



BASIC RESEARCH ARTICLE



Associations of parental labour migration and childhood maltreatment with psychosocial health among adolescents and young adults in China

Yuwei Yang^a, Weiqing Jiang^b, Yitong He^b, Wanxin Wang^b, Yiling Hua^b, Cuihong Huang^b, Xinyu Zheng^b, Ciyong Lu^b, Xueying Du^c and Lan Guo^b

^aDepartment of Disease Control and Prevention, Guangdong Provincial Center for Disease Control and Prevention, Guangzhou, People's Republic of China; ^bDepartment of Medical Statistics and Epidemiology, School of Public Health, Sun Yat-sen University, Guangzhou, People's Republic of China; ^cDepartment of Prevention and Treatment of Common Diseases, Health Promotion Center for Primary and Secondary Schools of Guangzhou Municipality, Guangzhou, People's Republic of China

ABSTRACT

Background: Few studies have simultaneously considered the impacts of parental labour migration and childhood maltreatment on psychosocial health.

Objective: To estimate the complex associations of parental labour migration and childhood maltreatment with psychosocial health among adolescents and young adults in China.

Method: This cross-sectional study was conducted among undergraduates aged 17 to 24 years from sixty colleges and universities across 10 provinces of China. Childhood maltreatment was assessed using the Childhood Trauma Questionnaire-Short Form, and psychosocial health was measured using the Strengths and Difficulties Questionnaire (SDQ). Weighted linear mixed regression models, multiplicative interactions, and joint and mediation analyses were performed.

Results: Of the 28,810 participants included (mean [SD] age, 19.87 [1.62] years), 12035 (41.8%) were male. In the fully adjusted model, participants who experienced parental migration were more likely to report higher levels of SDQ total difficulties (e.g. $\beta = 0.16$ [95% CI, 0.05 to 0.28]) compared with those with non-migrant parents. A positive association was found between the cumulative number of childhood maltreatment and SDQ total difficulties ($\beta = 0.54$ [95% CI, 0.49 to 0.60]), with a dose-response relationship observed for the levels of childhood maltreatment and SDQ total difficulties. Compared with individuals without exposure to both parental migration and childhood maltreatment, those exposed to both parental migration and at least 2 numbers of childhood maltreatment had the highest magnitude of psychosocial health difficulties ($\beta = 1.12$ [95% CI, 0.91 to 1.33]). Moreover, childhood maltreatment may partially mediate the association between parental migration and psychosocial health, with the mediation proportion being 58.8%.

Conclusion: Exposure to parental labour migration or childhood maltreatment was positively associated with psychosocial health among adolescents and young adults. Parental migration and childhood maltreatment may jointly aggravate psychosocial health problems. These findings indicate the necessity of comprehensive interventions targeting adversity stressors to improve psychosocial health, especially for left-behind children experiencing maltreatment.

Asociaciones entre la migración laboral de los padres y el maltrato infantil con la salud psicosocial en adolescentes y adultos jóvenes en China

Antecedentes: Pocos estudios han considerado simultáneamente los impactos de la migración laboral de los padres y el maltrato infantil en la salud psicosocial.

Objetivo: Estimar las complejas asociaciones entre la migración laboral de los padres y el maltrato infantil con la salud psicosocial en adolescentes y adultos jóvenes en China.

Método: Este estudio transversal se llevó a cabo entre estudiantes universitarios de 17 a 24 años, provenientes de sesenta instituciones de educación superior en diez provincias de China. El maltrato infantil fue evaluado mediante el Cuestionario de Trauma Infantil – Forma Abreviada, y la salud psicosocial se midió utilizando el Cuestionario de Fortalezas y Dificultades (SDQ, por sus siglas en inglés). Se realizaron análisis mediante modelos de regresión lineal mixta ponderada, interacciones multiplicativas, análisis conjuntos y de mediación.

Resultados: De los 28.810 participantes incluidos (edad media [DE] de 19,87 [1,62] años), 12.035 (41,8%) eran hombres. En el modelo con ajuste completo, los participantes que experimentaron migración parental presentaron una mayor probabilidad de reportar niveles

ARTICLE HISTORY

Received 2 July 2024

Revised 12 March 2025

Accepted 23 April 2025

KEYWORDS

Parental labour migration; childhood maltreatment; psychosocial health; adolescents; young adults


PALABRAS CLAVE

Migración parental; maltrato infantil; salud psicosocial; adolescentes; adultos jóvenes

HIGHLIGHTS

- Parental migration and childhood maltreatment were positively associated with the psychosocial health of adolescents and young adults.
- Individuals with parental labour migration were at a higher risk of experiencing childhood maltreatment.
- Parental migration and childhood maltreatment may jointly aggravate psychosocial health problems.

CONTACT Lan Guo  guolan3@mail.sysu.edu.cn  Department of Medical Statistics and Epidemiology, School of Public Health, Sun Yat-sen University, 74 Zhongshan Rd 2, Guangzhou, 510080, People's Republic of China

 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/20008066.2025.2500139>.

© 2025 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (<http://creativecommons.org/licenses/by-nc/4.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent.

más altos de dificultades totales en el SDQ (por ejemplo, $\beta = 0,16$ [IC 95%, 0,05 a 0,28]) en comparación con aquellos con padres no migrantes. Se encontró una asociación positiva entre el número acumulado de experiencias de maltrato infantil y las dificultades totales en el SDQ ($\beta = 0,54$ [IC 95%, 0,49 a 0,60]), observándose una relación dosis-respuesta entre los niveles de maltrato infantil y las dificultades totales en el SDQ. En comparación con las personas no expuestas ni a migración parental ni a maltrato infantil, aquellas expuestas a ambos factores, incluyendo al menos dos tipos de maltrato infantil, presentaron la mayor magnitud de dificultades psicosociales ($\beta = 1,12$ [IC 95%, 0,91 a 1,33]). Además, el maltrato infantil podría mediar parcialmente la asociación entre la migración parental y la salud psicosocial, con una proporción de mediación del 58,8%.

Conclusión: La exposición a la migración laboral de los padres o al maltrato infantil se asoció positivamente con problemas en la salud psicosocial en adolescentes y adultos jóvenes. La migración parental y el maltrato infantil pueden agravar conjuntamente los problemas de salud psicosocial. Estos hallazgos indican la necesidad de intervenciones integrales que aborden factores estresantes adversos para mejorar la salud psicosocial, especialmente en el caso de niños que quedan en casa y sufren maltrato.

1. Introduction

Labour migration refers to the movement of individuals from low-wage areas to regions offering higher-wage employment opportunities. Although many countries and regions have witnessed rising rates of international or internal labour migration (e.g. from rural to urban settings within a country) in recent decades, China stands out as the country most significantly impacted by internal labour migration (Yuan & Wang, 2016), with 375.8 million migrant workers in 2021 (National Bureau of Statistics, 2021). As a result of labour migration, the household incomes of migrants often increase, leading to improved financial stability and better living conditions for their families. However, the children of these migrants are frequently left behind in the care of other family members or caregivers due to the transient nature of their parents' work (Fellmeth et al., 2018). Although various services and intervention strategies have been implemented to improve the health and well-being of left-behind children, these children continue to face an elevated risk of poor psychosocial health (Fellmeth et al., 2018; Zhu et al., 2023). Psychosocial health broadly encompasses mental (e.g. values, attitudes, beliefs), social (e.g. interacting with others, social support), and emotional behaviour (e.g. emotional reaction to specific scenarios) dimensions of overall health (Smith & Hamer, 2018).

