indices showed significant differences in the index of emotional problems and in the index of behavioural problems. The females had more emotional difficulties than the males, whilst the males had more behavioural problems than the females.

Significant differences were observed in anxiety, social anxiety, and post-traumatic symptomatology. The females showed greater emotional symptomatology.

The results showed significant differences in problems of attention and hyperactivity-impulsiveness. The males presented a higher externalising symptomatology than the females. As for emotional problems, the females had more problems here than the males.

With respect to the relation between the executive processes, emotional problems, and the behavioural problems, **Table 3** shows the correlation data.

The results indicated a significant negative correlation between the index of emotional problems and the executive processes, such as those for words-colours ($p = 0.020$), interference ($p = 0.000$), speed ($p = 0.006$), and accuracy ($p = 0.002$). Anxiety correlates with the executive processes of interference ($p = 0.003$), execution ($p = 0.012$), speed ($p = 0.000$), and accuracy ($p = 0.000$); social anxiety correlates with speed ($p = 0.024$); and post-traumatic symptomatology correlates with words-colours ($p = 0.036$), interference ($p = 0.048$), speed ($p = 0.016$), and accuracy ($p = 0.011$).

With respect to the index of behavioural problems, the data indicated a significant negative correlation with interference ($p = 0.001$), execution ($p = 0.002$), speed ($p = 0.000$), and accuracy ($p = 0.000$). Attention correlates with the processes of interference ($p = 0.000$) and execution ($p = 0.028$); hyperactivity-impulsiveness correlates with execution ($p = 0.038$); and emotional problems correlates with interference ($p = 0.001$), speed ($p = 0.001$), and accuracy ($p = 0.001$).

Finally, we carried out a linear regression to identify whether the deficits in the executive processes can act as predictors of emotional problems and the behavioural problems (**Table 4**).

The results showed that, in the index of emotional problems, the processes involved in the tasks of words-colours ($\beta = -0.31$; $p = 0.013$), interference ($\beta = -0.45$; $p = 0.000$), speed ($\beta = -0.35$; $p = 0.005$), and accuracy ($\beta = -0.37$; $p = 0.003$) act as predictors.

It can also be seen that, in the index of behavioural problems, the processes involved in the tasks of words-colours ($\beta = -0.28$; $p = 0.027$), interference ($\beta = -0.43$; p = 0.000), execution ($\beta = -0.36$; $p = 0.004$), speed ($\beta = -0.57$; $p = 0.000$), and accuracy ($\beta = -0.64$; $p = 0.000$) act as predictors.

Similarly, in emotional problems, we found that interference ($\beta = -0.35$; $p = 0.005$), execution ($\beta = -0.33$; $p = 0.009$), speed ($\beta = -0.46$; $p = 0.000$), and accuracy ($\beta = -0.46$; $p = 0.000$) all act as predictors of anxiety; whilst the tasks of words-colours ($\beta = -0.27$; $p = 0.035$), interference ($\beta = -0.28$; $p = 0.028$), and speed ($\beta = -0.34$; $p = 0.007$) act as predictors of social anxiety.

As for behavioural problems, we found that the tasks of colours ($\beta = -0.27$; $p = 0.031$), interference ($\beta = -0.51$; $p = 0.000$), and execution ($\beta = -0.33$; $p = 0.008$) all act as predictors of problems with attention; whilst interference ($\beta = -0.36$; $p = 0.004$)

TABLE 2 | Mann-Whitney U test relating to the executive processes and emotional and behavioural problems according to gender.

	Male		Female			
	Mean	*SD*	*Mean*	*SD*	*Z*	*p*
Stroop						
Words	39.47	8.77	42.52	7.19	−1.27	0.203
Colours	35.66	8.53	36.41	6.67	−0.65	0.510
Words-colours	37.25	4.85	40.79	6.46	−2.03	0.042
Interference	44.44	2.46	47.31	2.36	−4.03	0.000
TESen						
Execution	28.28	3.93	30.86	4.44	−2.41	0.016
Speed	25.31	4.90	30.69	4.16	−3.97	0.000
Accuracy	22.34	3.58	27.24	2.86	−4.88	0.000
SENA						
Global indices						
Index of emotional problems	61.59	1.84	65.86	1.50	−6.19	0.000
Index of behavioural problems	66.31	0.69	62.45	0.78	−7.04	0.000
Emotional problems						
Depression	51.47	4.00	53.24	4.48	−1.16	0.246
Anxiety	62.13	1.96	65.86	1.48	−5.81	0.000
Social anxiety	59.59	2.46	62.07	2.17	−3.66	0.000
Somatic problems	60.97	6.19	62.66	3.99	−1.44	0.149
Post-traumatic symptomatology	58.00	8.60	63.07	8.40	−4.35	0.000
Obsessive-compulsive	56.44	6.70	60.07	7.27	−1.91	0.056
Behavioural problems						
Attention problems	66.38	2.49	62.17	5.81	−3.65	0.000
Hyperactivity-impulsiveness	67.41	4.44	61.21	7.07	−3.40	0.001
Problems controlling emotions	60.69	6.87	65.72	2.50	−3.60	0.000

TABLE 3 | Correlation analysis between the executive processes, emotional problems, and behavioural problems.

	Stroop				TESen		
	Words	**Colours**	**Words-colours**	**Interference**	**Execution**	**Speed**	**Accuracy**
Global indices							
EMO	0.227	0.050	−0.297*	−0.467**	0.158	−0.350**	−0.386**
BEH	−0.161	−0.238	−0.238	−0.416**	−0.387**	−0.581**	−0.660**
Emotional problems							
DEP	0.062	−0.047	−0.044	0.084	0.039	0.121	0.053
ANS	0.208	0.052	0.229	−0.376**	−0.321*	−0.463**	−0.494**
ASC	0.105	0.070	0.164	0.201	0.112	−0.288*	0.183
SOM	0.085	−0.027	0.166	0.168	0.031	0.121	−0.011
PST	0.124	0.155	−0.268*	−0.254*	0.117	−0.307*	−0.322*
OBS	0.090	0.221	0.211	0.231	0.125	0.089	0.194
Behavioural problems							
ATE	0.097	0.209	−0.103	−0.485**	−0.281*	0.165	0.031
HIP	0.106	0.043	−0.034	−0.250	−0.266*	0.127	0.008
REG	0.117	0.092	0.142	−0.408**	0.184	−0.432**	−0.419**

*EMO: Index of emotional problems; BEH: Index of behavioural problems; DEP: Depression; ANS: Anxiety; ASC: Social anxiety; SOM: Somatic problems; PST: Post-traumatic symptomatology; OBS: Obsessive-Compulsive; ATE: Attention problems; HIP: Hyperactivity-impulsiveness; REG: Problems controlling emotions. *$p<0.05$; **$p<0.01$.*

and execution ($\beta=-0.26$; $p=0.042$) act as predictors of hyperactivity-impulsiveness.

Finally, interference ($\beta=-0.37$; $p=0.003$), speed ($\beta=-0.37$; $p=0.003$), and accuracy ($\beta=-0.35$; $p=0.005$) act as predictors of problems with emotional control.

DISCUSSION

The objectives of the present research were to analyse the executive processes of youths under protective measures, together with the emotional and behavioural problems, to study the

TABLE 4 | Regression analysis concerning the executive processes and emotional problems and behavioural problems.

	EMO				BEH			
	R^2	β	*t*	*Sig.*	R^2	β	*t*	*Sig.*
Stroop								
Words	0.05	0.22	1.77	0.081	0.04	−0.21	−1.69	0.096
Colours	0.00	0.01	0.10	0.916	0.03	−0.17	−1.36	0.179
Words-colours	0.10	−0.31	−2.55	0.013	0.08	−0.28	−2.27	0.027
Interference	0.20	−0.45	−3.95	0.000	0.19	−0.43	−3.72	0.000
TESen								
Execution	0.02	0.16	1.24	0.219	0.13	−0.36	−2.97	0.004
Speed	0.12	−0.35	−2.90	0.005	0.33	−0.57	−5.38	0.000
Accuracy	0.13	−0.37	−3.07	0.003	0.41	−0.64	−6.42	0.000

EMO: Index of emotional problems; BEH: Index of behavioural problems.

presence of significant differences due to the youths' gender, and to analyse the extent to which the difficulties in the executive processes are related to and can predict the emotional problems and the behavioural problems.

Based on the results, the youths under protective measures had difficulties in the executive processes, resulting in emotional problems and behavioural problems.

The youths had difficulties in different specific executive processes. The performance was low in the tasks that involve execution, speed, and accuracy, and a low resistance to interference could also be observed. Thus, the youths had problems with processing information, attention control, planning behaviour, working memory, and inhibiting one's behaviour. In addition, they had scarce cognitive flexibility or adaptation to cognitive stress required in new situations, as well as a lower capacity for taking decisions, resolving problems, and looking for alternatives. In general, these difficulties were greater in males than in females. In this sense, Davis et al. (2015) also found problems in behaviour planning and decision-taking in abused youths; whilst Spann et al. (2012), Nikulina and Widom (2013), and Mothes et al. (2015) showed evidence of problems with mental flexibility, difficulties in problem solving and a low resistance to interference.

With respect to the emotional problems and the behavioural problems, the research demonstrated the presence of symptoms of anxiety, social anxiety, somatic problems, post-traumatic symptomatology, hyperactivity-impulsiveness, attention deficit, and problems regulating the emotions. Furthermore, there was a greater prevalence in females for emotional problems and for regulating emotional control than in males. However, in the case of males, there was a greater prevalence of problems in attention control and hyperactive and impulsive behaviour patterns than in females. The studies carried out by Greger et al. (2015), González-García et al. (2017), and Martín et al. (2020) also found emotional and behavioural problems in youths in residential care.

The youths presented anxiety symptomatology characterised by nervousness and recurrent worries. The research also demonstrated the presence of anxiety symptoms related to situations of a social nature, in both interactions with peers and when they participate in other social situations. In addition, there was evidence of somatic signs and the presence of post-traumatic symptomatology in some youths. The low resistance to interference may be related to the problems of anxiety, given the difficulties the youths had in resolving internal and interpersonal problems and the tendency to see themselves as having more problems than other people. Cougle et al. (2010) and Gardner et al. (2019) found a greater risk of youths suffering from abuse presenting anxiety symptoms or disorders. Bruce et al. (2011) found a relation between adverse experiences in childhood and the presence of social anxiety symptoms, whilst Kealy et al. (2018) found similar results concerning somatic problems.

As for post-traumatic stress disorder, different studies present it as one of the commonest consequences of stressful psychosocial situations (Rock et al., 2018), relating it in turn to alterations in the regulation of one's emotions (Barlow et al., 2017). As pointed out by these studies, these youths would have a worse performance in areas related to cognitive functioning, such as the executive functions.

With respect to the behavioural problems, the research concluded that the youths showed symptoms of inattention characteristic of ADHD, related to the difficulty of directing one's attention to tasks and inhibiting the interference of irrelevant stimuli, as well as the difficulty to maintain one's attention over prolonged periods of time. Hyperactive and impulsive behaviour patterns common in ADHD stand out. Several youths presented an excessive level of motor activity (hyperactivity), accompanied by difficulties with inhibiting one's behaviour (impulsiveness). The low resistance to interference could be indicative of the difficulties the youths have to inhibit or control the automatic responses; it could also be related to the results in hyperactivity-impulsiveness. They had a greater tendency to develop rigid and defensive behaviour patterns. Becker-Blease and Kering (2016) considered that some of the most frequent consequences of exposition to stressful psychosocial situations in childhood are attention deficits, hyperactivity, and impulsiveness. However, Stern et al. (2018) stated that victimisation may be associated with the diagnosis of ADHD in youths.

Concerning emotional regulation, the youths showed difficulties to identify, understand, and regulate the own emotions, as well as frequent, brusque changes in mood and ups and downs throughout the day. Beers and De Bellis (2002), Cicognani (2011), Wilson et al. (2011), and DeGregorio (2012) also found problems to regulate emotions and impulsiveness.

The research also demonstrated the presence of greater difficulties for males than for females in the executive processes. In females, there was a greater emotional symptomatology (anxiety, social anxiety, and post-traumatic stress); whilst males had greater externalising difficulties, such as attention deficits and hyperactivity/impulsiveness. Teicher et al. (2003) and De Bellis (2005) also observed a different vulnerability in females and males suffering abuse when they have to face stressful experiences in life.

We have found a significant relation between the problems that the youths have in the executive processes, the emotional problems, and the behavioural problems. In the youths with low scores in accuracy, execution, speed, and interference, there exists a greater presence of emotional symptomatology (anxiety, social anxiety, and post-traumatic stress) and behavioural problems (problems of attention and hyperactivity-impulsiveness). The research also demonstrated that the deficits in the executive processes act as predictors of the emotional problems and of the behavioural problems.

The research also found the repercussions of the youths in the executive processes necessary for decision-taking, establishing goals, planning behaviour, adapting to new situations, and regulating one's emotions. In this sense, Spann et al. (2012) and Heleniak et al. (2016) pointed out that the difficulties in the processes responsible for directing, guiding, and controlling the cognitive, emotional, and behavioural functions could be explained by alterations in the brain's prefrontal regions, which are responsible for the executive functions.

Regarding the limitations of the research, we must point out that, as the study is transversal, it has not been possible to consider the evolution of the problems, the youths suffered from the moment of the admittance to residential care. No psychological evaluation was carried out upon the admittance, so it has not been possible to establish whether the symptomatology they presented at that moment was a clear result of the situation of abuse, or whether it was a consequence of the time spent in residential care, or of other factors that may have intervened because of the separation from the nuclear family. It has not been possible to determine whether some of the youths had cerebral lesions prior to entering residential care, given that the files do not provide this information. We must also point out, as a limitation, the lack of a control group with which to compare the results. The results have not considered either the type of child abuse or the protective measures when examining differences in the groups. Furthermore, given the size of the sample, we do not consider it opportune to set limits with respect to the type of abuse and/or the protective measures. It would seem pertinent to do so in future research.

With respect to the instruments used to evaluate the youths' executive processes, we should point out that, in the research, we did consider the appropriateness of the tests, given the socio-cultural characteristics of the participants. Similarly, the tests were applied in the youths' residential centres/homes, as places of reference, thus avoiding any possible contextual influence that might affect the results.

This research has contributed to the identification of the emotional difficulties and the behavioural problems of the youths under protective measures. Based on the results found, we shall be able to design concrete interventions in the affected areas. To do so, the participation of the educators will be vital, as they are persons of reference for the youths in the residential care centres. Similarly, to carry out the intervention, the design of a structured programme from an ecological and functional perspective, focused on the systematic training of real activities, is essential (Whittaker et al., 2016). It will also be fundamental to work on awareness raising of the deficit and an adjusted perspective of the reality (James, 2011; Rath et al., 2011).

In this sense, it will be necessary to respond to the problems the youths have in the executive processes. We would recommend the use of restoration techniques, since the degree of deterioration is not too severe and the affected cognitive skills can be retrained, through training in real situations, thus providing them with strategies that will allow them to regulate the behaviour, whilst carrying out daily activities. In this way, the youths will have tools for resolving the conflicts that arise in the daily lives, enabling them to identify the problem, regulate the behaviour and look for alternatives before acting. Thus, they will be able to use the internal language (reflecting on the consequences of the behaviour and thus avoiding impulsive decisions).

In conclusion, we can say that the youths under protective measures had difficulties in the executive processes, emotional difficulties and behavioural problems, which may have serious implications for the personal and social development. Davis et al. (2015), Hanson et al. (2015), and Vasilevski and Tucker (2016) also concluded that victimisation may have both short- and long-term consequences for the emotional, social, cognitive, and behavioural development. However, certain circumstances such as the age at which abuse starts, its duration and persistence over time, the attachment to the abuser, as well as the separation from the nuclear family and the admittance to residential care, may cause the presence or not of psychopathology (Spratt et al., 2012).

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by University of Extremadura Ref.: 181/2020. Written

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

AUTHOR CONTRIBUTIONS

JM-M, MG-B, EG-B, and MGo-M: conceptualization and methodology. JM-M, MG-B, CB-T, and MGu-M: data curation. JM-M, CB-T, and MGu-M: formal analysis. JM-M, MG-B, and EG-B: supervision. JM-M, MG-B, and CB-T: writing – original draft preparation. JM-M, MG-B, EG-B, MGo-M, CB-T, and MGu-M: writing – review and editing. All authors contributed to the article and approved the submitted version.

FUNDING

This study received funding from FEDER funds & Junta de Extremadura (Exp. GR18005). The funder was not involved in the study design, collection, analysis, interpretation of data, the writing of this article or the decision to submit it for publication. All authors declare no other competing interests.

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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.

frontiers in Psychology

ORIGINAL RESEARCH
published: 10 September 2021
doi: 10.3389/fpsyg.2021.715327

Predictors of Parental Coping During the Covid-19 Pandemic: A Survey in Germany

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The Covid-19 pandemic has been profoundly affecting nearly everybody, but families with minors have been hit particularly. Closure of schools and kindergartens, home schooling, and working from home have led to a profound upheaval in family life. Parental adverse childhood experiences (ACEs) are an important determinant for parenting behavior. Importantly, ACEs can increase the vulnerability to stress and impair coping strategies. The current pandemic leads to increased parental stress, a risk factor for harsh parenting behavior, Therefore, we aimed to assess the role of ACEs and sociodemographic factors associated to parental coping during the current pandemic. In a cross-sectional online survey, 687 parents of minors in Germany were included. Demographic and psychosocial factors associated to parental coping during the first lockdown due to the Covid-19 pandemic were assessed. Results show that younger age of the respective child, income loss, dissatisfaction with the sharing of childcare duties, and ACEs were significantly associated with an increase of potential harmful parenting behavior during the Covid-19 pandemic. An increase of dissatisfaction with the sharing of childcare duties during the pandemic was predicted by working from home and taking care of the children mainly by oneself, while sharing childcare duties with the partner equally resulted even in an increase of satisfaction with sharing of childcare duties during the pandemic. These findings demonstrate that a history of childhood adversity in a parent is a risk factor for harmful parenting during the pandemic. Parental satisfaction with sharing of caregiving is an important factor for parental coping during the pandemic. Sharing of caregiving between partners should be encouraged.

Keywords: COVID-19, pandemic, adverse childhood experiences, parental coping, child maltreatment

OPEN ACCESS

Edited by:
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Reviewed by:
Serena Di Giandomenico, University of Urbino Carlo Bo, Italy
Thorsten Mikoteit, University of Basel, Switzerland

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Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *26 May 2021*
Accepted: *10 August 2021*
Published: *10 September 2021*

Citation:
Clemens V, Köhler-Dauner F, Ziegenhain U and Fegert JM (2021) Predictors of Parental Coping During the Covid-19 Pandemic: A Survey in Germany. Front. Psychol. 12:715327. doi: 10.3389/fpsyg.2021.715327

INTRODUCTION

Since the beginning of the Covid-19 pandemic, life of families all over the world has changed unprecedentedly. An estimated 90% or more of children and adolescents globally have faced the effects of school closures (UNESCO, 2020). Social contacts have been limited, out-of-home leisure time activities have been canceled (Imperial College COVID-19 Response Team, 2020). Parents have had to support children with home schooling, while working from home in parallel. Financial pressure has risen in many families due to unemployment and wage cuts. Economic problems can lead to feelings of stress and consequent marital conflict (Elder, 1974;

Elder and Conger, 2000). Altogether, this can severely affect parenting and – in the worst case – erupt in physical and psychological violence among families (Fegert et al., 2020a). First official data point toward an increase of child maltreatment during the pandemic (Nguyen, 2021; Salt et al., 2021).

The course of the current pandemic is hard to predict. Although, a first strict lockdown has ended in most parts of the world, several following pandemic waves have hit many countries and some even face or have seen new lockdowns. Therefore, it is important to identify predictors of families who struggle to master the situation and who consequently may need more support. The number of studies assessing parenting during the pandemic have been rising. They point toward high levels of stress (Marchetti et al., 2020; Romero et al., 2020; van Tilburg et al., 2020), anxiety, and financial burden (Fong and Iarocci, 2020) among parents and parenting-related exhaustion (Marchetti et al., 2020) during the pandemic. Importantly, higher levels of parental stress was shown to be associated with harsh parenting behavior and poorer parent child relationship since the beginning go of the pandemic (Chung et al., 2020; Romero et al., 2020).

One factor that may be of importance on how parents deal with pandemic-associated stressors are adverse childhood experiences (ACEs). ACEs include child maltreatment, in detail emotional, physical, and sexual abuse as well as emotional and physical neglect, and household dysfunction, comprising e.g., mental illness and substance abuse of any household member, violence against the mother, parental separation, and incarceration of a household member (Hughes et al., 2017). ACEs are frequent. In the German population, more than 40% have experienced at least one type of ACE, and nearly 9% have experienced four or more (Witt et al., 2019). Even in less stressful times, ACEs increase the risk for psychosocial and economic impairments as well as mental and somatic health problems in a dose-dependent manner (Felitti et al., 1998; Norman et al., 2012; Rehkopf et al., 2016; Clemens et al., 2018). Furthermore, ACEs can significantly impair attachment and relationships in later life (Thomson and Jaque, 2017), just as the relation to one's own children. ACEs can significantly affect parenting (Bailey et al., 2012) and increase the risk for harmful parenting behavior including child maltreatment (Dixon et al., 2005a,b; DuMont et al., 2007; Bailey et al., 2012; Clemens et al., 2019). This so called cycle of violence was initially based on the research finding that physical abuse is an important predictor for violence in adulthood (Hunter and Kilstrom, 1979). It describes the intergenerational transmission of violent behavior – although, it is important to emphasize that most abused and neglected children do not turn violent themselves (Wright et al., 2019). However, experience of violence during childhood is the strongest predictor for the use of violence as disciplinary method for one's own children (Witt et al., 2017).

The experience of adversity during childhood affects the long-term individual stress response (Bunea et al., 2017) and can increase vulnerability to stress and impair successful coping of stressful situations by increased emotional reactivity and decreased emotion regulation (Hein and Monk, 2017; Duffy et al., 2018). A purposeful response to a stressful or challenging life event such as a pandemic on the other hand can be understood as coping (Compas et al., 2017). The experience of ACEs during childhood is suggested to result in perceiving the environment as threatening and unpredictable, leaving no or little opportunity to impact or change the environment (Sheffler et al., 2019). Consequently, ACEs are associated with less successful coping strategies of stressful situations (Leitenberg et al., 2004). During the pandemic, the majority of parents feel stressed by social distancing and closure of schools and childcare facilities (Calvano et al., 2021), resulting in increased perceived parenting stress (Brown et al., 2020). Thus, a significant impact of ACEs on coping and parenting strategies during the pandemic can be assumed. Recently, in a smaller sample of mothers, we were able to demonstrate that maternal ACEs are associated with endangered parenting behavior during the current pandemic (Köhler-Dauner et al., 2021). To the best of our knowledge, however, besides, data on the role of parental ACEs are missing. Moreover, as ACEs are associated with other important predictors such as economical impairment, psychosocial well-being, and parenting, they may influence these other factors. Importantly, parental stress was already shown to be a risk factor for child maltreatment during the pandemic, such as job loss, and younger age of the parent and the child (Lawson et al., 2020; Calvano et al., 2021).

Here, we aimed to assess the role of ACEs and sociodemographic factors associated topotential harmful parenting actions and parental coping of the current pandemic. The hypothesis was that parents are at higher risk for less successful coping and harmful parenting behavior during the pandemic when they were exposed to ACEs themselves.

MATERIALS AND METHODS

Study Design

We have conducted a cross-sectional online survey, which was available from May 18th to July 21th 2020. The first lockdown in Germany began on March 23, 2020 and ended *via* gradual relaxations – the first schools reopened on April 22, the openings of schools and kindergartens stretched to the end of June 2020. Inclusion criteria were age above 18 years and informed consent. Information on the survey was distributed by our clinical homepage, social media, and print media and existing mailing lists from other studies and interested parties. In total, 1,399 participants have participated in the online survey. For the here presented analyses, only data of participants who stated to be currently parent of a minor were assessed ($N = 687$).

Ethics

Information on the study and data analysis were given, electronic informed consent was obtained from each participant. Participation was anonymous. Participants could withdraw from

the survey at any moment without providing any justification. The study was conducted in accordance with the Declaration of Helsinki. After consultation with the ethics committee of the University of Ulm, due to the anonymous character of the survey, there was no requirement for an ethics vote.

Measures

Socio-demographic questions included age, gender, educational level, and change of income during the pandemic and whether the participant has worked from home during the pandemic. In detail, the questions were "Did you work from home in the meantime during the start of the Covid-19 pandemic," "Has the income available in your household fallen by more than a quarter since the start of the Covid-19 pandemic?", "Who took care of the child during most of the time during the Covid-19 pandemic?", "Please indicate on a scale of 0–100 how satisfied you are with the sharing of childcare duties between you and your partner (before the pandemic and now). The best conceivable satisfaction is marked with a '100,' the worst with '0.'" "To what extent do the following statements apply to you? Since the beginning of the Covid-19 pandemic…(1) stands for 'does not apply at all,' (7) for 'applies very much' – …I yell more at the child/…Am I more impatient with the child/…Am I increasingly afraid that my hand to smack the child/… Am I increasingly afraid that my partner will smack the child" and "Summarized, on a scale from 0 to 100…., (0) stands for 'miserable,' (100) stands for 'excellent,' – … how well have you mastered the challenges of the Covid-19 pandemic to date?/…how well the child has mastered the challenges of the Covid-19 pandemic/…how well the family has mastered the challenges of the Covid-19 pandemic."

Regarding potential harmful parenting behavior, it was asked whether participants have yelled more at the child, whether they had been more impatient with the child, whether they had been more afraid to smack the child and whether they had been more afraid that their partner would smack the child since the beginning of the pandemic. Answers were possible on a Likert scale of 1–7, where (1) stood for "does not apply at all" and (7) for "applies very strongly."

Moreover, the participants were asked about parental satisfaction with the sharing of childcare duties before and during the pandemic and their assessment of how they, their children, and their family had dealt with the challenges of the pandemic (all answers: Likert scale 0 for worst and 100 for best).

The ACEs were assessed using the German version of the ACEs Questionnaire, a standard tool for retrospective assessment of ACEs with satisfactory reliability (Cronbachs $\alpha = 0.76$; Wingenfeld et al., 2011). With the ACE Questionnaire, five forms of child maltreatment (physical abuse, emotional abuse, sexual abuse, physical neglect, and emotional neglect) and five forms of household dysfunctions (substance abuse and mental illness of a family member, intimate partner violence between parents, incarceration of a family member, and disappearance of a parent through divorce, death, or other reason) are assessed in a dichotomous manner (yes/no). A sum score of all types of experienced ACEs can be calculated (Felitti et al., 1998). No experiences of any ACE is the lowest score "0," a score of "10" is the highest, meaning that a participant has experienced all 10 assessed forms of ACEs.

Data Analyses

Statistical analyses were performed with SPSS version 21.

Linear regression analyses were performed in order to identify factors associated to parenting and successful coping of pandemic-related challenges. Sociodemographic variables, Covid-19 related variables (for parental satisfaction with the sharing of childcare duties: difference between parental satisfaction with the sharing of childcare duties values during and before the pandemic), and the number of experienced forms of ACEs were included into the model.

A two-way repeated measures ANOVA was used to test differences in parental satisfaction with the sharing of childcare duties before and during the pandemic (main effect time). Between groups with gender, working from home and organization of child care (main effect gender) and a differential effect of gender, working from home and organization of child care on parental satisfaction with the sharing of childcare duties over time was tested (interaction effect time × parental satisfaction with the sharing of childcare duties).

RESULTS

Participants

Primary caregivers were predominantly female ($N = 615$, 89.5%). The mean age of the sample was 41.4 (±7.4) years for females and 45.8 (±8.0) for males (age range f: 26–67, m: 33–71). The majority of the sample lived with a partner (f: $N = 518$, 84.2%; m: $N = 65$, 90.3%). Academic degree of participants was generally high with the majority holding a diploma from German secondary school qualifying for university admission ("Abitur") or a university degree (f: $N = 416$, 67.6%, m: $N = 56$, 77.8%). A minority was affected financially by the pandemic, with a decreased income by more than a quarter (f: $N = 69$, 11.2%, m: $N = 6$, 8.3%).

Demographic information is displayed in **Table 1**.

Increase of Potential Harmful Parenting Behavior

First, we analyzed data on increase of potential harmful parenting behavior since the beginning of the pandemic. The majority of participants stated no or moderate increase of potential harmful parenting actions. However, the question whether they had yelled more at the child was answered by 5.3% of parents with "applies very strongly." A total of 8.8% of parents reported they had been more inpatient with the child. For 2.8% of parents it applied very strongly that they had been more afraid to smack their child since the beginning of the pandemic, while for 2.2% it applied very strongly that they had been more afraid of their partner smacking their child (see **Figure 1**).

TABLE 1 | Sample characteristics.

	Female	Male	*p*
Number of participants	615 (89.5)	72 (10.5)	
Age			
Mean (SD)	41.4 (7.4)	45.8 (8.0)	<0.001
Age range	26–67	33–71	
Highest level of education			
University degree or diploma from secondary school	416 (67.6)	56 (77.8)	0.079
Other or no school diploma	199 (32.4)	16 (22.2)	
Decrease of income >25% since the pandemic	69 (11.2)	6 (8.3)	0.455
Working from home	279 (51.6)	37 (52.9)	0.839
Living with partner	518 (84.2)	65 (90.3)	0.175
Number of children in household			
1	164 (30.7)	22 (34.4)	
2	263 (49.3)	33 (51.6)	
3	93 (17.4)	7 (10.9)	
4	11 (2.1)	2 (3.1)	
5	3 (0.6)	0 (0.0)	0.663
Gender of the child who's birthday is next			
Female	274 (50.6)	32 (49.2)	
Male	267 (49.4)	33 (50.8)	0.829
Mean age of the child who's birthday is next	7.2 (4.6)	8.1 (5.2)	0.159
Satisfaction with sharing of childcare duties			
Before the pandemic (M, SD)	7.8 (2.4)	8.4 (2.2)	0.080
During the pandemic (M, SD)	7.3 (2.8)	7.7 (2.5)	0.286
Decreased during the pandemic	191 (38.8)	19 (30.6)	0.211
Childcare during the pandemic			
Mainly by oneself	313 (59.6)	6 (9.4)	
Mainly by partner	28 (5.3)	49 (45.3)	
Mainly equally by oneself and partner	126 (21.4)	24 (37.5)	
Mainly by someone else (School/Kindergarden/relatives, etc.)	58 (11.0)	5 (7.8)	<0.001
Number of ACEs (M, SD)	1.7 (1.9)	1.3 (1.4)	0.011

Presented as N (%) unless stated otherwise.

Factors Associated to Parenting Behavior During the Pandemic

The results of the regression analyses revealed that a younger age of the child ($B = -0.06$, $p < 0.005$), a decrease in parental satisfaction with the sharing of childcare duties compared to before the pandemic ($B = -0.84$, $p < 0.001$) and decreased income by more than a quarter since the beginning of the pandemic ($B = -0.51$, $p < 0.05$) were associated with more frequent yelling at the child.

Factors associated to higher scores for being more impatient with the child were younger age of the child ($B = -0.08$, $p < 0.001$), decreased parental satisfaction with the sharing of childcare duties compared to before the pandemic ($B = -0.09$, $p < 0.001$), and decreased income since the beginning of the pandemic ($B = -0.91$, $p < 0.001$).

Affirmation of the sentence "I am increasingly afraid that I will smack the child" was higher if the respective child was younger ($B = -0.04$, $p < 0.05$), if parental satisfaction with the sharing of childcare duties had decreased since the pandemic ($B = -0.40$, $p < 0.01$) and higher numbers of ACEs were reported ($B = 0.13$, $p = 0.001$). Decreased income since the beginning of the pandemic lost significance after adding the number of ACEs into the analysis.

Concerns that the partner will smack the child were increased if participants reported a decrease of parental satisfaction with the sharing of childcare duties since the beginning of the pandemic ($B = -0.25$, $p < 0.05$) and if a higher number of ACEs ($B = 0.15$, $p < 0.001$) were reported (for details see **Table 2**).

Factors Associated to Change in Parental Satisfaction With the Sharing of Childcare Duties

A significant decrease in parental satisfaction with the sharing of childcare duties was seen in male and female participants ($F = 17.90$, $p < 0.001$). No significant difference regarding parental satisfaction with the sharing of childcare duties before and during the pandemic was seen for gender ($F = 0.24$, $p = 0.623$).

Working from home during the pandemic was associated with a lower parental satisfaction with the sharing of childcare duties ($F = 4.68$, $p < 0.05$). A stronger decrease of parental satisfaction with the sharing of childcare duties compared to before the pandemic was seen in participants who reported to have worked from home during the pandemic ($F = 4.39$, $p = <0.05$).

While parental satisfaction with the sharing of childcare duties increased in participants who reported to share caregiving equally, parental satisfaction with the sharing of childcare duties decreased if participants reported that mainly themselves or mainly their partners provided childcare ($F = 20.56$, $p > 0.001$). Lowest grades of parental satisfaction with the sharing of childcare duties before and during the pandemic was reported by participants who reported to mainly provide care of the child by themselves ($F = 13.08$, $p < 0.001$; see **Figure 2**).

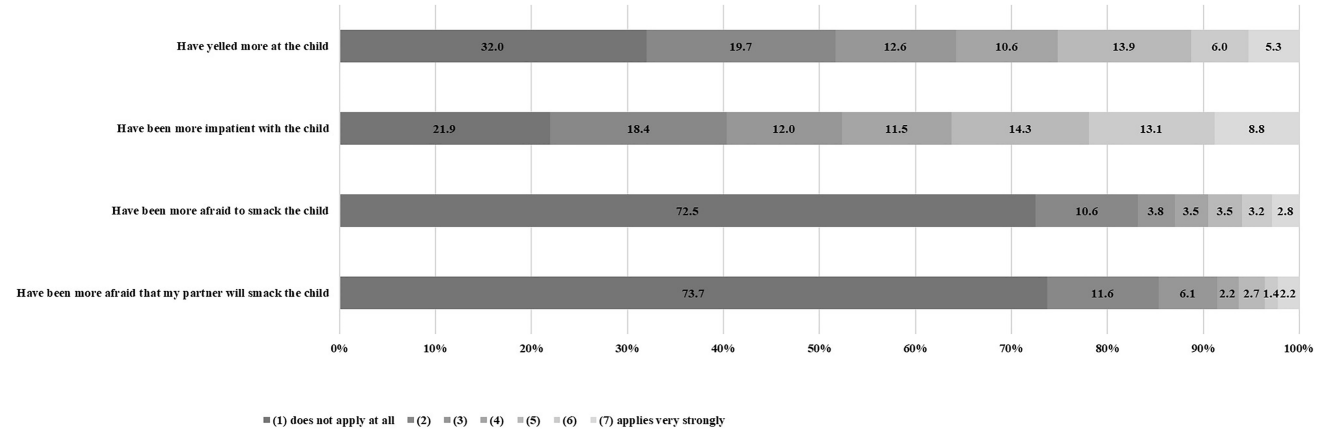

FIGURE 1 | Increase of potential harmful parenting actions since the beginning of the pandemic. Change of potential harmful parenting behavior since the beginning of the pandemic.

Factors Associated to Coping With the Pandemic

Higher scores in affirmation of the question "How well have you mastered the challenges of the Covid-19 pandemic to date?" were reported if participants did not report decrease of income since the beginning of the pandemic ($B = 0.45$, $p < 0.05$) and parental satisfaction with the sharing of childcare duties had not decreased since the beginning of the pandemic ($B = 1.11$, $p < 0.001$).

Higher scores regarding the question how well the child mastered pandemic-associated challenges were associated to a higher academic degree of participants ($B = 0.34$, $p < 0.05$), an increase of parental satisfaction with the sharing of childcare duties since the beginning of the pandemic ($B = 0.84$, $p < 0.001$) and a lower number of parental ACEs ($B = -0.17$, $p < 0.001$).

Families mastered the pandemic better if income ($B = 0.57$, $p < 0.05$) and parental satisfaction with the sharing of childcare duties had not decreased since the beginning of the pandemic ($B = 0.90$, $p < 0.001$, for details see **Table 3**).

DISCUSSION

To the best of our knowledge, this is the first study assessing the role of ACEs on paternal and maternal parenting behavior during the Covid-19 pandemic. Several factors critically predicted parenting behavior including "parental satisfaction with the sharing of childcare duties," "decrease of income since the beginning of the pandemic" and "ACEs" as the most frequent ones. Importantly, the experience of adversity during childhood or adolescence was associated with an increased concern about physical violence against the child. This is crucial, as an increase of violence within the family was hypothesized for the pandemic due to increased stress and challenges in daily life such as home schooling and working from home at the same time, reduced support, decreased leisure time activities for stress reduction, financial pressure, and reduced social control (Fegert et al., 2020b). ACEs are known to significantly increase the risk for harmful parenting behavior, including physical maltreatment, known as the "cycle of violence" (Dixon et al., 2005a,b; DuMont et al., 2007; Bailey et al., 2012; Clemens et al., 2019). Subjects who have experienced ACEs are known to have a higher stress-vulnerability (Hein and Monk, 2017; Duffy et al., 2018). The current pandemic leads to increased levels of perceived parenting stress (Brown et al., 2020; Calvano et al., 2021). The here shown data underline that parents with ACEs are at higher risk for maltreatment and suggest that targeted prevention for parents with ACEs is needed – in particular during the current pandemic.

In a German sample of more than 1,000 parents, 30% reported an increase in children witnessing domestic violence during the pandemic, and more than 40% reported an increase in emotional abuse. Affected families were characterized by higher parental stress, job loss, and younger parent and child age (Calvano et al., 2021). In a sample of over 3,000 parents in the United States, job loss during the pandemic was associated with increased risk for child maltreatment (Lawson et al., 2020). In our sample, a decrease of household income since the beginning of the pandemic by more than a quarter was associated with increased fear of physical violence against and yelling at the child. Moreover, income decrease was associated with less well individual and familiar coping of the pandemic. Recession was proven to increase rates for all forms of child maltreatment in a wide variety of cultures (Huang et al., 2011; Schneider et al., 2017). Income loss may be associated with economic hardship and higher distress in parents – increasing pressure within families and the risk for physical and psychological violence. These results strongly underline the importance of economic support for families whose household income has fallen significantly due to the current pandemic.

Change of parental satisfaction with childcare duties was crucial for parenting behavior during the pandemic. A decrease of parental satisfaction with the sharing of childcare duties compared to before lockdown was associated with stronger concern about physical violence against the child, as withmore frequent yelling at the child, impatience and worse individual

TABLE 2 | Factors associated to potential harmful parenting actions during the first lockdown.