Numerous studies have examined the association between parental migration and the health outcomes of their offspring (Fellmeth et al., 2018; Ma et al., 2021). A comprehensive meta-analysis found that parental migration was associated with an increased risk of depression, anxiety, suicidal ideation, conduct disorders, substance use, wasting, and stunting among left-behind children and adolescents in low-income and middle-income countries (LMICs) (Fellmeth et al., 2018). A recent study reported that compared with children of parents who did not migrate, children left behind by labour-migrating parents had an

elevated risk of emotional and behavioural problems (Zhou et al., 2020). However, while most previous studies focus on children and adolescents, limited research has explored the association of childhood parental migration with psychosocial health among left-behind young adults (Wang et al., 2022). Like childhood and adolescence, young adulthood is a developmentally distinct period that can be viewed as a critical window of development, significantly affecting life trajectories (Breiner et al., 2015).

Adverse childhood experiences (ACEs), including childhood maltreatment, encompass a broad spectrum of traumatic and distressing events during childhood, such as physical neglect, emotional neglect, or sexual abuse (Bhutta et al., 2023). A substantial body of literature has documented the profound and long-lasting impacts of ACEs on various social and health-related problems (Bhutta et al., 2023), including emotional and behavioural issues (Qu et al., 2024). Although evidence suggests that both parental migration and ACEs independently increase the risk of emotional and behavioural problems among left-behind children and adolescents (Fellmeth et al., 2018; Qu et al., 2024), few studies have simultaneously considered the associations of parental migration and childhood maltreatment with emotional and behavioural problems among adolescents and young adults. The life-span development theory posits that human development is a lifelong process, with earlier and later experiences interconnected (Shangguan et al., 2023). According to the cumulative risk hypothesis (Appleyard et al., 2005; Sameroff, 2000), the cumulation of risk factors, rather than the presence of specific individual risks, plays a critical role in psychological development. The separation caused by parental migration, when combined with childhood maltreatment, may create cumulative stress that significantly harms psychosocial health (Sokołowski et al., 2020). Furthermore, a recent study found that individuals with refugee-background parents reported higher rates of

ACEs compared to the general population (Bager et al., 2022), supporting the idea that ACEs may mediate the association between parental migration and psychosocial health.

Therefore, the primary aim of this study was to investigate the individual and joint associations between parental labour migration and childhood maltreatment with psychosocial health among adolescents and young adults in China. The secondary aim was to explore whether and to what extent childhood maltreatment mediates the association between parental labour migration and psychosocial health.

2. Methods

2.1. Study design and participants

This study used the data from a nationwide cross-sectional study of 30,733 undergraduates from sixty colleges and universities across 10 provinces of China, which was conducted from March to October 2019. This used a multistage, stratified cluster, random sampling approach. Detailed data collection procedures have been described previously (eMethods in Supplement). After excluding 110 participants who did not respond to the items regarding parental migration, 1,232 participants with missing information on any of the questions about childhood maltreatment, and 581 participants who did not complete an assessment of psychosocial health with missing data for more than 10% of the items on psychosocial health, we included 28,810 participants in the current analysis. A flowchart of this study can be found in Figure 1. The differences in demographics between included and excluded participants were shown in eTable 1 in Supplement. Participation in this study was voluntary, with all participants providing written informed consent explaining the study's purposes, processes, benefits, and risks. Ethical approval for the study was obtained from the Sun Yat-sen University School of Public Health institutional review board (Ethics Number: L2019119). This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines.

2.2. Measurement

2.2.1. Assessment of parental labour migration

Parental labour migration was categorized as yes based on the question, 'Before you were 16, have/did your father or/and mother migrate to an urban area for employment and not live with you for at least half a year?' For those who answered yes to parental migration, the parental migration pattern was investigated. The parental migration pattern was categorized into 3 groups (father, mother, or both parents) in response to the question, 'Before you were 16, which

of your parent(s) migrated to an urban area for employment and were not living with you for at least half a year?' (Ma et al., 2021; Zhou et al., 2020). These questions have shown good internal consistency reliability in previous studies (Ma et al., 2021; Zhou et al., 2020).

2.2.2. Assessment of childhood maltreatment

Childhood maltreatment was measured by the Childhood Trauma Questionnaire-Short Form (CTQ-SF) (Bernstein et al., 2003), which comprises five subscales that measure different types of childhood maltreatment, including physical neglect, emotional neglect, physical abuse, emotional abuse, and sexual abuse. The five subscale scores ranged from 5 to 25, with higher scores indicating more severe childhood maltreatment. Additionally, each type of maltreatment was dichotomized at validated cut-off points (see eMethods & eTable 2 in Supplement for details). The five types were summed to calculate the cumulative number of childhood maltreatment. Participants were then categorized into 3 groups based on the cumulative number of childhood maltreatment: 0, 1, and ≥ 2 (Wen et al., 2024). The CTQ-SF has demonstrated good test-retest reliability in previous studies (Badenes-Ribera et al., 2024; Xiang et al., 2021).

2.2.3. Dependent variable

Psychosocial health is defined by the emotional and behavioural problems derived from the self-report version of the Strengths and Difficulties Questionnaire (SDQ), which has been validated and widely used, demonstrating satisfactory psychometric properties (Goodman et al., 1998; Lai et al., 2010). Details about the measurements are provided in eMethods in Supplement. The SDQ comprises 25 items operationalizing 5 subscales: hyperactivity/inattention, conduct problems, emotional problems, peer problems, and prosocial behaviour. Each item is rated on a 3-point scale indicating the presence of the behaviour (not true, somewhat true, and certainly true). The total difficulties score is calculated as the sum of the scores from all subscales, excluding prosocial behaviour. Based on previous studies (Ammerman et al., 2023; Grootendorst-van et al., 2021), we used the total difficulties scores (range, 0–40, with higher values indicating greater severity of problems) as they reflect the broad expression of emotional and behavioural problems. The Cronbach's alpha for the total difficulties was 0.77 in the present study, 0.75 for peer problems, 0.78 for emotional problems, 0.75 for conduct problems, and 0.71 for hyperactivity.