Since the beginning of the pandemic	Have yelled more at the child			Have been more impatient with the child			Have been more afraid to smack the child			Have been more afraid that my partner will smack the child		
	B	95% CI	*p*	*B*	95% CI	*p*	*B*	95% CI	*p*	*B*	95% CI	*p*
Gender	−0.316	−0.821; 0.189	0.219	−0.439	−0.968; 0.091	0.104	0.136	−0.297; 0.569	0.537	0.138	−0.236; 0.512	0.470
Age in years	−0.015	−0.049; 0.019	0.383	−0.003	−0.039; 0.033	0.865	0.003	−0.027; 0.032	0.863	−0.008	−0.033; 0.018	0.554
Living with a partner	0.258	−0.367; 0.884	0.418	0.164	−0.491; 0.819	0.623	0.356	−0.180; 0.892	0.192	0.171	−0.299; 0.640	0.475
Number of children living in household	0.113	−0.088; 0.315	0.268	0.062	−0.149; 0.273	0.564	0.080	−0.093; 0.252	0.366	0.102	−0.048; 0.252	0.183
Age of the respective child	−0.055	−0.099; −0.011	**0.015**	−0.084	−0.131;−0.038	**<0.001**	−0.038	−0.076; 0.000	**0.049**	−0.024	−0.057; 0.009	0.153
Satisfaction with sharing of childcare duties	−0.842	−1.161; −0.523	**<0.001**	−0.900	−1.235; −0.566	**<0.001**	−0.399	−0.672; −0.125	**0.004**	−0.254	−0.491; −0.016	**0.036**
Household income >25% less	−0.507	−0.994; −0.020	**0.042**	−0.911	−1.422; −0.400	**<0.001**	−0.387	−0.807; 0.034	0.072	−0.206	−0.573; 0.161	0.271
ACE total score	0.055	−0.031; 0.142	0.211	0.050	−0.041; 0.142	0.280	0.130	0.056; 0.205	**0.001**	0.148	0.083; 0.213	**<0.001**
F (df)	8.000 (8)			10.235 (8)			4.395 (8)			4.499 (8)		
p (total model)	<0.001			<0.001			<0.001			<0.001		
R^2	0.095			0.135			0.049			0.051		

B, unstandardized coefficient. Bold values are statistically significant ($p < 0.05$).

and familiar coping of the pandemic. Although for the latter ones of course a reciprocal association cannot be excluded, these results point toward the relevance of parental satisfaction with the sharing of childcare duties for parenting and mastering of the pandemic-associated challenges. Dissatisfaction with sharing of childcare duties may lead to increased parenting distress, which was shown to be associated to child abuse potential during the pandemic (Brown et al., 2020; Chung et al., 2020). In a recent study of over 800 mother-child dyads, connectedness to caregivers was an important predictor for child mental health (McArthur et al., 2021).

In our sample, parental satisfaction with the sharing of childcare duties decreased overall. In an Australian study assessing satisfaction with work-family balance and partners' share, satisfaction decreased for most parents since the beginning of the pandemic (Craig and Churchill, 2020) – being in line with our results. However, in the study by Craig and Churchill (2020), before the pandemic, women were more dissatisfied than men, while during the pandemic, this difference narrowed. In our study, no significant difference was seen in regard to gender neither before nor during the pandemic. However, as the number of male participants was very low in our sample, the validity of this result may be limited.

While nearly 60% of female participants were the main caregiver for the children during lockdown, this was only the case for 9.4% of male participant. This finding is in line with other results from German studies, showing that during lockdown, females were the main caregivers for children (Zinn et al., 2020b).

Participants who worked from home during the pandemic had a significantly higher decrease in parental satisfaction with the sharing of childcare duties compared to other participants. This is easily understandable as parents of minors working from home had to guard the children and to support them in home schooling during lockdown – likely resulting in distress and overstrain. Consequently, having the main responsibility for childcare duties was associated with lower parental satisfaction with the sharing of childcare duties. Interestingly, in participants who shared childcare equally during the pandemic, satisfaction with the sharing of childcare duties increased. This is an encouraging finding. Despite the stress of the pandemic, taking these challenges together can even improve some aspects of family life.

Several limitations of our data have to be considered. Survey participants cannot be considered as representative for the general public, as data are based on a non-probability sample. Compared to data of a sample of parents derived from the Socio Economic Panel, a probability sample in Germany, assessed in a similar time frame, in our sample parents had a higher education, more children in the respective household were reported and rate of participants having a partner was higher (Zinn et al., 2020a). Therefore, the findings cannot be generalized for all families. As lower education correlates with higher rates of child maltreatment (Kotch et al., 1995; Berthold et al., 2019), the results of this study may tend to underestimate the negative impact of the pandemic on families. Accordingly, the results shown should be interpreted as an indication of possibly even

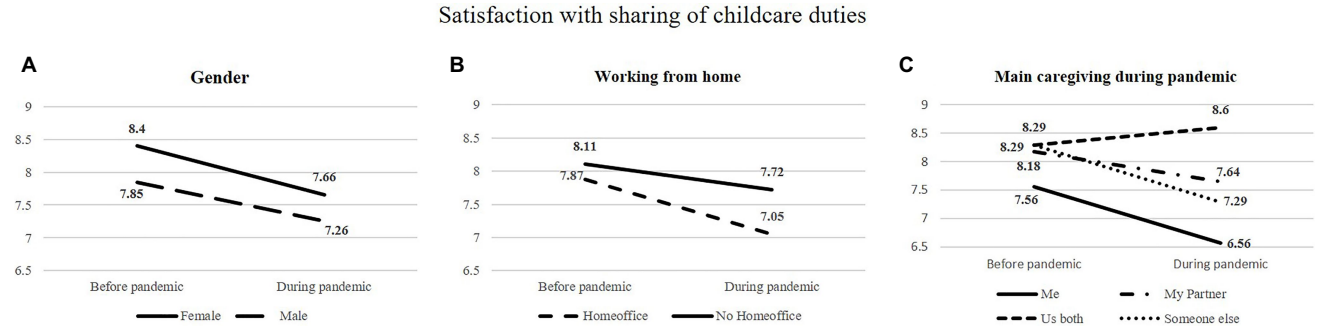

FIGURE 2 | Satisfaction with the sharing childcare duties before and during the Covid-19 pandemic. Assessed *via* repeated measure statistics. **(A)** Satisfaction with the sharing of childcare duties in dependence of gender of the participants. While satisfaction with the sharing of childcare duties decreased for all participants during compared to before the pandemic, no difference was seen in regard to gender of the participants. **(B)** Satisfaction with the sharing of childcare duties in dependence of working from home. Working from home was associated with a lower satisfaction with the sharing of childcare duties and a stronger decrease during compared to before the pandemic (interaction significant). **(C)** Satisfaction with the sharing of childcare duties in dependence of who mainly has taken care for the children during lockdown. Satisfaction was significantly lower in participants who mainly have been taking care by themselves compared to participants who shared childcare equally.

TABLE 3 | Factors associated to coping of the pandemic.

	How well oneself has mastered the challenges of the pandemic			How well the child has mastered the challenges of the pandemic			How well the family has mastered the challenges of the pandemic		
	B	**95% CI**	***p***	***B***	**95% CI**	***p***	***B***	**95% CI**	***p***
Gender	−0.090	−0.524; 0.344	0.685	−0.224	−0.689; 0.242	0.345	0.094	−0.341; 0.530	0.671
Age in years	−0.012	−0.044; 0.019	0.447	−0.011	−0.045; 0.022	0.506	−0.029	−0.060; 0.003	0.075
Living with a partner	−0.339	−0.888; 0.210	0.226	0.157	−0.433; 0.746	0.601	−0.024	−0.576; 0.527	0.931
Number of children living in household	−0.049	−0.233; 0.135	0.603	0.033	−0.168; 0.234	0.749	−0.016	−0.200; 0.169	0.868
Age of the respective child	0.027	−0.014; 0.068	0.200	−0.041	−0.085; 0.004	0.071	−0.001	−0.042; 0.040	0.960
Education	0.039	−0.267; 0.345	0.802	0.340	0.012; 0.668	**0.043**	0.091	−0.216; 0.398	0.559
Household income >25% less	0.449	0.003; 0.895	**0.048**	0.235	−0.243; 0.714	0.334	0.566	0.118; 1.014	**0.013**
Satisfaction with sharing of childcare duties	1.108	0.818; 1.398	**<0.001**	0.844	0.534; 1.155	**<0.001**	0.901	0.610; 1.191	**<0.001**
Working from home	0.151	−0.136; 0.437	0.302	0.069	−0.238; 0.376	0.660	0.131	−0.157; 0.418	0.371
ACE total score	−0.051	−0.129; 0.437	0.191	−0.172	−0.255; −0.088	**<0.001**	−0.058	−0.135; 0.020	0.144
F (df)	7.221 (10)			6.863 (10)			5.461 (10)		
p	<0.001			<0.001			<0.001		
R^2	0.136			0.130			0.106		

B, unstandardized coefficient. Bold values are statistically significant (p < 0.05).

greater stress in affected families. Questions on parenting before the pandemic are based on retrospective self-report, just as questions regarding ACEs, which may impair validity due to recall bias. There has been a critical debate on the validity of retrospectively assessed ACEs (Baldwin et al., 2019), but subjective reports of childhood maltreatment were shown to be highly relevant for adulthood (Danese and Widom, 2020). As to the best of our knowledge, no data on parenting during the Covid-19 pandemic are known yet from cohorts assessing ACEs and parenting prospectively, our findings are of high relevance.

In our cross-sectional study, causality cannot be deduced. Reciprocal associations – such as between parental satisfaction with the sharing of childcare duties and parenting behavior are likely. However, the presented results give an important insight into the relevance of factors such as economic pressure, parental satisfaction with the sharing of childcare duties, and ACEs on parenting during and coping with the pandemic. As the impact of economic pressure was already significant in our highly educated sample, it can be assumed that the impact of economic hardship may be even more relevant in a sample with a lower socioeconomic status, and consequently in a more representative sample.

Taken together, younger age of the child, economic pressure, dissatisfaction with the sharing of childcare duties, and ACEs are significantly associated with potential harmful parenting behavior during the Covid-19 pandemic. There is a need for targeted support for parents with ACEs and dissatisfaction with their family model regarding caregiving. Models where both parents share childcare duties shall equally be encouraged. Economic support is needed for families who have lost a significant part of their income due to the pandemic.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article was made available by the authors on reasonable request.

ETHICS STATEMENT

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

VC interpreted the data and wrote the manuscript. FK-D and UZ supported recruitment of the sample. JF conceptualized the survey and supervised data analyses. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

We thank all participants of our study.

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Conflict of Interest: JF has received research funding from the EU, DFG (German Research Foundation), BMG (Federal Ministry of Health), BMBF (Federal Ministry of Education and Research), BMFSFJ (Federal Ministry of Family, Senior Citizens, Women and Youth), G-BA Innovationsfonds, several state ministries, State Foundation Baden-Württemberg, Volkswagen Foundation, Porticus Foundation, and Diocese of Rottenburg-Stuttgart. Moreover, JF received travel grants, honoraria, and sponsoring for conferences and medical educational purposes from APK, Deutschlandfunk, DFG, DJI, DKSB, Infectopharm, med update, UNICEF, several universities, professional associations, political foundations, and German federal and state ministries during the last 5 years. JF holds no stocks of pharmaceutical companies.

The remaining 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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frontiers in Psychology

ORIGINAL RESEARCH
published: 27 October 2021
doi: 10.3389/fpsyg.2021.742293

Daily Stress and Behavioral Problems in Chinese Children: The Moderating Roles of Family Functioning and the Classroom Environment

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Grounded in the stress-coping model, our study examined family functioning and the classroom environment as protective factors in the relationship between daily stress and behavioral problems in Chinese children. The participants were 1,450 children (51.7% male, M_{age} = 10.91 years, SD = 0.96) in the fourth, fifth, and sixth grades at five schools. The children completed the questionnaires measuring daily stress, family functioning, and the classroom environment. Additionally, their parents rated their behavioral problems. The latent moderated structural (LMS) equation approach was used to test moderator effects. After controlling for sex and grade, our results indicate that daily stress positively predicted the children's behavioral problems. Both family functioning and the classroom environment moderated the relationship between daily stress and behavioral problems. Further assessment of latent interaction effects indicate that buffering effects on behavioral problems were most prominent in conditions involving low stress. In sum, families and schools should not ignore children's minor stressors, as interventions involving family functioning and favorable classroom environments may help to reduce behavioral problems in children who report low levels of daily stress.

Keywords: children, daily stress, behavioral problems, family functioning, classroom environment

OPEN ACCESS

Edited by:
Cheryl Zlotnick,
University of Haifa, Israel

Reviewed by:
Sha Xie,
Shenzhen University, China
Beata Łubianka,
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Specialty section:
This article was submitted to Health Psychology, a section of the journal Frontiers in Psychology

Received: *16 July 2021*
Accepted: *05 October 2021*
Published: *27 October 2021*

Citation:
Wu L, Ding F, Hu T, Cheng G and Chen X (2021) Daily Stress and Behavioral Problems in Chinese Children: The Moderating Roles of Family Functioning and the Classroom Environment. Front. Psychol. 12:742293. doi: 10.3389/fpsyg.2021.742293

INTRODUCTION

Daily stress—defined as "irritating, frustrating, distressing demands that to some degree characterize everyday transactions with the environment"—is increasingly recognized as an important risk factor for individual growth, with more daily stressors linked to behavioral problems (Schönfeld et al., 2016). Nevertheless, most studies have only considered domain-specific daily stress such as peer-linked, family-linked, and school-linked stress. Multiple facets of stress that may work synergistically are more potent than a single facet (Schneiderman et al., 2005), and children often face multiple, intersecting, cumulative stressors in their daily lives. They are likely to successfully manage isolated adverse events, but experience difficulty coping with ongoing stress.

In addition, some studies on daily stress and behavioral issues have been conducted with adolescents and adults, but research on children is limited (Rosenberg et al., 2016). Moreover, although social support may serve as a buffer against the impact of daily stress on behavioral problems, existing research on this matter has been conducted predominately in Western countries,

with few studies carried out in China. It is unclear whether findings from Western nations are generalizable to Chinese individuals, who have different traditions and family structures. To fill this research gap, we aimed to investigate the relationship between overall daily stress and behavioral problems, and to identify contextual factors that may diminish this relationship in Chinese children.

Daily childhood stress can be classified into three main categories: (1) illnesses and events that involve a concern with body image; (2) stressful events in the academic context; and (3) negative events in family and school settings (Escobar et al., 2011). Daily childhood stress predicts emotional problems (i.e., anxiety and depression), behavioral challenges, and school maladjustment (Bai and Repetti, 2018). Moreover, daily stress predicts mental and physical well-being more strongly than infrequent major life events (Compas, 1987). In addition, the association between daily stress and mental health is stronger for children than for adolescents (Twenge, 2000).

Behavioral problems occur at all ages and often begin during childhood (Magai et al., 2018). Children in the fourth through sixth grades are on the threshold of adolescence, a time filled with transition and change (Rew et al., 2012). With increased participation in peer group activities, children's social and emotional growth—that is, the ability to react to and interact with their social environment—undergoes a profound change. If children can develop prosocial relationships, obtain a sense of confidence, and express and manage their emotions, they are more likely to succeed in school. If not, a sense of inferiority can be particularly haunting during middle and late childhood (Raver, 2002). Research has indicated that behavioral problems are associated with poor-quality social relationships and learning difficulties (Chen et al., 2005).

Over the past 30 years, many epidemiological studies of childhood behavioral problems have been conducted in different countries. A recent meta-analysis estimated the worldwide prevalence of behavioral challenges in children to be 13.4% (Polanczyk et al., 2015). A review of child psychopathology studies found that the prevalence estimates of behavioral problems ranged from approximately 1% to nearly 51%, with a mean of 15.8% in Western countries (Roberts et al., 1998). A meta-analysis of Asian countries reported a general prevalence of 10–20% (Srinath et al., 2010). In China, children's behavioral problems are serious, and have shown an escalating trend in recent years (Chinese Center for Disease Control and Prevention, 2020). Yang et al. (2019), through a field survey, found that among 9,295 Chinese students aged 6–16, the total detection rate of behavioral difficulties was 16.7%. If not managed properly, these problems could hinder children's development and exert long-term negative influences, including subsequent antisocial behavior, active suicidal ideation, and poor academic performance (Crocetti et al., 2013; Kremer et al., 2016; Sarkisian et al., 2021). Given the harmful effects of behavioral problems, factors that help to reduce their detrimental effects should be identified and used to build effective intervention strategies.

Behavioral problems are often associated with environmental factors such as family and school settings (Joseph et al., 2021). Evidence is accumulating that daily stress (i.e., school- and family-related stress) may disrupt children's lives. For instance, parental conflict can be stressful for most children (Liu and Wang, 2015). Labella and Masten (2018) found parental conflict to be associated with more behavioral difficulties. Moreover, in a longitudinal study, Westrupp et al. (2018) revealed that repeated early-life exposure to parental conflict consistently predicted children's behavioral problems at 10–11 years old. Researchers have also identified school-linked stress, which may contribute to the emergence of behavioral problems. For example, involvement in school bullying is a major cause of stress for children (Swearer and Hymel, 2015). Children who experience bullying manifest emotional and behavioral difficulties (Garaigordobil and Machimbarrena, 2019). Additionally, Collins et al. (2017) indicated that children with high (versus low) teacher-child conflictual relationships exhibited more behavior problems in middle childhood. The literature therefore suggests that daily stress may increase the risk of behavioral problems.

In the stress-coping model (Folkman and Lazarus, 1988), cognitive appraisal, as well as coping resources and strategies, are the main factors that help individuals, and which explain and predict adjustment outcomes. According to the model, during stressful events, individuals evaluate the demands of stressors and available coping resources, determine stressors' potential impact (i.e., establish whether they pose a threat), and identify potential coping strategies. Based on this model, children may interpret chronic difficulties as stressful events, identify available coping resources (e.g., social support), and determine how to use them to reduce the negative effects of stressors. Social support acts both as a protective factor against depression and plays a buffering role in the relationship between daily stress and depression (Ouyang et al., 2020). Therefore, social support may offer protection from the negative impact of stress.

The family unit is central to children's growth. Parents are responsible for instilling their values, attitudes, beliefs, and behavior in their children, providing a framework for children to develop the ability to behave adaptively in later years (Blinkhorn et al., 2001). Family functioning, which embodies characteristics of the family system, has drawn increasing attention from psychologists and family researchers (Caprì et al., 2019; Pérez-Fuentes et al., 2019). For the current study, we focused on family functioning—which refers to the social and structural properties of the global family environment, encompassing communication, affective involvement, problem-solving, values and norms, and family roles—as it provides a broader perspective than the examination of parenting styles or parental behavior modeling alone (Mobach et al., 2020).

The process model of stress and coping (Armstrong et al., 2005) provides a theoretical framework to explain how families function; it emphasizes that coping resources and the use of coping strategies moderate vulnerability to the effects of stress. Within the domain of coping resources, the model acknowledges the contribution of factors such as specific aspects of family functioning. The protective-support hypothesis also posits that the companionship, status, and sense of purpose provided by family life buffers against chronic stressors in everyday life (Schwab et al., 2006). Functional families may help to prevent problematic behaviors in children by enhancing their cognitive

restructuring, encouraging them to consider stressors as less threatening, and providing them with appropriate feedback and behavioral models (Markiewicz et al., 2001).

Empirical research has also revealed that good family functioning or cohesion acts as a protective factor to promote resilience. For example, family functioning is negatively associated with externalizing problems (Richmond and Stocker, 2006; Li et al., 2018; Pérez-Fuentes et al., 2019). Good family functioning is characterized by open communication, high levels of support, the expression of feelings and thoughts, and cohesion among family members (Delalibera et al., 2015). Tichon and Shapiro (2003) demonstrated that providing material assistance, offering emotional support, and aiding social interaction could protect children against the adverse effects of stress. Moreover, a 2-year longitudinal study indicated that healthy family functioning exhibited a significant buffering effect on subsequent aggression following exposure to violence (Deane et al., 2018). Cultural comparative research suggests that cultural background, in terms of individualism-collectivism, influences the impact of family support on individual-level outcomes (Stock et al., 2016). Unlike individualistic cultures that endorse self-reliance, personal freedom, and independence, collectivistic cultures deeply value in-group codependence (Wang et al., 2019; Wang et al., 2021). China is a traditional collectivistic culture that values strong family ties and frequent contact (Hofstede, 2001). Thus, in Chinese culture, family plays an important role in helping children to cope with daily stress.

According to the process model of stress and coping (Armstrong et al., 2005), protective factors (in a given context) can buffer against the negative impact of stress on students' adjustment. In addition to family functioning, the classroom environment is a protective factor (Dilalla and Mullineaux, 2008). The classroom is a basic unit where Chinese primary school students study, play, socialize, and grow up with a stable group of classmates and several teachers across 6 years of schooling (Wang et al., 2018). The classroom environment—which encompasses a broad range of educational concepts, such as the psychological environment created through social contexts, teacher characteristics and behaviors, peer relationships, and discipline—strongly influences student outcomes, particularly in China's school system (Jiang, 2004; Chen et al., 2006). Collective cultures deeply value interdependent ties among individuals, group loyalty, conformity to collective standards, and respect for authority (Romi et al., 2009).

One study of 1,941 pairs of monozygotic twins showed that twins in the same classrooms were more similar in terms of behavioral problems than twins placed in different classrooms, indicating that the classroom environment affects children's behaviors (Dilalla and Mullineaux, 2008). Previous research has also shown that some aspects of the classroom environment play a vital role in children's behavioral problems. For instance, teachers are one of the most significant adults in children's lives as they provide comfort, guidance, and support to children (Marengo et al., 2021). In addition, peers provide students with companionship, assistance, a sense of belonging, and enjoyment at school (Gowing, 2019). Research has indicated that conflictual teacher-child relationships and problems in peer relationships could trigger various behavioral problems (Zhu et al., 2016). In a longitudinal study, Kim and Nho (2017) showed that peer relationship difficulties significantly predicted subsequent aggressive behaviors, even after controlling for previous degrees of aggression. Moreover, Jia et al. (2018) found that harmonious teacher-student bonds ameliorated the adverse impact of peer victimization on psychological security, which resulted in less internet addiction behavior among Chinese children. Abou-ezzeddine et al. (2007) also found that positive peer relationships could enhance children's positive perceptions of the school climate, and in turn mitigate the adverse impact of environmental risk factors on aggressive behavior, especially in a collectivist culture like that of China. The literature reviewed above indicates that a positive classroom environment may buffer against behavioral problems in children who experience daily stress.

Although relatively few studies have investigated the moderating effects of family functioning and the classroom environment on the association between daily stress and behavioral problems, according to all the aforementioned theories and literature jointly, we can infer that healthy family functioning and a favorable classroom environment may alleviate the relationship between daily stress and behavioral problems.

This study aimed to identify environmental factors that could protect children against the negative effects of daily stress. We examined the relationship between daily stress and behavioral problems in children, and explored the moderating effects of family functioning and the classroom environment on this relationship. Specifically, we used the latent moderated structural (LMS) equation method to test three hypotheses:

H1: Daily stress positively predicts children's behavioral problems.

H2: Family functioning moderates the relationship between daily stress and behavioral problems in children.

H3: The classroom environment moderates the relationship between daily stress and children's behavioral problems.

MATERIALS AND METHODS

Participants and Procedure

The participants were 1,495 children and their parents or guardians. We recruited the children from five randomly selected elementary schools in Southwest China. Of the 1,495 participants, 1,450 (ages 9–13, M = 10.91, SD = 0.96 years) completed the survey for a 96.99% response rate. The final sample of children consisted of 749 (51.7%) boys, 692 (48.6%) girls, and nine with their gender not reported. Among them, 446 (30.8%), 481 (33.2%), and 523 (36.1%) were in the fourth, fifth, and sixth grades, respectively. Class size varied from 46 to 69 students, with a typical number of approximately 52. The final sample of parents and guardians consisted of 683 (47.1%) fathers, 735 (50.7%) mothers, 21 (1.4%) other types of guardians (e.g., grandparents), and 11 (0.8%) with guardian information not reported. The participants were all of the Han ethnic background.

The Research Ethics Committee for psychological research at the authors' institution approved this study (ID: LL2021018).

Before administering the surveys, participating schools provided parents with an explanation regarding the study and assurance that participation was voluntary and that data would remain confidential. Informed consent was obtained from all participants. The children completed the three questionnaires (daily stress, family functioning, and the classroom environment) in their classrooms during regular school hours, with guidance provided by trained graduate researchers. Subsequently, the children delivered a questionnaire on their behavioral problems to their guardians (one in each family) to fill out. Next, the completed questionnaire was placed in a sealed envelope and forwarded to the researchers.

Measures

Daily Stress

Children's daily stress was assessed using the Children's Daily Stress Inventory, developed by "The Study of Chinese Children and Youth's Psychological Development" project team (Dong and Lin, 2011). The inventory lists six events occurring in everyday interactions that could have negative effects on children's development: bullying, examination failure, study load, financial problems in the family, family conflict, and chronic physical illness in a family member. Each item assesses the occurrence and self-reported impact of the event on a six-point Likert scale ranging from 1 (*no, this did not happen to me*) to 6 (*yes, extremely*). The total score is the sum of the scores of all items, with higher scores indicating higher levels of daily stress. The scale has demonstrated good reliability and validity in Chinese children (Yang et al., 2015). The Cronbach's alpha for the scale was 0.78 in this study.

Behavioral Problems

Behavioral problems were assessed using the Chinese version of the Strengths and Difficulties Questionnaire (SDQ) (Du et al., 2006). It consists of 25 items divided equally between five subscales: conduct problems, hyperactivity-inattention, emotional symptoms, peer problems, and prosocial behaviors. Scores for all items in the first four subscales were summed to generate a total difficulty score, which represented the extent of children's overall behavioral problems. Responses used a three-point scale ranging from 0 (*not true*) to 2 (*certainly true*). Because parents and guardians are a primary source of information on everyday interactions with children, the parental version of the SDQ (Du et al., 2006) was administered to parents (one in each family). The scale has been widely used in Chinese children and demonstrated excellent psychometric properties (Ren et al., 2018). The Cronbach's alpha coefficients for the subscales ranged from 0.69 to 0.85, and for the total scale was 0.73.

Family Functioning

Family functioning was evaluated with the Family functioning Assessment Scale, developed by "The Study of Chinese Children and Youth's Psychological Development" project team (Dong and Lin, 2011). The scale consists of six self-reported items, which evaluate perceived family cohesion, or the degree of commitment and help family members provide for one another (e.g., "When we face a problem, our family members can solve the problem together and count on each other"). Responses used a five-point Likert scale ranging from 1 (*not at all characteristic or true of me*) to 5 (*extremely characteristic or true of me*). Item scores were summed to provide a total score. The Family functioning Assessment Scale has demonstrated good reliability and validity in Chinese children (Shi et al., 2017; Li et al., 2018). In the present study, Cronbach's alpha for the total scale was 0.82.

Classroom Environment

The children's perception of their classroom environment was assessed using the revised version (Dong and Lin, 2011) of the Classroom Environment Scale (Jiang, 2004). The scale includes 24 items examining the following five dimensions: Teacher-student relationships (e.g., "Our head teacher is accessible to students"), peer relationships (e.g., "The students in our class get on very well"), class order and discipline (e.g., "When the teacher delivers a lesson, students keep quiet"), competitive atmosphere (e.g., "Each student seems eager for superiority over others"), and learning burden (e.g., "We rarely have time to play and relax"). Responses used a five-point scale ranging from 1 (*not at all true for my class*) to 5 (*very true for my class*). The Classroom Environment Scale has proven reliable and valid in previous studies (Ren et al., 2011; Bai and Jin, 2016). In the present study, the Cronbach's alpha coefficients ranged from 0.71 to 0.87.

Statistical Analysis

Since our data spanned two levels of analysis, with individual perceptions of the classroom environment being nested within their classrooms, we initially used hierarchical linear multilevel (HLM) modeling, which explicitly accounts for nested data. However, the intraclass correlation, representing the proportion of observed variance of a variable between peer groups, was only 0.03. This means that only 3% of the observed variance was between groups. Given the lower intraclass correlation coefficient value, we ultimately did not apply HLM modeling (Luke, 2004). Instead, we used the LMS equation approach, a new method developed to examine general interaction models with latent interaction effects. Hence, we performed all analyses based on the LMS equation approach using the software Mplus, version 7.4 (Muthén and Asparouhov, 2015, Los Angeles, CA, United States). However, this method has several limitations: (1) traditional model fit indices used in structural equation modeling (SEM) are not provided for LMS models; and (2) information regarding the proportion of variance explained by latent interactions is not available in Mplus. As such, interaction effects are difficult to interpret using only the standard output. Thus, following previous studies using LMS models, we employed a two-step method to assess each LMS model's overall fit (Maslowsky et al., 2015).

We obtained comparative fit index (CFI), Tucker-Lewis Index (TLI), root-mean-square error of approximation (RMSEA), and chi-square (χ^2) values from Model 0. Using a log-likelihood ratio test, denoted as *D*, we compared the relative fit of Model 0 (the null model, whereby the interaction is not estimated and

therefore assumed to be zero) and Model 1 (the alternative model, whereby the interaction is estimated) using the following equation:

$$D = -2[(\log - \text{likelihood for Model0}) - (\log - \text{likelihood for Model 1})]$$

.

To analyze the dependent variable (i.e., children's behavioral problems), we derived the total variance explained in Models 0 and 1, ${R_{Y0}}^2$ and ${R_{Y1}}^2$, respectively, from the Mplus standardized output. Finally, $\Delta {R_Y}^2 = {R_{Y1}}^2 - {R_{Y0}}^2$, the difference between these two R^2 values, provided the proportion of R^2 explained by the interaction.

RESULTS

Preliminary Analyses

Table 1 shows descriptive statistics and correlations. The analysis of variance (ANOVA) results indicate a significant main effect of grade, $F(2,1447) = 8.14$, $p < 0.001$, ${\eta_p}^2 = 0.01$. Parents reported significantly lower scores for sixth-graders than for fourth- and fifth-graders on behavioral problems. The outcomes of the independent-samples *t* test point to a significant difference in behavioral problems according to sex, $t(1448) = 2.18$, $p < 0.05$, $d = 0.11$. Parents rated boys ($M = 11.24$, $SD = 5.41$) significantly higher than girls ($M = 10.64$, $SD = 5.10$). Given these substantial differences in behavioral problems based on grade and sex, we included these variables as covariates in subsequent moderator analyses.

Measurement Model

We performed confirmatory factor analysis (CFA) to test the measurement model, which comprised the four latent variables: (1) daily stress; (2) behavioral problems; (3) family functioning; and (4) the classroom environment. The latent daily stress variable was indicated by six items. The latent behavioral problems variable was denoted by problems with conduct, hyperactivity-inattention, emotional symptoms, and peer problems. The family functioning latent variable was represented by six items. The classroom environment latent variable was embodied by teacher-student relationships, peer relationships, class order and discipline, a competitive atmosphere, and learning burden. The overall model yielded an acceptable fit, $\chi^2(183) = 907.66$, $p < 0.001$, RMSEA = 0.05, CFI = 0.92, TLI = 0.91. Standardized factor loadings ranged from 0.52 to 0.84 and were significant at $p < 0.001$.

Moderator Analyses

Model fit indices were calculated. Model 0 (**Figures 1A,B**) was estimated. Both models (**Figures 1A,B**) showed acceptable fit to the data: Model 0 (**Figure 1A**): $\chi^2(131) = 527.20$, $p < 0.001$, RMSEA = 0.04, CFI = 0.91, TLI = 0.90; and Model 0 (**Figure 1B**): $\chi^2(115) = 326.80$, $p < 0.001$, RMSEA = 0.05, CFI = 0.90, TLI = 0.89. Daily stress positively predicted the children's behavioral problems ($\beta = 0.29$, $t = 5.76$, $p < 0.001$ and $\beta = 0.38$, $t = 8.78$, $p < 0.001$), thus supporting Hypothesis 1. In addition, family functioning significantly predicted behavioral problems ($\beta = -0.20$, $t = 4.27$, $p < 0.001$), but the classroom environment did not ($\beta = -0.04$, $t = 1.13$, $p > 0.05$).

The two Models (**Figures 2A,B**) were then estimated. The fit of Model 1, relative to Model 0, was determined *via* a log-likelihood ratio test to compare the two models' log-likelihood values; the log-likelihood difference values for Models 0 and 1 were $D = 5.19$ and $D = 4.30$, respectively. The chi-square distribution shows that the log-likelihood ratio test was statistically significant ($p < 0.05$), indicating that Model 0 (the model without the interaction) exhibited a significant loss in fitness relative to Model 1 (the model with the interaction). The interaction effects of both daily stress × family functioning ($\beta = 0.08$, $t = 2.16$, $p < 0.05$) and daily stress × the classroom environment ($\beta = 0.07$, $t = 2.06$, $p < 0.05$) were statistically significant after controlling for grade and sex; therefore, Hypotheses 2 and 3 were supported.

The method described above was used to interpret the interaction effect size. The daily stress × family functioning and daily stress × the classroom environment interactions explain 2.6% and 1.7% of the variance in the children's behavioral problems, respectively.

Regarding the underlying processes, a simple slope analysis (Aiken and West, 1991) revealed that the positive relationships for both high family functioning and high classroom environment were significantly different from zero, *simple slope* = 1.47, $t = 7.32$, $p < 0.001$, and *simple slope* = 1.62, $t = 7.75$, $p < 0.001$, respectively. Moreover, the positive relationships for both low family functioning and low classroom environment were significantly different from zero, *simple slope* = 0.81, $t = 4.52$, $p < 0.001$, and *simple slope* = 1.11, $t = 5.89$, $p < 0.001$, respectively. We plotted the interactions (**Figures 3**, **4**) to aid interpretation, which suggest that both family functioning and the classroom environment exerted stronger protective influences on behavioral problems when daily stress level was lower. Note that children with favorable (versus poor) family functioning and classroom environments exhibited fewer behavioral problems, regardless of the level of daily stress.

DISCUSSION

We examined whether family functioning and the classroom environment could function as moderators between daily stress and behavioral problems. We sought to overcome the limitations of previous research in this field by investigating the effects of daily stress on children's behavioral problems in the context of broader family circumstances and classroom environments, focusing on the moderating processes within Chinese culture.

We explored the effects of demographic factors on behavioral problems. Regarding grade differences, in line with other Chinese studies (Wu et al., 2015; Wu et al., 2017), children in grade 6 reported the lowest levels of behavioral problems compared to other grades. This finding may be attributable to children's acquisition of self-control, which develops over time (Duckworth and Gross, 2014; Zhi et al., 2020); both cross-sectional and longitudinal studies suggest that self-control

TABLE 1 | Means, *SD*s, and correlations among study variables (*N* = 1,450).

	M	*SD*	1	2	3	4	5	6	7
1. DS	11.03	4.80							
2. FF	24.75	4.86	−0.37**						
3. CE	17.50	2.05	−0.29**	0.47**					
4. CP	1.78	1.52	0.19**	−0.20**	−0.11**				
5. H-I	4.09	2.44	0.20**	−0.20**	−0.14**	0.46**			
6. ES	2.42	2.01	0.22**	−0.15**	−0.06**	0.39**	0.28**		
7. PP	2.61	1.66	0.16**	−0.16**	−0.07**	0.18**	0.12**	0.35**	
8. BP	10.90	5.27	0.28**	−0.26**	−0.16**	0.71**	0.74**	0.73**	0.55**

*SD: standard deviation; DS = daily stress; FF = family functioning; CE = classroom environment; CP = conduct problems; H-I = hyperactivity-inattention; ES = emotional symptoms; PP = peer problems; BP = behavioral problems. **p < 0.01.*

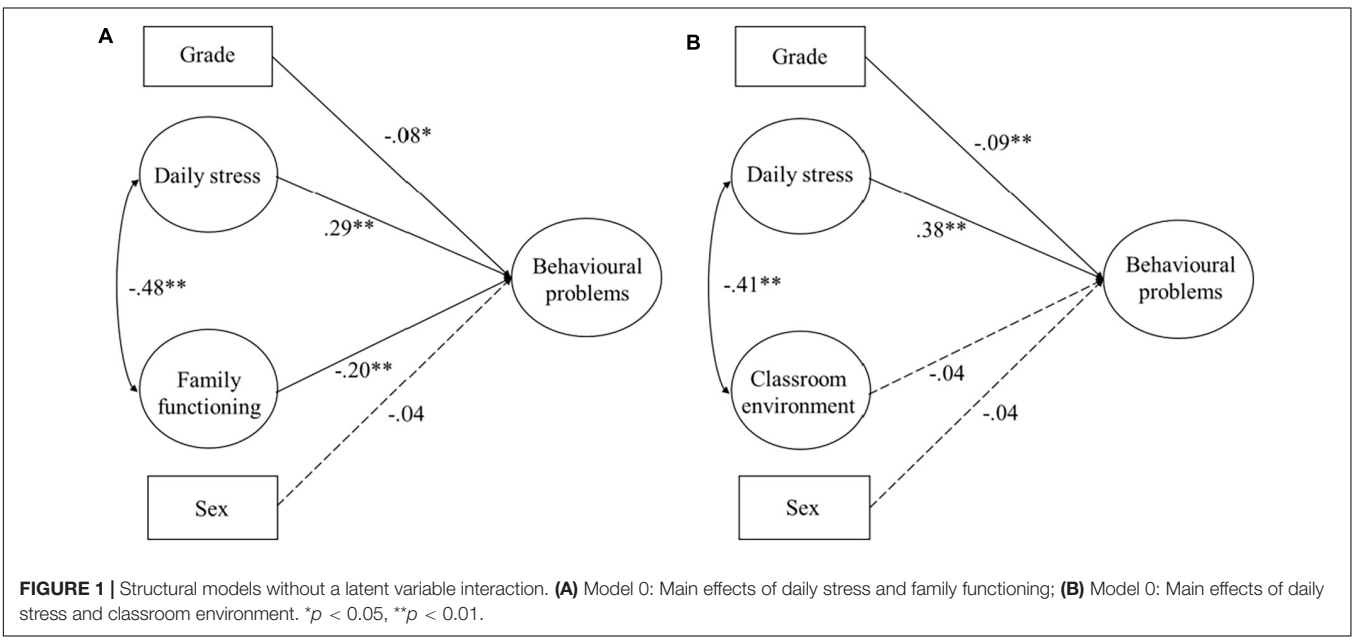

FIGURE 1 | Structural models without a latent variable interaction. **(A)** Model 0: Main effects of daily stress and family functioning; **(B)** Model 0: Main effects of daily stress and classroom environment. *$p < 0.05$, **$p < 0.01$.

in childhood strongly predicts individual behavioral problems (Daly and Perez, 2009; Schlam et al., 2013). Thus, behavioral problems showed a downward trend with grade in the present study. Regarding sex differences, consistent with previous findings (Wu et al., 2015; Cui et al., 2021), boys tended to have higher scores than girls on behavioral problems, as reported by parents. The peer-socialization model may provide an interpretation of this outcome, which implies that children are more likely to assimilate the characteristics of same-sex groups, placing boys at risk for behavioral problems (Rose and Rudolph, 2006).

Daily Stress and Behavioral Problems

One of our goals was to provide data on the relationship between daily stress and behavioral problems in Chinese children. After controlling for sex and grade, children reporting higher daily stress exhibited more parent-reported behavioral problems, which is in accordance with previous research indicating that daily stressors have a cumulative effect on children, and distress associated with these stressors is related to various behavioral difficulties (Garaigordobil and Machimbarrena, 2019; Zhang and Mersky, 2020). For instance, Escobar et al. (2011) found that daily stress is a significant predictor of emotional and behavioral maladjustment in Caucasian schoolchildren. Roberts et al. (2018) also found that the amount of daily stressors appears to be strong predictors of psychosocial outcomes and risk behaviors among children in the United States. In a Chinese study, Chen and Hong (2010) also examined the relationship between daily stressors and behavioral problems among children in fifth and sixth grade, and found that daily stressors directly predicted both internalizing and externalizing problems.

The daily stressors included in our study were children's daily experiences. Adults may regard these things as trivial or as part of life that children must learn to live with; however, such stressors may become sources of pressure for elementary school children, as children's social circles are mostly restricted to their home and school, and their problem-solving abilities and resources are limited. Moreover, the pressure is likely to be exacerbated by the recurrent nature of daily stressors (Chan et al., 2016). Compas (2006) postulated that chronic stress impacts health through its allostatic load. The organism functions within a level of normal resistance. However, when stress levels exceed

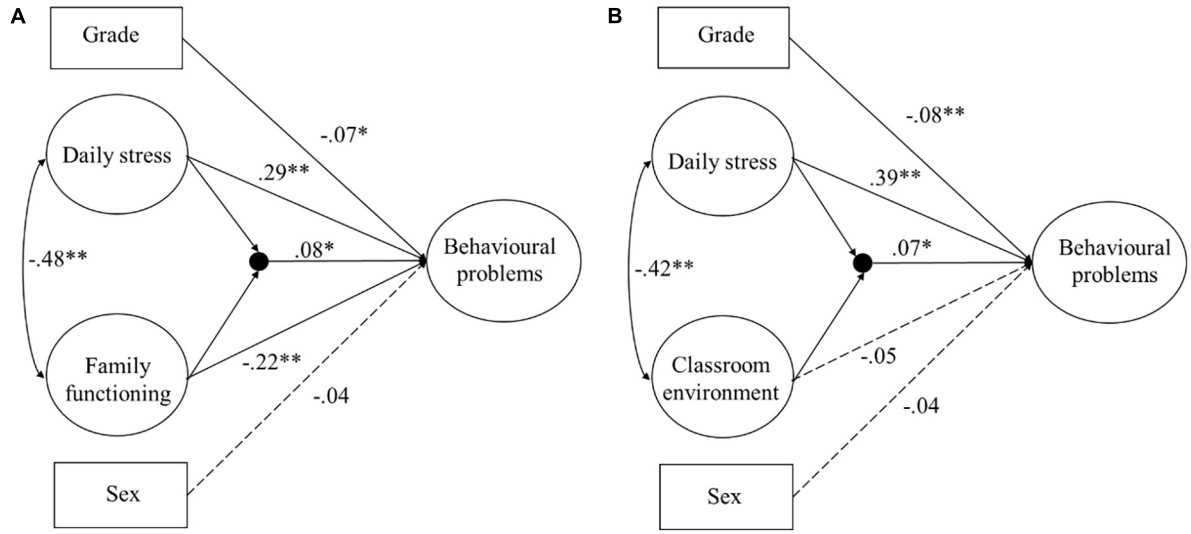

FIGURE 2 | Structural models with the latent variable interaction. **(A)** Model 1: Model including the latent variable daily stress × family functioning interaction, depicted as a filled circle according to Mplus standard notation; **(B)** Model 1: Model including the latent variable daily stress × classroom environment interaction. $^{*}p < 0.05$, $^{**}p < 0.01$.

adaptive resources, they will pose threats to homeostasis; this may lead to high-cost responses, which include elevations in psychosomatic reactions and the elicitation of harmful behaviors (i.e., aggression, risk-taking, and self-damaging conduct; Rice, 2012). In addition, daily stress in childhood can disrupt the neural systems responsible for stress responses, predict emotional symptoms, and impair an individual's ability to cope with social interactions and potential threats, potentially leading to behavioral problems (Shonkoff et al., 2012). Chinese research has shown that daily stress related to academic performance, schoolwork, and relationships with parents, teachers and peers is associated with anxiety (Chan et al., 2015).

The Buffering Role of Family Functioning

The results show that family functioning served as a buffer in the relationship between daily stress and behavioral problems; this provides empirical evidence for the stress-coping model, which states that the ways in which children deal with stress affect mental health (Lazarus and Folkman, 1984). The results also support the protective-support hypothesis whereby social support, as a coping resource, can reduce the adverse mental health risks of stress (Schwab et al., 2006).

In terms of family functioning, children at this age rate their parents as their most frequent providers of social support in times of stress, and healthy family functioning can provide a supportive context for children's physical, psychological, and social growth, and promote a wide range of experiences to avoid emotional suppression through open communication, which in turn decreases behavioral problems (Thompson et al., 1992). The societal culture where a family exists contributes to family functioning. Collectivism is a significant value practiced by Chinese society. Values such as cooperation, helpfulness, obedience, interdependence, and maintaining harmonious interpersonal ties are encouraged, especially during childhood (Kling, 1995); these relationships help children face challenges and obstacles (Sumari et al., 2019). Moreover, they can buffer against the effects of disadvantages and offer significant psychological resources for healthy development. Healthy family functioning is connected to children's ability to deal with daily life and unforeseen circumstances (Sumari et al., 2019). For example, a recent study from China suggests that good family functioning fosters better coping with life events and helps to relieve psychological problems, such as anxiety and loneliness (Pan et al., 2021). Thus, compared to children with poor family functioning, children with good family functioning can seek formal and informal advice or emotional assistance from family members to positively handle daily stress; they hence exhibit fewer behavioral problems.

The Buffering Role of the Classroom Environment

The finding that the classroom environment serves as a buffer in the relationship between daily stress and behavioral problems is another novel contribution to extend the literature, which also provides empirical evidence for the stress-coping model (Lazarus and Folkman, 1984) and the protective-support hypothesis (Schwab et al., 2006).

Differences exist in the perception of the classroom environment and its effects on students' development between Western and Chinese regions (Wong et al., 2016). In China, students have a fixed classroom, with a specially designated classroom teacher before college. Educators regard the class as a collective or social system. Close teacher-student bonds and serious classroom discipline are two salient features of the classroom environment; thus, a typical classroom in China often has good classroom management and obedient and attentive students (Wang et al., 2017). Empirical research has repeatedly shown that the quality of the classroom environment is linked

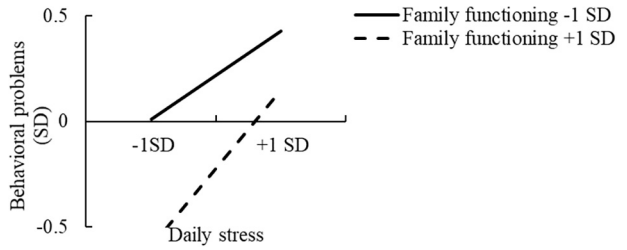

FIGURE 3 | Interaction between daily stress and family functioning, predicting children's behavioral problems.

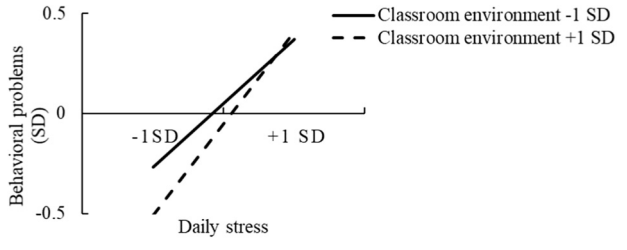

FIGURE 4 | Interaction between daily stress and classroom environment, predicting children's behavioral problems.

to behavioral outcomes in primary and secondary schools. For instance, Xie (2000) found that students in classes with high (versus low) perceived rule clarity, teacher support, and student involvement reported greater contentment and fewer absences, especially those from collectivist backgrounds. In addition, at-risk students can benefit from a positive classroom environment. The classroom environment and its dimensions can moderate the influence of risk factors (e.g., socioeconomic status and low self-efficacy) on students' outcomes (e.g., academic achievement) (Malecki and Demaray, 2006; Martin and Rimm-Kaufman, 2015). Thus, a positive classroom environment can serve as a protective factor against the harmful impact of daily stress on behavioral problems in China.

Expanding on previous findings (Zhu et al., 2016; Li et al., 2018), the results revealed that in the context of low levels of daily stress, children with good family functioning and a favorable classroom environment exhibited fewer behavioral problems than those with poor family functioning and an unfavorable classroom environment; whereas in the context of high levels of daily stress, children with both good and poor family functioning and classroom environment showed more behavioral problems. Regarding the moderating processes, the stress-vulnerability hypothesis offers an appropriate framework for grasping the underlying processes observed in our results; this theory argues that possessing certain attributes is generally advantageous, particularly when stress levels are low. However, these protective factors might lose their ability to counteract risk once it reaches a certain level. Hence, it might be difficult for individuals exposed to severe adversity to achieve positive outcomes (Vanderbilt-Adriance and Shaw, 2008; Li et al., 2012). In line with the stress-vulnerability hypothesis, the findings suggest that healthy family functioning and a positive classroom environment might not be sufficient to protect children from behavioral problems when facing high levels of daily stress.

Implications

The present study contributes to the literature regarding children's daily stress and behavioral problems by extending the prior focus on major life events in examining daily stress among Chinese children. Moreover, the current study showed that the beneficial effects of good family functioning and a favorable classroom environment may be overwhelmed by high levels of daily stress; this offers empirical support for the stress-vulnerability hypothesis.

In practice, first, we should be alert to the negative effect of daily stress on children's behavioral problems. Second, the buffering effects of family functioning and the classroom environment are more likely to be observed in children who report minor stress. These findings could serve to warn educators and caregivers that they should pay attention to the creation of functional families and favorable classroom environments. However, we should not exaggerate the roles of good family functioning and a favorable classroom environment. When children are exposed to severe daily stressors, the potential values of functional families and favorable classroom environments in interventions to reduce behavioral problems are limited. This may be because other family factors (i.e., parental stress), personality (i.e., extraversion, trait resilience), and mindfulness training also moderate the relationship between daily stress and behavioral problems (Korotkov, 2008; van de Weijer-Bergsma et al., 2014; Weiss et al., 2015). Therefore, to reduce children's behavioral problems, educators and caregivers need to help families stay strong and build healthy classroom environments on the one hand, and assist children in reducing their stress levels.

Limitations and Future Directions

While the results provide new insight into how environmental factors reduce children's stress-related behavioral problems, the study has some limitations. First, to gage stressors, we used retrospective and subjective evaluations, which could have been biased. Future research should include alternative measures (e.g., daily diaries) to minimize such problems by focusing on objective, external measurements and allowing participants to report on their experiences immediately after they occur. Second, our study was limited to a restricted population of children from Southwest China. Thus, some caution should be exercised in drawing conclusion, and future studies should use a larger, more diverse sample to ensure the generalizability of the findings. Third, since we focused selectively on environmental domains as the sole explanatory factor, future research should analyze additional moderating mechanisms across multiple domains. Other internal resources, such as self-esteem or trait resilience, may also be determinants in the buffering process. Fourth, although we found that family functioning and the classroom environment can buffer against the effect of daily stress on behavioral problems in collectivist cultures such as that of China, whether there are differences in the stress-buffer effects among different cultures is unclear. Hence, cultural comparative

research is needed. Last, our study is based on a cross-sectional design, which does not allow us to make definitive conclusion that daily stress leads to more behavioral problems. To better ascertain causality, longitudinal studies are needed to verify the current findings.

CONCLUSION

The present study provides new, useful information about the association between daily stress and behavioral problems and the underlying psychological mechanisms. The findings imply that daily stress is positively related to behavioral problems, and that both family functioning and the classroom environment moderate the relationship between daily stress and behavioral problems after controlling for sex and grade. Moreover, a functional family and a favorable classroom environment are generally advantageous, particularly when the daily stress level is low. These results provide novel information, emphasizing the importance of a functional family and a favorable classroom environment as additional factors that may protect against behavioral problems in children who experience mild daily stressors.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

LW conceived the study, participated in its design, and drafted the manuscript. FD performed the statistical analysis and contributed to the design of the study and the interpretation of data. TH assisted with literature review, proofed the results, and participated in manuscript drafting and revision. GC participated in the design of the study, coordinated the work, and carefully revised the manuscript. XC contributed to editing the manuscript. All authors agreed with the final manuscript.

FUNDING

This study was supported by the Science and Technology Foundation of Liaoning Province (Grant Number 2021-BS-202) and the Natural Science Foundation of Liaoning Normal University (Grant Number BS2020L004).

ACKNOWLEDGMENTS

The authors gratefully acknowledge Professor Jinliang Wang, Xiaofan Peng, and Jia Wei for their precious advice on interpreting the significance of the results of this study. Appreciation is also expressed to all students and their parents who participated in our study.

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

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frontiers in Psychology

ORIGINAL RESEARCH
published: 01 November 2021
doi: 10.3389/fpsyg.2021.720094

P300 Event-Related Potentials Mediate the Relationship Between Child Physical Abuse and Externalizing Behavior

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The psychophysiological mechanism linking early childhood experiences to behavior problems remains unclear. This study aimed to examine the association of child physical abuse with P300 event-related potentials (ERP), and to test the mediating effect of P300 amplitude and latency in the relationship between child physical abuse and externalizing behaviors. Cross-sectional secondary data were obtained from 155 children (55.5% boys, mean age: 11.28 ± 0.57 years) who participated in the China Jintan Child Cohort Study. Children self-reported maternal and paternal physical abuse and externalizing behaviors, as well as P300 were obtained in 2013. Additionally, parents and teachers reported child externalizing behaviors in preschool in 2007. P300 were recorded during a standard novel auditory oddball task. Path analysis shows that after controlling for child sex, socioeconomic status, area of residence, IQ, and child externalizing behavior in preschool, children exposed to maternal physical abuse exhibited increased novelty P300 amplitude, which links to more externalizing behavior. Novelty P300 amplitude partially mediated the relationship between maternal physical abuse and externalizing behavior. These findings are the first to document the partial mediating effect of P300 amplitude on the abuse-externalizing relationship and are consistent with the view that physical abuse affects the attention bias to novel cues that likely places them at increased risk for the development and maintenance of externalizing behavior.

Keywords: physical abuse, P300 amplitude, event-related potential, externalizing behavior, mediation

OPEN ACCESS

Edited by:
Leonardo De Pascalis, University of Liverpool, United Kingdom

Reviewed by:
Antonia Cascales-Martinez, University of Murcia, Spain
Pamela Schuetze, University at Buffalo, United States
Xiangru Zhu, Henan University, China

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Specialty section:
This article was submitted to Developmental Psychology, a section of the journal Frontiers in Psychology

Received: *03 June 2021*
Accepted: *05 October 2021*
Published: *01 November 2021*

Citation:
Cui N, Raine A, Connolly CA, Richmond TS, Hanlon AL, McDonald CC and Liu J (2021) P300 Event-Related Potentials Mediate the Relationship Between Child Physical Abuse and Externalizing Behavior. Front. Psychol. 12:720094. doi: 10.3389/fpsyg.2021.720094

INTRODUCTION

The relationship between child physical abuse and behavior problems has been well documented in the literature across cultures (Fry et al., 2012; Gershoff et al., 2012; Pace et al., 2019). Consistently, a recent meta-analytic study of 42 studies in Mainland China also found that physically abused children manifested more externalizing behaviors (Cui and Liu, 2020). The link remains significant even after controlling for other forms of maltreatment (Renner and Boel-Studt, 2017; Muniz et al., 2019), and the effect of physical abuse practiced by mothers demonstrates more salient effect on externalizing behaviors than that practiced by fathers (Cui et al., 2018).

Nevertheless, not all maltreated children develop behavior problems, which raises the question of the mechanism underlying the association between child physical abuse and behavior problems. Altered neurocognitive development related to child physical abuse is suggested to be a potential pathway (McCrory et al., 2012; Kavanaugh et al., 2017), which is supported by the empirical evidence of the mediating effect of neurocognition measured by neuropsychological tasks or functional magnetic resonance imaging (fMRI) in the relationship between child maltreatment and externalizing behavior (Xing et al., 2018; Hallowell et al., 2019).

At the neurophysiological level, the P300 event-related potential (ERP) is a widely-used proxy measure of the allocation of neural resources and neurocognitive processing capability (Polich, 2007). The P300 is a large positive-going peak occurring approximately 300 to 800 ms following stimulus onset. A three-stimulus oddball paradigm is widely used for elicitation of P300, in which participants are instructed to detect infrequent deviant stimuli (target; e.g., low-pitched tone) amongst a series of standard stimuli (non-target; e.g., high-pitched tone) and novel stimuli (e.g., dog barks and bird chirp) (Gao et al., 2011). Two P300 components, the "P3a" and "P3b" can be derived from such a task to assess the participants' neural processes of directing attention to events of importance. The P3a is elicited by novel stimuli (i.e., stimuli with low probability, task-irrelevant, but contextual salience) and is commonly regarded as reflecting a bottom-up process of attention orienting to prepare the organism for deviant events in the environment (Debener et al., 2002; Polich, 2007). The P3b peaks 60–80 ms later than the P3a, and is considered a measure of effortful top-down attentional shift to infrequent but task-relevant stimulus and working memory updating when participants are actively engaged in the task of detecting the targets (Polich, 2007). P300 has been extensively studied in relation to both child maltreatment and externalizing behavior, respectively.

A number of studies have examined the effects of maltreatment on neural processes utilizing ERP. For example, Pollak et al. (2001) have conducted a series of studies on school-age maltreated children and found that maltreated children show hyper-responsive to angry facial expressions and greater P3b amplitude in response to angry facial affect (Pollak and Tolley-schell, 2003; Shackman et al., 2007; Shackman and Pollak, 2014). These findings indicate that enhancement in P3b amplitude may be an adaptive mechanism to help maltreated children to detect and respond to anger stimuli more efficiently (Shackman and Pollak, 2014).

Literature also documents relatively consistent evidence that an attenuated P300 amplitude is an endophenotype of externalizing disorders featured by excessive impulsivity (Patrick et al., 2006; Brennan and Baskin-Sommers, 2018), such as alcohol use disorder and substance disorders (Iacono and Mcgue, 2002; Euser et al., 2012; Hamidovic and Wang, 2019), antisocial behavior and impulsive-antisocial psychopathy (Pasion et al., 2018), attention deficit hyperactivity disorder (ADHD; Bitter, 2011; Kallen et al., 2020), and conduct disorder (Iacono and Mcgue, 2002). Reduced novelty P300 amplitude in oddball tasks using non-affective auditory or visual stimuli was found among criminal psychopaths (Venables and Patrick, 2014), offenders (Brazil et al., 2012), and men convicted of spousal/partner abuse (Stanford and Kockler, 2007) in comparison to healthy controls. P300 amplitude reduction also shows association with deficient inhibit control, a cognitive process that links to externalizing behavior.

Despite the cumulative evidence of the pairwise relationships among child maltreatment, P300, and externalizing behavior, the more complex relationships among the three constructs have not been fully examined. To our best knowledge, only two studies (Shackman et al., 2007; Shackman and Pollak, 2014) have hypothesized the pathway leading maltreatment to behavior problems through impaired neural activity indicated by P300 abnormalities and tested the hypothesis empirically. Shackman et al. (2007) in a study of 30 male and female children reported that physically abused children exhibited increased P300 amplitude to threatening stimuli (i.e., their mother's angry faces and angry voices), and that enhanced P300 amplitude mediated the relationship between physical abuse and child self-reported anxiety. Findings from a subsequent study of 50 boys by Shackman and Pollak (2014) found that physical abuse was associated with increased P300 amplitude to negative visual stimuli (i.e., angry adult faces), but that increased P300 amplitude did not significantly correlate with child self-reported aggression.

The inconsistent findings in these studies may be attributed to the differences in participant characteristics (e.g., both boys and girls vs. boys only and age differences), task modality (both visual and vocal stimuli from children's mothers vs. visual stimuli from unfamiliar adults), and behavioral outcomes (anxiety reported by parents using a questionnaire vs. aggression measured objectively using an aggression task). Moreover, the non-significant finding in Shackman and Pollak (2014) may be due to lack of statistical power since the sample size was small (N = 50). In addition, neither study controlled for possible confounders, such as prior behavior problems in the analysis. Therefore, larger-scale studies using a standard task protocol to elicit P300 are necessary to further investigate the relationships among physical abuse, P300, and child externalizing behavior.

The objectives of this study were twofold: (1) to test the relationship between child physical abuse and P300 amplitude elicited by a standard novel auditory oddball task stimuli, and (2) to examine the mediating effect of P300 amplitude to novel and target stimuli in the relationship between child physical abuse and externalizing behavior. Because prior studies have not controlled for the possibility that earlier externalizing behavior could result in later enhanced P300 (as opposed to enhanced P300 predisposing to externalizing behavior), we controlled for externalizing behavior collected 6 years prior to P300 assessment.

MATERIALS AND METHODS

Design and Participants

This is a cross-sectional study using secondary data (de-identified) collected from a sub-cohort of children during Wave II (T2) of the China Jintan Child Cohort Study (the Jintan Study).

The Jintan Study is an ongoing prospective longitudinal study to investigate the impact of environmental exposures, such as lead, on children's neurobehavioral outcomes (Liu et al., 2010, 2015), and child physical abuse was measured as an important social confounder. It initially recruited three sub-cohorts of children when they were 3 to 5 years old in 2004–2005. All of these children were invited to participate in two waves of data collection when they were about 6 years old in preschool in 2005 (sub-cohort 1), 2006 (sub-cohort 2), and 2007 (sub-cohort 3), and when they were about 12 years old in grade 6 elementary school in 2011 (sub-cohort 1), 2012 (sub-cohort 2), and 2013 (sub-cohort 3), respectively. The cohort children were regarded representative of children of the same age in Jintan City, a small-scale city on the east coast in Mainland China. Details of the cohort design and sampling information are described elsewhere (Liu et al., 2010, 2011, 2015).

In 2013, in additional to the T2 questionnaire survey, all the children of sub-cohort 3 (n = 414) were also invited to participate in psychophysiological recordings. Out of the 414 children, 155 with complete data on child physical abuse, P300, and externalizing behavior at T2 were included in this study. Comparisons of these children and the remaining sub-cohort children who were not included in this study demonstrated no significant differences in age, sex, socioeconomic status, area of residence, externalizing behaviors at age 6 and 12, and maternal and paternal physical abuse experiences. **Table 1** displays the sample characteristics and the comparison results.

We obtained verbal assent from children and informed consent from their parents. This study was approved by the Institutional Review Board (IRB) of the University of Pennsylvania and the Ethics Committee of the Jintan Hospital. Clear instruction of voluntary participation, rights of withdrawing or skipping questions whenever they did not feel like answering was given to the children. Considering the potential distress caused by completing the survey, especially questions regarding harsh parenting practice, information of school psychological services and local professional mental health institutions were provided for all participated children in case they needed. When the study was conducted, there was no mechanism/laws/regulations of reporting and dealing with cases of physical abuse that did not meet the criteria of crime in Mainland China. Therefore, action of reporting was not taken.

Measures

Child Physical Abuse at Age 12 Years Old

Children reported their physical abuse experiences in the previous year using the severe physical assault subscale of the Chinese Version of the Parent–Child Conflict Tactics Scale (CTSPC; Straus and Hamby, 1998). They were asked to provide information on whether they were: (1) hit on body parts besides the bottom with objects, (2) thrown or knocked down, (3) hit with a fist or kicked hard, (4) beaten up, (5) grabbed around the neck and choked, (6) burned or scalded on purpose, or (7) threatened with a knife or other weapons by their mothers and fathers separately in the preceding year (0 = "No", or 1 = "Yes"). Children who answered "Yes" to at least one of these items were regarded as having experienced physical abuse. The CTSPC has shown good construct validity (Straus and Hamby, 1998) and reliability in Chinese studies (Chan, 2012; Cui et al., 2016, 2018). In the present study, Cronbach's alpha coefficients for maternal (0.84) and paternal (0.87) physical abuse were acceptable. Our previous study using the same data source demonstrated that children with only maternal physical abuse scored higher on behavior problems but those with only paternal physical abuse did not, and the effect of both maternal and paternal physical abuse on behavior problems was driven by maternal physical abuse. Therefore, we tested the effect of maternal and paternal physical abuse separately, even though they could co-occur.

Child Externalizing Behaviors at Age 12 and 6 Years Old

Externalizing behaviors at ages 12 and 6 were reported by children themselves using the Chinese version of the Youth Self-Report (YSR) and by mothers using the Chinese version of Child Behavior Checklist for age 1.5–5 (CBCL/1.5–5), respectively. Each item was evaluated on a 3-point scale (2: "often true", 1: "sometimes", and 0: "not true"). The sum score of all items in the externalizing behavior subscale were normalized (mean = 50.00 and standard deviation = 10.00) to obtain T scores for data analysis according to the measurement manuals (Achenbach and Rescorla, 2000). Higher T scores indicate more externalizing behavior. The YSR and CBCL showed good reliability and validity in Chinese children and adolescents (Su et al., 1998; Wang et al., 2013). Complete data on externalizing behavior at age 12 and 6 were obtained from 279 children and 350 mothers, respectively.

Psychophysiological Assessment at Age 12 Years Old

Standard novel auditory oddball task

Given the overarching goal of the parent study of investigating the impact and mechanism of environmental exposure on child neurobehavioral outcomes, the standard novel auditory oddball paradigm was chosen because it was widely used in studies of brain function and behavioral problems with externalizing traits [e.g., substance abuse (Euser et al., 2012; Hamidovic and Wang, 2019), and psychopathology (Gao et al., 2018)]. The oddball task used in this study contains 280 high-pitched tones (non-target, presented at 1000 Hz) and 35 low-pitched tones (target, presented at 500 Hz), as well as 35 novel tones (e.g., dog-bark, bell, bird, and honk) at 75 dB. Each tone lasted for 150 ms, with an inter-stimulus interval of 1.1 s, an inter-trial interval of 1.25 s, and rise and fall times of 5 ms. The target, non-target, and novel tones were presented in random order. The duration of the task was 7.5 min.

Children were tested in a temperature-controlled, light- and sound-attenuated laboratory, with a computer screen placed at a distance of 1 m. For the duration of the task, the children were instructed to keep their eyes fixated on an "X" on the computer screen. To ensure they could distinguish between the non-target and target tones before the actual test, they were given six practice trials. In the actual test, they were instructed to press a response button as quickly as possible with their dominant hand in response to the

TABLE 1 | Sociodemographic characteristics of the present sample and comparisons with the children not included in the present study.

	Children included (n = 155) M ± SD/n(%)	Children excluded (n = 259) M ± SD/n(%)	t/χ^2	p-Value
Age (n_i = 155, n_e = 257)	11.28 ± 0.57	11.32 ± 0.54	0.71	0.48
Gender			0.01	0.98
Girls	69 (44.5)	115 (44.4)		
Boys	86 (55.5)	144 (55.6)		
Family location			0.20	0.91
Urban	66 (42.6)	113 (43.6)		
Suburban	65 (41.9)	110 (42.5)		
Rural	24 (15.4)	36 (13.9)		
SES (n_i = 133, n_e = 140)	0.19 ± 0.99	0.22 ± 0.98	0.24	0.81
IQ (n_i = 113, n_e = 91)	105.65 ± 11.39	103.40 ± 13.09	1.31	0.19
Externalizing behavior at age 12 (n_i = 155, n_e = 184)	52.52 ± 11.43	51.18 ± 9.67	1.11	0.27
Externalizing behavior at age 6 (n_i = 132, n_e = 218)	13.23 ± 6.74	13.47 ± 6.96	0.31	0.76
Maternal physical abuse			2.52	0.11
Yes	51 (32.9)	37 (24.7)		
No	104 (67.10)	113 (75.3)		
Paternal physical abuse			1.24	0.27
Yes	54 (37.8)	47 (29.0)		
No	101 (65.2)	115 (71.0)		

SES, socioeconomic status; IQ, intellectual quotient. Family location was self-identified. n_i, number of children with available information included in this study; n_e, number of children with available information but not included in this study.

target tones, but not to other tones. The number and reaction time of correct responses to target, and the number of incorrect responses to non-target (commission error) and novel stimuli (false alarms) were recorded as behavioral information-processing indicators.

Event-related potentials recording and data acquisition

During the oddball task, electroencephalography (EEG) was recorded from an Electro-Cap (Eaton, OH, United States) with tin (Sn) electrodes placed at 12 sites on the scalp (FP1, FP2, F3, F4, F7, F8, P3, P4, T3, T4, O1, and O2) according to the International 10–20 system. A single-channel EEG100C biopotential module (BIOPAC Systems, Inc., Goleta, CA, United States) was used to amplify the EEG signal from each electrode. The same parameters used in Rudo-Hutt's (2014) study were applied. Specifically, the EEG signal was grounded *via* 8 mm diameter silver/silver chloride (Ag/AgCl) electrodes attached to the distal phalanges of the first and second fingers of the non-dominant hand. In addition, an electrooculograph (EOG) channel monitored vertical eye movement *via* 4 mm diameter Ag/AgCl electrodes placed above and below the supra- and infra-orbital ridges of the left eye. A Q-tip stick was used to abrade the scalp electrode sites, whereas skin on the earlobes and around the left eye was prepared using NuPrep abrasive skin prepping paste. Biopac isotonic recording gel was used as the electrolyte medium for EOG, and Electro-gel was used for the earlobes and scalp. Impedance for EEG was kept below 10 kΩ and was under 5 kΩ for most participants, while impedance for EOG and ear electrodes was kept below 20 kΩ. Data from EEG channels were recorded using a bandpass of 0.01–35 Hz and a 50 Hz notch filter, with a 1000 Hz sampling rate and gain set to 5000. Data from the EOG channel were recording using a bandpass of 0.05–35 Hz and a 50 Hz notch filter, with a 1000 Hz sampling rate and gain set to 1000.

After ERP recording, data from each EEG channel were visually inspected in Acq*Knowledge* (BIOPAC Systems Inc., Goleta, CA, United States), and clearly artifactual data on EEG (e.g., due to equipment failure or eye movement) were discarded. To help better ensure fidelity of data, the EEG was further processed for remaining artifacts by rejecting EEG epochs that exceeded ±80 μV using custom scripts in MATLAB (MathWorks Inc., Natick, MA, United States). Next, the cleaned EEG data was divided into epochs based on stimulus presentation (from 200 ms before to 800 ms after each stimulus) and averaged over all trials and all electrodes for each stimulus type in MATLAB to generate the average P300 (i.e., the greatest positive deflection post-stimulus) amplitude across electrode sites to target, non-target, and novel stimuli, respectively. P300 was defined as the largest positive-going wave in the range of 100–600 ms after the stimulus onset. A total of 166 children completed the ERP recording.

Other Covariates

In addition to mother-reported externalizing behavior at age 6, other covariates include child sex, socioeconomic status (SES), area of residence (i.e., urban, suburban and rural areas reported by mothers) at the time of cohort recruitment, and intellectual functioning (IQ) at age 12 because these variables were both associated with physical abuse and externalizing behaviors based on literature (Fergusson and Horwood, 2002; Liao et al., 2011; Cui and Liu, 2016) and data availability of the parent study. SES was calculated as the standardized z score of the sum of standardized z scores of mothers' and father's education years and monthly wage as described in Straus (2004). IQ was measured using the validated Chinese version of the Wechsler

intelligence scale for children-revised (WISC-R; Dan and Yu, 1990; Liu and Lynn, 2015).

Statistical Analysis

Complete data were obtained on key variables (physical abuse, P300, and externalizing behavior at age 12 years old) from 159 children. Four children were further excluded because one had an IQ lower than 70 and three had 0 correct responses to targets in the oddball task. Therefore, data from 155 children were used in further analysis.

Sample characteristics of the 155 children were compared with their counterparts who were not included. Bivariate analyses, including independent *t*-tests, Wilcoxon sum rank test, *Pearson* correlation were used to examine the bivariate association among physical abuse, externalizing behavior, behavioral performances on the oddball task, and target P300 (P3b) and novelty P300 (P3a) amplitude. The P300 variables that showed bivariate relationships with physical abuse or externalizing behavior with *p*-values less than 0.25 were submitted to the path analysis as potential mediators (Bursac et al., 2008).

Path analysis using structural equation modeling (SEM) was implemented to analyze the mediating effect of P300 amplitude based on the model shown in **Figure 1**. Maternal and paternal physical abuse served as the initial exogenous variables with direct paths to externalizing behavior and indirect paths to externalizing behavior through the P300 variable(s) identified from the above process, controlling for the covariates. The full information maximum likelihood method was used to address missing data on mother-reported externalizing behavior at age 6. Because a mediation model is saturated, the commonly used goodness of fit indices, such as root square error of approximation (RMSEA), comparative fit index (CFI) and Tucker-Lewis Index (TFI) cannot be applied. Instead, as recommended by Kenny (2016), Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were used to evaluate the mediation model fit by comparing the model without the direct path, the model without the path from predictor to mediator, and the model without the path from mediator to the outcome, respectively. The model with the smallest AIC or BIC was selected. Bootstrapping with 500 replications was used to estimate the bias-corrected 95% confidence interval for the indirect, direct and total effects. Significance level was set at $\alpha = 0.05$. Analyses were performed using STATA 13.0 for Windows (College Station, TX, United States).

RESULTS

Sample Characteristics

There were slightly more boys (86, 55.5%) than girls (69, 44.5%) among the included sample. The average age was 11.28 ± 0.57 years old. A total of 51 (32.9%) children reported maternal physical abuse, and 54 (37.8%) reported paternal physical abuse, out of whom 41 reported physical abuse by both mothers and fathers. See **Table 1**.

Bivariate Associations of Physical Abuse With Behavioral Performance on the Oddball Task, P300 and Externalizing Behavior

Children who experienced physical abuse by either mother or father displayed significantly more externalizing behavior at age 12 when compared with their non-abused counterparts (**Table 2**). Children with maternal physical abuse showed increased novelty P300 amplitude (11.40 ± 4.30 μV) compared with non-maternal-abused counterparts (9.63 ± 4.47 μV), but the associations of paternal physical abuse with P300 parameters did not yield any statistical significance. Neither maternal nor paternal physical abuse showed significant associations with the behavioral performances on the oddball task.

Relationship Between Externalizing Behavior at 12 and 6 Years old and P300

Externalizing behavior at 12 and 6 years old were positively correlated with a small correlation coefficient ($r = 0.204$, $p = 0.020$). More externalizing behavior at 12 years old was positively correlated with higher novelty P300 amplitude ($r = 0.255$, $p < 0.01$), but was not significantly correlated with target P300 amplitude ($r = 0.028$, $p = 0.728$). See **Table 3**. Therefore, novelty P300 amplitude was submitted to path analysis as a mediator and target P300 amplitude was not. Paternal physical abuse was dropped from the path model because it was significantly related to neither the mediator (i.e., novelty P300 amplitude) nor the externalizing behavior.

Path Analysis Results

The path coefficients of the final mediation model are displayed in **Figure 2**. The indirect, direct and total effects with bias-corrected 95% confidence interval using the bootstrapping method were 1.08 (0.26–2.58), 4.11 (0.17–10.08), and 5.19 (1.22–11.00), respectively. The AIC and BIC values were 5004.666 and 5169.011, respectively. Next, the final model was compared with itself without the direct path (AIC = 5007.294, BIC = 5169.595), as well as without the path from maternal abuse to novelty P300 amplitude (AIC = 5008.402, BIC = 5169.703), and without the path from novelty P300 amplitude to self-report externalizing behavior (AIC = 5011.274, BIC = 5172.576), respectively. The results showed that the final model itself has the smallest AIC and BIC. Taken together, novelty P300 amplitude partially mediated the relationship between maternal physical abuse and self-report externalizing behavior. The indirect effect accounts for 20.8% of the total effect between maternal physical abuse and self-report externalizing behavior.

DISCUSSION

This study tested the mediation hypothesis that the P300 ERP partly underlies the relationship between physical abuse and child externalizing behavior. Children who reported physical abuse by mothers also reported higher externalizing behavior problems and showed increased amplitude of the

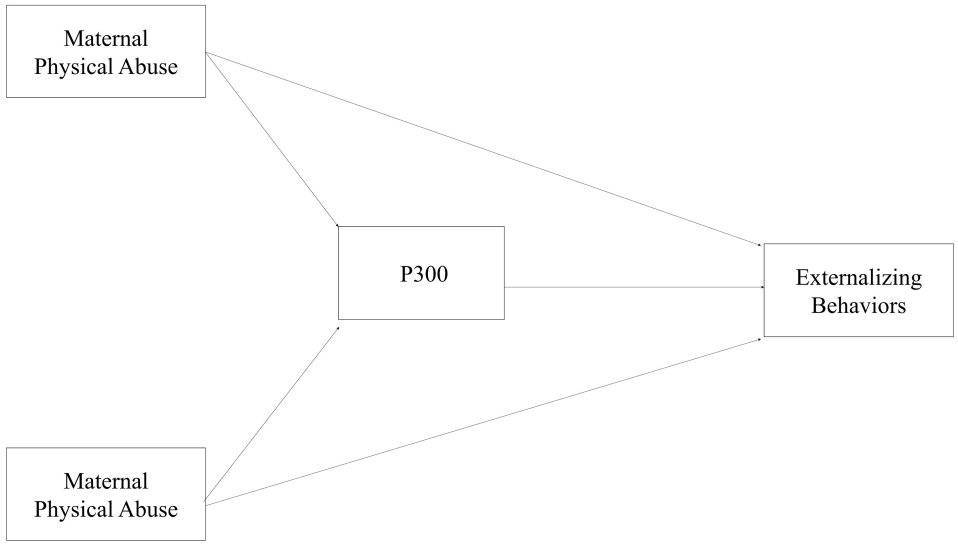

FIGURE 1 | The full mediation model. The model illustrates the relationship between maternal and paternal physical abuse and self-reported externalizing behaviors and the mediating role of P300. The variable P300 refers to any of the following variables: novelty P300 amplitude and target P300 amplitude. All the variables in the figure were measured at age 12. The model was adjusted child sex, socioeconomic status, area of residence, IQ at age 12, anxiety at age 12 and externalizing behaviors in preschool at age 6.