2.3. Covariates

Covariates for this study were selected following established guidelines (Greenland et al., 2016; Greenland &

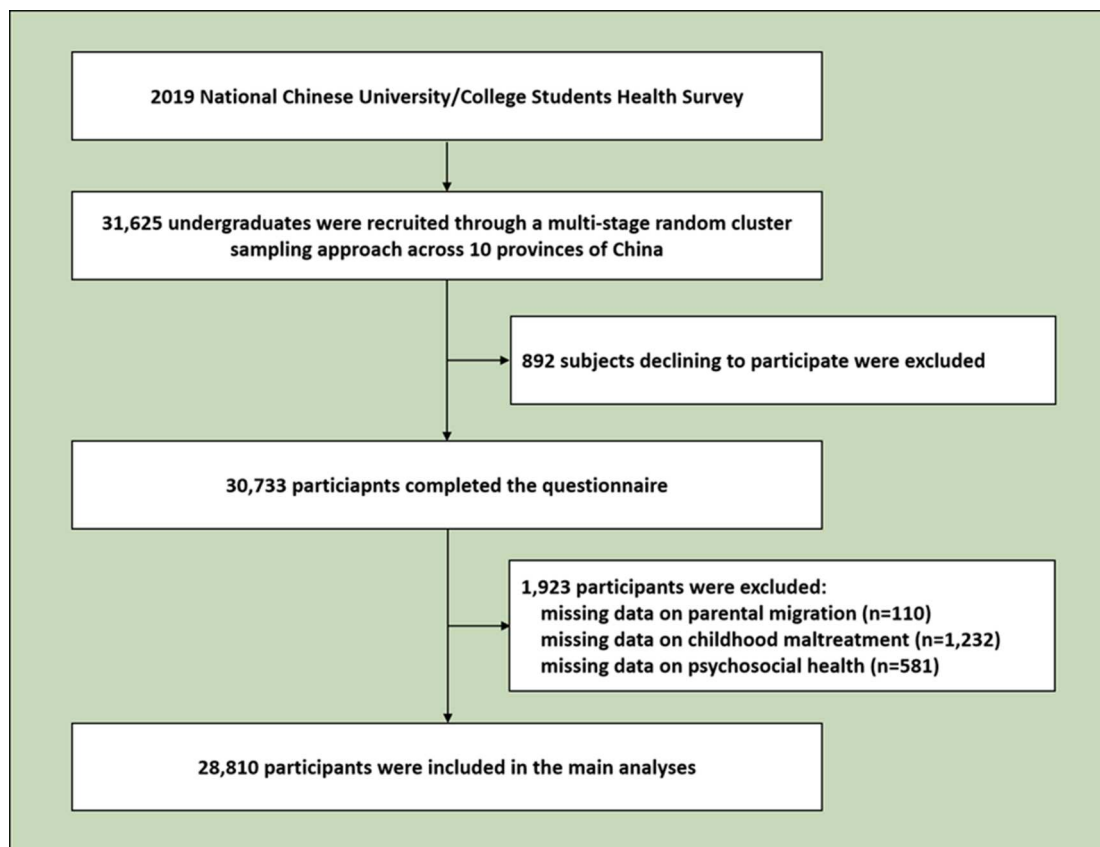


Figure 1. A flowchart of this study.

Pearce, 2015; von Elm et al., 2007) based on two primary criteria: (1) evidence from prior literature identifying these variables as potential confounders in the associations between parental labour migration, childhood maltreatment, and psychosocial health (Ma et al., 2021; Qu et al., 2024; Rosado et al., 2021); and (2) results from univariate analyses performed on our dataset (Table 1). The covariates included age, sex, province, ethnicity, residence, living costs, academic pressure, feeling lonely, a single-parent family, a single-child family, parental education, family relationships, parental drunkenness, teacher-classmate relationships, and classmate relationships. Details regarding the coding of the covariables are presented in eTable3 in Supplement.

2.4. Statistical analysis

Participants' characteristics were summarized according to parental migration and levels of childhood maltreatment. Data were presented as mean (SD) for continuous variables or number (percentage) for categorical variables. To estimate the association of parental labour migration (categorized as a dichotomous variable: presence or absence of migration, or as an unordered categorical variable: none, father, mother, or both parents) with psychosocial health, we performed weighted linear mixed regression models. These models accounted for the stratified cluster survey

design and non-response (Dey et al., 2025). Similarly, the associations between childhood maltreatment (treated as continuous: cumulative number of experienced maltreatment; ordinal: 0, 1, or ≥ 2 events; or individual types: physical neglect, emotional neglect, emotional abuse, physical abuse, and sexual abuse) and psychosocial health were assessed using separate weighted linear mixed regression models. The overall proportion of missing covariates was low, ranging from 0.14% to 3.13%, and the missingness was missing at random by the Little's MCAR test. As such, cases with missing covariate data were automatically excluded when performing regression analyses (Dong & Peng, 2013). Weighted linear mixed regression models were implemented using the 'meglm' command in Stata, and results were reported as unstandardized β coefficients with 95% confidence intervals (CIs). To explore the associations between parental migration and the cumulative number of childhood maltreatment experiences, additional weighted linear mixed regression models were performed. To investigate the joint association of childhood maltreatment and parental migration with psychosocial health, we conducted joint analyses, which required ordinal variables to designate the hypothesized lowest-risk group as the reference category (Li et al., 2012). Childhood maltreatment was classified into three levels (0, 1, or ≥ 2 events), and parental migration was categorized as a binary variable (with or without migration) to

Table 1. Characteristics of the study population by the parental labour migration status and different levels of experienced childhood maltreatment.

Characteristics	Overall (N = 28810)	Parental labour migration status			Different levels of experienced childhood maltreatment			
		Yes (n = 11734, 40.7%)	No (n = 17076, 59.3%)	P- value ^a	0 (n = 16204, 56.2%)	1 (n = 7169, 24.9%)	≥2 (n = 5437, 18.9%)	P- value ^a
Age, mean (SD), y	19.87 (1.62)	19.90 (1.56)	19.86 (1.65)	.044	19.88 (1.65)	19.86 (1.60)	19.88 (1.53)	.656
Sex ^b								
Male	12035 (41.8)	5180 (44.2)	6855 (40.2)	<.001	5957 (36.8)	3246 (45.3)	2832 (52.2)	<.001
Female	16736 (58.2)	6532 (55.8)	10204 (59.8)		10230 (63.2)	3913 (54.7)	2593 (47.8)	
Province								
Guangdong	3135 (10.9)	1173 (10.0)	1962 (11.5)	<.001	1621 (10.0)	828 (11.5)	686 (12.6)	<.001
Guizhou	2726 (9.5)	1314 (11.2)	1412 (8.3)		1309 (8.1)	739 (10.3)	678 (12.5)	
Henan	3081 (10.7)	1371 (11.7)	1710 (10.0)		1861 (11.5)	777 (10.8)	443 (8.1)	
Heilongjiang	2743 (9.5)	1149 (9.8)	1594 (9.3)		1486 (9.2)	599 (8.4)	658 (12.1)	
Hunan	2921 (10.1)	1403 (12.0)	1518 (8.9)		1559 (9.6)	807 (11.3)	555 (10.2)	
Inner Mongolia	2802 (9.7)	888 (7.6)	1914 (11.2)		1767 (10.9)	621 (8.7)	414 (7.6)	
Shandong	3057 (10.6)	908 (7.7)	2149 (12.6)		2085 (12.9)	634 (8.8)	338 (6.2)	
Xinjiang	2627 (9.1)	973 (8.3)	1654 (9.7)		1562 (9.6)	598 (8.3)	467 (8.6)	
Yunnan	2671 (9.3)	962 (8.2)	1709 (10.0)		1436 (8.9)	733 (10.2)	502 (9.2)	
Chongqing	3047 (10.6)	1593 (13.6)	1454 (8.5)		1518 (9.4)	833 (11.6)	696 (12.8)	
Ethnicity ^b								
Han	23932 (83.6)	9722 (83.5)	14210 (83.8)	.485	13602 (84.5)	5935 (83.4)	4395 (81.4)	<.001
Other	4678 (16.4)	1926 (16.5)	2752 (16.2)		2495 (15.5)	1180 (16.6)	1003 (18.6)	
Residence ^b								
Rural	8665 (30.2)	8723 (74.7)	11293 (66.4)	<.001	11103 (68.7)	5092 (71.4)	3821 (70.8)	<.001
Urban	20016 (69.8)	2960 (25.3)	5705 (33.6)		5048 (31.3)	2038 (28.6)	1579 (29.2)	
Living costs ^b , \$/month								
<150	8570 (29.8)	3689 (31.5)	4881 (28.7)	<.001	4484 (27.7)	2182 (30.5)	1904 (35.2)	<.001
150–300	18931 (65.9)	7538 (64.4)	11393 (66.9)		11043 (68.3)	4660 (65.2)	3228 (59.6)	
>300	1228 (4.3)	471 (4.0)	757 (4.4)		639 (4.0)	309 (4.3)	280 (5.2)	
Academic pressure ^b								
Below average	8460 (29.5)	3167 (27.1)	5293 (31.1)	<.001	4924 (30.5)	1980 (27.8)	1556 (28.8)	<.001
Average	12256 (42.7)	4954 (42.4)	7302 (42.9)		7055 (43.7)	3102 (43.5)	2099 (38.9)	
Above average	7967 (27.8)	3555 (30.4)	4412 (25.9)		4175 (25.8)	2053 (28.8)	1739 (32.2)	
Feeling lonely ^b								
Yes	12759 (44.5)	5703 (48.9)	7056 (41.5)	<.001	6175 (38.3)	3406 (47.8)	3178 (58.8)	<.001
No	15899 (55.5)	5962 (51.1)	9937 (58.5)		9956 (61.7)	3718 (52.2)	2225 (41.2)	
Single-parent family								
Yes	1836 (6.4)	1393 (11.9)	443 (2.6)	<.001	765 (4.7)	478 (6.7)	593 (10.9)	<.001
No	26974 (93.6)	10341 (88.1)	16633 (97.4)		15439 (95.3)	6691 (93.3)	4844 (89.1)	
Single-child family ^b								
Yes	8295 (28.9)	3105 (26.5)	5190 (30.5)	<.001	4819 (29.8)	1924 (26.9)	1552 (28.6)	<.001
No	20432 (71.1)	8597 (73.5)	11835 (69.5)		11345 (70.2)	5220 (73.1)	3867 (71.4)	
Parental education ^b								
Junior middle school or below	20395 (73.3)	8707 (77.4)	11688 (70.6)	<.001	11354 (72.3)	5169 (74.7)	3872 (74.6)	<.001
Senior middle school or technical school	4872 (17.5)	1770 (15.7)	3102 (18.7)		2868 (18.3)	1154 (16.7)	850 (16.4)	
College or above	2549 (9.2)	778 (6.9)	1771 (10.7)		1487 (9.5)	595 (8.6)	467 (9.0)	
Family relationship ^b								
Good	24450 (85.7)	9216 (79.3)	15234 (90.0)	<.001	14810 (92.1)	6032 (84.9)	3608 (67.3)	<.001
Average	3146 (11.0)	1796 (15.4)	1350 (8.0)		1042 (6.5)	871 (12.3)	1233 (23.0)	
Poor	950 (3.3)	614 (5.3)	336 (2.0)		227 (1.4)	204 (2.9)	519 (9.7)	
Parental drunkenness ^b								
Yes	10593 (38.0)	4439 (38.8)	6154 (37.4)	.013	5612 (35.8)	2664 (38.4)	2317 (43.9)	<.001
No	17313 (62.0)	6994 (61.2)	10319 (62.6)		10081 (64.2)	4274 (61.6)	2958 (56.1)	
Teacher-classmate relationship ^b								
Good	16856 (58.7)	6338 (54.2)	10518 (61.7)	<.001	10188 (63.0)	3970 (55.5)	2698 (49.8)	<.001
Average	11548 (40.2)	5203 (44.5)	6345 (37.2)		5875 (36.3)	3113 (43.5)	2560 (47.3)	
Poor	332 (1.2)	161 (1.4)	171 (1.0)		106 (0.7)	69 (1.0)	157 (2.9)	
Classmate relation ^b								
Good	21620 (75.2)	8490 (72.5)	13130 (77.0)	<.001	12852 (79.4)	5236 (73.1)	3532 (65.2)	<.001
Average	6924 (24.1)	3113 (26.6)	3811 (22.4)		3270 (20.2)	1877 (26.2)	1777 (32.8)	
Poor	214 (0.7)	109 (0.9)	105 (0.6)		57 (0.4)	45 (0.6)	112 (2.1)	
SDQ score ^c , mean (SD)								
Total difficulties	12.29 (4.83)	12.57 (4.96)	12.09 (4.72)	<.001	11.80 (4.09)	12.35 (4.66)	13.66 (6.50)	<.001
Hyperactivity-inattention	3.94 (1.55)	4.00 (1.58)	3.90 (1.52)	<.001	3.89 (1.41)	3.95 (1.55)	4.07 (1.89)	<.001
Conduct problems	1.85 (1.47)	1.93 (1.51)	1.80 (1.44)	<.001	1.66 (1.26)	1.86 (1.42)	2.42 (1.89)	<.001
Emotional symptoms	2.22 (2.06)	2.39 (2.12)	2.10 (2.02)	<.001	1.89 (1.86)	2.30 (2.03)	3.08 (2.39)	<.001
Peer problems	4.27 (1.50)	4.25 (1.50)	4.29 (1.49)	.054	4.35 (1.38)	4.24 (1.45)	4.09 (1.83)	<.001

Note. Abbreviations: SDQ Strengths and Difficulties Questionnaire, SD standard deviation.

^aP value was based on the chi-square test for categorical data and t-test or analysis of variance for continuous data where appropriate.

^bmissing data: 39 for sex, 200 for ethnicity, 129 for residence, 81 for living costs, 127 for academic pressure, 152 for feeling lonely, 83 for single-child family, 994 for parental education, 264 for family relationship, 904 for parental drunkenness, 74 for teacher-classmate relationship, 52 for classmate relation.

^cEach of the four SDQ subscale scores (hyperactivity, conduct problems, emotional problems, and peer problems) ranged from 0 to 10, and a higher score indicates a greater level of emotional and behavioural problems. The total difficulties score is calculated as the sum of the scores from the four subscales. Based on previous studies, we used the total difficulties scores (range, 0–40, with higher values indicating greater severity of problems) as they reflect the broad expression of emotional and behavioural problems.

facilitate these analyses. Participants were divided into six groups based on their combined parental migration and childhood maltreatment status, with the group reporting no parental migration and no childhood maltreatment designated as the reference group (lowest-risk group) (Millen et al., 2015; Wang et al., 2023). To assess the multiplicative interactions between childhood maltreatment and parental migration, we included a product interaction term (childhood maltreatment \times parental migration) in the adjusted weighted linear mixed regression models, and the β (95% CI) and corresponding P -value of the product term was used to measure interaction on the multiplicative scale.