TABLE 2 | Comparisons of behavior problems, performance on oddball task and P300 between physically abused children and their non-abused counterparts.

	Maternal physical abuse				**Paternal physical abuse**			
	No M ± SD(Median)	**Yes M ± SD(Median)**	***t/z***	***p***	**No M ± SD(Median)**	**Yes M ± SD(Median)**	***t/z***	***p***
Externalizing behavior at age 12	50.60 ± 9.24	56.43 ± 14.24	3.07	<0.001	51.09 ± 11.85	55.18 ± 10.15	2.15	0.03
Externalizing behavior at age 6	12.84 ± 6.91	14.12 ± 6.34	1.02	0.31	12.68 ± 6.54	14.43 ± 7.08	1.40	0.17
Mean reaction time	504.07 ± 97.5	482.64 ± 78.09	1.36	0.18	501.05 ± 92.97	489.56 ± 90.25	0.73	0.46
Correct response to target	31.38 ± 4.22 (33)	30.58 ± 5.35 (32)	0.73^{w}	0.46	31.32 ± 4.1 (32)	30.74 ± 5.48 (33)	0.11^{w}	0.91
Errors to novels	5.63 ± 7.44 (3)	5.54 ± 6.95 (3)	0.21^{w}	0.83	6.16 ± 8.09 (3)	4.55 ± 5.25 (3)	0.23^{w}	0.82
Errors to non-targets	1.59 ± 2.05 (1)	1.94 ± 1.97 (1)	1.45^{w}	0.15	1.47 ± 1.81 (1)	2.15 ± 2.34 (1)	1.88^{w}	0.06
Novelty P300 amplitude (μV)	9.63 ± 4.47	11.40 ± 4.30	2.35	0.02	10.04 ± 4.66	10.54 ± 4.14	0.67	0.51
Target P300 amplitude (μV)	10.98 ± 7.13	11.08 ± 5.06	0.09	0.93	11.31 ± 7.15	10.46 ± 5.09	0.77	0.44

The parenthetical numbers in the 2nd, 3rd, 5th and 6th columns refer to the medians of the variables among corresponding subgroup of children. Superscript w, Wilcoxon rank-sum test.

novelty P300. Externalizing behavior was positively related to novelty P300 amplitude. Further path analysis revealed that enhanced P300 amplitude to novel stimuli partially mediated the relationship between maternal physical abuse and self-reported externalizing behavior after adjusting for child sex, socioeconomic status, area of residence, IQ, and earlier externalizing behavior. To our knowledge, findings appear to be the first to document the mediating role of P300 amplitudes on the abuse-externalizing relationship.

The Relationships Among Physical Abuse, Novelty P300 Amplitude, and Externalizing Behaviors

This study found increased novelty P300 amplitudes in a cognitive task using non-affective auditory stimuli among children who had experienced maternal physical abuse. This result is broadly consistent with prior findings showing that abused children are hypervigilant to negative visual and vocal stimuli (Pollak et al., 2001; Pollak and Tolley-schell, 2003; Shackman et al., 2007; McCrory et al., 2012; Gabriela et al., 2014; Shackman and Pollak, 2014; Okazaki et al., 2020). We extend prior literature by illustrating that physically abused children also showed hypervigilance to novel non-affective stimuli. Taken together, physically abused children may demonstrate generalized hypervigilance and tend to orient more attentional resources involuntarily toward distractors or negative emotional stimuli in the environment. This feature may reflect an adaptive mechanism for abused children to be more capable of detecting, and hence reacting more efficiently to potential social threats in the environment (Pollak, 2015).

Further, the enhanced novelty P300 amplitude partially mediated the relationship between maternal physical abuse

TABLE 3 | Pearson correlations between ERP and behavior problem.

	1	2	3	4
1. Externalizing behavior at age 12	1			
2. Externalizing behavior at age 6	0.204*	1		
3. Novelty P300 amplitude (μV)	0.255**	0.171	1	
4. Target P300 amplitude (μV)	0.028	0.135	0.250**	1

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

and externalizing behaviors, which is generally consistent with the prior findings that attention problems mediated the relationship between physical abuse and aggression in children and adolescents (Kenny, 2016), and that attention bias toward mothers' angry faces or voices indicated by enhanced P300 amplitude mediated the association of physical abuse and anxiety (Debener et al., 2002). These data are consistent with the view that physical abuse affects the attention bias to novel cues that likely place them at increased risk for the development and maintenance of externalizing behavior (Liao et al., 2011).

However, the finding that increased novelty P300 was associated with more externalizing behaviors is contradictory to the existing findings of reduced novelty P300 responses of studies among criminals, offenders, and university students (Stanford and Kockler, 2007; Brazil et al., 2012; Venables and Patrick, 2014; Bernat et al., 2020). Nonetheless, some other studies among psychopaths reported no associations (Munro et al., 2007; Gao et al., 2011) or enhanced P300 to non-affective auditory or digital stimuli (Raine, 1987; Raine and Venables, 1988; Roberti, 2004; Gao et al., 2018). Although differences in task modality (affective vs. non-affective) can be a possible reson for the mixed findings, it is also possible that different traits of psychopaths are related to different patterns of P300 change. This is supported by the notion proposed by Pasion et al. that P300 decrement may be a neurobiological marker of externalizing dispositions of many personality and mental disorders, whereas enhanced P300 amplitude during non-affective cognitive tasks is associated with interpersonal-affective psychopathic traits (Pasion et al., 2018). Hence, our finding of positive association of novelty P300 and externalizing behavior may suggest the interpersonal-affective impairment be the potential mechanism of the link between physical abuse and externalizing behavior. It may be also possible that this result was confounded by internalizing behaviors as externalizing and internalizing behaviors tend to be comorbid (Bernat et al., 2020).

It is worth noting that the participated children were generally healthy school children without obvious or diagnosed externalizing disorders, and, therefore, their neural activity may be different from those with diagnosed or severe antisocial behavior or psychopathy in the past studies. More longitudinal studies can be conducted to further investigate whether the neural activity toward novel stimuli changes from externalizing behavior to the course of externalizing disorders.

Target P300 and Externalizing Behaviors

Unlike the previous studies that reported reduced target P300 amplitude among individuals with generic antisocial behavior (Gao and Raine, 2009), substance abuse disorders (Iacono and Mcgue, 2002; Euser et al., 2012; Hamidovic and Wang, 2019), ADHD (Bitter, 2011), and conduct disorder (Iacono and Mcgue, 2002), we did not find a significant relationship between target P300 and externalizing behavior. It may be because the oddball task used in this study is not complex enough to reveal potential cognitive deficiency in such a sample of healthy children suggested by the finding that no significant difference in the behavioral responses in the oddball task was found between abused and non-abused children. Nonetheless, a recent meta-analysis did not find a significant mean effect of target-P300 (Go-P300) amplitude between individuals with and without ADHD (Kaiser et al., 2020). Bernat et al. (2020) found that lower novelty P300 amplitude elicited by a rotated-head visual oddball task was associated with more externalizing behavior, but target P300 amplitude was not among a sample of healthy university students. Therefore, the exact relationship between target P300 and child externalizing problems needs further investigation.

Maternal vs. Paternal Physical Abuse

The present study did not find a significant association of paternal physical abuse with P300 and externalizing behavior in the path analysis, which is consistent with the previous findings. For example, our study among Chinese children using the same data source showed that in comparison to paternal physical abuse, maternal physical abuse showed

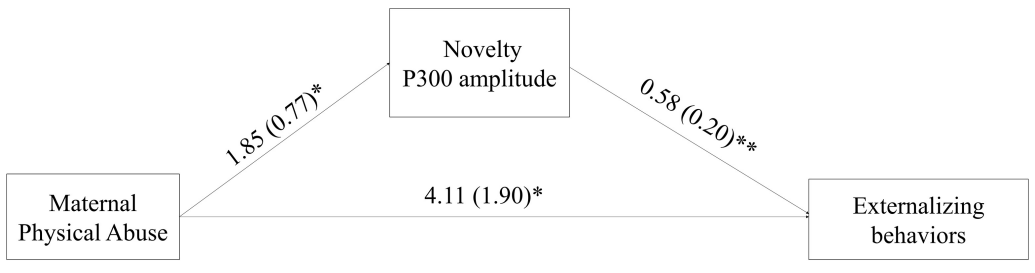

FIGURE 2 | The final mediation model with path coefficients. The model illustrates that novelty P300 amplitude mediated the relationship between maternal physical abuse and self-report externalizing behaviors. *, $p < 0.05$; ** $p < 0.01$.

a more salient relationship with child externalizing and internalizing behaviors (Cui et al., 2018). Gao et al. (2010) reported that paternal care was not significantly associated with psychopathy after controlling for maternal care. Likewise, a meta-analysis by Kawabata et al. (2011) conducted a review of 48 studies and found that maternal parenting stress was associated with child relational regression, whereas paternal parenting stress was not.

Previous research suggested paternal and maternal abuse may link to externalizing behavior through different neurocognitive pathways that may be not captured by the P300 in the study. For example, Xing et al. (2018) found that inhibitory control mediated the relationship between maternal corporal punishment (CP) and child externalizing behavior, and working memory mediated the relationship between paternal CP and child externalizing behavior. More studies are needed to clarify the different effects of maternal and paternal parenting behaviors on child neurophysiological and behavioral development.

Strengths and Limitations

The study's strength lies in testing the mediating role of P300 on the relationship between physical maltreatment and externalizing behavior adjusting for earlier measured externalizing behavior in a relatively large sample (N = 155). The sample size is 3–5 times larger than the two prior studies [N = 30 and 50 (Shackman et al., 2007; Shackman and Pollak, 2014)]. Nonetheless, causal inferences cannot be made as data was cross-sectional. Furthermore, a significant proportion of children of the original sub-cohort did not participate in the psychophysiological data collection. Although comparisons of the sociodemographic characteristics between the retained children and excluded children due to missing data or drop-out from the parent study did not yield significant differences, potential differences in unobserved characteristics cannot be ruled out. In addition, other forms of child maltreatment were not assessed, and, therefore, the effect of physical abuse on P300 and externalizing behavior may be contaminated, especially considering that multiple forms of child maltreatment tend to co-occur (Brown et al., 2019). Also, this study examined the between group (exposure or non-exposure of physical abuse) differences, but did not examine the possible within group differences (e.g., frequency, severity, and chronicity) among children exposed to physical abuse in the past year. The physical abuse and externalizing behavior information were self-reported, and may be subject to report bias and common method bias. Last but not least, although the novel auditory oddball task is widely used in the area of behavioral problems with externalizing traits, it was relatively rarely used among maltreated children. It has been suggested that P300 elicited by different cognitive modalities can be different and such differences can be informative for distinguishing cognitive patterns across different populations (Barry et al., 2009; Nan et al., 2018). Future studies can utilize the bimodal/inter-modal design of oddball task to further investigate the patterns of brain activity in the context of child maltreatment and externalizing behaviors.

CONCLUSION

In conclusion, physically abused children showed increased P300 amplitude to novel stimuli, and this enhancement partially mediated the relationship between physical abuse and externalizing behavior. The findings contribute to the very sparse literature on how psychophysiological pathways underpin the relationship between physical abuse and externalizing behavior. They further suggest that attention bias to novel/negative stimuli in the environment could be targeted to potentially treat childhood externalizing behavior associated with physical abuse. Such intervention studies could further test the casual nature of associations documented in this study. The findings also shed light on future research to investigate the mechanism using more rigorous methodology, such as measuring physical abuse and externalizing behaviors using objective or multiple-informant approach, taking other forms of child maltreatment into consideration, using other paradigms for ERP recording.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

NC: conceived of the presented idea, performed the analysis, and wrote the manuscript. JL: conceptualized the cohort study, collected the data, conceived of the presented idea, and revised the manuscript. AR, CC, TR, AH, and CM: intellectual contribution to theorizing and revising the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

This study was supported by the National Institute of Environmental Health Sciences (grants R01-ES018858, K01-ES015877, and K02-ES019878), the Research Award from Office of Nursing Research at the University of Pennsylvania School of Nursing, the National Social by the National Social Science Fund (18CSH061), the National Natural Science Fund (3210070458), and the Seed Fund for Candidates for "Qilu Outstanding Scholars" by Shandong University (2018WLJH46).

ACKNOWLEDGMENTS

We thank the child participants in the study.

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

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frontiers in Psychology

ORIGINAL RESEARCH
published: 03 November 2021
doi: 10.3389/fpsyg.2021.768315

Cumulative Childhood Adversity and Its Associations With Mental Health in Childhood, Adolescence, and Adulthood in Rural China

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Capitalizing on a 15-year longitudinal dataset of 9–12 years old children in rural China, this study adopts a life course perspective and analyzes cumulative childhood adversity and its associations with mental health problems from childhood to adulthood. Four domains of childhood life are selected to construct cumulative childhood adversity: socioeconomic hardship, family disruption, physical issue, and academic setback. Overall, cumulative childhood adversity significantly associates with children's internalizing and externalizing problems as well as adults' depression and self-esteem. However, cumulative childhood adversity has no significant relationship with internalizing and externalizing problems in adolescence. Furthermore, different domains of childhood adversity matter differently for mental health problems in different life stages. Physical issue and academic setback have the strongest association with internalizing and externalizing problems in childhood, while only socioeconomic hardship has a significant relationship with depression and self-esteem in adulthood. The relationship between cumulative childhood adversity and adult mental health problems is fully mediated by educational attainment. Finally, there is no gender difference in either the occurrence of cumulative childhood adversity or the association between cumulative childhood adversity and mental health problems.

Keywords: cumulative childhood adversity, internalizing problem, externalizing problem, depression, self-esteem

OPEN ACCESS

Edited by:
Cheryl Zlotnick,
University of Haifa, Israel

Reviewed by:
Jiajia Liu,
Peking University, China
Lei Chang,
University of Macau, China

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Specialty section:
This article was submitted to Developmental Psychology, a section of the journal Frontiers in Psychology

Received: *31 August 2021*
Accepted: *11 October 2021*
Published: *03 November 2021*

Citation:
Shen W (2021) Cumulative Childhood Adversity and Its Associations With Mental Health in Childhood, Adolescence, and Adulthood in Rural China. Front. Psychol. 12:768315. doi: 10.3389/fpsyg.2021.768315

INTRODUCTION

Childhood adversity is a common challenge faced by children worldwide (McLaughlin, 2016). The prevalence of exposure to childhood adversity has been found to be 38–39% across high-, middle, and low-income countries (Kessler et al., 2010). Much research also demonstrates that adversity in childhood could have lifelong costs that impair learning, behavior, and health (Green et al., 2010; Shonkoff et al., 2012; Appleton et al., 2017; Edalati et al., 2017; Jakubowski et al., 2018; You et al., 2019). Despite the extensive amount of evidence linking childhood adversity to negative health consequences, debates and inconsistencies still remain regarding the definitions, measurement, and time-varying consequences of childhood adversity (Oh et al., 2018a), particularly when the contexts in which childhood adversity is defined vary.

Most of the existing studies of childhood adversity focus on western countries (Björkenstam et al., 2019), perhaps because of the richness of data in these countries. However, the social contexts

of developing countries could be sharply different from those in western countries. Even within developing countries, there is a high degree of heterogeneity in social contexts. Therefore, whether the findings obtained from particular countries in the existing literature still hold in other countries remains unclear. This uncertainty calls for more empirical studies based on developing countries, particularly the longitudinal studies that reveal the complex relationships between cumulative childhood adversity and child development outcomes over a long time span.

In China, there have been some longitudinal studies about early exposure to adversity and subsequent developmental outcomes. For example, Chen et al. (2012) examine the reciprocal direct and indirect effects among aggression, peer relationships, and depression based on a sample of 1,162 children in Beijing from the third grade to the sixth grade (ages 9–12). They find that children's initial aggression and peer isolation positively contribute to later depression, which suggests that early adverse social-behavioral conditions exacerbate children's developmental problems. Similarly, relying on the life history framework, Lu and Chang (2019) analyze a longitudinal sample of 198 rural adolescents in China. They find that adverse environmental factors, such as parental separation, are positively associated with subsequent aggression and risk-taking behaviors.

Based on a 6-year longitudinal sample of 1,245 adolescents from 9 counties including China, Chang et al. (2019) investigate how environmental harshness and unpredictability (measured by unsafe neighborhood, negative life events, family chaos, and family income change) affects adolescents' developmental outcomes. Results show that environmental harshness and unpredictability longitudinally corresponds to more externalizing problems and lower academic performance, and such results are invariant to countries. In another study of 206 Chinese adolescents in rural areas, Chang and Lu (2018) examine the associations of family risk factors (such as stress, parental absence, and exposure to mortality and morbidity) and subsequent psychosocial outcomes after 18 months. Results demonstrate that family risk factors are significantly linked to more risky behaviors as well as academic underperformance.

In the Chinese context, while such studies provide valuable insights on the associations between early adversity and later developmental outcomes, due to data constraints, such longitudinal studies are mainly focused on childhood and adolescence. It remains unclear how the influences of early adversity will vary or persist over a long time span from childhood to adulthood. Thus, more research is needed to reveal the long-term associations between childhood adversity and developmental outcomes not only in childhood and adolescence but also in adulthood.

Drawing on a 15-year longitudinal dataset of children in rural China, this study tries to fill these gaps. I will examine the cumulative adversity, its different domains, and its associations with mental health problems in childhood, adolescence, and adulthood. The following sections will first lay the theoretical background for research questions, and then describe the data and methods. After presenting the empirical results, this paper concludes with a discussion.

THEORETICAL BACKGROUND

Definition and Measurement of (Cumulative) Childhood Adversity

Childhood adversity is often defined as the adverse childhood experiences or even trauma that could impair children's health and wellbeing over a long time period (e.g., Patterson et al., 2014; Reid et al., 2017; Racine et al., 2020). Since adversity might take place in different aspects of life, researchers have developed many comprehensive measures, such as Adverse Childhood Experiences (ACEs), to capture the complexity of childhood adversity. While some have used the weighting methods to differentiate the importance of various adverse events, "weighting of events, either through regression-based techniques or by independent judges, does not typically improve correlations with outcomes" (Turner and Butler, 2003, p. 95). Also, "previous findings have suggested that the number of adverse events within a specified time period is more important than the novelty or types of events, and that adolescents are at greatest risk when simultaneously experiencing multiple adaptive challenges" (Davidson and Adams, 2013, p. 534). Therefore, cumulative childhood adversity, which is a composite score of a series of adverse experiences, has been extensively used in the existing research (e.g., Clark et al., 2010; Ford et al., 2011; Tan et al., 2017; Danielson and Sanders, 2018).

Cumulative childhood adversity covers a wide range of childhood life, which should include at least four domains. First, cumulative childhood adversity is most frequently measured by family disruption or dysfunction such as parental separation, divorce, abuse, or neglect (Schilling et al., 2008; Clark et al., 2010; Danielson and Sanders, 2018; Edalati et al., 2020). Second, it is also often measured by household low socioeconomic status such as economic hardship (Surtees and Wainwright, 2007; Benjet et al., 2009; Tan et al., 2017) and parents' low levels of education and occupation (Wheaton et al., 1997; Yazgan et al., 2021). In addition to these two domains, another domain that could be integrated into cumulative childhood adversity is physical issue since physical health problems could cause huge or even lifelong stress on children. For example, in the existing literature, cumulative childhood adversity has incorporated such measures of children's physical conditions as hospitalization, chronic disease, or poor health (Turner and Lloyd, 1995; Wheaton et al., 1997; Surtees and Wainwright, 2007; Davidson and Adams, 2013; Shen et al., 2017). Finally, educational adversity also contributes to cumulative childhood adversity since schooling and education comprises a critical part of childhood life. Children "spend more time in school than any other setting except their bed" (Eccles and Roeser, 2011, p. 225). Also, poor academic performance could result in tremendous mental distress among students (Chen et al., 2000; Roeser and Eccles, 2000; Davidson and Adams, 2013; Huang, 2015). For instance, research has showed that children with poor academic performance feel more pressure from parents, receive more criticism from teachers, and get

less friendliness from peers (Shen, 2020). For these reasons, the domain of education deserves consideration when constructing cumulative childhood adversity.

While cumulative childhood adversity provides a convenient tool to investigate the consequences of overall adverse experiences in childhood, a single score might mask some critical, differential information between different types of adversity. Some research has shown that "categorization based on adversity type did appear to result in varying strength of association between each index and mental health outcomes" (Schilling et al., 2008, p. 1141). Therefore, in addition to cumulative childhood adversity, its different domains also need to be examined, which will reveal whether these different domains have equal or differential influences on child development.

Health Consequences of Cumulative Childhood Adversity

Research to date has demonstrated a series of health and developmental problems associated with cumulative childhood adversity. For example, a meta-analysis of 35 studies shows that cumulative childhood adversity corresponds to delays in cognitive development, infection, and sleep disruption at age 20 (Oh et al., 2018b). Cumulative childhood adversity is also linked to mental health problems in later life periods. Such mental health problems might include anxiety, depression, eating disorders, self-harm behaviors, internalizing problems, externalizing problems, antisocial behavior, and personality disorder, among others (Turner and Butler, 2003; Schilling et al., 2008; Putnam et al., 2013; McLaughlin, 2016; Björkenstam et al., 2017, 2021; Steine et al., 2017; Hébert et al., 2018).

Undoubtedly, there has been an extensive amount of evidence showing the detrimental effects of cumulative childhood adversity on adolescents' and adults' mental health. In contrast, much less evidence is presented in the existing literature regarding whether such detrimental effects of childhood adversity change across different life stages and whether different domains of childhood adversity contribute equally to mental health in different life periods. More research is needed to address these issues.

The Mediating Role of Educational Attainment and Moderating Role of Gender

In addition to mental health problems, research to date has found that cumulative childhood adversity impairs academic functioning like doing homework, staying calm, and curiosity in learning (Tan et al., 2017). Childhood adversity might also lower status attainment such as educational attainment (Haas, 2006; Shen et al., 2017). Some research has pointed out that "childhood adversity is associated with worse outcomes through lower adult socioeconomic status "(Jakubowski et al., 2018, p. 702). Since educational attainment is a critical component of adult socioeconomic status (e.g., King and Bearman, 2011) and also closely related to mental health (e.g., Esch et al., 2014; Mojtabai et al., 2015), it is necessary to investigate whether educational attainment mediates the relationship between childhood adversity and mental health problems in adulthood.

Furthermore, due to historical and cultural reasons, girls are often a particularly vulnerable group compared with boys. For instance, girls are more likely than boys to have abuse experiences (Mathews et al., 2017) and suffer depression (Kessler, 2003). Research on childhood adversity also finds that girls are more likely than boys to experience childhood adversity (Baglivio et al., 2014). Despite such gender differences in childhood adversity and mental health, whether girls and boys have the same relationship between childhood adversity and mental health over life periods remain unclear.

RESEARCH QUESTIONS

As many previous studies (e.g., Schilling et al., 2008; Montez and Hayward, 2014), the present study adopts a life course perspective to investigate how childhood adversity relates to mental health over a long life course from childhood to adulthood. The theoretical framework is illustrated in **Figure 1**. Capitalizing on a 15-year longitudinal dataset that traced the development of children from childhood to early adulthood in rural China, I will investigate the following research questions:

1. What are the associations between cumulative childhood adversity and children's mental health over a long time span including childhood, adolescence, and adulthood?
2. Do different domains of childhood adversity have similar or differential weights (or effects) on children's short-term and long-term mental health?
3. Could educational attainment, as a critical marker of socioeconomic status, mediate the potential association between cumulative childhood adversity and mental health in adulthood?
4. Are there gender differences in the associations between cumulative childhood adversity and children's short-term and long-term mental health?

MATERIALS AND METHODS

Participants

The data came from the Gansu Survey of Children and Families (GSCF, 2000, 2004, 2015). GSCF is a longitudinal study of 2,000 children in 100 rural villages in Gansu. Gansu was a rural province in Northwest China where over 60% of the population resided in rural areas in 2010 (Shen et al., 2021). The percentage of rural population was even higher when the data was first collected in the year 2000. Thus, although the sample was not a representative sample of all children in China, they came from a less developed and more impoverished area and were more likely to experience adversity than the average Chinese children. Moreover, to my knowledge, this is the only available longitudinal data in China that has focused on child development an education and traced their life trajectories from childhood

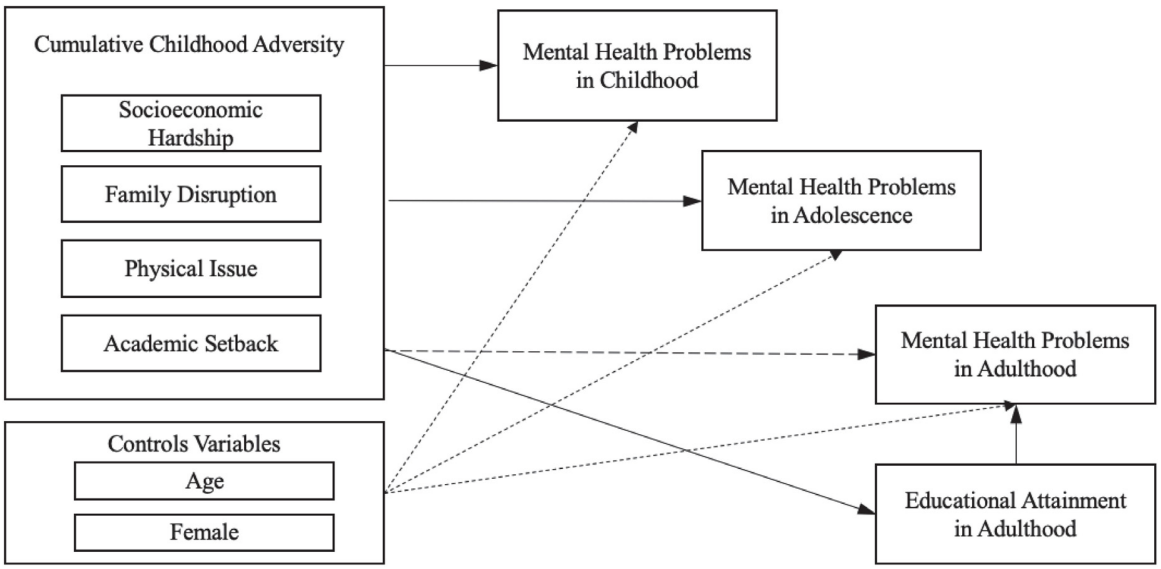

FIGURE 1 | Illustration of the life-course theoretical framework.

to adulthood in 15 years. For this reason, the data was suitable for this study.

The sampled children were first interviewed between ages 9 and 12 in the year 2000, and last interviewed in early adulthood in the year 2015. In the 2000 and 2004 waves, questionnaires were administered at schools and in homes to children, teachers, school principals, mothers, and household heads. In 2015, to reduce non-response and attrition due to out-migration, interviews were conducted in family homes during Chinese New Year, when out-migrants were likely to return home for family reunions during the festival. For respondents who did not return home during the festival, basic demographic and education information from the household head and self-reported information through phone interviews were collected. This resulted in 1,613 out of the initial 2,000 respondents successfully followed in 2015. In the 2000 and 2004 waves, both children's internalizing and externalizing problems were measured, while in 2015, the now-adults' depression and self-esteem were measured as the indicators of their mental health.

Measures

In the present study, childhood adversity consisted of four domains that covered a wide range of childhood life experience: socioeconomic hardship, family disruption, physical issue, and academic setback. Each domain included three binary indicators with 1 denoting a particular adversity and 0 denoting the lack of that particular adversity. All adversity indicators were measured in the year 2000.

Socioeconomic hardship measured the socioeconomic status of a household. In extensive research, socioeconomic status comprises three indicators—education, income, and occupation (e.g., Kessler, 1982; Duncan et al., 2002; Baker, 2014; Ayoub et al., 2018). As the sample were drawn from rural areas where all children's parents were farmers, their occupation had no variation and thus only education and income were utilized for socioeconomic hardship. Specifically, socioeconomic hardship was measured by maternal education, paternal education, and income insufficiency. Back to 2000 in the study site, the educational levels of most parents were really low. For instance, in the sample, 51% of mothers and 24% of fathers received no education at all. Thus, no education instead of a low level of education (such as primary education) was selected as the indicator of adversity. A parent who received no education was coded as 1 which indicated adversity for children. Back to the year 2000 in rural Gansu, many households still suffered from poverty and some even relied on borrowing money to afford children's education (Shen and Hannum, 2020). Therefore, income insufficiency was another measure of socioeconomic hardship. It was obtained from the question "whether your household income in the past year was sufficient" in mother's questionnaire. An answer of "no" was coded as 1 for income insufficiency.

Family disruption has been found to have long-term negative influences on children's status attainment and mental health (e.g., Biblarz and Raftery, 1993; Gilman et al., 2003; Steele et al., 2009). In the existing research, family disruption is defined as the "discontinuation of cohabitation between the child's biological parents" (Eriksen et al., 2017, p. 1080). It often includes the separation and divorce of parents (e.g., Somers et al., 2011). In GSCF, family disruption measured both the formal and informal separations of parents. Formal separation denoted the dissolution of marriage such as divorce, while informal separation denoted the separation due to migration. Therefore, family disruption included three indicators: maternal migration, paternal migration, and parental divorce. A parent was defined as being in migration if he or she was absent from home for at least 6 months in the past year (Graham and Jordan, 2011; Sun and Wang, 2016; Viet Nguyen, 2016).

Physical issue denoted the physiological problems that may directly or potentially harm children's physical, emotional, and academic functioning. In GSCF, physical issue was measured by whether children had any chronic disease, insufficient breakfast, or myopia. Children who cannot have enough breakfast, either because of poverty or because of eating habit, tend to have low protein intake (Chitra and Reddy, 2007). "Protein malnutrition is prevalent in the developing parts of the world and children are the most affected" (Navam et al., 2014, p. 1). In China, research has shown that children who had no or little breakfast would have higher risks for malnutrition (Li et al., 2018). In GSCF, 15% of sampled children reported that they could not have breakfast enough to feel full. In this context, insufficient breakfast was taken as a marker of adversity since it was strongly related to malnutrition of children. Myopia among children and youth has become a global problem (Leo, 2017). Yet it is rarely considered as adversity because glasses to correct myopia are often easily accessible and affordable, particularly in urban areas. However, in the context of impoverished rural areas in this study, people either lacked the awareness or had insufficient financial resources to correct for children's myopia. For instance, in this study, 20% of the sampled children reported that they had difficulties in reading blackboard or doing homework due to short-sightedness. For this reason, myopia was included as an indicator of adversity.

Academic setback denoted the problems and difficulties children encountered in their schooling and education, such as poor school performance (Davidson and Adams, 2013; Shen et al., 2017). This was measured by two questions in the data: whether children perceived their language (i.e., Chinese) performance was very poor and whether they perceived their math performance was very poor. An answer of "yes" was coded as 1 to denote a particular educational adversity. Furthermore, some children might experience grade retention. Grade retention, often due to falling behind peers, could result in a series of mental health problems such as low self-concept, misconduct in school, and depressive symptoms (Demanet and Van Houtte, 2013; Klapproth et al., 2016; Hu and Hannum, 2020). It was also adopted as an indicator of cumulative adversity in past research (e.g., Wheaton et al., 1997). Thus, grade retention was also included as a third marker of educational adversity.

These measures of (cumulative) childhood adversity, although together describing the total adverse events children encountered in particular domains of childhood life, were not necessarily correlated with each other. For instance, a child with poor math performance might not have any chronic disease, and poor math performance was also not indicative of whether parents were divorced. Therefore, Cronbach's reliability score was not calculated for adversity measures. This is consistent with the practice in many existing studies (e.g., Schilling et al., 2008; Montez and Hayward, 2014; Björkenstam et al., 2018). In fact, the reliability of adversity measures concerns more about whether the reported adversity was truly experienced by children. Many past studies adopted retrospective data on childhood adversity and showed a good reliability (Surtees and Wainwright, 2007). Childhood adversity in GSCF were all measured in the year 2000 when children were still in childhood and when such events just took place. Thus, those adversity measures should be more reliable than the retrospective recalls.

TABLE 1 | Descriptive statistics.

	Mean/Proportion	*SD*	Min	Max	N
Cumulative childhood adversity	2.022	1.439	0	7	1,933
Socioeconomic hardship	1.145	0.959	0	3	1,971
Family disruption	0.251	0.476	0	3	1,968
Physical issue	0.253	0.480	0	3	1,990
Academic setback	0.379	0.639	0	3	1,973
Internalizing problems 2000	39.975	8.140	18	72	1,970
Externalizing problems 2000	35.295	8.877	18	72	1,976
Internalizing problems 2004	37.094	6.560	18	65	1,868
Externalizing problems 2004	31.550	7.011	18	64	1,867
Depression 2015	17.642	4.279	10	40	1,019
Self-esteem 2015	27.577	3.053	14	38	1,059
Educational attainment	11.387	3.537	0	19	1,613
Age in 2000	11.089	1.146	9	13	1,994
Female (1 = Yes, 0 = No)	0.464		0	1	2,000

Due to age calculation formula (i.e., 2000—birth year), some children aged 12 (e.g., those born in November of 1987 and interviewed in July of 2000) could be rounded up to 13.

TABLE 2 | Maximum likelihood estimates of the associations between cumulative childhood adversity and mental health in childhood.

	Unstandardized coefficients	
	Internalizing problems in 2000	Externalizing problems in 2000
Model A		
Cumulative childhood adversity	0.892***	0.983***
	(0.123)	(0.138)
Age	−1.050***	−1.454***
	(0.153)	(0.164)
Female	−0.304	−0.745
	(0.358)	(0.386)
Model B		
Socioeconomic hardship	0.354	0.208
	(0.191)	(0.200)
Family disruption	0.211	0.559
	(0.407)	(0.444)
Physical issue	1.355***	1.701***
	(0.374)	(0.409)
Academic setback	2.122***	2.450***
	(0.266)	(0.298)
Age	−1.092***	−1.507***
	(0.152)	(0.162)
Female	−0.244	−0.643
	(0.357)	(0.385)

All independent variables were measured in 2000. Number of observations is 2,000. R-squared is 6.5% for Model A and 8.5% for Model B. Robust standard errors in parentheses.
** < 0.05, ** < 0.01, *** < 0.001.*

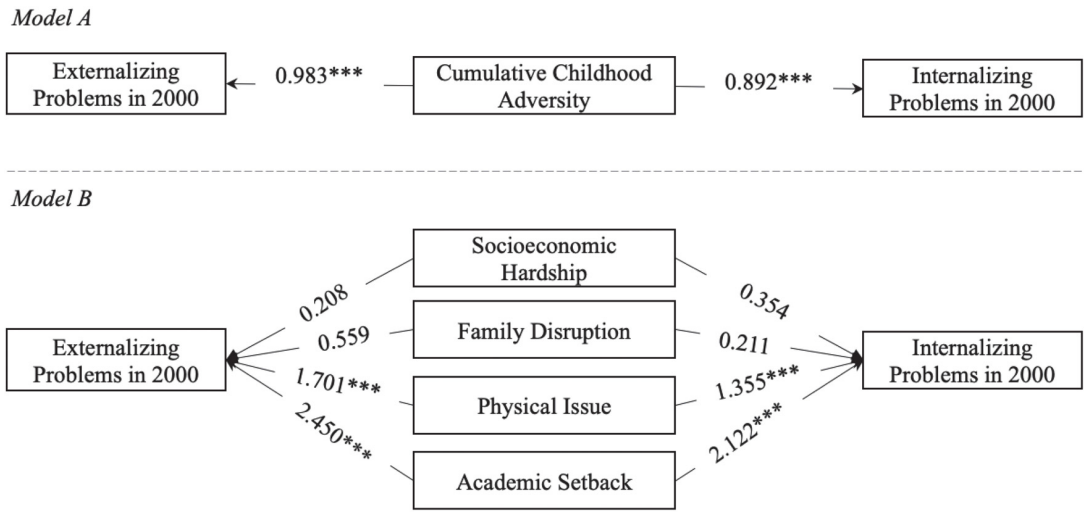

FIGURE 2 | Illustration of the associations between childhood adversity and childhood mental health in childhood. Age and gender are not shown in this figure for simplicity. Numbers on arrows are unstandardized regression coefficients. * < 0.05, ** < 0.01, *** < 0.001.

TABLE 3 | Maximum likelihood estimates of the associations between cumulative childhood adversity and mental health in adolescence.

	Unstandardized coefficients	
	Internalizing problems in 2004	**Externalizing problems in 2004**
Model A		
Cumulative childhood adversity	−0.003	0.033
	(0.108)	(0.114)
Age	0.664***	0.333*
	(0.136)	(0.141)
Female	−0.391	−1.721***
	(0.302)	(0.321)
Model B		
Socioeconomic hardship	−0.102	−0.172
	(0.165)	(0.175)
Family disruption	−0.294	−0.307
	(0.308)	(0.336)
Physical issue	0.401	0.527
	(0.309)	(0.329)
Academic setback	0.043	0.391
	(0.243)	(0.267)
Age	0.658***	0.319*
	(0.135)	(0.141)
Female	−0.384	−1.701***
	(0.305)	(0.322)

All independent variables were measured in 2000. Number of observations is 2,000. R-squared is 3.7% for Model A and 4.1% for Model B. Robust standard errors in parentheses.
** < 0.05, ** < 0.01, *** < 0.001.*

In 2000 and 2004, children's mental health was measured by their internalizing and externalizing behavioral problems. Internalizing and externalizing problems were measured by a set of questions adapted from the Youth-Self Report (Achenbach, 1991), edited through local piloting for cultural relevance (Liu, 2003). Each type of behavioral problems contained 18 questions, and each question was rated on a 4-point Likert scale (1–4: totally disagree, disagree somewhat, agree somewhat, and fully agree). A summative score was calculated for each type of behavioral problems, with a higher score implying more behavioral problems. For internalizing problems, the Cronbach's alpha scores in 2000 and 2004 were 0.834 and 0.802, respectively. For externalizing problems, the Cronbach's alpha scores in 2000 and 2004 were both 0.870. In 2000, the sampled children were in their late childhood. 4 years later in 2004, they entered their adolescence. Thus, the 2000 and 2004 measures of behavioral problems depicted their mental health from childhood to adolescence.