Additional and sensitivity analyses were performed. First, if the multiplicative interaction was not significant, we performed mediation analyses to assess the contribution of potential social psychological mechanisms (i.e. childhood maltreatment) to the associations between parental migration and psychosocial health. The mediation analysis partitioned the total effect of the exposure-outcome association into direct effect and indirect effect using the causal mediation framework (Robins & Greenland, 1992). Mediation analyses were conducted using the 'mediation' and 'bootstrap' commands in Stata. Parametric bootstrapping (1000 times) was used to calculate 95% CI and P -value. Second, to explore potential variations in different subgroups, we conducted subgroup analyses by sex (male and female) and age groups (adolescents [≤ 19 years] and young adults [20 to 24 years] defined by the World Health Organization) (World Health Organization [WHO], 2022). Third, we used a predefined threshold of over 17 points on the SDQ total difficulties score to classify potential psychopathology (Du et al., 2008). We repeated the analyses examining the individual and joint associations of childhood maltreatment and parental migration with psychosocial health. Prevalence ratios (PRs) with 95% CIs were estimated using a weighted Poisson regression model due to the relatively common occurrence of potential psychopathology based on this threshold (Tamhane et al., 2016). Fourth, we used each of the five CTQ-SF subscale scores and the

overall CTQ-SF score (a sum score over all CTQ-SF subscale scores) instead of the categorized types of experienced childhood maltreatment and the cumulative number of childhood maltreatment in the weighted linear mixed regression models. All analyses were conducted using Stata 18.0 (Stata Corporation, College Station, TX, USA). A two-sided $P < .05$ was considered statistically significant.

3. Results

3.1. Characteristics of the study population

Among the 28,810 participants included in the study, 12,035 (41.8%) were male, with a mean (SD) age of 19.87 (1.62) years and an age range of 17 to 24 years. Participants were approximately equally distributed across the 10 study provinces. The mean (SD) total difficulties SDQ scores were 12.29 (4.83). The characteristics of the study population, stratified by parental migration status and levels of childhood maltreatment, are presented in Table 1. In total, 11,734 participants (40.7%) experienced parental labour migration; 1,841 (6.4%) experienced migration of the father, 577 (2.0%) experienced migration of the mother, and 9,316 (32.3%) experienced migration of both parents. A total of 12,606 (43.8%) participants reported experiencing at least 1 type of childhood maltreatment. Participants exposed to parental migration or higher levels of childhood maltreatment were more likely to be female, live in rural areas, experience above-average academic pressure, feel lonely, live in a single-parent family, have less educated parents, experience poor family relationships or parental drunkenness, and have poor relationships with teachers or classmates.

3.2. Parental migration, childhood maltreatment, and psychosocial health

In Table 2, adjusted regression models indicated that participants who experienced parental migration were more likely to report higher levels of SDQ total difficulties ($\beta = 0.16$ [95% CI, 0.05 to 0.28]) in

Table 2. Associations between parental labour migration and psychosocial health among their offspring.

	Total difficulties score, β coefficient (95% CI)		
	Model 1	Model 2	Model 3
Parental migration status			
No migration	0 (Ref)	0 (Ref)	0 (Ref)
Migration	0.48 (0.37 to 0.60)	0.25 (0.14 to 0.36)	0.16 (0.05 to 0.28)
Parental migration type			
None	0 (Ref)	0 (Ref)	0 (Ref)
Father	0.73 (0.50 to 0.96)	0.43 (0.21 to 0.65)	0.30 (0.07 to 0.53)
Mother	0.54 (0.15 to 0.94)	0.29 (−0.09 to 0.68)	−0.04 (−0.45 to 0.38)
Both parents	0.43 (0.31 to 0.55)	0.21 (0.09 to 0.32)	0.15 (0.02 to 0.27)

Note. Model 1 was unadjusted.

Model 2 was adjusted for age, sex, province, ethnicity, residence, living costs, academic pressure, and feeling lonely.

Model 3 was adjusted as Model 2 plus single-parent family, single-child family, parental education, family relationship, parental drunkenness, teacher-classmate relationship, and classmate relation.

Table 3. Associations between childhood maltreatment and psychosocial health.

	Total difficulties score, β coefficient (95% CI)		
	Model 1	Model 2	Model 3
The cumulative number of childhood maltreatment (1-unit increase) ^a	0.85 (0.80 to 0.91)	0.59 (0.54 to 0.65)	0.54 (0.49 to 0.60)
Levels of childhood maltreatment			
0	0 (Ref)	0 (Ref)	0 (Ref)
1	0.54 (0.41 to 0.67)	0.26 (0.13 to 0.38)	0.22 (0.09 to 0.36)
≥ 2	1.84 (1.69 to 1.98)	1.17 (1.02 to 1.31)	1.04 (0.88 to 1.19)
Different types of experienced childhood maltreatment			
Physical neglect			
No	0 (Ref)	0 (Ref)	0 (Ref)
Yes	0.94 (0.82 to 1.07)	0.62 (0.50 to 0.74)	0.54 (0.41 to 0.67)
Emotional neglect			
No	0 (Ref)	0 (Ref)	0 (Ref)
Yes	0.51 (0.37 to 0.64)	0.01 (−0.12 to 0.15)	0.01 (−0.13 to 0.15)
Physical abuse			
No	0 (Ref)	0 (Ref)	0 (Ref)
Yes	3.03 (2.78 to 3.27)	2.29 (2.05 to 2.53)	2.06 (1.81 to 2.31)
Emotional abuse			
No	0 (Ref)	0 (Ref)	0 (Ref)
Yes	3.57 (3.36 to 3.78)	2.89 (2.69 to 3.10)	2.72 (2.51 to 2.94)
Sexual abuse			
No	0 (Ref)	0 (Ref)	0 (Ref)
Yes	2.06 (1.88 to 2.24)	1.49 (1.31 to 1.67)	1.39 (1.21 to 1.57)

Note. Model 1 was unadjusted.

Model 2 was adjusted for age, sex, province, ethnicity, residence, living costs, academic pressure, and feeling lonely.

Model 3 was adjusted as Model 2 plus single-parent family, single-child family, parental education, family relationship, parental drunkenness, teacher-classmate relationship, and classmate relation.

^aContinuous variable.

Model 3) compared with those with non-migrant parents. Furthermore, participants with a father or both parents who migrated but not a mother had a significantly increased risk of SDQ total difficulties.

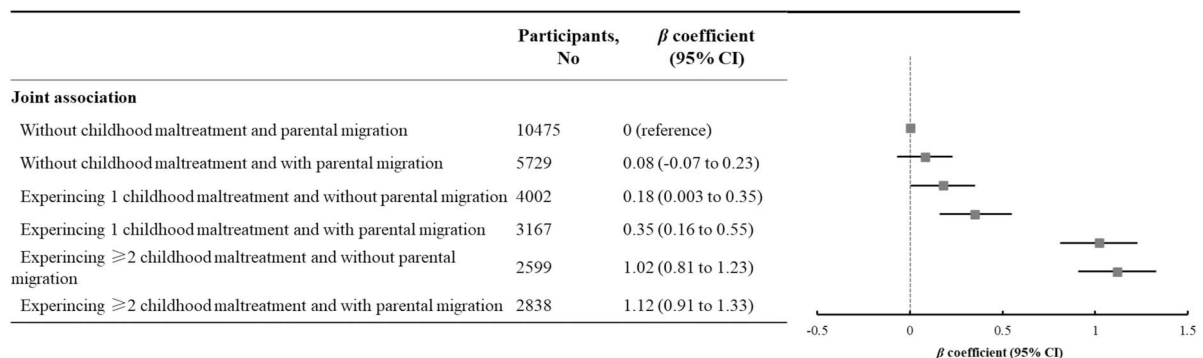
As shown in Table 3, a positive association was found between the cumulative number of childhood maltreatment and SDQ total difficulties score ($\beta = 0.54$ [95% CI, 0.49 to 0.60] in Model 3). Compared with individuals without childhood maltreatment, those exposed to 1 or ≥ 2 types of childhood maltreatment had adjusted β s of 0.22 (95% CI, 0.09 to 0.36) and 1.04 (95% CI, 0.88 to 1.19) for SDQ total difficulties, respectively, in the fully adjusted model. Further analysis of individual maltreatment types showed that the associations with SDQ total difficulties scores ranged from physical neglect ($\beta = 0.54$ [95% CI, 0.41 to 0.67]) to emotional abuse ($\beta = 2.72$ [95% CI, 2.51 to 2.94]).