In 2015, the respondents' mental health was measured by their depression and self-esteem. Depression in 2015 was measured by a shortened (10-item) form of the CES-D scale, validated and used in many studies (Andresen et al., 1994; Baron et al., 2017; González et al., 2017). For each question, a Likert scale of 1–4 denoted never, occasionally, sometimes, and often for the frequency of each depressive symptom. Thus, higher values indicated a higher likelihood or level of depression. The Cronbach's reliability score was 0.737. Self-esteem in 2015 was measured by the widely used and validated 10-item Rosenberg Self-esteem Scale (e.g., Schmitt and Allik, 2005; Zhang and Kong, 2021). Each item was rated on a 4-point Likert scale denoting totally disagree, disagree somewhat, agree somewhat, and fully agree. A summative score was calculated and a higher score indicated a higher level of self-esteem. The Cronbach's reliability score was 0.722.

Educational attainment in 2015 was measured by the total years of education that children had attained, transformed from a categorical variable of children's highest level of education. According to children's age, all sampled children should have completed formal education by 2015. Thus, the 2015 measure represented their stable or fixed educational attainment. In

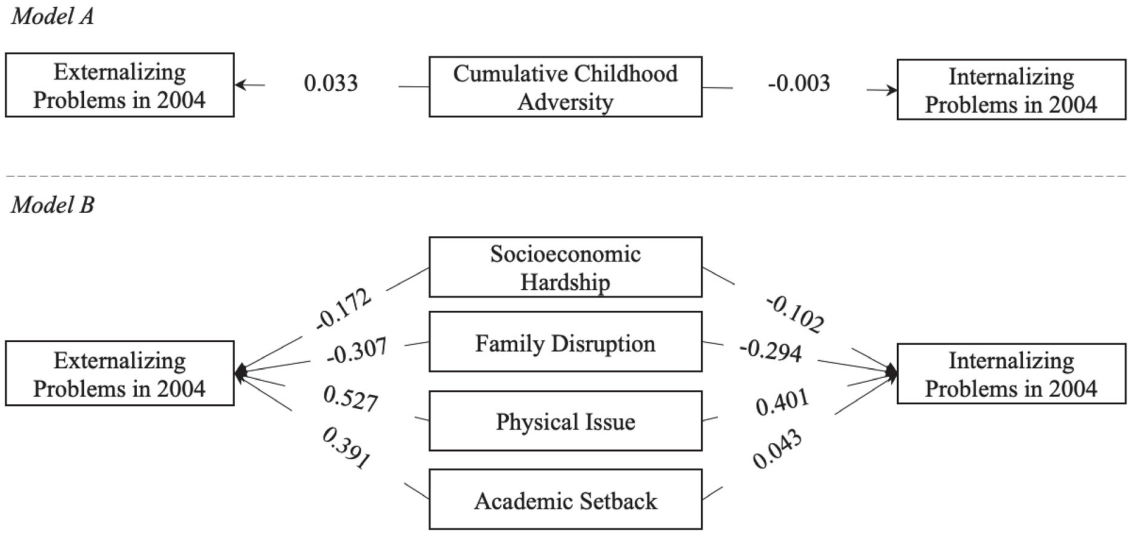

FIGURE 3 | Illustration of the associations between childhood adversity and childhood mental health in adolescence. Age and gender are not shown in this figure for simplicity. Numbers on arrows are unstandardized regression coefficients. * < 0.05, ** < 0.01, *** < 0.001.

addition, children's age in 2000 and gender (1 for female and 0 for male) were used as control variables. Children's age was calculated by taking the difference between the survey year 2000 and children's birth year reported in the household questionnaire.[1] The descriptive statistics for all variables are listed in **Table 1**.

Statistical Analysis

This study utilized structural equation models (SEM) for statistical analysis. SEM has the following advantages. First, it can estimate how childhood adversity corresponds to different mental health problems simultaneously. Second, it has a convenient and powerful technique of handling missing data, i.e., the full information maximum likelihood (FIML) method. Different from the conventional multiple imputation method, the results estimated by FIML are unaffected by the imputation model and also asymptotically efficient (Allison, 2015). Third, the multiple group analysis in SEM can estimate the same model for different subgroups simultaneously, which facilitates the comparison between girls and boys for the relationships between childhood adversity and mental health outcomes. Given these advantages, SEM is a preferred method for this study.

For each life stage (e.g., childhood, adolescence, and adulthood), a model with mental health problems as endogenous variables was estimated. In each model, the error terms of the two types of mental health problems in the same life stage were also correlated to indicate that they could be both affected by some unobserved factors. Age in 2000 and gender were included as control variables (except that gender was not included as a control

TABLE 4 | Maximum likelihood estimates of the associations between cumulative childhood adversity and mental health in adulthood.

	Unstandardized coefficients	
	Depression in 2015	**Self-esteem in 2015**
Model A		
Cumulative childhood	0.270**	−0.284***
	(0.092)	(0.064)
adversity		
Age	0.219	−0.095
	(0.120)	(0.086)
Female	−0.244	0.272
	(0.267)	(0.190)
Model B		
Socioeconomic hardship	0.610***	−0.373***
	(0.142)	(0.099)
Family disruption	0.135	−0.234
	(0.305)	(0.212)
physical issue	−0.333	0.142
	(0.263)	(0.186)
Academic setback	−0.076	−0.336*
	(0.202)	(0.139)
Age	0.244*	−0.099
	(0.120)	(0.085)
Female	−0.292	0.279
	(0.266)	(0.190)

All independent variables were measured in 2000. Number of observations is 1,613. R-squared is 2.4% for Model A and 3.8% for Model B. Robust standard errors in parentheses.
** < 0.05, ** < 0.01, *** < 0.001.*

[1]Due to this age calculation formula (i.e., 2000—birth year), some children aged 12 (e.g., those born in November of 1987 and interviewed in July of 2000) could be rounded up to 13. Also, due to some unknown errors in response (e.g., respondents might confuse the lunar year and solar year when reporting birth year) or data input, there were 6 observations whose calculated ages fell out of children's true age range. The ages of these 6 observations were treated as missing values in this study. I also excluded these 6 observations from the sample for a robustness check. Whether the ages of 6 observations were treated as missing values or excluded from analytical sample, results are always consistent without any substantial change.

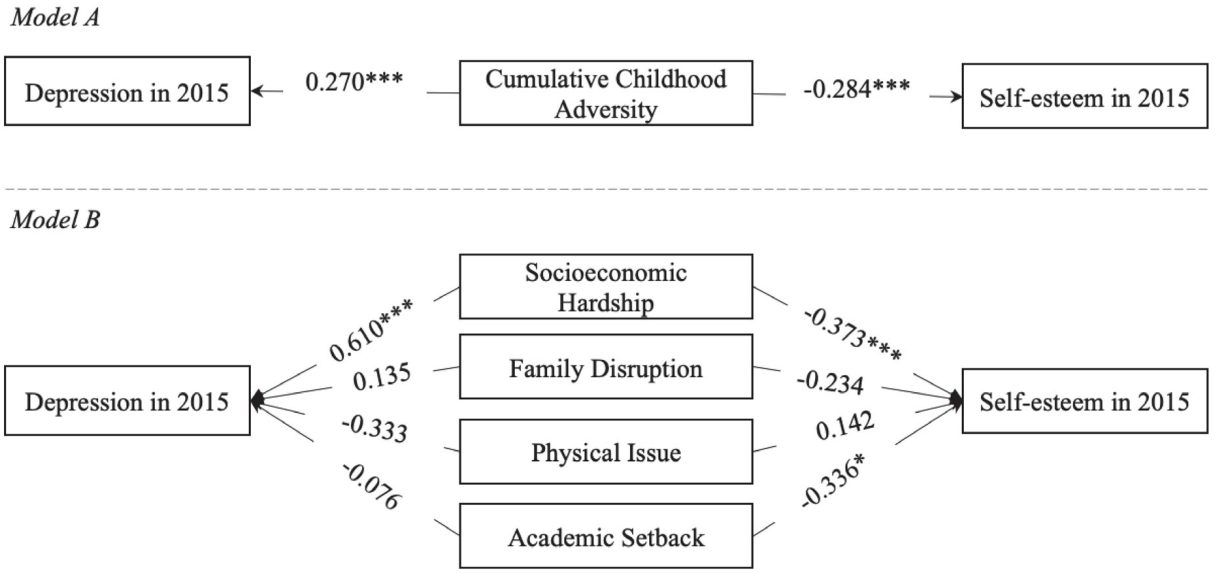

FIGURE 4 | Illustration of the associations between childhood adversity and childhood mental health in adulthood. Age and gender are not shown in this figure for simplicity. Numbers on arrows are unstandardized regression coefficients. * < 0.05, ** < 0.01, *** < 0.001.

variable for the gender difference model). For each life stage, another model that used the four domains of childhood adversity was also estimated in order to show the differential contributions of these four domains.

Next, educational attainment was added to the adulthood model to examine whether it mediates the relationship between childhood adversity and adults' mental health. As for gender differences, the same model was estimated for both girls and boys, and then their parameters were compared. The childhood and adolescence models used all the 2,000 observations. In 2015, only 1,613 respondents were followed, and thus the adulthood model only analyzed these 1,613 observations. FIML was used for parameter estimation and the handling of missing data. All models were saturated models and thus no goodness-of-fit test statistics were reported. To adjust for non-normality in dependent variables, robust standard errors were calculated for all models (Chou et al., 1991; Hu et al., 1992). All the SEM models were estimated by STATA 17.

RESULTS

Table 1 depicts the descriptive statistics. The average of cumulative childhood is 2.022, which indicates that the overall frequency of childhood adversity is not high. The most common childhood adversity is socioeconomic hardship. This is not surprising given that the sample was collected in rural areas. Academic setback is the second most frequent childhood adversity. This result illustrates the importance of incorporating educational adversity into the construct of childhood adversity when children spend so much time in school.

Table 2 and **Figure 2** show that after adjusting for children's age and gender, cumulative childhood adversity is significantly associated with both internalizing and externalizing problems in childhood. However, when childhood adversity is decomposed to four domains, not all domains matter for children's behavioral problems. Academic setback has the strongest association with children's behavioral problems. The second strongest association exists between physical issue and children's behavioral problems. In contrast, socioeconomic hardship and family disruption have no significant relationship with children's behavioral problems in childhood.

When children become adolescents, the results are listed in **Table 3** and **Figure 3**. Surprisingly, neither cumulative childhood adversity nor any of its four domains measured in childhood has a significant relationship with behavioral problems in adolescence. One particular reason might be that when children enter adolescence and middle school, their living environments change dramatically and thus their behavioral problems also change. Such sharp changes render the previous significant relationship between childhood adversity and behavioral problems no longer significant.

Table 4 and **Figure 4** show that more cumulative childhood adversity is significantly associated with higher depression and lower self-esteem in adulthood. Yet, this significant association mainly results from socioeconomic hardship in childhood. Moreover, more academic setback in childhood significantly reduces adult self-esteem but not adult depression.

The significant association between cumulative childhood adversity and adult mental health problems in **Table 4** seems to contradict the results in **Table 3**. If the effect of childhood adversity on mental health has diminished in adolescence, how could the effect become significant in adulthood? Of course, one reason could be that the measures of mental health problems in adolescence and adulthood used in this study are not exactly

the same. But another reason could be the mediating role of educational attainment.

As shown in **Table 5** and **Figure 5**, after educational attainment is included in the model, cumulative childhood adversity no longer has a direct, significant relationship with either depression or self-esteem in adulthood. Rather, cumulative childhood adversity has significant, indirect effects on adult depression and self-esteem via educational attainment. Such indirect effect sizes are comparable to the effect sizes identified in **Table 4** (i.e., the adulthood model without educational attainment).

Finally, **Table 6** describes the gender differences in the relationships between cumulative childhood adversity and mental health problems across different life stages. Consistent with previous models in each life stage, for both girls and boys, cumulative childhood adversity is significantly linked to more behavioral problems in childhood, as well as high depression and low self-esteem in adulthood, but is not significantly related to behavioral problems in adolescence. More importantly, there are no significant gender differences in the relationships between cumulative childhood adversity and mental health problems across different life stages. (The significant gender difference in the association between cumulative childhood adversity and externalizing problems in 2004 is more like a statistical artifact since the coefficients for both girls and boys are non-significant.) A further analysis shows that there is no gender difference in the occurrence of cumulative childhood adversity either (t-test p-value = 0.157).

TABLE 5 | Educational attainment as a mediator of cumulative childhood adversity and mental health in adulthood.

Parameter	Unstandardized coefficient
Depression in 2015	
← Cumulative childhood adversity	0.068 (0.094)
← Educational attainment	−0.223*** (0.041)
← Age	0.207 (0.118)
← Female	0.272 (0.264)
Self-esteem in 2015	
← Cumulative childhood adversity	−0.085 (0.067)
← Educational attainment	0.225*** (0.030)
← Age	−0.085 (0.067)
← Female	0.305 (0.184)
Educational attainment	
← Cumulative childhood adversity	−0.898*** (0.056)
← Age	−0.051 (0.074)
← Female	−0.376* (0.165)
Indirect effect	
Depression in 2015	0.201*** (0.038)
← Educational attainment	
← Cumulative childhood adversity	
Self-esteem in 2015	−0.202*** (0.029)
← Educational attainment	
← Cumulative childhood adversity	

*All independent variables were measured in 2000. Number of observations is 1,613. R-squared for the model is 14.3%. Robust standard errors in parentheses. * < 0.05, ** < 0.01, *** < 0.001.*

DISCUSSION

This study focuses on cumulative childhood adversity and examines its associations with mental health problems in childhood, adolescence, and adulthood, capitalizing on a unique, 15-year longitudinal dataset in rural China. Consistent with previous literature (e.g., Turner and Butler, 2003; McLaughlin, 2016; Steine et al., 2017), cumulative childhood adversity is associated with various mental health problems in both short and long terms. However, such associations vary across different life stages and different domains of childhood adversity.

Different from a 45-year study of birth cohorts in Britain that finds unattenuated effects of childhood adversity on psychological problems over time (Clark et al., 2010), this study in China shows that cumulative childhood adversity has no significant relationship with behavioral problems in adolescence, although that relationship is significant at first in childhood. Indeed, the samples of these two studies are not comparable. But the different results regarding the time-varying effects of childhood adversity again reminded us of the importance of social contexts in which childhood adversity is studied.

Furthermore, this study shows the different values of childhood adversity as a summative score and as separate domains. As a cumulative score, it facilitates the discovery of the overall effect of childhood adversity. As separate domains, childhood adversity could reveal the unequal effects of different types of childhood adversity at different times. For example, this study finds that in childhood, physical issue and academic setback have the strongest associations with behavioral problems while in adulthood only socioeconomic hardship matters. Similarly, another study finds that family dysfunction and maltreat have different effects, with the former being more significant in early childhood and the latter being more significant in adolescence (Oh et al., 2018b). These pieces of evidence demonstrate that we cannot simply understand childhood adversity as a homogenous set of adverse experiences even if we continuously use cumulative childhood adversity.

This study also demonstrates that the effects of childhood adversity might be complex and implicit. In the long term,

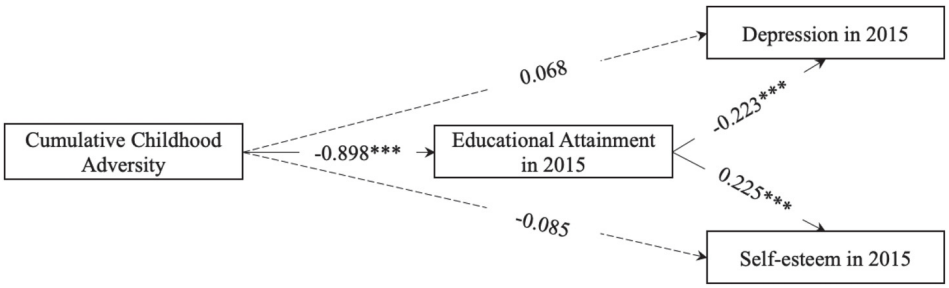

FIGURE 5 | Illustration of educational attainment as a mediator of cumulative childhood adversity and mental health in adulthood. Age and gender are not shown in this figure for simplicity. Numbers on arrows are unstandardized regression coefficients. * < 0.05, ** < 0.01, *** < 0.001.

TABLE 6 | Gender differences in the associations between cumulative childhood adversity and mental health.

Parameter	Unstandardized coefficient		
	Female	Male	Female—Male
Internalizing problems in 2000	0.916***	0.866***	0.050
← Cumulative childhood adversity	(0.167)	(0.178)	(0.244)
Externalizing problems in 2000	1.015***	0.950***	0.065
← Cumulative childhood adversity	(0.189)	(0.198)	(0.273)
Internalizing problems in 2004	(0.162)	−0.156	0.325
←Cumulative childhood adversity	0.168	(0.146)	(0.218)
Externalizing problems in 2004	0.272	−0.183	0.455*
← Cumulative childhood adversity	(0.167)	(0.157)	(0.229)
Depression in 2015	0.296*	0.257*	0.038
← Cumulative childhood adversity	(0.137)	(0.124)	(0.185)
Self-esteem in 2015	−0.282**	−0.284***	0.002
← Cumulative childhood adversity	(0.101)	(0.083)	(0.131)

All independent variables were measured in 2000. Robust standard errors in parentheses.
** < 0.05, ** < 0.01, *** < 0.001.*

even if childhood adversity has no direct effect on adult mental health, it could indirectly affect adult mental health through educational attainment. This result also illuminates the importance of including education in the examination of childhood adversity. Previous research has found that among different types of childhood adversity, dropping out or failing out of school has one of the strongest effect on adult's health (Kuhlman et al., 2018) and low school grades further heighten the risk for mental disorders among those who have experienced childhood adversity (Björkenstam et al., 2017). Similar findings are also observed in this present study. For example, academic setback has a strong association with not only children's behavioral problems but also adults' self-esteem 15 years later. Therefore, education—whether taken as a component of childhood adversity or a mediating or moderating role of childhood adversity's effect—needs to be considered for the study of childhood adversity.

Some previous studies have found gender differences in childhood adversity experiences and mental health problems (e.g., Kessler, 2003; Mathews et al., 2017). However, this is not the case in the present study. In the present study, no gender difference is found in either the occurrence of childhood adversity or the association between childhood adversity and mental health problems. This further illustrates the complex relations between childhood adversity and mental health in varying contexts, and calls for more studies on the gender differences regarding both childhood adversity and its health consequences.

Of course, the differences between findings in the present study and those in other research might result from different samples. Admittedly, the sample analyzed in this study was drawn from rural China and might not be representative of the Chinese children. Thus, the results in the present study cannot be simply generalized to a different social setting. As pointed out in the introduction, more studies based on empirical evidence from developing countries are needed in order to better reveal the influences of childhood adversity in different contexts.

Another limitation in this study is that it has identified the associations between childhood adversity and mental health problems in different life stages, yet such associations are not causations. Thus, whether childhood adversity causes such mental health problems or their associations are just a result of some unobserved confounders remains unclear. Future research could develop better research design to identify more causal

interpretations of the complex relationships between childhood adversity and mental health problems.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

WS contributes to data analysis and manuscript writing.

FUNDING

The Gansu Survey of Children and Families (GSCF) was supported by the Hong Kong Research Grants Council (HSSPFS 36600014). Earlier waves of data were supported by the United Kingdom Economic and Social Research Council and Department for International Development (ESRC RES-167-25-0250), the Spencer Foundation Small and Major Grants Programs, the World Bank, and NIH Grants 1R01TW005930-01 and 5R01TW005930-02. The writing and submission of the manuscript was supported by the Improvement on Competitiveness in Hiring New Faculties Funding Scheme of the Chinese University of Hong Kong.

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Conflict of Interest: The author declares 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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BRIEF RESEARCH REPORT
published: 19 November 2021
doi: 10.3389/fpsyg.2021.753008

The Independent and Joint Effects of Different Childhood Abuse Types on Subjective Prospective and Retrospective Memory Impairment During Pregnancy

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OPEN ACCESS

Edited by:
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Reviewed by:
Nadeeka Chandraratne, University of Colombo, Sri Lanka
Kristine Marie Jacquin, Fielding Graduate University, United States

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Specialty section:
This article was submitted to Health Psychology, a section of the journal Frontiers in Psychology

Received: *04 August 2021*
Accepted: *15 October 2021*
Published: *19 November 2021*

Citation:
Zhang X, Wu L, Wang J, Mao F, Sun J, Cao D and Cao F (2021) The Independent and Joint Effects of Different Childhood Abuse Types on Subjective Prospective and Retrospective Memory Impairment During Pregnancy. Front. Psychol. 12:753008. doi: 10.3389/fpsyg.2021.753008

Background and Objective: Childhood abuse is considered a risk factor in various health outcomes during pregnancy. However, no study has explored the relationship between childhood abuse and memory impairment during pregnancy. This study is the first to explore the relationship between childhood abuse and subjective memory impairment.

Participants, Setting, and Methods: A total of 1,825 pregnant women were recruited from a comprehensive hospital in Shandong province, China, and completed a questionnaire survey. Multivariable linear regression analysis was used to explore the relationship between childhood abuse and subjective prospective and retrospective memory.

Results: Pregnant women with high total childhood abuse scores had high prospective and retrospective memory impairment. Among pregnant women reporting only emotional abuse, only physical abuse, or only sexual abuse, women reporting only emotional abuse were found to have high prospective and retrospective memory impairment. Women with all three childhood abuse types also had high prospective and retrospective memory impairment.

Conclusion: Women who experienced childhood abuse, especially childhood emotional abuse, had high subjective memory impairment during pregnancy. It is important to ask pregnant women about their experiences of childhood abuse, especially emotional abuse, during early prenatal care, as such abuse is likely to have negative effects on memory during pregnancy.

Keywords: childhood abuse, pregnancy, memory impairment, emotional abuse, physical abuse, sexual abuse

INTRODUCTION

Childhood abuse, including physical abuse (PA), emotional abuse (EA), and sexual abuse (SA), has become a public concern in China. It has been estimated that 26.6% of children suffer from PA, 19.6% suffer from EA, and 8.7% suffer from SA in China (Fang et al., 2015). CA is one of the strong social and environmental predictors for many of the leading causes of death, disease, and disability during all stages of life (Viola et al., 2016). Among these, pregnancy is a vulnerable stage, during which CA might play an important role. CA has been considered as a risk factor in various health outcomes during pregnancy, such as depression and suicide ideation (Wosu et al., 2015; Zhong et al., 2016; Zhang et al., 2020).

However, the relationship between CA and subjective cognitive impairment during pregnancy has received limited attention compared to that given to depression and suicidal ideation. Subjective decline in cognition is a common problem during pregnancy. The phenomenon has been described as "baby brain" (Davies et al., 2018) or "pregnancy brain" (Brown and Schaffir, 2019). Of the cognitive impairments that follow pregnancy, subjective memory impairment is the most frequently cited change (Henry and Rendell, 2007). In one study, over 80% of women complained of forgetfulness during pregnancy, and 38% of women reported that forgetfulness was the only physical or neuropsychological disorder occurring during their pregnancy (Poser et al., 1986). Pregnant women with memory impairment may have problems with skills, tasks, and activities related to planning, thereby affecting their quality of life (Davies et al., 2018). Thus, it is important to explore the relationship between CA and memory impairment in order to help clinicians identify memory impairment in high-risk groups and conduct targeted interventions.

Prior studies explored the relationship between CA and memory impairment in the general population (Goodman et al., 2010). A review showed an association between CA and volume reduction in the prefrontal cortex (PFC) (Hart and Rubia, 2012). The PFC has been found to be related to working memory (Miller and Cohen, 2001). Thus, PFC abnormalities following CA may lead to memory impairment. In addition, CA has been found to be related to subjective memory in adolescents *via* neuroticism (Lin et al., 2017). However, no study has explored the association between CA and memory impairment during pregnancy. During pregnancy, early adverse experiences may reappear during this transition to motherhood, activating the cognitive and emotional responses associated with those childhood experiences (Stockl and Gardner, 2013). These responses may exacerbate memory decline.

Thus, the first aim of this study was to explore the relationship between CA and subjective memory impairment during pregnancy. We focused on subjective prospective memory and retrospective memory based on the following considerations. In case study interviews (Brett and Baxendale, 2001), women complained that they required greater reliance on note taking for organizing work and that they frequently forgot appointments. These are examples of prospective impairments that affect memory for events in the future and retrospective impairment that affects memory of past events. The second aim of this study was to explore the independent and joint associations between different types of CA and subjective memory impairment. Because of the high coincidence among different types of CA, the precise relationship with subjective memory impairment is likely not to be determined accurately if the independent effects of each type are not considered. Overall, this study is the first to explore the association of CA, including PA, EA, and SA, with subjective prospective and retrospective memory impairment during pregnancy. We predicted that there was a relationship between CA and subjective prospective and retrospective memory. We did not establish a prior hypothesis regarding the association of different CA types and subjective memory impairment, as no study has explored the roles of different CA types on memory impairment during pregnancy.

METHODS

This cross-sectional study was conducted at a comprehensive hospital in Shandong province, China, and in accordance with the Declaration of Helsinki. It was approved by the ethics committee of School of Nursing of Shandong University (No. 2017-R-103).

Participants

Pregnant women at 28 weeks or more of gestation were invited to participate in the study when undertaking a routine prenatal checkup. The inclusion criteria were: (1) age, 18 years or older, and (2) an ability to speak and understand Chinese well. Of the 2,000 eligible pregnant women, 1,825 were willing to participate and completed the questionnaire survey.

Measurements

Childhood Abuse

Childhood abuse, including PA, EA, and SA, was assessed using the Childhood Trauma Questionnaire-Short Form (CTQ-SF) (Bernstein et al., 2003). EA refers to a verbal attack on a sense of worth or well-being of a child, or any humiliating, demeaning, or threatening behavior, directed at the child by an older person (e.g., "The family said hurtful things"). PA refers to forms of physical attack by an older person on a child that are dangerous or lead to harm (e.g., "Hit hard enough to require seeing a doctor"). SA refers to sexual contact between a child and an older person, including explicit coercion (e.g., "Was touched sexually"). CA scored at or above the following threshold was considered as indicating the occurrence of that particular type of CA: PA = 8, EA = 10, and SA = 8. The Chinese version of the CTQ has demonstrated good validity and reliability (Fu et al., 2005). The Cronbach's α of the CA subscales of the CTQ-SF in this study was 0.811.

Subjective Memory Impairment

Subjective memory impairment was assessed using a prospective and retrospective memory questionnaire (PRMQ) (Crawford et al., 2003). This is a 16-item self-report scale with eight items, assessing PM and RM. High PRMQ scores represent

high subjective memory impairment. The Chinese version of the PRMQ has demonstrated good validity and reliability (Wu, 2013). The Cronbach's α of the PRMQ in this study was 0.934.

Covariates

According to previous studies, age, education, and parity are important factors in relation to memory impairment (Economou, 2009; Kvavilashvili et al., 2009; Glynn, 2012), and were considered as part of this study. Age (year), education (junior high school or less/high school or higher), and parity (nulliparity/multiparity) were self-reported by the participants.

Data Analysis

Pearson correlation analysis was conducted to explore the bivariate association between CA and subjective prospective and retrospective memory. Since there was no cut-off value in the PRMQ, the dependent variable was continuous, and the multivariable linear regression analysis was used to explore the relationship between CA and subjective prospective and retrospective memory after adjusting for covariates. We established five separate models in all: Model 1, CA total scores; Model 2, EA scores; Model 3, PA scores; Model 4, SA scores; Model 5, only EA/only PA/only SA/both PA and SA/both EA and SA/both EA and PA/all three. Model 5 was conducted to explore the independent effects of different types of CA on subjective prospective and retrospective memory. All models were adjusted for covariates, including age, education, and parity. An alpha level of $p < 0.05$, two-tailed, was used to establish statistical significance.

TABLE 1 | The Pearson correlation analysis of childhood abuse and prospective memory and retrospective memory.

Variables	EA	PA	SA	Prospective memory	Retrospective memory
EA	1				
PA	0.46***	1			
SA	0.47***	0.55***	1		
Prospective memory	0.17***	0.05*	0.08**	1	
Retrospective memory	0.18***	0.07**	0.10***	0.88***	1

*EA, emotional abuse; PA, physical abuse; SA, sexual abuse, ***p < 0.001, **p < 0.01, *p < 0.05.*

RESULTS

The average age of the 1,825 participants was 31.14 (standard deviation: 4.43) years. The average gestation period at the time of questionnaire administration was 38 weeks (standard deviation: 2.36). A total of 6.7% of the respondents had a junior high school level of education or lower. Nulliparity was observed in 46% of the participants. Pearson correlation analysis showed that all types of CA were positively related to prospective and retrospective memory impairment (all $p < 0.05$, see **Table 1**). After adjusting for covariates, Model 1 in **Tables 2**, **3** shows that pregnant women with higher CA total scores had a higher subjective prospective ($B = 0.22$, SE = 0.04, $\beta = 0.13$, $p < 0.001$) and retrospective memory impairment ($B = 0.22$, SE = 0.04, $\beta = 0.14$, $p < 0.001$).

We also explored the relationships between the different types of CA and subjective prospective and retrospective memory impairment after adjusting for covariates (see Models 2, 3, and 4 in **Tables 2**, **3**). EA, PA, or SA scores were associated with prospective memory impairment (EA: $B = 0.59$, SE = 0.08, $\beta = 0.17$, $p < 0.001$; PA: $B = 0.20$, SE = 0.10, $\beta = 0.05$, $P = 0.051$; SA: $B = 0.36$, SE = 0.12, $\beta = 0.07$, $p = 0.002$) and retrospective memory impairment (EA: $B = 0.56$, SE = 0.08, $\beta = 0.17$, $p < 0.001$; PA: $B = 0.23$, SE = 0.10, $b = 0.05$, $P = 0.022$; SA: $B = 0.39$, SE = 0.11, $b = 0.08$, $p < 0.001$).

Furthermore, we explored the independent and joint effects of CA on subjective prospective memory and retrospective memory impairment. Among pregnant women with only EA, only PA, or only SA, women with only EA were found to have high subjective prospective memory ($B = 2.53$, SE = 1.07, $\beta = 0.06$, $P = 0.019$) and subjective retrospective memory impairment ($B = 2.25$, SE = 1.05, $\beta = 0.05$, $P = 0.032$). Women with both EA and PA ($B = 4.42$, SE = 1.78, $\beta = 0.06$, $P = 0.013$) were found to have high-subjective prospective memory. Women with both EA and SA ($B = 5.85$, SE = 2.76, $\beta = 0.05$, $P = 0.034$) or both EA and PA ($B = 5.15$, SE = 1.74, $\beta = 0.07$, $P = 0.003$) were found to have high-subjective retrospective memory. Women with all three CA types had high-subjective prospective ($B = 3.23$, SE = 1.34, $\beta = 0.06$, $P = 0.016$) and retrospective impairment ($B = 2.59$, SE = 1.31, $\beta = 0.05$, $P = 0.049$).

DISCUSSION

To the best of our knowledge, this study is the first to explore the relationship between CA and subjective memory impairment during pregnancy. Women with high CA total scores had high subjective prospective and retrospective memory impairment. We also explored the independent and joint effects of different types of CA and subjective prospective and retrospective memory impairment during pregnancy. Among pregnant women with only EA, only PA, or only SA, women with only EA were found to have high-subjective prospective and retrospective memory impairment. Women with both EA and PA had high-subjective prospective memory. Women with both EA and SA and both EA and PA were found to have high-subjective retrospective memory. Women with all three CA types had high-subjective prospective and retrospective memory impairments.

Women who had experienced CA were found to have higher-subjective prospective and retrospective memory impairment, which is consistent with the findings of prior studies among other groups such as adolescents (Lin et al., 2017). Our study found that CA has a profound effect on memory function in certain key stages of life, such as pregnancy, which adds to the literature in this area. The following are possible mechanisms that may explain the relationship between CA and memory impairment in adulthood. First, CA can cause stress-induced

TABLE 2 | The association between childhood abuse and prospective memory.

Variable	*B*	*SE*	β	*P*
Model 1				
Age	−0.03	0.04	−0.02	0.393
Education	0.02	0.54	0.001	0.964
Parity	1.15	0.32	0.10	<0.001
Total childhood abuse scores	0.22	0.04	0.13	<0.001
$F = 11.32$, $df = 4$, adj.$R^2 = 0.02$				
Model 2				
Age	−0.03	0.04	−0.02	0.444
Education	0.01	0.53	0.001	0.978
Parity	1.19	0.31	0.11	<0.001
EA scores	0.59	0.08	0.17	<0.001
$F = 17.51$, $df = 4$, adj.$R^2 = 0.04$				
Model 3				
Age	−0.04	0.04	−0.03	0.317
Education	0.22	0.54	0.01	0.684
Parity	1.12	0.32	0.10	<0.001
PA scores	0.20	0.10	0.05	0.051
$F = 4.55$, $df = 4$, adj.$R^2 = 0.01$				
Model 4				
Age	−0.04	0.04	−0.03	0.300
Education	0.17	0.54	0.01	0.758
Parity	1.13	0.32	0.10	<0.001
SA scores	0.36	0.12	0.07	0.002
$F = 6.01$, $df = 4$, adj.$R^2 = 0.01$				
Model 5				
Age	−0.04	0.04	−0.03	0.248
Education	0.15	0.54	0.0	0.785
Parity	1.18	0.32	0.10	<0.001
Only EA	2.53	1.07	0.06	0.019
Only PA	0.30	0.83	0.01	0.718
Only SA	1.15	0.98	0.03	0.240
Both PA and SA	−1.20	1.99	−0.01	0.546
Both EA and SA	3.51	2.82	0.03	0.213
Both EA and PA	4.42	1.78	0.06	0.013
All three	3.23	1.34	0.06	0.016
$F = 3.64$, $df = 10$, adj.$R^2 = 0.01$				

EA, emotional abuse; PA, physical abuse; SA, sexual abuse.

TABLE 3 | The association between childhood abuse and retrospective memory.

Variable	*B*	*SE*	β	*P*
Model 1				
Age	−0.03	0.03	−0.02	0.423
Education	1.23	0.53	0.06	0.020
Parity	0.77	0.31	0.07	0.013
Total childhood abuse scores	0.22	0.04	0.14	<0.001
$F = 12.35$, $df = 4$, adj.$R^2 = 0.03$				
Model 2				
Age	−0.03	0.03	−0.02	0.468
Education	1.23	0.52	0.06	0.018
Parity	0.80	0.31	0.07	0.009
EA scores	0.56	0.08	0.17	<0.001
$F = 17.51$, $df = 4$, adj.$R^2 = 0.04$				
Model 3				
Age	−0.03	0.04	−0.03	0.345
Education	1.41	0.53	0.06	0.008
Parity	0.73	0.31	0.07	0.019
PA scores	0.23	0.10	0.05	0.022
$F = 5.33$, $df = 4$, adj.$R^2 = 0.01$				
Model 4				
Age	−0.03	0.04	−0.03	0.323
Education	1.36	0.53	0.06	0.010
Parity	0.75	0.31	0.07	0.016
SA scores	0.39	0.11	0.08	<0.001
$F = 7.07$, $df = 4$, adj.$R^2 = 0.02$				
Model 5				
Age	−0.04	0.04	−0.03	0.263
Education	1.37	0.53	0.06	0.010
Parity	0.79	0.31	0.07	0.011
Only EA	2.25	1.05	0.05	0.032
Only PA	0.94	0.81	0.03	0.247
Only SA	1.50	0.95	0.04	0.116
Both PA and SA	−0.88	1.95	−0.01	0.652
Both EA and SA	5.85	2.76	0.05	0.034
Both EA and PA	5.15	1.74	0.07	0.003
All three	2.59	1.31	0.05	0.049
$F = 4.08$, $df = 10$, adj.$R^2 = 0.02$				

EA, emotional abuse; PA, physical abuse; SA, sexual abuse.

dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis. For example, it has been shown that CA is associated with greater hair cortisol levels during pregnancy (Schreier et al., 2015). In turn, the HPA axis can influence memory in situations of acute and chronic stress (Wolf, 2003). Thus, CA may affect memory function *via* the HPA axis. Second, existing findings suggest that CA negatively affects the PFC, which plays an important role in cognitive function. It has been found that participants with a history of CA show significantly increased activation in the dorsolateral prefrontal cortex (dlPFC), insula, and precuneus, and significantly decreased activation in the ventromedial prefrontal cortex (vmPFC) during psychosocial stress tasks (Zhong et al., 2019). In addition, evidence from neuropsychological and cognitive neuroscience studies has shown frontal lobe activation during prospective task completion in healthy individuals, suggesting a central role of the PFC in

prospective memory (Hashimoto et al., 2011). Therefore, CA may cause prospective deterioration through its deleterious effect on the PFC. Third, emerging evidence has shown that childhood adversity is related to changes in gut microbiota composition during pregnancy (Hantsoo et al., 2019). Specifically, women reporting two or more childhood adverse events had greater differential abundance of Prevotella than the participants with few or no childhood adverse events. In turn, Prevotella abundance has been found to be associated with cognitive function (Panee et al., 2018). Future studies are needed to explore the possible biological mechanisms involved in relation to CA and memory impairment.

Importantly, CA has a major impact on various health outcomes during pregnancy. Because pregnancy involves confronting a role transformation, and abuse is often carried out by parents, early traumatic experiences may resurface, thereby activating cognitive and emotional responses related to childhood experiences (van der Kolk, 1994; Stockl and Gardner, 2013). Our study emphasizes that any adverse effects are also likely to involve memory impairment during pregnancy.

When we considered the independent effects of different types of CA among pregnant women with only EA, only PA, or only SA, only those women who had experienced only EA were found to have higher-subjective memory impairment. One study reported that childhood EA was associated with a significant reduction in predominantly left dorsal medial prefrontal cortex (mPFC) gray matter (GM) volume. This mPFC GM volume reduction was not due to concomitant childhood PA and/or SA, because the reductions were also found when childhood EA was experienced in the absence of concurrent childhood PA and/or SA (van Harmelen et al., 2010). The mPFC plays a role in both recent and remote memories (Hugues and Garcia, 2007). In addition, the findings showed the joint effects of EA and other CA types (PA and/or SA), which emphasize the important role of EA in subjective memory impairment during pregnancy. Significantly, given that variables in this study were measured using self-report questionnaires, the participants who had severe forms of abuse may have higher grade of amnesia (even in relation to their abusive experiences), and this could be the reason for not observing significant association with physical and sexual abuse.

This study has some limitations. First, CA was measured using self-report questionnaires, which could have caused recall bias. Second, we assessed only subjective prospective and retrospective memory impairment. Future studies are needed to assess more different aspects of memory loss, using subjective and objective measures, and explore the association between memory impairment and CA. However, data drawn from subjective memory are considered to have better ecological validity than neuropsychological testing (Bender et al., 2006).

CONCLUSION

Childhood abuse is an important public concern worldwide. Our study further expands on the literature in this area. We found a relationship between childhood abuse and subjective prospective and retrospective memory impairment among pregnant women, and that emotional abuse plays a crucial role in subjective prospective and retrospective memory impairment during pregnancy. The results of this study suggest that evaluation of maternal childhood abuse during prenatal care, with special focus on emotional abuse, and providing support if necessary may mitigate the adverse effects associated with childhood abuse.