3.3. Interaction and joint analyses

In the fully adjusted model, no significant multiplicative interaction was observed between parental migration and childhood maltreatment on psychosocial health ($P > .05$, eTable 4 in Supplement). Figure 2 shows the joint association of parental migration and childhood maltreatment on psychosocial health. Exposure to both parental migration and at least 2 numbers of childhood maltreatment was associated with the highest magnitude of psychosocial health ($\beta = 1.12$ [95% CI, 0.91 to 1.33]).

3.4. Additional and sensitivity analyses

As shown in eTable 5 in Supplement, participants with migrant parents were more likely to report childhood

**Figure 2.** Joint analysis of parental migration and childhood maltreatment with psychosocial health.

Note. Models were adjusted as age, sex, province, ethnicity, residence, living costs, academic pressure, feeling lonely, single-parent family, single-child family, parental education, family relationship, parental drunkenness, teacher-classmate relationship, and classmate relation. β coefficients were calculated for associations of different levels of experienced childhood maltreatment (0, 1, ≥ 2) with the studied total difficulties outcome across parental migration status (no migration and migration) using participants without parental migration and with childhood maltreatment level = 0 as reference.

maltreatment compared with those with non-migrant parents ($\beta = 0.16$; 95% CI, 0.13–0.18). This increased risk was observed across categories of paternal, maternal, or dual parental migration. In adjusted mediation models, parental migration was significantly associated with cumulative childhood maltreatment (Path A; standardized $\beta = 0.083$; 95% CI, 0.073 to 0.093), and the indirect effect of parental migration on psychosocial health through childhood maltreatment was significant (standardized $\beta = 0.010$; 95% CI, 0.008 to 0.011), with childhood maltreatment accounting for 58.8% of the mediation effect (eTable 6 in Supplement). Stratified analyses by sex and age groups showed that parental migration was significantly associated with psychosocial health in female participants and those younger than 19 years. Associations between childhood maltreatment and psychosocial health, as well as the combined effects of parental migration and childhood maltreatment, were significant across sexes and age groups. The mediation effect of childhood maltreatment in these associations was consistent across subgroups and aligned with the main analyses (eTables 7–8 and eFigure 1 in Supplement).

In the sensitivity analysis using defined psychopathology thresholds based on SDQ total difficulties scores, results were consistent with the main findings (eTables 9–11 in the Supplement). Analyses of individual CTQ-SF subscale scores revealed significant associations with psychosocial health for all subscales except emotional neglect, as well as for the overall CTQ-SF score (eTable 12 in Supplement).

4. Discussion

Using data from a nationwide, university/college-based survey, our primary findings suggest that both parental labour migration and childhood maltreatment were independently and positively associated with psychosocial health problems in adolescence and young adulthood. Specifically, the migration of the father or both parents, rather than the mother, was associated with these psychosocial health issues. The highest risks for psychosocial health problems were observed in individuals who experienced both childhood parental migration and higher levels of maltreatment. Additionally, our secondary findings reveal that the association between childhood parental migration and psychosocial health may be mediated by childhood maltreatment.

The association between parental migration and the psychosocial health of offspring has been widely discussed. A previous meta-analysis found that parental migration was associated with an increased risk of depression, anxiety, and conduct disorders among left-behind children and adolescents (Fellmeth et al., 2018). Another meta-analysis reported higher

levels of behavioural problems in male left-behind children (Qu et al., 2018). A recent longitudinal study indicated that Chinese adolescents who experienced parental migration had a higher risk of emotional and behavioural problems (Li et al., 2024). However, few studies have examined these associations in young adults. In the present study, we adjusted for several potential confounders, confirming the independent association between childhood parental migration and psychosocial health among offspring, and extended the findings to the young adult population. Consistent with previous findings (Ma et al., 2021), our study found that individuals who experienced the migration of their father or both parents, rather than the migration of their mother, were at a higher risk of psychosocial health problems. These results might be related to the fact that although parental labour migration can have economic benefits for families, it may also have negative health consequences for the offspring left behind in the care of other family members or caregivers (Fellmeth et al., 2018). The caretakers of left-behind children often have different family roles, parenting styles, educational levels, and lifestyles compared to the children's own parents, which may create an unfavourable environment for psychosocial development. This environment can lead to issues such as insecure attachment, low self-esteem, poor emotional regulation, and reduced sociability (Spruijt et al., 2018; Su et al., 2013). Furthermore, parental labour migration may lead to parent-child separation, which can disrupt the development of critical brain systems, including the reward and oxytocin systems (Scatliffe et al., 2019). These systems are essential for emotional and behavioural regulation (Scatliffe et al., 2019). Evidence from experimental and animal studies suggests that parent-child separation can alter gene expression during crucial developmental stages, potentially contributing to psychosocial health problems (Coley et al., 2019; Houtepen et al., 2018). Moreover, compared with the migration of the mother, the migration of the father appeared to have a stronger association with psychosocial health problems. This may be because migrating fathers may feel the stresses of immigration more keenly and are also associated with providing less warmth and emotional support than migrating mothers (Lamb & Bougher, 2009). These findings underscore the need for targeted policies and interventions to address the unmet psychosocial health needs of adolescents and young adults affected by parental migration. Encouraging more frequent communication between labour migrant parents and their children – such as increasing the use of digital tools like phones or promoting more frequent home visits, especially for fathers – may help reduce the negative effects of parent-child separation (Dominguez & Hall, 2022).

Furthermore, we observed a consistent positive association between childhood maltreatment and psychosocial health problems among adolescents and young adults in a dose-response manner, which aligns with prior research findings on children and adolescents (Qu et al., 2024). Childhood maltreatment represents a significant cumulative psychological stressor, and its adverse influences on brain function and the stress response system have been extensively documented (Chan et al., 2024). This impairment renders individuals who experienced childhood maltreatment more susceptible to emotional and behavioural problems due to emotional dysregulation or weak self-control (De Bellis & Zisk, 2014). Moreover, consistent with previous evidence (Qu et al., 2024), our study found that emotional abuse exhibited the strongest association with psychosocial health among all types of childhood maltreatment. This finding may be attributed to the fact that emotional abuse may be the most damaging form of maltreatment due to causing damage to the nervous system and brain changes, particularly in the prefrontal cortex and medial temporal lobe. Such changes can adversely affect emotional and physical health, as well as hinder social and cognitive development (Dye, 2020).

Moreover, this study identified significant associations between the combination of experiencing childhood parental migration and maltreatment and psychosocial health among adolescents and young adults. Specifically, a higher risk of psychosocial health problems was observed when parental migration was combined with a higher cumulative number of childhood maltreatment, suggesting that parental migration and childhood maltreatment may jointly aggravate the functional impairment of brain areas and lead to psychosocial health problems. While prior research has not extensively explored the complex association of parental migration and childhood maltreatment during childhood with psychosocial health, existing literature does report associations between childhood maltreatment and depressive symptoms in rural left-behind adolescents (Song et al., 2024). Additionally, our study revealed that individuals exposed to childhood parental migration exhibited an elevated susceptibility to childhood maltreatment. These findings align with a previous study in Denmark, which demonstrated that children with parents from refugee-sending countries (e.g. international migration) have a higher rate of childhood maltreatment compared with the general population (Bager et al., 2022). The present study expands on previous research by observing the mediating role of childhood maltreatment in the association between parental migration and psychosocial health among general offspring. Although parental migration may be seen as an indirect childhood maltreatment, it can be speculated that its influence on psychosocial health

may be partially through direct childhood maltreatment, which needs to be verified in the future. Although parental migration and childhood maltreatment have drawn attention and several strategies and policies have been promoted to guarantee the health and well-being of left-behind children in China (Fellmeth et al., 2018), our findings suggest that efforts aimed at preventing childhood maltreatment may further help mitigate the impact of parental labour migration on the psychosocial health of their children.

Our subgroup analysis revealed that the association of parental migration with psychosocial health was only significant among females. This aligns with prior research, which suggests that females may be more susceptible to the adverse effects of parental migration, leading to emotional and behavioural problems (Qu et al., 2018). According to stress exposure and reactivity models (Hankin et al., 2007), girls tend to exhibit greater emotional distress than boys, particularly in response to interpersonal stressors within the family (Hankin et al., 2007). However, a systematic review and meta-analysis indicated that sex may not be a significant predictor of health outcomes among left-behind children and adolescents (Fellmeth et al., 2018). Given these conflicting findings, further research is needed to clarify the role of sex in the association between parental migration and psychosocial health, which may inform the development of sex-specific intervention strategies. Additionally, we found that the association between parental migration and psychosocial health was significant only among adolescents younger than 19 years. This may be explained by the fact that parental labour migration is more temporally proximate for adolescents compared to adults. Moreover, the observed mediating role of childhood maltreatment remained significant across age and sex subgroups, indicating that the pathways linking parental migration to psychosocial health through childhood maltreatment may not be moderated by age or sex. Nevertheless, although our study is one of the first studies to examine the associations of parental migration and childhood maltreatment with psychosocial health among adolescents and young adults, these findings emphasize the need for further investigation into the modifying roles of biological sex and age.

Our study has several strengths, including a relatively large sample of adolescents and young adults, comprehensive consideration of various confounding factors, and a detailed exploration of the mediation and interaction role of childhood maltreatment on the association between parental migration and psychosocial health. However, several limitations warrant consideration. First, the cross-sectional nature of our data limits the ability to establish definitive causal relationships. Therefore, the exploratory findings

regarding the mediating role of childhood maltreatment in the association between parental labour migration and psychosocial health should be interpreted with caution. Second, recall or report biases may exist because of self-reported questionnaires for data collection. Third, the data collection method used in colleges or universities may have excluded individuals who do not attend college or university. This is important because evidence has shown that parental labour migration and childhood maltreatment are more prevalent in individuals with lower educational achievement (Zhu et al., 2023). Fourth, although the missing rate of covariates data was low, it is possible that individuals with missing data were more affected, and thus, the issue of missing not at random may exist, which could lead to underestimated associations (Wen et al., 2024). Fifth, the instrument SDQ is usually used among children and adolescents. Although some previous studies indicated the young adult SDQ would yield similar psychometric properties to the children or adolescent version (Brann et al., 2018), the validation and utilization of the young adult SDQ among Chinese young adults need to be further studied. Sixth, although the SDQ is a widely used tool for assessing psychosocial health, it may not fully capture the complexity of this concept, which lacks a universally accepted definition. Sixth, although using categorized variables for childhood maltreatment instead of continuous ones allowed us to assess cumulative exposure and perform joint analyses, it may have resulted in some loss of information and reduced statistical power. Seventh, this study assessed only the parental labour migration status before the child reached the age of 16 years and did not capture the specific age at which the child was first separated from one or both migrating parents. The developmental stage at the time of separation may influence its impact on the child. Future research is suggested to investigate the role of developmental timing to better understand its implications. Finally, this study focused on Chinese university or college students, which may limit the generalizability of findings to other populations.

5. Conclusions

In summary, exposure to parental labour migration (particularly the migration of the father or both parents) or childhood maltreatment was positively associated with psychosocial health problems among adolescents and young adults. Our study also found that parental migration and childhood maltreatment may jointly aggravate psychosocial health problems, with individuals exposed to both parental labour migration and higher levels of childhood maltreatment exhibiting the highest risk. Furthermore, this study provided evidence that childhood maltreatment

may mediate the association between parental labour migration and psychosocial health. While future cohort studies are needed to confirm these findings, the results of this study underscore the importance of strengthening ongoing surveillance of psychosocial health, addressing childhood maltreatment, and implementing intervention programmes to mitigate related stressors among left-behind children, ensuring their long-term health and development.

Acknowledgment

The authors would like to thank the participating colleges and universities and all participants in this study.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by Natural Science Foundation of Guangdong Province: [Grant Number 2022A1515012333].

Data availability statement

The datasets from this study are held in coded form, and legal data sharing agreements prohibit the authors from making the dataset publicly available. Access to individual de-identified participant data (including data dictionaries) may be granted to those who send a request with specific data needs, analysis plans, and dissemination plans to the corresponding authors.

ORCID

Weiying Jiang  <http://orcid.org/0009-0000-5000-9087>

Yitong He  <http://orcid.org/0009-0006-5928-7159>

Yiling Hua  <http://orcid.org/0000-0003-2265-0656>

Cuihong Huang  <http://orcid.org/0009-0008-4684-386X>

Xinyu Zheng  <http://orcid.org/0000-0002-4538-2490>

Lan Guo  <http://orcid.org/0000-0002-5213-2158>

References

- Ammerman, R. T., Mara, C. A., Anyigbo, C., Herbst, R. B., Reyner, A., Rybak, T. M., McClure, J. M., Burkhardt, M. C., Stark, L. J., & Kahn, R. S. (2023). Behavior problems in low-income young children screened in pediatric primary care. *JAMA Pediatrics*, 177(12), 1306–1313. <https://doi.org/10.1001/jamapediatrics.2023.4229>
- Appleyard, K., Egeland, B., van Dulmen, M. H. M., & Alan Sroufe, L. (2005). When more is not better: The role of cumulative risk in child behavior outcomes. *Journal of Child Psychology and Psychiatry*, 46(3), 235–245. <https://doi.org/10.1111/j.1469-7610.2004.00351.x>
- Badenes-Ribera, L., Georgieva, S., Tomás, J. M., & Navarro-Pérez, J. J. (2024). Internal consistency and test-retest reliability: A reliability generalization meta-analysis of the Childhood Trauma Questionnaire – Short Form