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of School of Nursing of Shandong University. The patients/participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

AUTHOR CONTRIBUTIONS

XZ performed the manuscript preparation. LW, JW, and FM performed data analysis. JS and DC performed the data collection. FC contributed to the design of the study. All the authors have approved the final draft.

FUNDING

This study was funded by the Surface Project of National Natural Science Foundation of China (Grant Number: 32071084) and the National Social Science Fund of China (Grant Number: 17BSH054).

ACKNOWLEDGMENTS

The authors thank all the participants for their time and efforts.

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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.

frontiers in Psychology

ORIGINAL RESEARCH
published: 11 March 2022
doi: 10.3389/fpsyg.2022.816373

The Mediating Role of Forgiveness and Self-Efficacy in the Relationship Between Childhood Maltreatment and Treatment Motivation Among Malaysian Male Drug Addicts

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Edited by:
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Reviewed by:
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University of Extremadura, Spain

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Specialty section:
This article was submitted to Developmental Psychology, a section of the journal Frontiers in Psychology

Received: *16 November 2021*
Accepted: *14 February 2022*
Published: *11 March 2022*

Citation:
See Mey L, Khairudin R, Tengku Muda TEA, Abdullah @ Mohd Nor H and Kamaluddin MR (2022) The Mediating Role of Forgiveness and Self-Efficacy in the Relationship Between Childhood Maltreatment and Treatment Motivation Among Malaysian Male Drug Addicts. Front. Psychol. 13:816373. doi: 10.3389/fpsyg.2022.816373

Studies have reported high rates of childhood maltreatment among individuals with drug addiction problems; however, investigation about the potentially protective factors to mitigate the effects of maltreatment experiences on motivation to engage in addiction treatment has received less attention. This study aims at exploring the mediating effects of forgiveness and self-efficacy on the association between childhood maltreatment and treatment motivation among drug addicts. A total of 360 male drug addicts (mean age = 33.34, *SD* = 7.25) were recruited from three mandatory inpatient rehabilitation centers in Malaysia. Participants completed a package of self-report questionnaires including measures of childhood maltreatment experiences, forgiveness, self-efficacy, and motivation for treatment. The analysis conducted using the structural equation model (SEM) revealed that childhood maltreatment significantly predicted lower treatment motivation, while forgiveness and self-efficacy played a fully mediating role regarding the effect of childhood maltreatment on treatment motivation. In conclusion, these findings suggest that combining the element of forgiveness and self-efficacy in treatment programs appears to benefit the drug addicts with childhood maltreatment history.

Keywords: forgiveness, self-efficacy, childhood maltreatment, treatment motivation, drug addicts

INTRODUCTION

Exposure to maltreatment during childhood has long been associated with an increased risk of subsequent psychological and behavioral problems across the human lifespan including mood disorders (Norman et al., 2012; Lippard and Nemeroff, 2020), depression (Dhamayanti et al., 2020), post-traumatic stress disorder (McLaughlin et al., 2017; Schuck and Widom, 2019), borderline personality disorder (Mainali et al., 2020), adult criminality (Minh et al., 2013; Kim et al., 2016),

and drug and substance abuse (Elwyn and Smith, 2013; Mandavia et al., 2016). Studies have demonstrated that maltreatment histories are relatively common among individuals receiving treatment for substance and drug abuse (Funk et al., 2003; Banducci et al., 2014; Loy et al., 2020a). However, most studies on the effects of childhood maltreatment among drug addicts are often focused on behavioral consequences and psychological risk factors associated with maltreatment, yet less is known about how the experience of maltreatment in the early stage impacts the motivation among drug addicts entering substance abuse treatment, which can be considered as a significant factor to influence the treatment outcomes and service provision.

Furthermore, studies indicated that not all children with maltreatment experience grow up to abuse drugs or substances (Simpson and Miller, 2002). Therefore, the mechanism regarding the pathways between childhood maltreatment and subsequent addiction, which might influence the later treatment engagement to abstain from drug use, remains unclear. Moreover, in Malaysia, various efforts have been made by the government to combat illicit drugs over the past decades; however, the continued failure of the war on drugs with increasing number of drug addicts being reported each year and high relapse rate following treatment has aroused controversies surrounding the effectiveness of government agencies and local leaders in addressing the country's drug addiction problem. Therefore, examining the etiologies, such as early maltreatment history that might explain the onset of drug use, would be essential for refining the existing treatment program that lacks tackling the issue of adverse experience, particularly for drug addicts who have experienced adversity in early life. In short, interventions that can provide support to drug addicts' unresolved childhood issues might help to increase their motivation to remain in treatment and further reduce their risk of relapse and improve their adaptive functioning after discharge from the rehabilitation center.

Rehabilitation programs are essential for recovery among drug addicts. However, research indicated that a high number of drug addicts receiving treatment failed to stay throughout the rehabilitation programs or experienced relapse due to adverse effects such as anxiety, anger, shame, and guilt (McKay, 2011; McGaffin et al., 2013; Serafini et al., 2016). Moreover, several studies have pointed out the use of the drug as a coping mechanism to eliminate the overwhelming negative emotions in drug addicts (Baker et al., 2004; Webb et al., 2006; Blevins et al., 2014). In view of the association between drug abuse, negative emotions, and treatment failure; forgiveness, which was well supported by literature to demonstrate a significant relationship with mental wellbeing and positive emotional states (Ricciardi et al., 2013; Raj et al., 2016; Toussaint et al., 2016; Long et al., 2020), has been hypothesized and proven to play a role in addiction and recovery (Worthington et al., 2006; Scherer et al., 2011).

Although the definition of forgiveness varied by the scholars who defined it, however, most definitions agreed that forgiveness refers to a decrease in negative feelings, thoughts, and behaviors while being able to cultivate positive or neutral emotions toward the wrongdoer (Enright, 1996; Maynard et al., 2016; Worthington et al., 2016). In relation to the context of trauma, a higher level of childhood maltreatment was often associated with a lower level of forgiveness (Guloglu et al., 2016; Arslan, 2017). Moreover, studies indicated that individuals who have experienced negative life events at an early age are predisposed to develop more maladaptive thoughts and behavioral dysfunction, which might impede their coping skills and strategies later in life (Pears and Fisher, 2005; Kim and Cicchetti, 2010; Milojevich et al., 2018). Furthermore, it seems reasonable to expect that drug use would be the most convenient option for someone with poor coping skills to deal with negative emotions. Therefore, in view of the positive effects shown by forgiveness, this element can be considered as an effective coping strategy to buffer against the negative impacts of traumatic experience, to improve the mental wellbeing (e.g., anger, guilt, and depression), and, finally, to improve the drug treatment outcomes. In other words, forgiveness could be a positive coping mechanism in lieu of drugs.

The concept of self-efficacy, which originated from Bandura's Social Learning Theory, referred to a person's beliefs in their capacity to use resources and skills to accomplish certain tasks (Bandura, 1993). In the context of drug abuse, abstinence self-efficacy, which is considered as a specific form of self-efficacy to examine the ability among drug addicts to abstain from drug use, has been identified as a significant intrapersonal resource to predict substance use (McKay et al., 2004; Majer et al., 2016) and also as a crucial component to improve drug treatment outcomes (Litt et al., 2008; Kadden and Litt, 2011) and future abstinence (Chavarria et al., 2012). However, in drug treatment research, an area in which knowledge is currently lacking is the association between drug addicts' motivation when entering drug treatment in relation to their level of self-efficacy. Moreover, existing research in this area has tended to focus on abstinence self-efficacy (Kelly and Greene, 2014; Majer et al., 2015) rather than to explore the role of general self-efficacy which covers the overall beliefs in drug addict's ability to succeed in treatment.

Studies have indicated that self-efficacy played a role as an effective predictor of children's subsequent development (Bandura, 1993; Tsang et al., 2012). Moreover, in the context of child abuse, childhood maltreatment is associated with lower self-efficacy and various health problems in adulthood (Sachs-Ericsson et al., 2011; Taylor et al., 2016; Basu et al., 2017). According to the attachment theory, childhood maltreatment negatively affects the formation of secure attachments among children which later poses a challenge to the development of self-efficacy beliefs throughout their lives (Riggs, 2010) which, in turn, can affect one's self-regulation of motivation to accomplish something later in life (Tsang et al., 2012). In short, the adverse experience in the early years can negatively impact the cognitions about the self and the control one can exert over his or her own functioning.

Significantly, the evidence of individuals' differences in negative outcomes, such as the development of drug use problems in response to childhood maltreatment, implies an indirect pathway between the relationship of maltreatment experience and drug addiction (Simpson and Miller, 2002; Rutter, 2007; Wahab et al., 2021). In other words, other factors may play a role in explaining the mechanism underlying this relationship. In addition, in view of the inconsistent findings reported by previous

studies between the association of maltreatment experience and drug treatment motivation (Battjes et al., 2003; Rosenkranz et al., 2012; Lu et al., 2017), the purpose of this study was to examine the relationship between childhood maltreatment and motivation among drug addicts entering treatment and the factors that have the potential to explain the relationship between the two variables.

In view of the impacts of childhood maltreatment on the formation of forgiveness and self-efficacy and the significant role as coping strategy played by both factors (Witvliet and McCullough, 2007; Cieslak et al., 2008), this study hypothesized that the association between childhood maltreatment and treatment motivation among drug addicts would be mediated by individual differences in forgiveness and self-efficacy, with higher levels of forgiveness and self-efficacy predicting higher levels of motivation in treatment. In addition, there is evidence that different types of childhood maltreatment experiences may yield specific pathways to the development of negative outcomes (Infurna et al., 2016). Thus, this study further examined the predictive value of different forms of childhood maltreatment, which included emotional, physical, sexual abuses, and emotional and physical neglect on motivation as well as its association with forgiveness and self-efficacy.

MATERIALS AND METHODS

Participants and Procedure

The study protocol was approved by the National Anti-Drugs Agency (AADK) of Malaysia. All participants were recruited from three mandatory drug rehabilitation centers managed by AADK that comes under the supervision of the Malaysia Home Ministry that provides free treatment and rehabilitation programs to the individual who has been confirmed as a drug addict. First, a pilot study was conducted by recruiting 160 inpatient drug addicts from a drug rehabilitation center, where 144 questionnaires were completed and used for the analysis. Next, in view of the gender ratio of drug addicts which was close to 40 males per 1 female in Malaysia according to the statistics provided by AADK, a total of 380 male inpatient drug addicts entering substance abuse treatment were selected through a simple random sampling. However, after excluding the poorly completed questionnaires and missing data, 360 samples remained to use for the analysis. A briefing session regarding the ethical measures and research objectives was conducted at the beginning, and informed consent was requested from each participant to use the information for research purposes. The average age of the sample was 33.34 years (SD = 7.25), and participants were predominately Malay (96.4%) and single (53.1%). All participants have gone through evaluations and assessments and were diagnosed with substance use disorder (SUD) by psychiatrists and narcotic officers under AADK before they were admitted to the rehabilitation centers to receive treatment. In addition, several different drugs were reported by the participants throughout their drug use histories which encompassed opioids, ecstasy, amphetamines, cocaine, marijuana, and other types of psychotropic drugs. All recruited participants were with reading and comprehension abilities to take part in the research.

Measures

Childhood Maltreatment

Childhood maltreatment was examined using the 28 items of the Childhood Trauma Questionnaire Short Form (CTQ-SF). CTQ-SF is a retrospective self-administered screening device used to detect histories of childhood abuse and neglect. It is the most commonly used and valid assessment tool to enable the identification of five dimensions of childhood maltreatment experiences, namely, emotional abuse (EA), physical abuse (PA), sexual abuse (SA), emotional neglect (EN), and physical neglect (PN) (Bernstein et al., 2003). The original version of CTQ-SF has shown sufficient psychometric properties across different settings (Bernstein and Fink, 1998; Gerdner and Allgulander, 2009). Meanwhile, the Malay version of CTQ-SF (M-CTQ-SF), which exhibited good performance in reliability and validity, and cultural equivalence in the Malaysian population, was used in this study (Loy et al., 2020b). Participants were asked to report the frequency of their maltreatment experience during their first 16 years of life by using a 5-point Likert-type response, ranging from 1 = never to 5 = very often. Items are generally phrased in a non-evaluative manner, given as follows: "People in my family said hurtful or insulting things to me" for emotional abuse and "My family was a source of strength and support" for emotional neglect. Overall, the raw and total scores of CTQ-SF examine the separate and combined effects of multiple forms of childhood abuse and neglect experiences. The Cronbach's alpha coefficient of the total M-CTQ-SF was 0.88, while the alpha coefficient for the five subscales ranged from 0.61 for sexual abuse to 0.81 for emotional abuse in the current sample.

Motivation in Treatment

The Circumstances, Motivation, and Readiness (CMR) Scales were used to examine the drug addicts' motivation in treatment. The CMR is a self-report measure with 18 items scoring on a 5-point Likert-type response ranging from 1 = strongly disagree to 5 = strongly agree. The subscale of Circumstances refers to the external factors that influence an individual to seek treatment, the Motivation subscale refers to an individual's inner factors for change, whereas the Readiness subscale assesses an individual's perceived need for treatment in order to change (De Leon et al., 1994). Besides, potential total scores for CMR range from 0 to 90 with higher scores indicating higher motivation and readiness for treatment. Overall, CMR demonstrated adequate total score reliability with Cronbach's alpha coefficient ranging from 0.70 to 0.80 across a wide variety of substance-using populations (De Leon et al., 2000; Melnick et al., 2014). Meanwhile, the Cronbach's alpha of the total scores of CMR was 0.843 in this sample.

Forgiveness

The Heartland Forgiveness Scale (HFS) was used to measure an individual's dispositional forgiveness of themselves, others, and situations. The HFS is an 18-item self-report measure scoring on a 7-point Likert-type response ranging from 1 = almost always false of me to 7 = almost always true of me. Participants were

asked to report their typical responses to the negative events which occur due to their own actions (e.g., "I hold grudges against myself for negative things I've done"), the actions of others (e.g., "I continue to be hard on others who have hurt me"), or circumstances out of their control (e.g., "It's really hard for me to accept negative situations that aren't anybody's fault"). Besides, total HFS scores range from 18 to 126 with higher scores indicating higher levels of forgiveness. Previous research reported adequate psychometric properties with Cronbach's alpha coefficient ranging from 0.86 to 0.87 for the total HFS, while 0.72–0.82 for the subscales (Thompson et al., 2005). In this sample, the Cronbach's alpha of HFS was 0.825.

Self-Efficacy

The General Self-Efficacy Scale (GSES) is a 10-item self-report measure that was used to assess an overall sense of self-belief in coping with various difficult demands in life (Schwarzer and Jerusalem, 1995). A sample item included: "It is easy for me to stick to my aims and accomplish my goals." Participants were asked to rate their agreement on each item on a 4-point Likert-type response ranging from 1 = not at all true to 4 = always true. The GSES sum score ranges from 10 to 40 with higher scores indicating greater self-efficacy. Besides, this scale has been shown valid and reliable in numerous studies, with good internal consistency ranging from 0.75 to 0.94 (Schwarzer et al., 1997; Luszczynska et al., 2005); meanwhile, the Cronbach's alpha coefficient of GSES in this sample was 0.908.

Statistical Analysis

Overall, several data analyses were conducted to examine the associations between childhood maltreatment, treatment motivation, forgiveness, and self-efficacy. First, the exploratory factor analysis (EFA) was carried out *via* IBM-SPSS 22 using the data from the pilot study to explore the usefulness of items that measure the respective constructs being studied. Certain items with poor factor loading were being removed based on the EFA results (McNeish, 2017). Thereafter, in order to investigate the validity of the model, 360 sets of field data (collected *via* the final version of questionnaires which is being constructed using the results of EFA) were used to conduct the confirmatory factor analysis (CFA) using IBM-SPSS AMOS 22. Following CFA, associations between the variables were examined with the scores of the variables being standardized into *z*-values. Furthermore, the structural equation modeling (SEM) was performed to examine the interrelationships among the constructs in this study. Finally, the mediation effects of forgiveness and self-efficacy were assessed using 5,000 bootstrapped samples with a 95% CI.

RESULTS

Validity and Reliability

Prior to performing the SEM for hypothesis testing, CFA was conducted to examine the construct validity, convergent validity, and discriminant validity of all constructs that were being researched in this study (Hair et al., 2006). The three constructs, namely, childhood maltreatment, forgiveness, and treatment motivation, being studied were second-order constructs with complicated measurement model; therefore, the CFA for each measurement model was assessed separately, and all models were combined to perform a pooled-CFA after all constructs achieved the respective thresholds of validity and reliability in individual assessment (Awang et al., 2018). The results of individual CFA assessment for all constructs were presented in **Supplementary Appendix**.

Thereafter, in pooled-CFA assessment, all second-order constructs that have been validated were simplified into first-order constructs. First, the construct validity was assessed by looking at the fitness indexes of the model. According to the CFA outputs, as presented in **Figure 1**, the fitness indexes have achieved the requirement of construct validity with the absolute fit (RMSEA = 0.073) less than 0.08 and the parsimony fit index ($chi^2/df = 2.930$) below 5, while all the other indices (e.g., GFI, CFI, IFI, NFI, TLI) were higher than 0.9 (Awang et al., 2018). Moreover, the factor loadings for all items were above 0.6, which indicated the unidimensionality of the model (Byrne, 2016) except for SA and PN with factor loadings below the cutoff point. However, the two items were retained due to the suggestion that factor loading above 0.4 in CTQ-SF was acceptable (Bernstein et al., 1994).

The average variance extracted (AVE), which determines the convergent validity, and CR, which determines the composite reliability for all latent constructs, are presented in **Table 1**. Because the values for both AVE and CR were computed using the factor loadings, the AVE for the construct of childhood maltreatment was unsatisfactory (0.45), while the AVE for other latent constructs was above 0.5, which indicated a high convergent validity (Byrne, 2016). However, since the composite reliability of childhood maltreatment was above 0.6, its convergent validity is still considered adequate (Fornell and Larcker, 1981). Besides, concerning the discriminant validity, AVE for each latent construct in the model was greater than its respective square root of correlation value with other constructs as presented in **Table 1** ($AVE > r^2$); thus, the discriminant validity of all latent constructs was accomplished (Byrne, 2010). Furthermore, the correlation value (r) between self-efficacy with its respective constructs was all below 0.85, which indicated that the model was free from the multicollinearity problem. Therefore, it can be concluded that the construct validity, convergent validity, and discriminant validity of all constructs in this study have been achieved.

Relationship Analysis

Findings from preliminary analysis demonstrated that all variables in this sample have adequate internal reliability, ranging from 0.80 to 0.89. Thereafter, Pearson correlation was conducted in exploring the relationship among childhood maltreatment, forgiveness, self-efficacy, and treatment motivation. Childhood maltreatment was negatively correlated with treatment motivation ($r = 0.562$, $p < 0.01$), forgiveness ($r = -0.638$, $p < 0.01$), and self-efficacy ($r = -0.612$, $p < 0.01$). In addition, treatment motivation indicated a positive relationship with forgiveness ($r = 0.810$, $p < 0.01$) and self-efficacy ($r = 0.812$,

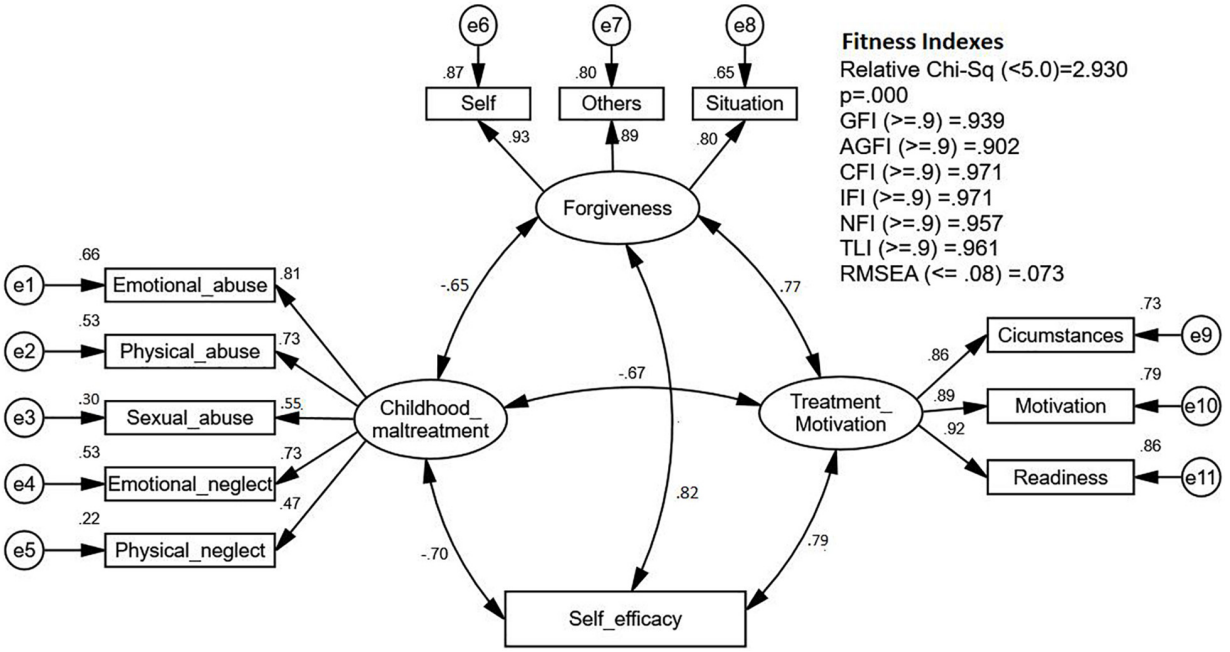

FIGURE 1 | The Results of Confirmatory Factor Analysis (CFA).

$p < 0.01$). Furthermore, the inter-correlations between the total score of CTQ-SF with the five maltreatment subscales were found to be significant. Among the five subscales, EN and SA indicated the highest and lowest correlations with the total CTQ-SF, respectively (**Table 2**).

Model Analysis

After all the constructs have been validated, SEM was followed to test the interrelationships among the constructs in the model. Overall, the results of the regression path coefficient (β) which reflected the predictive effects of exogenous constructs on the endogenous constructs were presented in **Figure 2** with the interpretation in **Table 3**. Childhood maltreatment was a negative predictor of forgiveness (β = –0.861, $p < 0.001$) and self-efficacy (β = –0.831, $p < 0.001$), yet it did not significantly predict treatment motivation (β = –0.178, $p = 0.678$) in the mediation model. Therefore, the association between childhood maltreatment, forgiveness, and treatment motivation was continued to assess in the direct model. Moreover, treatment motivation was significantly predicted by forgiveness (β = 0.740, $p < 0.001$) and self-efficacy (β = 0.373, $p < 0.032$).

TABLE 1 | Discriminant validity index summary.

Construct	Composite reliability	Childhood maltreatment	Forgiveness	Treatment motivation
Childhood maltreatment	0.80	**0.45**		
Forgiveness	0.91	0.42	**0.77**	
Treatment motivation	0.91	0.44	0.59	**0.79**

Bold values indicate average variance extracted (AVE).

Mediating Analysis

In order to examine whether forgiveness plays a mediator role between childhood maltreatment and treatment motivation, the bootstrap procedure involving both the mediation model and direct model was utilized. Results from these two models were used to assess for the mediation effect of forgiveness (**Table 4**). In the direct model, all the indirect paths were constrained to zero in order to eliminate the mediator effect in the model (**Figure 3**). As a result, without the interference of the mediator, treatment motivation was significantly predicted by childhood maltreatment (β = –0.678 $p < 0.001$). Taken together, these results supported the predictive role of childhood maltreatment in treatment motivation *via* forgiveness and self-efficacy, with forgiveness and self-efficacy fully mediating this association.

The Effects of Different Forms of Childhood Maltreatment

Overall, this study aimed to examine the association between childhood maltreatment and treatment motivation among drug addicts; thus, besides investigating the overall effects of childhood maltreatment as an individual variable on its endogenous constructs, the predictive value of various forms of maltreatment from the overall maltreatment in the model was further assessed to attain a more holistic data. As presented in **Figure 4**, the outcomes produced by SEM were consistent with the previous results when replacing the total scores of maltreatment with different forms of maltreatment. In other words, four forms of maltreatment, namely, EA, PA, SA, and EN, were significantly related to forgiveness and self-efficacy, and they played a predictive role in treatment motivation in

TABLE 2 | Descriptive statistics and correlation results of variables.

Construct	Descriptive statistics									
	Mean	*SD*	CTQ-SF	PA	EN	EA	SA	PN	HFS	GSE
CTQ-SF	40.81	12.11	1							
PA	8.53	3.22	0.801	1						
EN	11.21	4.23	0.823	0.532	1					
EA	8.50	3.54	0.833	0.652	0.523	1				
SA	5.29	2.23	0.482	0.329	0.147	0.298	1			
PN	6.21	2.81	0.611	0.238	0.495	0.324	0.162	1		
HFS	64.22	28.3	–0.638	–0.479	–0.572	–0.557	–0.167	–0.269	1	
GSE	29.73	6.73	–0.612	–0.501	–0.544	–0.523	–0.155	–0.283	0.862	1
CMR	41.44	13.9	–0.562	–0.424	–0.521	–0.447	–0.222	–0.256	0.810	0.812

All correlation values are significant at the 0.01 level (2-tailed).
CTQ-SF, total score of childhood maltreatment; PA, physical abuse; EN, emotional neglect; EA, emotional abuse; SA, sexual abuse; PN, physical neglect; HFS, forgiveness; GSE, self-efficacy; CMR, treatment motivation.

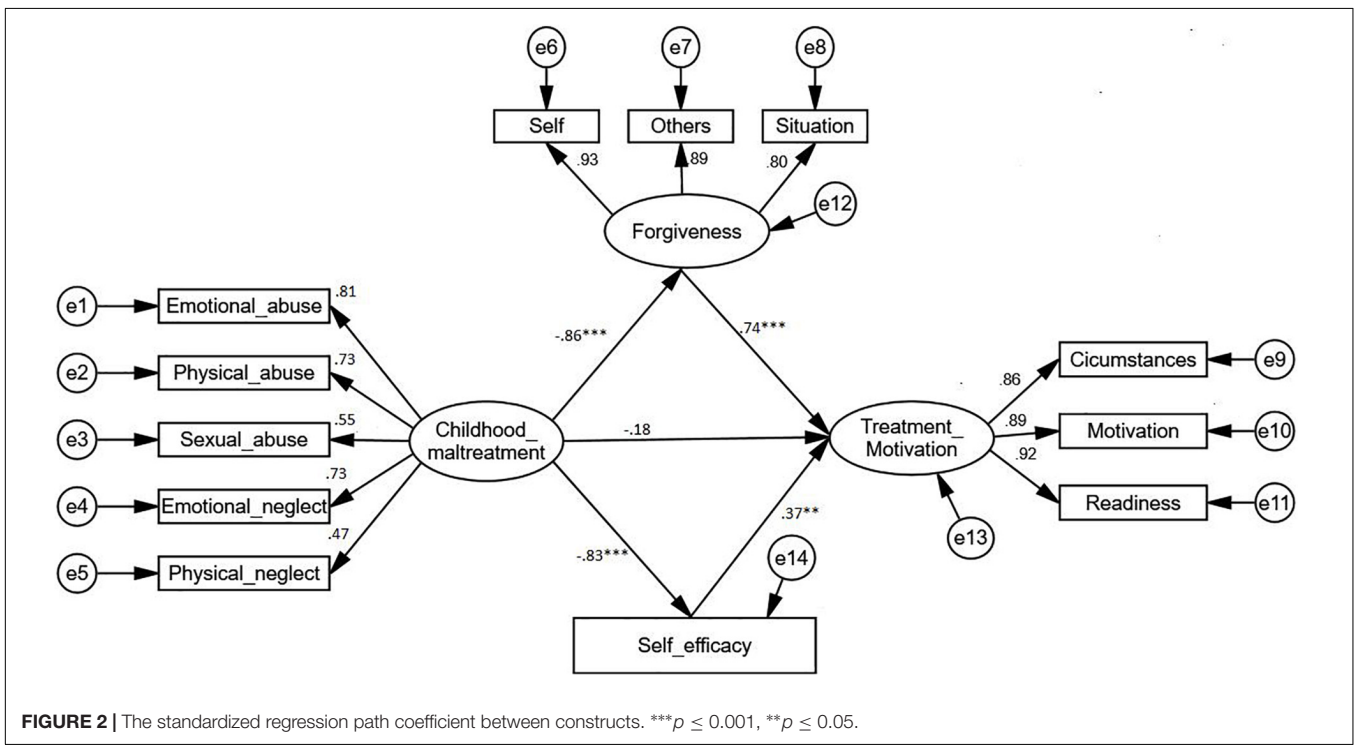

FIGURE 2 | The standardized regression path coefficient between constructs. ***$p \leq 0.001$, **$p \leq 0.05$.

the direct model (**Table 5**). These results further suggested that a strong association exists between the various forms of maltreatment with forgiveness and treatment motivation among drug addicts. Furthermore, it also supported the full mediating role of forgiveness in the relationship between various forms of maltreatment and treatment motivation.

DISCUSSION

Child maltreatment that included various forms of abuse and neglect is a significant social problem that affects all races, ethnicities, and socioeconomic groups with severe lifelong consequences. Research has highlighted the link between childhood maltreatment and later engagement in high-risk behaviors, such as substance and drug abuse (Mandavia et al., 2016; Yen et al., 2021; Lim et al., 2021), followed by different kinds of mental difficulties that pose threat to the motivation of abstaining from addictive behaviors (Grella and Joshi, 2003; Rosenkranz et al., 2012). Therefore, this study aimed to alleviate the negative impacts of childhood maltreatment on motivation to engage in treatment programs among drug addicts. To this end, this study examined the potential variables that were deemed effective in reducing the negative emotions resulting from past adverse experiences in a healthy way. Furthermore, both forgiveness and self-efficacy, which were considered as positive elements with a strong association with resilience (Srivastava, 2011; Kelly, 2018; Bikar et al., 2021), have been investigated for

their mediating effects on the association between childhood maltreatment and treatment motivation in drug addicts.

Overall, the results of this study were consistent with previous research that demonstrated a significant association between childhood maltreatment and treatment motivation among drug addicts undergoing inpatient treatment programs. The negative association between both overall childhood maltreatment and different forms of maltreatment with treatment motivation supported and extended the previous research that the childhood adverse personal histories could undermine the treatment engagement and recovery process (Sacks et al., 2008; Lu et al., 2017). Moreover, the present results implied the role of a drug as an unhealthy alternative for the addicts with adverse histories to escape from pain and emotional distress. Previous research has indicated the myriad challenges encountered by addicts with histories of abuse in drug treatment including negative psychological functioning (Sacks et al., 2008) and greater severity of anxiety that co-occurred with strong feelings of shame, anger, and self-blame (Bennett et al., 2005; Rosenkranz et al., 2012), which could pose formidable threats to their willingness to abstain from drug use. Furthermore, the findings of Grella and Joshi (2003) indicated that a more intensive level of care in treatment required by drug addicts with histories of abuse also implied the negative impacts of childhood maltreatment on treatment motivation.

Moreover, findings from this study indicated that childhood maltreatment is a significant predictor of forgiveness, consistent with previous studies that reported a negative association between maltreatment histories and forgiveness (Snyder and Heinze, 2005; Arslan, 2017). Various negative outcomes on physical and mental health are well documented for those who experience childhood maltreatment (Currie and Widom, 2010; Norman et al., 2012; Tharshini et al., 2021), thereby potentially affecting their social functioning, such as lack of engagement and support from families in the growing up process (Lamis et al., 2014). Moreover, Müller et al. (2019) demonstrated the negative impacts of poor social functioning as a result of childhood maltreatment, which includes difficulties making connecting relationships and insensitivity toward others, which may thereby affect their development of forgiveness (Müller et al., 2019). Furthermore, considering the nature of abusive families, maltreated children were prone to believe that they cannot rely on others for care and support, which may later develop an insecure attachment style (Ainsworth, 1989). Research indicated that individuals with insecure attachment have more difficulty repairing the relationship after an offense occurs (McCullough et al., 1998) and as well demonstrated a lower level of forgiveness (Burnette et al., 2009). To sum up the literature, an individual's forgiveness may indirectly be affected by childhood maltreatment experiences, and it seems logical to expect that individuals with maltreatment histories might face various challenges in the development of forgiveness, supported by findings from this study.

TABLE 3 | The regression path coefficient.

Path	β	p	95% bootstrap BC CI	
			LB	UB
Childhood maltreatment → Forgiveness	–0.861	0.001	–2.32	–1.62
Childhood maltreatment → Self-efficacy	–0.831	0.001	–0.243	–1.32
Childhood maltreatment → Treatment motivation	–0.178	0.678	–0.186	0.133
Forgiveness → Treatment motivation	0.740	0.001	0.261	0.587
Self-efficacy → Treatment motivation	0.373	0.032	0.037	0.251

TABLE 4 | Results of the direct model.

Path	β	*p*	95% bootstrap BC CI	
			LB	UB
Direct model				
Childhood maltreatment → Treatment motivation	–0.68	0.001	–1.341	0.928

First, the indirect effect analysis demonstrated the full mediation effect of forgiveness in the relationship between childhood maltreatment and treatment motivation. In other words, the results supported the role of forgiveness as a mitigating factor in alleviating the effect of childhood maltreatment on treatment motivation among drug addicts. Thus, forgiveness might be an effective element in helping drug addicts in the face of childhood adverse experiences. Research has indicated that childhood maltreatment was the predictor of shame proneness, and drug use may work as the mechanism to cope with negative emotions (O'Connor et al., 1994; Rahim and Patton, 2015). Besides, previous studies have demonstrated higher levels of anger among drug addicts (Lin et al., 2004), which may function as a defense mechanism against the feeling of shame and guilt associated with their addiction behavior (Worthington et al., 2006). Thus, it seems reasonable to expect a cyclical relationship between negative emotions and drug addiction. Therefore, an introduction of a positive element, such as forgiveness, may help in alleviating negative feelings, thereby reducing the probability of drug use as a coping mechanism, and may further help in increasing their motivation to engage in treatment. Moreover, in addition to the positive effects of forgiveness on psychological and physical wellbeing as having been supported by previous research (Toussaint et al., 2016; Long et al., 2020), forgiveness is as well considered an effective element to cope with maltreatment experiences in the context of trauma (Freedman and Enright, 2017). Taken together, the literature supported the positive effect of forgiveness on one's wellbeing, which is consistent with the present findings indicating its full mediating role in the association between childhood maltreatment and treatment motivation among drug addicts.

On the contrary, in view of earlier research that has identified deficits in self-efficacy as a potentially negative outcome of early maltreatment experiences (Sachs-Ericsson et al., 2011; Singer et al., 2016), this study sought to support a relationship between childhood maltreatment and self-efficacy. As a result, the negative

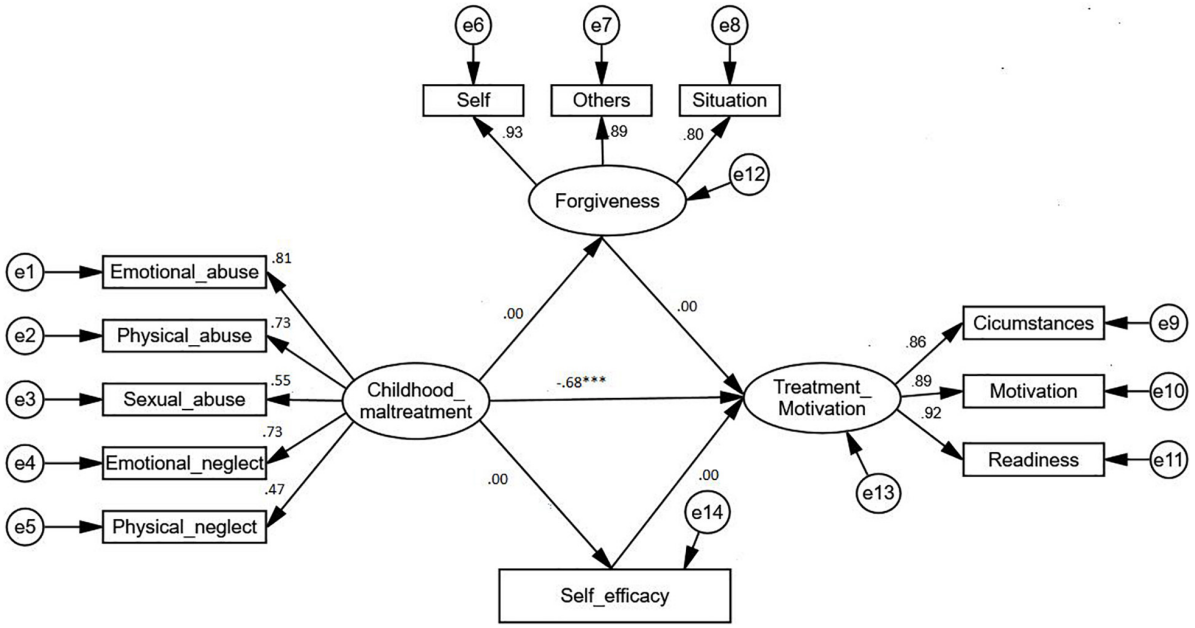

FIGURE 3 | The direct model. ***$p \leq 0.001$.

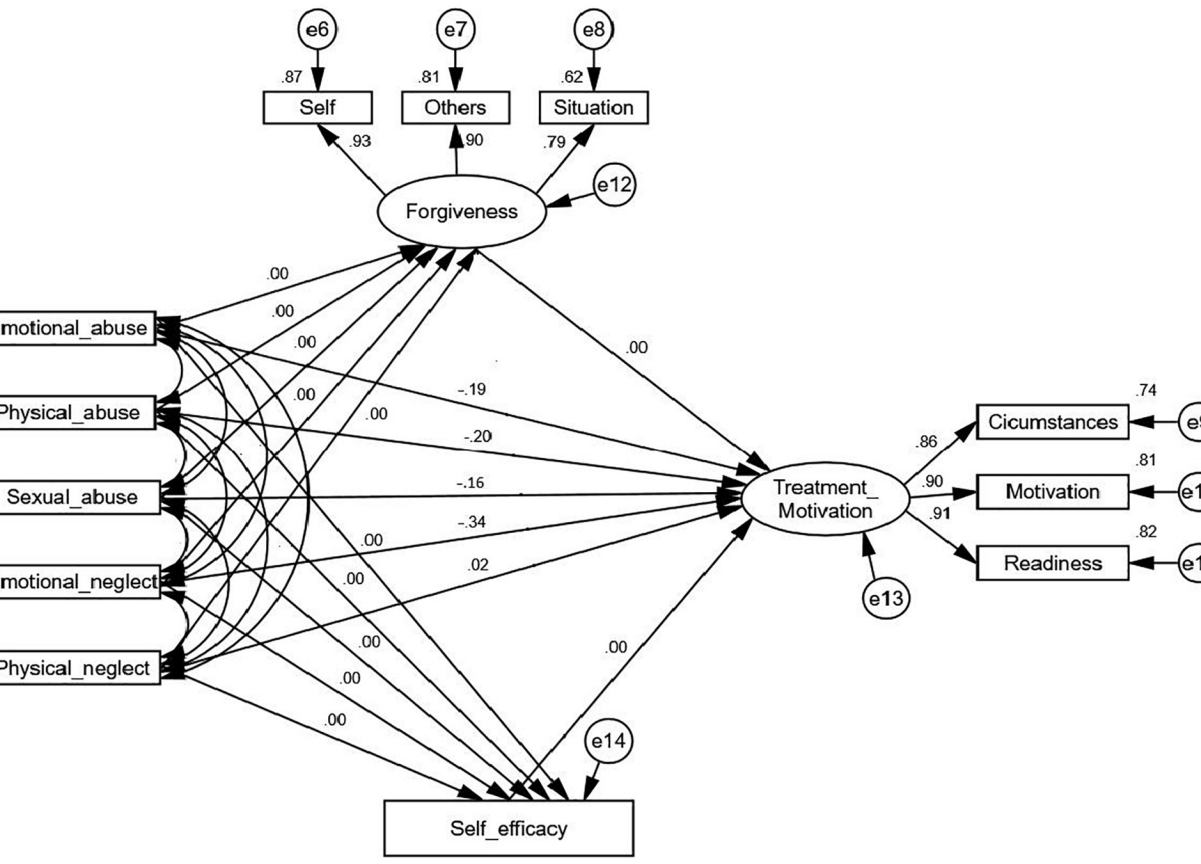

FIGURE 4 | The direct model of various forms of maltreatment. All indirect paths constrained to 0.

TABLE 5 | Results of mediation effect of forgiveness and self-efficacy on various forms of maltreatment and treatment motivation.

Path	β	*p*
Direct model		
Emotional abuse → Treatment motivation	–0.19	0.003
Physical abuse → Treatment motivation	–0.20	0.001
Sexual abuse → Treatment motivation	–0.16	0.046
Emotional neglect → Treatment motivation	–0.34	0.001
Physical neglect → Treatment motivation	–0.02	0.546
Mediation model (Forgiveness)		
Emotional abuse →Forgiveness	–0.289	0.001
Physical abuse →Forgiveness	–0.184	0.001
Sexual abuse →Forgiveness	–0.171	0.042
Emotional neglect →Forgiveness	–0.365	0.001
Physical neglect →Forgiveness	0.049	0.685
Forgiveness → Treatment motivation	0.670	0.001
Mediation model		
Emotional abuse →Self-efficacy	–0.280	0.001
Physical abuse → Self-efficacy	–0.167	0.002
Sexual abuse → Self-efficacy	0.026	0.126
Emotional neglect → Self-efficacy	–0.336	0.001
Physical neglect → Self-efficacy	0.025	0.224
Self-efficacy → Treatment motivation	0.814	0.001

association between the two constructs was found in the SEM analysis. Meanwhile, the significant association between self-efficacy and treatment motivation demonstrated that the efforts in this study to explore the mediating effect of self-efficacy between childhood maltreatment and treatment motivation were deemed successful. In other words, this finding indicated that negative experiences in childhood lowered the level of treatment motivation *via* a negative self-efficacy. Thus, consistent with previous studies, the results of this study suggested that childhood maltreatment experiences predict a low level of self-efficacy after decades.

Nevertheless, the indirect effect analysis showed that the association between self-efficacy and treatment motivation was statistically significant but not at the 0.001 level. Research has indicated that drug addicts with maltreatment histories reported a significantly higher number of lifetime addiction and treatment admission (Westermeyer et al., 2001; Khoury et al., 2010), which implies a high relapse rate after they were successfully recovered from addiction and were discharged from rehabilitation centers. Consequently, the high failure records to abstain from drug use might either negatively affect their sense of self-efficacy or strengthen their beliefs in their capacity to complete the treatment program and recover from addiction once again. Therefore, it seems reasonable to expect that some drug addicts involved in this sample have higher levels of self-efficacy. Furthermore, this sample reported high levels of self-efficacy on average (mean = 29.6) (**Table 1**), with the scale score ranging from a minimum of 10 to a maximum of 40, thereby causing a weaker effect for self-efficacy in this equation. Overall, the mediating results of this study suggested the critical role of forgiveness in drug treatment, while improving self-efficacy may be beneficial for drug addicts to abstain from drug use.

LIMITATIONS AND FUTURE RESEARCH

There were several methodological limitations to be considered when interpreting the results of this study. First, this sample was not ethnic and gender diverse. Previous research has indicated the gender, ethnic, and cultural differences in child maltreatment and its consequences (Lee et al., 2012; Asscher et al., 2015; Lansford et al., 2015). Moreover, several studies have pointed out the gender and cultural diversity in forgiveness (Toussaint and Webb, 2005; Paz et al., 2008) and self-efficacy (Klassen, 2004; Wang et al., 2019). However, the majority of respondents in this study were Malay males (96.4%), which may limit the findings to be generalized to a more diverse sample. Therefore, there is a need for future research to identify male and female samples of drug addicts from different ethnic groups that may be directly compared on the variables of various forms of childhood maltreatment and its effects on forgiveness, self-efficacy, and treatment motivation, which may thereby provide useful information regarding unique and common elements of treatment programs for drug-addicted male and female subjects.

Moreover, the study was conducted using a cross-sectional approach in which the data of childhood maltreatment, forgiveness, self-efficacy, and treatment motivation were collected at one point in time. However, several investigated variables are likely to fluctuate over time. For example, Gecas (1989) pointed out the dynamic nature of self-efficacy which may change over the life course depending on the immediate social context (Gecas, 1989). Moreover, previous research has demonstrated the relationship between active participation in addiction treatment programs with greater self-efficacy (Ilgen et al., 2005; McKellar et al., 2008). Thus, this might explain the average high levels of reported self-efficacy in this study, which might probably decrease after the completion of treatment. In addition, McCullough et al. (2003) also underlined the fluctuation of forgiveness over time (McCullough et al., 2003). Consequently, these instability factors limited the generalizability of the results. Thus, future research may focus on capturing fluctuations in these dynamic variables that might be related to treatment motivation and dropout in drug addicts by conducting a longitudinal study.

In addition, the respondents were asked to recall their maltreatment experiences that occurred before the age of 16 years (Bernstein et al., 2003). Their reports regarding the adverse experience that happened to them in childhood may have been influenced by their current health conditions and many years of illicit drug use after a long period of time, which thereby may complicate their memories regarding the effects of childhood maltreatment on their intention to use drug and motivation to abstain from drug use. Moreover, research has demonstrated that individuals who reported poor health conditions may have a bias to recall their childhood maltreatment experiences (Edwards et al., 2001; Sheikh, 2018). Therefore, future research may pay more attention to the factors that might aggravate the recall bias such as the length and duration of the questionnaire or bias explanations regarding the study's objective in order to obtain a more precise estimate of the prevalence of childhood maltreatment histories.

Finally, lower socioeconomic status has consistently been shown to be associated with a higher risk of child maltreatment (Drake and Pandey, 1996; Lefebvre et al., 2017) mainly because of the stress and conflict that arise between children and parents due to economic pressures. Therefore, children from low-income families are more likely to be exposed to child abuse and neglect; meanwhile, poverty, which is usually followed by unemployment and insufficient level of education attainment, might increase stress and the likelihood of abuse drugs in adulthood. In short, all these confounding variables may influence the respondents' motivation to abstain from drug use which might pose a threat to the research reliability and validity. Thus, future research should attempt to validate the findings of this study with comparative data from different socioeconomic groups of drug addicts.

CONCLUSION

Findings from this study highlighted the critical role of negative personal experiences developed early in life that appeared to carry over into adulthood and possibly incline the victims toward drug use to escape from painful memories or an attempt to reduce negative emotions associated with trauma, thereby negatively affecting their willingness to abstain from drug use or compromise their motivation in addiction treatment. Furthermore, the results demonstrated that forgiveness and self-efficacy played the role as protective factors to reduce the effects of childhood maltreatment experiences on treatment motivation. Moreover, the findings indicated that total scores of childhood maltreatment yielded similar results with different forms of maltreatment in relation to other investigated variables in this study, and supported and confirmed the co-occurrence across multiple types of maltreatment in an abusive family as has been found in earlier studies (Descartes et al., 2020). In addition, the mediating role of self-efficacy demonstrated that high self-efficacy may play a role in buffering the negative effects of childhood maltreatment on treatment motivation. Finally, forgiveness, by effectively reducing the negative emotions among drug addicts, may promote acceptance of self and further increase their motivation to engage in addiction treatment, thereby potentially preventing relapse. However, although forgiveness can be recommended as a mitigating element to assist individuals with a history of maltreatment, counselors or other professionals need to be careful when offering it. Recovery involving forgiveness is a difficult and long process, so avoid rushing to the outcomes and beware not to instill any kind of moral responsibility in victims to forgive their parents who have had hurt them.

DATA AVAILABILITY STATEMENT

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

AUTHOR CONTRIBUTIONS

LS: manuscript writing, data collection, and data analysis. MK: manuscript writing. RK, TT, and HA: data collection. All authors contributed to the article and approved the submitted version.

ACKNOWLEDGMENTS

We wish to thank Universiti Kebangsaan Malaysia for providing financial assistance in publishing this manuscript (publication grant: GP-2021-K021070).

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2022.816373/full#supplementary-material

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frontiers in Psychology

BRIEF RESEARCH REPORT
published: 14 March 2022
doi: 10.3389/fpsyg.2022.720149

Examining the Prevalence and Risk Factors of School Bullying Perpetration Among Chinese Children and Adolescents

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Background and Objectives: School bullying threatens the health of children and adolescents, such as mental health disorders, social deviant behaviors, suicidal behaviors, and coping difficulties. The present study aims to address (1) prevalence rates of both traditional and cyber school bullying perpetration, and (2) the associations between self-control, parental involvement, experiencing conflicts with parents, experiencing interparental conflict, and risk behaviors, and school bullying perpetration among Chinese children and adolescents.

Method: This study used data from a national representative school bullying survey (n = 3,675) among children and adolescents from all grades (primary school 4th grade to high school 12th grade) in seven cities in China. Negative binomial regression was used to estimate the effects of these predictive factors on traditional and cyber school bullying perpetration, respectively. Seven control variables were included, such as gender, boarding school, family socioeconomic status, and parents' education levels.

Results: The sample comprised 52% female, 18% at boarding school, 70% of the participants' academic performance was average or above. Approximately 17.3% of the participants reported participating in traditional school bullying against their peers, and 7.8% perpetrated cyberbullying behaviors. Also, after controlling sociodemographic characteristics and high self-control, parental involvement reduced the likelihood of traditional and cyberbullying perpetrating. Experiencing interparental conflict and risk behavior was significantly associated with increased perpetration of traditional and cyber school bullying. We found that having a conflict with parents was significantly associated with cyberbullying perpetration.

Implications: Findings have implications for practice. Anti-bullying intervention programs targeting this population should consider these factors. For example, school administrators may develop school programs involving parents in the efforts and interventions workshops improving children and adolescents' levels of self-control. Limitations are also discussed.

Keywords: school bullying behavior, cyberbullying, children, family environment, parenting

OPEN ACCESS

Edited by:
Yang Li,
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Reviewed by:
Martha Frías Armenta, University of Sonora, Mexico
Alexa Guy, University of Wolverhampton, United Kingdom

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Specialty section:
This article was submitted to Personality and Social Psychology, a section of the journal Frontiers in Psychology

Received: *03 June 2021*
Accepted: *02 February 2022*
Published: *14 March 2022*

Citation:
Xue J, Hu R, Chai L, Han Z and Sun IY (2022) Examining the Prevalence and Risk Factors of School Bullying Perpetration Among Chinese Children and Adolescents. Front. Psychol. 13:720149. doi: 10.3389/fpsyg.2022.720149

INTRODUCTION

School bullying is an important social problem affecting children and adolescents in China (Chai et al., 2020a,b). Face-to-face bullying or traditional bullying is defined as "(a) repeated incidents amongst the same bullies and victims over time; (b) a physical, verbal, relational, or social attack or intimidation that is intended to cause harm, distress, or fear to victims; and (c) an imbalance of power between bullies and victims that more powerful adolescents dominate less powerful ones." (Cho, 2019, p. 285; also see Olweus, 1978). Cyberbullying refers to bullying behaviors delivered in electronic contexts, such as e-mail, blogs, and text messages (Kowalski et al., 2014), and has emerged as a phenomenon in the field (Chai et al., 2020a,b). For example, Chan and Wong (2015) find that traditional bullying perpetration range from 2 to 68%. The rates of cyberbullying perpetration range from 3 to 60% in a sample of children and adolescents from Mainland China, Hong Kong, and Taiwan. Bullying behaviors have negative consequences, such as psychosomatic symptoms (e.g., headache, abdominal pain, and sleep problem) (Li et al., 2019), mental health outcomes (e.g., depression, anxiety, suicidal thoughts) (Gower and Borowsky, 2013; Benedict et al., 2015; Weng et al., 2017), and health behavior problems (e.g., alcohol, cigarettes) (Topper et al., 2011; Sangalang et al., 2016). The examination of potential risk factors of school bullying perpetration is helpful to prevent adverse health and well-being consequences for children and adolescents. However, empirical evidence of risk factors associated with school bullying perpetration is limited in China. The present study aims to address the research gap by examining the effects of several predicting factors on school bullying perpetration among a large sample of Chinese children and adolescents, including the impact of self-control behaviors, parental involvement, conflicts with parents, interparental conflict, and risk behaviors.

LITERATURE REVIEW

Self-Control Behaviors

A growing body of research has observed that self-control relates to bullying perpetration (Chui and Chan, 2015; Moon and Alarid, 2015). Self-control is an intrapersonal characteristic that influences bullying involvement (Hemphill et al., 2014). According to self-control theory, children and adolescents with lower levels of self-control are less likely to engage in socially desirable behaviors. Given certain circumstances, these individuals tend to be involved in risk and criminal behaviors because of their greater tendency to be impulsive, self-centered, and short-sighted (Gottfredson and Hirschi, 1990). In addition, these individuals are less likely to fear the potential adverse consequences of violent behaviors, which contributes to a greater chance of engaging in risk activities (Reisig and Pratt, 2011; Turanovic and Pratt, 2014). For example, Chui and Chan (2015) measure the levels of self-control in a sample of 365 adolescents in Macau, China, which is estimated based on risk-taking activities, self-centeredness, and volatile tempers. The study shows that youth with low self-control are more likely to report traditional bullying perpetration. Likewise, using the EU Kids Online II study, Vazsonyi et al. (2012) found that low self-control is associated with higher risks of cyberbullying perpetration. Similar patterns have also been observed in recent longitudinal analyses (Cho, 2018; Cho et al., 2019; Cho and Rustu, 2020).

Parental Involvement

Parental involvement is an important factor influencing bullying behaviors (Shetgiri et al., 2012; Espelage, 2014). According to social control theory, individuals are more likely to develop risk behaviors if they lack social bonds (Hirschi, 1969). Social control theory has four components: attachment, commitment, involvement, and belief. Each component has an independent effect on risk behaviors, but the combined effect is expected to be the greatest (Hirschi, 1969). Given that parents are the primary agents that help children develop socialization, parents' involvement significantly affects their children's behaviors (Cho and Lee, 2018). Research has suggested that parents of bullying perpetrators tend not to be actively involved in their children's lives.

In contrast, youth's parents who are actively involved in children's lives are less likely to become bullies (Espelage, 2014). Empirical studies have found evidence supporting this claim. For instance, using data from the National Survey of Children's Health, Shetgiri et al. (2012) found that parental involvement was associated with a lower likelihood of traditional bullying perpetration. Likewise, using two parent-child dyads studies, Barlett and Fennel (2018) showed that lack of parental involvement is linked to greater risks of cyberbullying perpetration. Similar patterns have also been observed in other studies (Cho et al., 2019; Paez, 2020).

Conflict With Parents

The conflict between parents and their kids is another important factor contributing to the youth's involvement in bullying. General strain theory posits that strains are essential factors resulting in risk behaviors; individuals who experience stresses tend to engage in risk activities as a coping strategy to respond to injustice (Agnew, 2002, 2006). Some studies have indicated that criminally victimized, or racially discriminated individuals are associated with a higher likelihood of committing deviant behaviors (Agnew et al., 2002; Baron, 2004; Moon et al., 2009). Within the context of bullying perpetration, researchers have identified that conflict with parents is a common strain factor shaping bullying behaviors among children and adolescents (Moon et al., 2012). Using the Korea Youth Survey, Moon et al. (2012) found that children who experienced conflict with parents were more likely to engage with traditional bullying perpetration. Likewise, a recent review piece demonstrates an inverse association between relationships with parents and cyberbullying perpetration (Camerini et al., 2020). Other studies have also observed a similar pattern (Stevens et al., 2000; Pepler et al., 2008).

Interparental Conflict

Interparental conflict is an external family factor that impacts the youth's bullying involvement (Gini et al., 2014). Interparental

conflict refers to "verbal or physical assaults and disputes between parents due to disagreement or other reasons" (Yang et al., 2018, p. 257; also see Fincham, 1994). According to social learning theory, children can learn behaviors by observing their parents (Akers, 2009). They can apply what they have learned at home to their peers at school or online (Tanrikulu and Campbell, 2015). Research reveals that children who grow up in an interparental conflict environment are more likely to involve in bullying perpetration (Baldry, 2003; Low and Espelage, 2013; Yang et al., 2018; Hsieh et al., 2021). For instance, using a sample of elementary school children in South Korea, Shin et al. (2014) demonstrate that interparental conflict is linked to higher likelihoods of traditional bullying perpetration. Likewise, using a sample of 649 Chinese high school students, Yang et al. (2018) observed that interparental conflict is positively associated with cyberbullying perpetration among adolescents.

Risk Behaviors

To reiterate, social learning theory posits that children tend to learn their behaviors based on observation (Bandura, 1978). In addition to observing the parents that shape children's and adolescents' behaviors are through social media platforms. Prior research has stressed that children and adolescents might engage in aggressive behaviors through media use (Bandura, 1978). More specifically, playing online games provide opportunities for youth to learn and develop aggression (Huesmann, 2007; Anderson et al., 2010; Lam et al., 2013). Chang et al. (2015) sampled 2,315 students in Taiwan and observed that online game use is associated with a higher likelihood of involving in cyberbullying perpetration. Lam et al. (2013) found that youth exposed to violent online games are more likely to engage in cyberbullying perpetration. A recent piece also finds a similar pattern (Teng et al., 2020). Although existing literature has documented the association between online games and cyberbullying perpetration, some researchers have proposed that the adverse effect of online games might apply to real-time (Boyd and Swanson, 2016). In addition, a growing body of research links substance use (e.g., drinking and smoking) to various health-risk behavioral outcomes among youth (Ellickson et al., 2003; Cho et al., 2007; Swahn et al., 2008). However, little is known about whether the same detrimental patterns can be applied to another important but as yet understudied health-risk behavior—bullying perpetration. Some preliminary evidence is that youth's alcohol use was positively associated with bullying perpetration (Swahn et al., 2011).

Aim of the Study

The present study proposes five hypotheses based on existing empirical research as follows:

Hypothesis 1: Low self-control is more likely to associate with both traditional bullying and cyberbullying perpetration.

Hypothesis 2: Parental Involvement is associated with a lower likelihood of both traditional bullying and cyberbullying perpetration.

Hypothesis 3: Experiencing conflict with parents is more likely to perpetrate traditional bullying and cyberbullying.

Hypothesis 4: Experiencing interparental conflict is positively associated with traditional bullying and cyberbullying perpetration.

Hypothesis 5: Risk Behaviors are positively associated with both traditional bullying and cyberbullying perpetration.

METHODS

Sample

The present study used data drawn from a nationwide research project conducted in 2016 in seven regions of China, including the capital city (Beijing) and six provinces (Liaoning, Hunan, Jiangsu, Guangdong, Guizhou, and Gansu[1]). For geographical variety, we purposively selected them using stratified sampling. In each of the seven cities, we selected a primary school, a middle school, a high school, and a vocational school[2]. Then, we randomly chose one class for each grade from these sampled schools. Then we invited the students from the sampled classes to complete the survey. Grades one to three students were not a part of the sample because they could not read and understand the survey questions. The sampling strategy was chosen to best balance the "representativeness," the scientific rationale, and the available reality (Lohr, 2009).

Research assistants distributed paper questionnaires to students at each school site. We informed the participants that participation in the study was voluntary. In addition, we also obtained consent from their parents and teachers. Students who consented to participate in the study completed the questionnaire independently. The research team collected a total of 3,777 questionnaires across all school sites, of which 3,675 were valid. Therefore, the sample comprised 3,675 students in the present study. Slightly over half of the sample were female (52%, n = 1,903) and 48% (n = 1,772) were male students. For educational level, 38% (n = 1,388) were attending primary school at the time of the survey, 28% were in middle school (n = 1,020), and 34% were in either high school (n = 1,089) or vocational training school (n = 178). **Table 1** described the sociodemographic characteristics of the sample.

Measures

Dependent Variables

Two dependent variables examined in the study were (a) traditional bullying behavior and (b) cyberbullying behavior. Participants were invited to recall their bullying behavior that had occurred in the past year at the time of the survey. Questions on both scales were adapted from the National Center for education Statistics' School Survey on Crime and Safety (Robers et al., 2014). Participants were asked, "In this past year, have you done any of the following to any of your classmates?" A frequency Likert scale was used for each item (0 = *never*, 1 = *occasionally*, 2 = *sometimes*,

[1]Beijing is located in North China, and Liaoning, Hunan, Jiangsu, Guangdong, Guizhou, and Gansu are located in Northeast, South Central, eastern-central coastal, South, Southwest, and North-central China, respectively.

[2]Vocational training schools in China are equivalent to high schools but are preparing students for specific vocational tracks rather than focusing on academics.

3 = *frequently*). For the present study, we created two count outcome variables with each item was dichotomized first and then summed up. Traditional bullying behavior (α = 0.88) included six items representing six different types of bullying behavior: (1) making fun of other students in a hurtful way, (2) spreading rumors about other students, (3) threatening others, (4) physically pushing, shoving, striping, or spitting on others, (5) isolating others on purpose, and (6) damaging others' belongings. The six items were summed up to construct the dependent variable, traditional bullying behavior. Cyberbullying behavior included four types (α = 0.91): (1) making fun of other students online, (2) threatening or insulting online, (3) spreading rumors or disclosing private information about others online, and (4) isolating other students online. The four items were summed up to construct the dependent variable, cyberbullying behavior.

TABLE 1 | Descriptive statistics of variables (*N* = 3,675).

Variables	Mean	SD	Range	Cronbach's Alpha
Dependent variables				
Traditional bullying	0.40	1.11	0–6	0.88
Cyberbullying	0.17	0.68	0–4	0.91
Independent variables				
Parental attachment	19.00	3.92	6–24	0.85
Conflict with parents	0.21	0.41	0–1	–
Inter-parental conflict	0.17	0.38	0–1	–
Self-control	21.17	4.83	7–28	0.81
Risk behaviors	9.04	2.96	7–28	0.72
Control variables				
	n	**%**		
Gender				
Male	1,764	48		
Female	1,911	52		
Boarding at school				
Yes	662	18		
No	3,013	82		
Grade level				
Elementary school*	1,388	37.77	–	–
Middle school	1,020	27.76	–	–
High school	1,267	34.48	–	–
Academic performance				
Top of the class*	361	9.82	–	–
Above average	1,153	31.37	–	–
Average	1,416	38.53	–	–
Below average	542	14.75	–	–
Bottom of the class	203	5.52	–	–
Father's education level				
Below middle school*	370	10.07	–	–
Middle school	1,152	31.35	–	–
High/vocational school	891	24.24	–	–
College	935	25.44	–	–
Graduate or above	327	8.90	–	–
Mother's education level				
Below middle school*	527	14.34	–	–
Middle school	1,103	30.01	–	–
High/vocational school	819	22.29	–	–
College	919	25.01	–	–
Graduate or above	307	8.35	–	–
Family economic status				
Poor or below average*	545	14.83	–	–
Average	1,992	54.20	–	–
Above average	970	26.39	–	–
Very well	168	4.57	–	–

**Reference group in regression analysis.*

Independent Variables

There were five independent variables, including self-control, parental involvement, experiencing conflict with parents, experiencing interparental conflict, and risk behaviors.

We measured self-control by summing up seven items (α = 0.85): (1) I am an impulsive person; (2) when tasks get challenging or complicated, I tend to give up; (3) When I am angry at people, I feel more like hurting them than talking to them about why I am upset; (4) I lose my temper easily; (5) it is hard for me to have empathy for people in difficult situations; (6) when I am angry, people better stay away from me; and (7) when I disagree with others, I often do not give in.

Parental involvement was constructed by summing up six items (α = 0.85): (1) my parents know most of my friends, (2) my parents usually know where I go if I am not home, (3) my parents spend a lot of time with me, (4) my parents chat with me often, (5) my parents encourage me often, and (6) I feel my parents care for me. Each item was assessed using a Likert scale from 1 to 4 (1 = *strongly disagree,* and 4 = *strongly agree*).

The team created one item to measure participants' experience conflict with their parents, "I have a conflict with my parents often." This item is a binary (1 = *yes*, 0 = *no*).

We also created a single binary item to measure experiencing the interparental conflict, "my parents fight often" (1 = *yes*, 0 = *no*).

Risk behavior was constructed by summing up six items (α = 0.76): (1) truancy, (2) smoking, (3) street fight, (4) alcohol use, (5) excessive online gaming, and (6) did not fasten the safety belt while sitting in the front seat. A frequency Likert scale was used for each item (1 = *absolutely agree*, 2 = *agree*, 2 = *disagree*, 3 = *absolutely disagree*).

Control Variables

There were 7 control variables, including gender, schooling, boarding at school, father's education, mother's education, self-rated family economic status and academic performance. Gender was a binary variable (0 = *female*, 1 = *male*). Schooling included three categories[3] (1 = *primary school*, 2 = *middle school*, and 3 = *high school*). Boarding at school is a binary variable (1 = *yes*, 0 = *no*). Father's education included five levels (1 = *below middle school*, 2 = *completed middle school*, 3 = *completed high/vocational training school*, 4 = *completed college*, and 5 = *completed graduate school or above*). Mother's

[3]We included primary students from 4th grade to 6th grade. In China, primary school students from 4th to 6th grade are typically in the age range 9 – 12; middle school students are in the age range 13 – 15; high school students are in the age range 16 – 18.

education included five categories (1 = *below middle school*, 2 = *completed middle school*, 3 = *completed high/vocational training school*, 4 = *completed college*, and 5 = *completed graduate school or above*). Family economic status were self-reported, including four levels (1 = *poor or way below average*, 2 = *average*, 3 = *above average*, and 4 = *very well*). Academic performance was a self-rated five-level variable (1 = *top of the class*, 2 = *above average*, 3 = *average*, 4 = *below average*, and 5 = *bottom of the class*). We presented the results in **Table 1**.

Analytical Plan

Negative binomial regression models with robust error variance were used to examine the effects of parental involvement, conflict with parents, risk behavior, self-control, interparental conflict, and conflict with parents on traditional school bullying and cyberbullying, respectively. Negative binomial models were selected over Poisson regression models for the two count outcome variables because (1) incidents of bullying perpetration remained low among students, resulting in the skewness of the distribution, and (2) the issue of overdispersion (Huang and Cornell, 2012). All analyses were conducted using Stata 16.1.

RESULTS

Traditional Bullying Perpetration

We found that 17.3% of the respondents reported having participated in any traditional forms of bullying behavior. Parental involvement reduced the likelihood of traditional bullying behavior (b = −0.108, SE = 0.012, p = 0.000, AME = −0.063) after controlling sociodemographic variables. Self-control was also negatively associated with traditional bullying behavior (b = −0.095, SE = 0.01, p = 0.000, AME = −0.055). Those who reported witnessing interparental

TABLE 2 | Negative binomial regression models predicting traditional bullying and cyberbullying (N = 3,675).

	Traditional bullying				Cyberbullying			
	B (SE)	***p***	**95% CIs**	**AME**	***B***	***p***	**95% CIs**	**AME**
Independent variables								
Parental involvement	−0.108*** (0.012)	0.000	[−0.132, −0.084]	−0.063	−0.118***(0.02)	0.000	[−0.157, −0.079]	−0.013
Conflicts with parents	0.207 (0.109)	0.058	[−0.007, 0.421]	0.126	0.331*(0.163)	0.042	[0.011, 0.65]	0.09
Interparental conflict	0.34**(0.113)	0.003	[0.118, 0.562]	0.217	0.382*(0.185)	0.039	[0.02, 0.744]	0.108
Self-control	−0.095***(0.01)	0.000	[−0.114, −0.075]	−0.055	−0.126***(0.015)	0.000	[−0.155, −0.097]	−0.033
Risk behaviors	0.215***(0.02)	0.000	[0.176, 0.253]	0.126	0.232***(0.027)	0.000	[0.179, 0.286]	0.061
Control variables								
Male	0.209*(0.099)	0.034	[0.016, 0.403]	0.119	0.453**(0.152)	0.003	[0.154, 0.751]	0.108
Boarding at school	0.398** (0.136)	0.003	[0.132, 0.665]	0.264	0.229 (0.191)	0.232	[−0.146, 0.604]	0.064
Grade level								
Middle school	−0.98***(0.125)	0.000	[−1.226, −0.734]	−0.686	−0.472*(0.195)	0.016	[−0.855, −0.089]	−0.139
High school	−1.486***(0.123)	0.000	[−1.728, −1.244]	−0.850	−0.686***(0.18)	0.000	[−1.038, −0.334]	−0.183
Academic performance								
Above average	0.109 (0.19)	0.566	[−0.264, 0.482]	0.063	−0.089 (0.262)	0.734	[−0.602, 0.424]	−0.025
Average	0.044 (0.187)	0.813	[−0.322, 0.41]	0.025	−0.19 (0.264)	0.471	[−0.706, 0.327]	−0.050
Below average	0.075 (0.209)	0.721	[−0.336, 0.485]	0.042	−0.048 (0.298)	0.872	[−0.631, 0.535]	−0.014
Bottom of the class	0.122 (0.24)	0.612	[−0.349, 0.593]	0.071	−0.169 (0.37)	0.648	[−0.893, 0.556]	−0.045
Father's education level								
Middle school	−0.486** (0.156)	0.002	[−0.793, −0.18]	−0.331	−0.344 (0.242)	0.154	[−0.819, 0.13]	−0.094
High/vocational school	−0.681*** (0.182)	0.000	[−1.037, −0.324]	−0.424	−0.48 (0.26)	0.065	[−0.99, 0.03]	−0.123
College	−0.4* (0.201)	0.047	[−0.794, −0.006]	−0.283	−0.117 (0.295)	0.693	[−0.694, 0.461]	−0.035
Graduate or above	−0.613* (0.284)	0.031	[−1.168, −0.057]	−0.393	0.198 (0.486)	0.684	[−0.754, 1.15]	0.071
Mother's education level								
Middle school	−0.003 (0.153)	0.984	[−0.303, 0.297]	−0.002	0.017 (0.24)	0.943	[−0.453, 0.487]	0.005
High/vocational school	−0.126 (0.179)	0.482	[−0.476, 0.225]	−0.075	−0.145 (0.277)	0.602	[−0.687, 0.398]	−0.040
College	−0.281 (0.189)	0.138	[−0.652, 0.09]	−0.157	−0.256 (0.294)	0.384	[−0.833, 0.321]	−0.068
Graduate or above	−0.143 (0.294)	0.626	[−0.718, 0.432]	−0.085	−0.47 (0.482)	0.329	[−1.414, 0.474]	−0.112
Family economic status								
Average	−0.163 (0.132)	0.214	[−0.421, 0.094]	−0.100	−0.338 (0.201)	0.092	[−0.731, 0.055]	−0.094
Above average	−0.11 (0.151)	0.466	[−0.405, 0.185]	−0.069	−0.099 (0.225)	0.659	[−0.54, 0.342]	−0.031
Very well	−0.237 (0.261)	0.363	[−0.748, 0.274]	−0.140	−0.64 (0.399)	0.109	[−1.423, 0.143]	−0.156
Likelihood-ratio test of overdispersion	G^2 = 639.70, p < 0.000						G^2 = 1012.03, p < 0.000	

*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. AME, Average marginal effects. $G^2 = 2\,(\ln L_{NBRM} - \ln L_{NBR})$.

conflict at home were reporting more traditional bullying perpetration (b = 0.34, SE = 0.113, p = 0.003, AME = 0.217). The association between experiencing conflicts with parents and traditional bullying perpetration was marginally significant (b = 0.207, SE = 0.109, p = 0.058, AME = 0.126). Risk behavior was also positively associated with increased traditional bullying perpetration (b = 0.215, SE = 0.02, p = 0.000, AME = 0.126).

Cyberbullying Perpetration

When examining the prevalence rates of children and adolescents' participation in bullying behavior, 7.8% of the respondents reported that they have participated in cyberbullying in the past year. **Table 2** presented the results of the two negative binomial regression models.

After controlling sociodemographic characteristics, parental involvement was negatively associated with cyberbullying behavior (b = −0.118, SE = 0.02, p = 0.000, AME = −0.013). Self-control were negatively associated with cyberbullying behavior (b = −0.126, SE = 0.05, p = 0.000, AME = −0.033). Witnessing interparental conflict was positively associated with cyberbullying perpetration (b = 0.382, SE = 0.185, p = 0.039, AME = 0.108). Those who reported having conflicts with parents were also reporting increased cyberbullying perpetration (b = 0.331, SE = 0.163, p = 0.042, AME = 0.09). Last, results showed that risk behavior was also positively associated with increased traditional and cyberbullying behavior (b = 0.232, SE = 0.027, p = 0.000, AME = 0.061).

DISCUSSION

The present study contributes to the school bullying literature in China in two ways: (1) assessing the prevalence of both traditional and cyberbullying perpetration, and (2) examining risk factors contributing to bullying behaviors among Chinese children and adolescents using a national survey from China in 2016. About seventeen percent of the respondents reported having participated in any traditional forms of bullying behavior, and 7.8% of the respondents reported that they have participated in cyberbullying in the past year. Findings support our five hypotheses and are consistent with previous studies.

Findings support our hypothesis 1 that low self-control is more likely to associate with both traditional bullying and cyberbullying perpetration. Self-control has long been recognized as an important factor related to deviant behaviors (Gottfredson and Hirschi, 1990; Pratt and Cullen, 2000), such as school bullying behaviors in the present study (Chui and Chan, 2015; Moon and Alarid, 2015). Consistent with past findings, we find that participants with lower self-control scores are more likely to perpetrate both traditional and cyberbullying against their peers. Empirical evidence has supported that individuals with adequate self-control are likely to conform to social rules, and early efforts can be made toward correcting norm violations (Vazsonyi and Huang, 2010). In addition, a study in 25 European countries found no significant differences between females and males on the association between low self-control and cyberbullying perpetration (Vazsonyi et al., 2012). Future research may consider examining the gender differences in the links between self-control and school-based bullying among the Chinese population.

Findings support our hypotheses 2, 3, and 4 that Parental Involvement is associated with a lower likelihood of both traditional bullying and cyberbullying perpetration. Experiencing conflict with parents or interparental conflict is more likely to perpetrate traditional bullying and cyberbullying. These three factors focus on children's and adolescents' experiences of interactions with family, teachers, peers, or school environments in the field of school bullying research (Lee, 2011). We assessed three predictive factors in the present study: parental involvement, experiencing interparental conflict, and having a conflict with parents. The present study shows that parents' involvement reduces the likelihood of both traditional and cyberbullying perpetration among children and adolescents. Parental involvement in this study refers to the social interconnections between more than one microsystem relationship (Lee, 2011). It is also worthy to note that some earlier studies operationalize parental involvement as parents communicate with teachers and peers at schools and observe that a lack of parent involvement is associated with increased bullying behaviors (Flouri and Buchanan, 2003). In contrast, the present study operationalizes parent involvement as a friendly familial interaction between parents and the kids, such as "parents and kids spend a lot of time together," "parents chat often with kids," or "kids feel their parents care for them."

Respondents who reported having conflicts with parents also reported increased cyberbullying perpetration instead of traditional bullying perpetration. This finding conflicts with Moon et al. (2012), which finds Korean children experiencing conflict with parents are more likely to engage with traditional bullying perpetration. Our findings are consistent with other studies which reveal a positive association between having conflicts with parents and cyberbullying perpetration (Stevens et al., 2000; Pepler et al., 2008; Camerini et al., 2020).

Likewise, experiencing interparental conflict is associated with increased perpetration behaviors. Relevant studies have suggested that childhood exposure to domestic violence, having a poor relationship with parents, or lack of parental monitoring are more likely to bully their peers (Cho et al., 2019). Our findings confirm the significant role of a number of factors in shaping school bullying behaviors among children and adolescents throughout psychological growth (Bronfenbrenner, 1979).

Findings support our hypothesis 5 that risk behaviors are positively associated with traditional bullying and cyberbullying perpetration. Our designed risk behaviors items are adopted and revised based on CDC's Youth Risk Behavior Survey (Brener et al., 2013). It is worth mentioning that excessive online gaming provides opportunities for children and adolescents to participate in risk behaviors via media use, contributing to the likelihood of increased cyberbullying behaviors. Our findings are consistent with existing studies among the Chinese population (Lam et al., 2013; Chang et al., 2015; Teng et al., 2020). Future research might explore further the real-time effects of online games on cyberbullying behaviors.

Implications

This study has significant implications for practice and research. First, supportive familial relations and environment (e.g., minimizing exposure to domestic violence) and adequate parental supervision have been recognized as protective factors for bullying perpetration. Teachers and staff alone will not fundamentally mitigate school-based face-to-face or cyberbullying behaviors. School programs involving parents in efforts should be developed. For example, school administrators may consider inviting parents to their safety and health committee and raising parents' awareness about the identified protective factors in empirical evidence in Chinese society. Besides, self-control can be improved through training programs or workshops at school. For example, anger management is suggested to be incorporated into these workshops because proper anger management intervention was reported in previous studies associated with a 60 to 70% decrease in the odds of physical assault (Xue et al., 2019).

Second, the present study does not examine the effects of any interaction terms on bullying. For example, self-control may interact with being at boarding school because the living arrangements by the school potentially affect students' level of self-control (Chui and Chan, 2015). Besides, we find low self-control and having risk behaviors significantly contribute to participants' bullying perpetration. Gottfredson and Hirschi (1990) claim that low self-control correlates with all sorts of deviant behaviors, such as truancy, street fight, or excessive online gaming in the present study. We hypothesize that low self-control affects these moderate risk behaviors, which would, in turn, influence school-based bullying perpetration. Future research may assess further the mediating effect of these proposed risk behaviors on self-control and bullying perpetration.

Last, limited research exists with regard to the examination of different levels of factors from the ecological model in school-based bullying. Since it is not the present study's focus, we do not examine the effects of all levels of factors in the ecological system theory in school-based bullying behaviors. Future studies may consider employing this framework to assess bullying victimization and perpetration among Chinese children and adolescents. In particular, the interactions across the different levels of systems (Espelage, 2014).

Limitations

There are several limitations in the study. First, the present study has a limitation of potential causality due to its cross-sectional nature. Second, participants' self-reporting of conflict with parents, socio-economic status, and academic performance is based on their subjective perceptions, which may not fully reflect the actual situations. Last, we do not assess the victimization experience of the participants. Results may be interpreted differently when we consider the occurrence of both perpetration and victimization.

CONCLUSION

The present study provides insights into understanding the school bullying perpetration among children and adolescents in China. More specifically, findings show that parental involvement and stronger self-control are critical to reducing traditional and cyberbullying perpetration. Besides, we find that participants who have conflicts with parents, witness interparental conflict, and experience risk behaviors positively predict increased traditional and bullying perpetration. Future studies should explore and develop the intervention school programs targeting this population.

DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/restrictions: Available upon request to protect participant's privacy. Requests to access these datasets should be directed to ZH, ziqiang.han@sdu.edu.cn.

ETHICS STATEMENT

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

AUTHOR CONTRIBUTIONS

JX designed the study and wrote the manuscript. RH analyzed the data. LC wrote a portion of the manuscript. ZH and IS revised the manuscript. All authors contributed to the article and approved the submitted version.

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ORIGINAL RESEARCH
published: 25 April 2022
doi: 10.3389/fpsyg.2022.870371

Longitudinal Association Between Child Psychological Abuse and Neglect and Academic Achievement in Chinese Primary School Children: A Moderated Mediation Model

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OPEN ACCESS

Edited by:
Naixue Cui, Shandong University, China

Reviewed by:
Wensong Shen, The Chinese University of Hong Kong, China
Richard Krugman, University of Colorado, United States

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Specialty section:
This article was submitted to Developmental Psychology, a section of the journal Frontiers in Psychology

Received: *06 February 2022*
Accepted: *28 March 2022*
Published: *25 April 2022*

Citation:
Li J, Li Z, Lei X, Yang J, Yu X and Liu H (2022) Longitudinal Association Between Child Psychological Abuse and Neglect and Academic Achievement in Chinese Primary School Children: A Moderated Mediation Model. Front. Psychol. 13:870371. doi: 10.3389/fpsyg.2022.870371

To investigate the relationships among child psychological abuse and neglect (CPAN), children's learning engagement, family socioeconomic status (family SES), and children's academic achievement, 271 children ($M_{age} = 9.41 \pm 0.81$ years old) and their parents participated in this study with a longitudinal design. Results revealed that learning engagement at T1 mediated the relationship between CPAN at T1 and academic achievement at T2 when gender, age, grade, and academic achievement at T1 were under control. Family SES at T1 moderated the relationship between children's learning engagement at T1 and academic achievement at T2. The association between learning engagement and academic achievement was stronger among children from lower family SES. Our findings highlighted the negative impact of CPAN and the critical role of learning engagement in children's academic achievement, especially for those from low SES families.

Keywords: academic achievement, Chinese primary school children, learning engagement, family SES, child psychological abuse and neglect

INTRODUCTION

Child psychological abuse and neglect (hereafter, CPAN) has been a serious public health and social concern in the West (U.S. Department of Health and Human Services et al., 2020), Eastern Europe (Sebre et al., 2004), and Asia (Haque et al., 2021; Yu et al., 2021). The case is similar in China where the prevalence of child abuse was about 37% (Ji and Finkelhor, 2015) and that of neglect of 13 year old was around 49% (Cui et al., 2016). Although it has been widely demonstrated that CPAN could increase the risk of poor academic achievement during childhood (Nikulina et al., 2011; Raby et al., 2019; Scharpf et al., 2021), the roles of individual factors (i.e., children's learning engagement) and family factors (i.e., family socioeconomic status and hereafter, family SES) in its mechanism have not been identified yet. Clarifying how CPAN contributes to children's academic achievement can provide theoretical insight into the adverse factors of children's academic development and may help to guide the intervention with children who have experienced CPAN in practice.

Recent evidence demonstrated that CPAN was inversely correlated to children's academic achievement (McGuire and Jackson, 2018; Zhao et al., 2021), which was related to a crucial individual factor—learning engagement (Mullins and Panlilio, 2021). Specifically, a higher level of CPAN decreased children's learning engagement, and thus, it impeded academic achievement of children. However, there were only samples from the United States to support the mediation mechanism of learning engagement underlying CPAN and children's academic achievement (Mullins and Panlilio, 2021). Other countries, like China, gave no empirical support. In traditional Chinese culture, especially Confucianism, parents always regard child psychological abuse (e.g., harsh rebuke) as loving and caring (Qiao and Chan, 2005). One of the reasons is that they resort to abuse to improve children's learning engagement, in order to improve the child's academic performance. This is different from western culture (Liao et al., 2011). As a result, it is important to explore the relationship among CPAN, learning engagement, and academic achievement in China. In addition, recent studies show that the link between children's learning engagement and their academic achievement may be influenced by family factors, such as family SES (Tucker-Drob and Harden, 2012; Lawson and Farah, 2017; Chen et al., 2021). Thus, this study aimed to investigate whether and how CPAN contributed to children's academic achievement through their learning engagement and to examine the moderation of family SES in Chinese primary school children.

Child Psychological Abuse and Neglect and Academic Achievement

CPAN, also known as child psychological maltreatment, refers to continuously and repetitively inappropriate parenting practices and can be characterized by five types: threatening, ignoring, belittling, intermeddling, and corrupting (Pan et al., 2010). Specifically, abuse involves parents using words and expressions to threaten or humiliate children, restricting them, or encouraging their inappropriate behavior. However, it does not involve physical or sexual contact. Neglect means parents' chronic neglect of children's needs (Pan et al., 2010; Liu F. et al., 2020). Compared with other forms of abuse and neglect, child psychological abuse and neglect is less likely to be identified and addressed (Baker and Brassard, 2019; Baker et al., 2021). In this study, the term of psychological abuse and neglect referred to that children imposed by parents.

Studies highlighted that CPAN and children's academic achievement were significantly and negatively correlated (De Bellis et al., 2013; Romano et al., 2015; McGuire and Jackson, 2018; Su et al., 2019; Strathearn et al., 2020). For example, De Bellis et al. (2013) found that children from 6 to 18 who had been abused and neglected were worse off in mathematics and reading than those who had never been. Meta-analysis evidence (McGuire and Jackson, 2018) also demonstrated that children with experiences of abuse and neglect had lower academic achievement than those without. Recently, a 21-year longitudinal study with 5,200 children highlighted the negative relationship between CPAN and long-term educational outcomes (Strathearn et al., 2020).

However, other studies demonstrated such relationship was insignificant (Eckenrode et al., 1993; Perez and Widom, 1994; Briscoe-Smith and Hinshaw, 2006; Tanaka et al., 2015). For instance, researchers found no significant differences between abused and non-abused ADHD girls in mathematics and reading (Briscoe-Smith and Hinshaw, 2006). Tanaka et al. (2015) also found that those child victims of sexual abuse had similar teacher-rated school performance as those who were not. However, it is worth noting that the participants in the former study were children with atypical development (children with attention deficit hyperactivity disorder), whereas in the latter study, the children's academic achievement was only evaluated by their teacher. More evidence is required from normal children by standard academic tests. Furthermore, researchers have also noted that the relationship between CPAN and children's academic achievement may be affected by other factors (Todd and Wolpin, 2003), such as family factors (i.e., family SES) and individual ones (i.e., learning engagement). Therefore, it is essential to investigate what mechanisms and conditions of CPAN affect children's academic achievement to account for these inconsistent results.

Learning Engagement as a Mediator

As a motivational outcome, learning engagement is concerned with participation in initiating and learning activities (Gonida et al., 2009; Skinner et al., 2009; Xiong et al., 2021), which manifests within the behavioral, emotional, and cognitive components (Archambault and Dupéré, 2017; Olivier et al., 2021). Behavioral engagement involves efforts and persistence in learning activities (Xiong et al., 2021). Emotional engagement includes feelings about school, such as a sense of belonging to the school as well as connection with teachers and peers (Pears et al., 2013; Lam et al., 2014). Cognitive engagement emphasizes on cognitive strategies such as focusing attention (Corno and Mandinach, 1983).

According to ecosystem theory (Bronfenbrenner, 1979; Krishnakumar and Black, 2002; Romano et al., 2015; McGuire and Jackson, 2018), children's development is influenced by interlocking nested environments. Specifically, distal family factors (i.e., CPAN) may influence their developmental outcomes (i.e., academic achievement) through proximal individual factors (i.e., learning engagement; Shonk and Cicchetti, 2001; Mullins and Panlilio, 2021). In other words, children's learning engagement may mediate between CPAN and their academic achievement.

In addition, empirical studies have indicated how children's learning engagement mediated the relationship between CPAN and their academic achievement. Firstly, the significant and negative relationship between CPAN and children's learning engagement has been found (Font and Maguire-Jack, 2013; Johnson and Sinatra, 2013; Pears et al., 2013; Ringle et al., 2020). For example, Pears et al. (2013) found that abused and neglected children had lower emotional and cognitive engagement than other children. Ringle et al. (2020) also noted that CPAN was directly related to poor learning engagement in a longitudinal study. Secondly, children's learning engagement and academic achievement were positively and significantly correlated (Fredricks et al., 2016; Leonard et al., 2016;

Hershberger and Jones, 2018; Ahun et al., 2020; Zhao et al., 2021). For instance, Leonard et al. (2016) identified that learning engagement could positively predict children's reading and mathematics performance. Ahun et al. (2020) also demonstrated that cognitive and behavioral engagement significantly predicted children's later academic achievement. Based on the convergent evidence, it is reasonable to assert that children's learning engagement might mediate between CPAN and academic achievement.

Family SES as a Moderator

Family socioeconomic status (Family SES) broadly represents the ranking or accumulated capital of an individual or a family in a socio-cultural system (Hackman et al., 2010; Chen et al., 2021; Coetzee et al., 2021). Transactional theory (Sameroff, 2009) has emphasized that children's development is influenced by the interaction between the individual and his or her environment. It has also been shown that family SES played a role when learning engagement predicts children's academic achievement (Tucker-Drob and Harden, 2012). Therefore, family SES may moderate between children's learning engagement and academic achievement.

In China, parents' parenting beliefs about children's educational attainment vary according to family SES (Chi and Rao, 2003). As a Chinese saying goes, "knowledge changes destiny," suggesting that low SES families strongly believe that children's learning engagement can enhance academic achievement. Parents and children from low SES families believe that only by studying hard and improving their academic achievement can children change their future (Chi and Rao, 2003; Behrman et al., 2017). Furthermore, these families do not have sufficient capital (e.g., educational resources) to meet the needs of children so that children can only improve their academic achievement on their own, such as through more learning engagement (Kim and Fong, 2013). Thus, the relationship between children's learning engagement and academic achievement was more prominent for children from low SES families (Shah et al., 2018). On the other hand, in high SES families, parents emphasize on holistic development and create an artistic atmosphere, cultivating parent–child reading habits, etc. (Niklas et al., 2020; Yuan et al., 2021). Meanwhile, parents in high SES families help their children promote learning skills; thus, learning engagement is not the only way to improve academic achievement. In summary, in China, family SES may moderate the relationship between learning engagement and academic achievement. The correlation between learning engagement and academic achievement is stronger for children from low SES families than those from high SES families.

The Current Study

Although there has been some evidence of the relationships among CPAN, learning engagement, family SES, and academic achievement in cross-sectional design studies, little is known about the specific mechanism and the direction of the causality underlying such relationships (Armfield et al., 2021; Mullins and Panlilio, 2021). Thus, the main purpose of the present study was to examine the mediating role of learning engagement and moderating role of family SES underlying the relationship between CPAN and children's academic achievement by a longitudinal design. In addition, because CPAN or learning engagement correlated more significantly to children's academic achievement in primary school years (Chung, 2015), the study targeted elementary school children. Moreover, previous studies have indicated that children's gender, age, and grade are statistically and significantly correlated to CPAN, learning engagement, family SES, and children's academic achievement (Meeus, 2016; Guo et al., 2020). Thus, the current study included gender, age, and grade as covariates. The current study proposed three hypotheses (**Figure 1**):

H1: CPAN at T1 would negatively associate with children's academic achievement at T2.

H2: Learning engagement at T1 would mediate the relationship between CPAN at T1 and academic achievement at T2.

H3: Family SES at T1 would moderate the path from learning engagement at T1 to academic achievement at T2. Specifically, the relationship between learning engagement at T1 and academic achievement at T2 is stronger for children from low family SES at T1.

MATERIALS AND METHODS

Participants

Participants were randomly recruited from an elementary school in Shandong Province, China. There were 271 participants at T1 (146 girls; mean age was 9.41 ± 0.81 years old). Nineteen participants were ruled out due to uncompleted data in the questionnaire at T1, and three absent from the exam at T2 were also excluded. Thus, total participants at T2 were 249 (135 girls; mean age was 9.97 ± 0.69 years old). All students were typically developing children without learning difficulties. Written informed consent was received from parents.

Measures

Child Psychological Abuse and Neglect

CPAN was recorded by Child Abuse and Neglect Scale (CPANS) with 23 items (Pan et al., 2010; Luo et al., 2020; Sun et al., 2020). There were five dimensions: threatening (seven items, such as *"my parents have yelled at me"*), ignoring (six items, such as *"my parents have never cared about the changes in my academic performance"*), belittling (four items, such as *"my parents have verbally abused me when I was not expecting it"*), intermeddling (four items, such as *"my parents have peeked at my diary"*), and corrupting (two items, such as *"my parents did not forbid me from drinking alcohol"*). Children gave scores ranging from 0 (never) to 4 (always) on these items. Then, the average scores were calculated, with higher scores indicating a higher level of CPAN. This

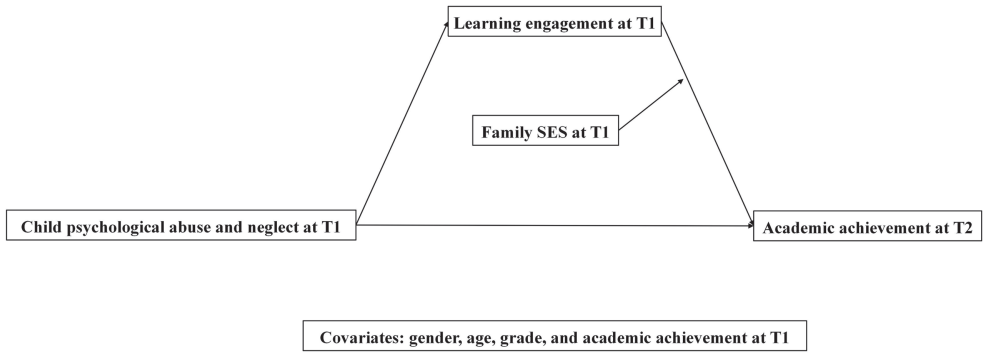

FIGURE 1 | The hypothesized model of child psychological abuse and neglect, children's learning engagement, family SES, and children's academic achievement, controlling for gender, age, grade, and academic achievement at T1.

measure has been widely used among Chinese students. It has been shown well reliability and well valid in previous research (Zhang and Lyu, 2017; Liu F. et al., 2020; Li et al., 2021). Confirmatory factor analyses were also conducted (CFAs) to examine the five dimensions. The CFA supported the model fit indices: $\chi^2/df = 1.88$, CFI = 0.92, TLI = 0.91, SRMR = 0.06, and RMSEA = 0.06. In the current sample, the Cronbach's α of the whole measure was 0.90.

Learning Engagement

Children were required to indicate to what extent each statement was true for the last 6 months on a 5-point Likert scale from "1 = not at all" to "5 = fully." Ten items were used to assess children's learning engagement (Lam et al., 2014). For instance, *"I can study for a long time with few breaks during the period, "I feel happy when I am fully engaged in learning," and "Learning inspires me."* The mean scores were calculated with a higher score indicating more learning engagement. The scale has shown well reliability and validity in Chinese students (Tian and Chen, 2020; Yi et al., 2020). In the current sample, the CFA supported the model fit indices: $\chi^2/df = 1.70$, CFI = 0.98, TLI = 0.98, SRMR = 0.03, and RMSEA = 0.05. In this sample, the Cronbach's α was 0.91.

Family Socioeconomic Status

Family Socioeconomic Status (Family SES) was measured in two aspects: caregivers' educational background and the monthly household income (Cui et al., 2018; Zhou et al., 2018; Liu J. et al., 2020; Chen et al., 2021). The first aspect was coded with "1 = uncompleted elementary school," "2 = elementary school graduation," "3 = junior high school graduation," "4 = high school or junior college," "5 = undergraduate or college," and "6 = master's degree and above," which were reversely scored to calculate the mean value of parental education. For the second aspect, a scale with 11 options ("1 = ¥0 - ¥3,999," "2 = ¥4,000 - ¥5,999," "3 = ¥6,000 - ¥7,999," "4 = ¥8,000 - ¥9,999," "5 = ¥10,000 - ¥11,999," "6 = ¥12,000 - ¥13,999," "7 = ¥14,000 - ¥15,999," "8 = ¥16,000 - ¥17,999," "9 = ¥18,000 - ¥19,999," "10 = ¥20,000 - ¥39,999," and "11 = upper than ¥39,999″) was used. Based on previous studies (Bradley and Corwyn, 2002), the scores of these two measurements were separately standardized and summed as an indicator of family SES, with a higher score indicating higher family SES.

Academic Achievement

Compared with other school subjects, Chinese and mathematics are more valued in Chinese culture. Thus, scores on these two subjects can represent students' academic achievement at school (Ren et al., 2021; Wang et al., 2021). In this study, children's academic achievement was assessed according to their Chinese and math scores in the final examinations based on the national compulsory education curriculum standards. Both the average Chinese and mathematics scores were obtained, and standardized by grade to get a composite academic achievement score (Sebre et al., 2004; Hibbard et al., 2012; Morrissey et al., 2014; Lv et al., 2016). Higher composite standardized scores represented better academic achievement. In this sample, Cronbach's α of academic achievement at T1 was 0.77; Cronbach's α of academic achievement at T2 was 0.80.

Covariates

Students' gender (female and male), grade (2–4 grades), age (7–11 years old), and the composite standardized academic achievement at T1 were included as covariates in the analyses of all models.

Procedures

Two rounds of data on children's academic achievement were collected at school in December 2020 (T1) and June 2021 (T2). There was a semester in the six-month interval between T1 and T2. Previous studies have proven that the developmental changes in academic achievement of primary school students can be revealed in one semester (Bartee et al., 2018). Other variables were collected at T1. Children were required approximately 8 to 10 min to complete the questionnaires. In addition, it took their parents about 3 min to complete family SES survey. Before administering the test, experimenters had received rigorous and standardized training. In addition, to ensure that the participants understood the meaning of 5-point Likert scale from "1" to "5" and each item, experimenters

explained the differences of the five options and each item carefully to the participants during the test. At the end of each survey, each participant received a gift as a compensation for their time. This study was authorized by the university's ethics committee.

Data Analysis

Firstly, preliminary analyses, including descriptive statistics and Pearson correlation analysis, were conducted by the SPSS 26.0 to provide an initial overview of the variables. Secondly, the PROCESS macro software was used to examine the mediation of learning engagement on the relationship between CPAN at T1 and children's academic achievement at T2 (Hayes, 2013). According to Fairchild et al. (2009), the calculation formula of R^2 effect size for mediation analysis is as follows: $R^2_{med} = r^2_{MY} - (R^2_{Y \cdot MX} - r^2_{XY})$. Thirdly, whether family SES at T1 could moderate the mediation was investigated. The moderated mediation was used to examine whether the mediation effect varies with the value of the moderator (Muller et al., 2005). The moderated mediating model was analyzed in the PROCESS macro of Hayes (2013) based on the bootstrapping method. There were 5,000 samples. The effect was significant when the confidence interval did not contain 0 (Preacher et al., 2007). Fourthly, a simple slope analysis was conducted when the moderating effect was significant. Finally, the subgroup (sensitivity) analysis among the fourth graders was conducted (the corresponding results were shown in **Appendix 1**).

RESULTS

Preliminary and Correlation Analyses

Harman's One-factor Test was conducted to test common method bias (Harris and Mossholder, 1996). The results showed that eigenvalues of seven factors were greater than 1 and the factor with the largest eigenvalue explained 27.34% of the variance, which was below the critical value of 40%. Therefore, there was no significant common method bias.

Table 1 presented the results of descriptive statistics (means and standard deviations) and Pearson correlations for the main variables. Specifically, CPAN at T1 was significantly and negatively correlated with learning engagement at T1 ($r = -0.29$, $p < 0.01$), family SES at T1 ($r = -0.13$, $p < 0.05$), and academic achievement at T1 ($r = -0.18$, $p < 0.01$). Learning engagement at T1 was significantly and positively correlated to academic achievement at T1 ($r = 0.14$, $p < 0.05$) and academic achievement at T2 ($r = 0.35$, $p < 0.01$). Family SES at T1 was significantly and positively related to academic achievement at T2 ($r = 0.35$, $p < 0.01$).

Mediation Analyses

First, the total effect of CPAN at T1 on children's academic achievement at T2 was statistically nonsignificant (total effect size = −0.05, $SE = 0.07$, $t = -0.72$, $p = 0.41$, bootstrapped 95% CI = [−0.18, 0.08], $R^2 = 0.10$) when gender, age, grade, and academic achievement at T1 were under control. Then, the results (**Figure 2**) indicated that CPAN at T1 was negatively associated with learning engagement at T1 ($\beta = -0.29$, $SE = 0.06$, $p < 0.001$), which in turn positively predicted academic achievement at T2 ($\beta = 0.42$, $SE = 0.06$, $p < 0.001$). The bootstrapped 95% CI confirmed that the mediation of learning engagement at T1 was significant ($\beta = -0.12$, $SE = 0.05$, bootstrapped 95% CI = [−0.23, −0.05]). The results suggested that learning engagement at T1 mediated the relationship between CPAN at T1 and children's academic achievement at T2, accounting for 63.16% of the total effects. And in our study, R^2 effect-size measures for mediation analysis are 0.05.

Table 2 demonstrated the results of the moderated mediation analysis (Edwards and Lambert, 2007), suggesting that the interaction between learning engagement at T1 and family SES at T1 significantly and negatively predicted children's academic achievement at T2 ($\beta = -0.08$, $SE = 0.03$, $p < 0.05$). Thus, Family SES at T1 moderated the relationship between learning engagement at T1 and children's academic achievement at T2. **Table 3** showed the bootstrapping estimates and slope coefficients for the conditional indirect effects of the models. Learning engagement at T1 was stronger correlated to children's academic achievement at T2 of low family SES. The simple slope tests revealed that the effect of learning engagement at T1 on academic achievement at T2 was stronger for children from low family SES ($\beta = 0.45$, $t = 6.22$, $p < 0.001$) than those from high family SES ($\beta = 0.23$, $t = 2.75$, $p < 0.001$).

DISCUSSION

This study investigated the mechanisms underlying the relationship between CPAN at T1 and children's academic achievement at T2 when individual factors (i.e., learning engagement) and family factors (i.e., family SES) were considered from a longitudinal perspective. The findings showed that children's learning engagement at T1 mediated the relationship between CPAN at T1 and children's academic achievement at T2. Moreover, family SES at T1 moderated the pathway from children's learning engagement at T1 to academic achievement at T2. Specifically, the relationship between children's learning engagement and academic achievement was stronger for those from low SES families.

Child Abuse and Neglect and Academic Achievement

Our findings showed that the relationship between CPAN at T1 and academic achievement at T2 was not significant when gender, age, grade, and academic achievement at T1 were under control, which was inconsistent with our hypothesis. There might be two possible explanations. First, this might be related to the broad conceptual implications of CPAN. Previous studies have shown that neglect is more strongly correlated to academic deficits than other forms of abuse (Gauthier et al., 1996; Fantuzzo et al., 2011; Romano et al., 2015). For example, Maclean et al. (2016) found that children's poorer academic achievement was strongly correlated with neglect rather than emotional abuse. Researchers believed that neglect was more detrimental to academic achievement because children's basic

TABLE 1 | Descriptive statistics and correlations among variables.

Variable	*M*	SD	Min.	Max.	1	2	3	4	5	6	7
1. Gender	-	-	1	2	-						
2. Grade	3.16	0.78	2	4	−0.26	-					
3. Age	9.47	0.69	7	11	−0.03	0.80**	-				
4. Academic achievement at T1	0.00	1.00	−4.62	1.53	−0.13*	0.00	−0.02	-			
5. CPAN at T1	0.66	0.50	0.00	3.22	0.01	0.17**	0.09	−0.19**	-		
6. Learning engagement at T1	3.40	1.86	1.00	5.00	−0.06	0.01	0.03	0.14*	−0.30**	-	
7. Family SES at T1	0.00	1.00	−4.77	4.55	−0.02	−0.05	−0.13*	0.01	−0.13*	0.10	-
8. Academic achievement at T2	0.00	1.00	−5.24	1.39	−0.11	0.00	−0.07	−0.05	−0.03	0.39**	0.35**

*N = 249. Age was expressed by years; academic achievement and family SES were indicated by standardized z-scores. *p < 0.05; **p < 0.01.*

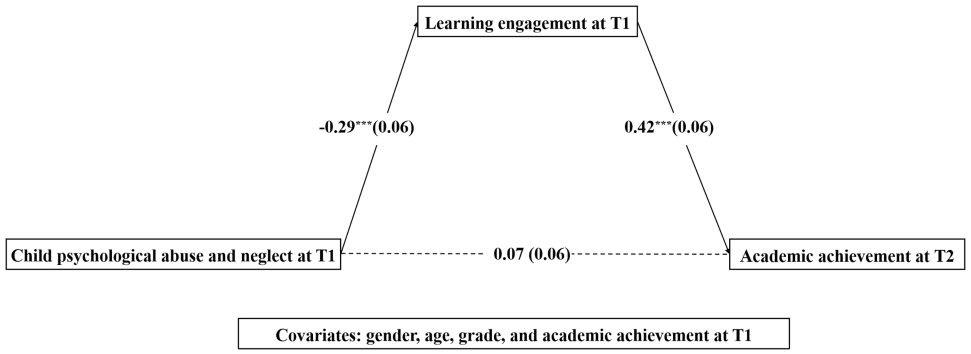

FIGURE 2 | The mediation effect of learning engagement at T1 in the relationship between child psychological abuse and neglect at T1 and children's academic achievement at T2.

TABLE 2 | The moderated mediation models.

Predictor	Learning engagement at T1			Academic achievement at T2		
	β	*SE*	Bootstrapped 95% CI	*β*	*SE*	Bootstrapped 95% CI
Gender	−0.12	0.12	[−0.36, 0.13]	−0.16	0.11	[−0.38, 0.05]
Age	0.06	0.13	[−0.20, 0.32]	−0.12	0.12	[−0.36, 0.11]
Grade	0.04	0.12	[−0.19, −0.28]	0.07	0.10	[−0.13, 0.28]
CPAN at T1	−0.27***	0.06	[−0.40, −0.15]	0.10	0.06	[−0.02, 0.22]
Family SES at T1				0.19***	0.03	[0.12, 0.25]
Learning engagement at T1 × Family SES at T1				−0.08*	0.03	[−0.15, −0.01]
Learning engagement at T1				0.38***	0.06	[0.27, 0.50]
R^2	0.11			0.30		
F	4.00***			11.25***		

*N = 249. The models control for gender, age, grade, and academic achievement at T1. *p < 0.05; **p < 0.01; ***p < 0.001.*

TABLE 3 | Bootstrap estimates of indirect effects at −1SD and +1SD family SES levels.

SD level	Indirect effect (*β*, *Boot SE*)	Bootstrapped 95% CI
−1SD	−0.15, 0.06	[−0.29, −0.05]
+1SD	−0.06, 0.05	[−0.21, −0.01]

The results control for gender, age, grade, and academic achievement at T1.

needs were chronically unmet. These children may not have access to the resources needed for early development, including the resources they need to succeed in school (Fantuzzo et al., 2011). As a result, children who suffer from chronic neglect struggle to reach significant developmental milestones in areas related to academic achievement (McGuire and Jackson, 2018). However, CPAN, in our study, included not only neglect but also multiple forms of abuse such as verbal threats and humiliation of children, which may have prevented us from finding a direct

link between CPAN and academic achievement. Future research could expand the sample size and make a clear distinction between neglect and abuse to examine how different forms of CPAN correlated to children's academic achievement. Second, the correlation between variables may become insignificant when additional variables are more tightly controlled (Boden et al., 2007; Amland et al., 2020; Xiong et al., 2021). Therefore, no direct association between CPAN and academic achievement was found in this study.

Mediation of Children's Learning Engagement

The results showed that learning engagement at T1 fully mediated the relationship between CPAN at T1 and academic achievement at T2, which supported hypothesis 2 and was consistent with Mullins and Panlilio (2021). This indirect effect can be accounted for as follows. Firstly, children who suffered psychological abuse and neglect find it difficult to connect to teachers and peers (Bigras et al., 2015; He et al., 2015), and they lack a sense of belonging to school (Sperry and Widom, 2013), reducing emotional learning engagement. Secondly, children with CPAN could not engage constructively in learning activities (Furrer and Skinner, 2003), which impedes behavioral learning engagement. Next, abused and neglected children were chronically exposed to an unsafe and threatening environment, so they find it difficult to focus their attention and make efforts to complete learning tasks. (Van Harmelen et al., 2014; Hawkins et al., 2021). In other words, they lack cognitive engagement in learning activities. Based on these, exposure to CPAN had a negative impact on children's learning engagement. Moreover, according to learning motivation theory (Skinner et al., 2009), learning engagement, as a motivational factor, played a critical role in children's academic achievement. For example, low cognitive engagement of a child would make him unwilling to study hard, which impeded academic achievement (Quílez-Robres et al., 2021).

Moderation of Family SES

The hypothesis that family SES at T1 moderated the path from learning engagement at T1 to academic achievement at T2 was confirmed in this study. Specifically, the relationship between learning engagement at T1 and academic achievement at T2 was stronger for children from low SES families. This phenomenon could be explained by the "compensation effects" (Wang et al., 2017). Children from higher SES families had more learning resources and support conducive to learning achievement (Shi and Tan, 2021). However, since children from low SES families have limited learning resources, learning motivation behavior (i.e., learning engagement) compensates for this deficiency (Shah et al., 2018). Thus, learning engagement had a greater impact on the children from low SES families. It is worth noting that among all the participants, children with high family SES at T1 and learning engagement at T1 got the best academic achievement at T2. Children with lower family SES and learning engagement at T1 got the worst (**Figure 3**). These findings could be accounted for by previous studies (Poon, 2020), low family SES and low learning engagement were could be dual risk factors for academic achievement of children, showing "compensatory effect" is limited and cannot fully compensate for the academic risks caused by low family SES (Wang et al., 2017). Therefore, educators should pay more attention to children with lower family SES who has lower learning engagement. This moderation further supported that more learning engagement could compensate for the lower academic achievement of the children from lower SES families.

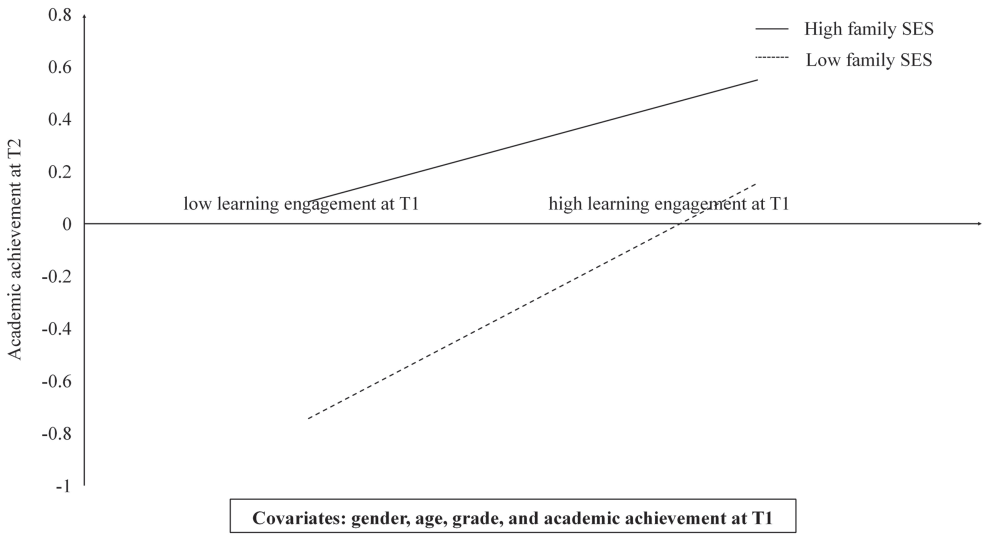

FIGURE 3 | Family SES at T1 as a moderator in the association between learning engagement at T1 and academic achievement at T2. Two levels of family SES are represented graphically: a standard deviation above and below the mean.

Limitations and Future Directions

Firstly, previous research had shown that the relationship between CPAN and children's academic achievement varied according to CPAN forms (Coohey et al., 2011; Maclean et al., 2016). However, these different forms of CPAN were not distinguished in the study. It is still unknown whether these differences affect the moderated mediation model. CPAN in the study was also limited within the family. Future studies could refine instruments to further distinguish and compare different forms or scales of abuse (e.g., physical versus mental abuse and neglect; in-home versus out-of-home abuse and neglect) to show different effects in the moderated mediation model. Secondly, the participants in this study were mainly from one primary school in a medium-sized city in China, which cannot represent the scope of family SES in China. According to the challenge model (Fergus and Zimmerman, 2005), the relationship between family risk factors (i.e., SES) and children's academic outcomes (i.e., academic achievement) is nonlinear. Future studies could include subjects from extreme family SES and explore whether its moderation on the pathway from learning engagement to academic achievement differed. Besides, our participants also include a group of young children. Although we have taken a lot of measures to promote students' understanding, including having a strict and uniform application process, offering detailed explanation before testing and providing one-to-one explanation to unclear students, there was a possibility of information bias among younger children. In the future, students in fourth grade and above should be included for further verification. Thirdly, CPAN and learning engagement in this study both relied on children's self-reports, which may to some bias (Hambrick et al., 2014). Future studies could validate the results by using objective measures based on different samples (e.g., teachers and parents). Finally, the following up time was a semester (6 months) in the current study. It is more convincing to infer causality between early CPAN and children's academic achievement with a longer time interval in a follow-up design. Besides, the study was conducted during the COVID-19 pandemic, so results in a normal situation are needed.

Conclusion and Educational Implications

This longitudinal study demonstrated how individual factors (i.e., learning engagement) and family factors (i.e., family SES) affect the relationship between CPAN and children's academic achievement. Specifically, learning engagement at T1 mediated the correlation between CPAN at T1 and academic achievement at T2. Family SES at T1 moderated the pathway from learning engagement at T1 to children's academic achievement at T2.

The findings provided guidance for the government, schools, and parents. Firstly, the government should provide more policy support for children exposed to CPAN and from low SES families because they are more prone to have poor academic achievement (Dube and McGiboney, 2018). Secondly, schools and teachers should focus more on the learning engagement of children of CPAN to mitigate the negative impact on academic achievement. For example, they can improve children's cognitive engagement through attention training, emotional engagement by improving the teacher-student relationship, and behavioral engagement by measures such as raising their rule awareness. Thirdly, parents from low SES families should focus more on their children's learning engagement. For instance, mothers can provide more emotional warmth and fathers can provide more behavioral guidance to improve children's learning engagement (Pereira et al., 2016; Wang et al., 2019).

DATA AVAILABILITY STATEMENT

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

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Ethics Committee of the Department of Psychology, School of Humanities and Social Sciences, Beijing Forestry University. Written informed consent to participate in this study was provided by the participants' legal guardian/ next of kin.

AUTHOR CONTRIBUTIONS

XY, JL, and ZL contributed to the conception and design of the study. XY and HL organized the database. XY is the gatekeeper of the article as a whole. JL and ZL performed the statistical analysis and wrote the first draft of the manuscript. JY and XL wrote parts of the manuscript. All authors contributed to the article and approved the submitted version.

FUNDING

This research was supported by the Medium- and Long-term Research Projects for Teachers, Beijing Forestry University (BJFU2021ZCQ01) to XL.

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APPENDIX 1

The subgroup (sensitivity) analysis among the fourth graders was conducted. The results (see the table below) indicated that CPAN at T1 was negatively associated with learning engagement at T1 ($\beta = -0.27$, $SE = 0.06$, $p < 0.001$), which in turn positively predicted academic achievement at T2 ($\beta = 0.40$, $SE = 0.09$, $p < 0.001$). This indicated significant mediating role of learning engagement at T1. However, family SES at T1 did not moderate the relationship between learning engagement at T1 and children's academic achievement at T2. We speculate that the insignificant moderating results may due to limited sample ($N = 99$). In the future, we could expand the sample size for fourth graders and above to investigate the moderating role of family SES at T1.

The moderated mediation models in fourth graders.

Predictor	Learning engagement at T1			Academic achievement at T2		
	β	*SE*	Bootstrapped 95% CI	*β*	*SE*	Bootstrapped 95% CI
Gender	0.18	0.21	[−0.23, 0.60]	0.37*	0.18	[0.03, 0.72]
Age	−0.31	0.30	[−0.91, 0.29]	−0.23	0.25	[−0.72, 0.27]
CPAN at T1	−0.27***	0.06	[−0.45, −0.09]	0.06	0.08	[−0.10, 0.22]
Family SES at T1				0.12*	0.05	[0.12, 0.25]
Learning engagement at T1 × Family SES at T1				−0.04	0.05	[−0.14, 0.05]
Learning engagement at T1				0.40***	0.09	[0.23, 0.57]
R^2	0.11			0.31		
F	4.00***			5.84***		

*N = 99. The models control for gender, age, grade, and academic achievement at T1. *p < 0.05; **p < 0.01; ***p < 0.001.*

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