- (CTQ-SF). *Child Abuse & Neglect*, 154, 106941. <https://doi.org/10.1016/j.chiabu.2024.106941>
- Bager, L., Laursen, T. M., Palic, S., Nordin, L., & Høgh Thøgersen, M. (2022). Adverse childhood experiences among children of parents who are refugees affected by trauma in Denmark: A register-based cohort study. *The Lancet. Public Health*, 7(10), e825–e833. [https://doi.org/10.1016/S2468-2667\(22\)00194-3](https://doi.org/10.1016/S2468-2667(22)00194-3)
- Bernstein, D. P., Stein, J. A., Newcomb, M. D., Walker, E., Pogge, D., Ahluvalia, T., Stokes, J., Handelsman, L., Medrano, M., Desmond, D., & Zule, W. (2003). Development and validation of a brief screening version of the Childhood Trauma Questionnaire. *Child Abuse & Neglect*, 27(2), 169–190. [https://doi.org/10.1016/S0145-2134\(02\)00541-0](https://doi.org/10.1016/S0145-2134(02)00541-0)
- Bhutta, Z. A., Bhavnani, S., Betancourt, T. S., Tomlinson, M., & Patel, V. (2023). Adverse childhood experiences and lifelong health. *Nature Medicine*, 29(7), 1639–1648. <https://doi.org/10.1038/s41591-023-02426-0>
- Brann, P., Lethbridge, M. J., & Mildred, H. (2018). The young adult Strengths and Difficulties Questionnaire (SDQ) in routine clinical practice. *Psychiatry Research*, 264, 340–345. <https://doi.org/10.1016/j.psychres.2018.03.001>
- Breiner, H., Stroud, C., & Bonnie, R. J. (2015). *Investing in the health and well-being of young adults*. National Academies Press (US).
- Chan, S. Y., Ngoh, Z. M., Ong, Z. Y., Teh, A. L., Kee, M. Z. L., Zhou, J. H., Fortier, M. V., Yap, F., MacIsaac, J. L., Kobor, M. S., Silveira, P. P., Meaney, M. J., & Tan, A. P. (2024). The influence of early-life adversity on the coupling of structural and functional brain connectivity across childhood. *Nature Mental Health*, 2(1), 52–62. <https://doi.org/10.1038/s44220-023-00162-5>
- Coley, E., Demaestri, C., Ganguly, P., Honeycutt, J. A., Peterzell, S., Rose, N., Ahmed, N., Holschbach, M., Trivedi, M., & Brenhouse, H. C. (2019). Cross-Generational transmission of early life stress effects on HPA regulators and Bdnf are mediated by sex, lineage, and upbringing. *Frontiers in Behavioral Neuroscience*, 13, 101. <https://doi.org/10.3389/fnbeh.2019.00101>
- De Bellis, M. D., & Zisk, A. (2014). The biological effects of childhood trauma. *Child and Adolescent Psychiatric Clinics of North America*, 23(2), 185–222. <https://doi.org/10.1016/j.chc.2014.01.002>
- Dey, D., Haque, M. S., Islam, M. M., Aishi, U. I., Shammy, S. S., Mayen, M. S. A., Noor, S. T. A., & Uddin, M. J. (2025). The proper application of logistic regression model in complex survey data: A systematic review. *BMC Medical Research Methodology*, 25(1), 15. <https://doi.org/10.1186/s12874-024-02454-5>
- Dominguez, G. B., & Hall, B. J. (2022). The health status and related interventions for children left behind due to parental migration in the Philippines: A scoping review. *The Lancet Regional Health – Western Pacific*, 28. <https://doi.org/10.1016/j.lanwpc.2022.100566>
- Dong, Y., & Peng, C. J. (2013). Principled missing data methods for researchers. *SpringerPlus*, 2(222), 1–17. <https://doi.org/10.1186/2193-1801-2-222>
- Du, Y., Kou, J., & Coghill, D. (2008). The validity, reliability and normative scores of the parent, teacher and self report versions of the Strengths and Difficulties Questionnaire in China. *Child and Adolescent Psychiatry and Mental Health*, 2(1), 8. <https://doi.org/10.1186/1753-2000-2-8>
- Dye, H. L. (2020). Is emotional abuse as harmful as physical and/or sexual abuse?. *Journal of Child & Adolescent Trauma*, 13(4), 399–407. <https://doi.org/10.1007/s40653-019-00292-y>
- Fellmeth, G., Rose-Clarke, K., Zhao, C., Busert, L. K., Zheng, Y., Massazza, A., Sonmez, H., Eder, B., Blewitt, A., Lertgrai, W., Orcutt, M., Ricci, K., Mohamed-Ahmed, O., Burns, R., Knipe, D., Hargreaves, S., Hesketh, T., Opondo, C., & Devakumar, D. (2018). Health impacts of parental migration on left-behind children and adolescents: A systematic review and meta-analysis. *Lancet*, 392(10164), 2567–2582. [https://doi.org/10.1016/S0140-6736\(18\)32558-3](https://doi.org/10.1016/S0140-6736(18)32558-3)
- Goodman, R., Meltzer, H., & Bailey, V. (1998). The Strengths and Difficulties Questionnaire: A pilot study on the validity of the self-report version. *European Child & Adolescent Psychiatry*, 7(3), 125–130. <https://doi.org/10.1007/s007870050057>
- Greenland, S., Daniel, R., & Pearce, N. (2016). Outcome modelling strategies in epidemiology: Traditional methods and basic alternatives. *International Journal of Epidemiology*, 45(2), 565–575. <https://doi.org/10.1093/ije/dyw040>
- Greenland, S., & Pearce, N. (2015). Statistical foundations for model-based adjustments. *Annual Review of Public Health*, 36, 89–108. <https://doi.org/10.1146/annurev-publhealth-031914-122559>
- Grootendorst-van, M. N., Bouter, D. C., Hoogendijk, W., van Jaarsveld, S., Tiemeier, H., Mulder, C. L., & Roza, S. J. (2021). The iBerry study: A longitudinal cohort study of adolescents at high risk of psychopathology. *European Journal of Epidemiology*, 36(4), 453–464. <https://doi.org/10.1007/s10654-021-00740-w>
- Hankin, B. L., Mermelstein, R., & Roesch, L. (2007). Sex differences in adolescent depression: Stress exposure and reactivity models. *Child Development*, 78(1), 279–295. <https://doi.org/10.1111/j.1467-8624.2007.00997.x>
- Houtepen, L. C., Hardy, R., Maddock, J., Kuh, D., Anderson, E. L., Relton, C. L., Suderman, M. J., & Howe, L. D. (2018). Childhood adversity and DNA methylation in two population-based cohorts. *Translational Psychiatry*, 8(1), 266. <https://doi.org/10.1038/s41398-018-0307-3>
- Lai, K. Y., Luk, E. S., Leung, P. W., Wong, A. S., Law, L., & Ho, K. (2010). Validation of the Chinese version of the Strengths and Difficulties Questionnaire in Hong Kong. *Social Psychiatry and Psychiatric Epidemiology*, 45(12), 1179–1186. <https://doi.org/10.1007/s00127-009-0152-z>
- Lamb, M. E., & Bougher, L. D. (2009). How does migration affect mothers' and fathers' roles within their families? *Reflections on Some Recent Research. Sex Roles*, 60(7), 611–614. <https://doi.org/10.1007/s11199-009-9600-1>
- Li, M., Qiu, Y., Xia, Y., Li, D., Ma, G., Ma, S., Zhang, J., & Wang, X. (2024). Parental migration trajectories from childhood through adolescence: Longitudinal impact on emotional and behavioral problems Among Chinese adolescents. *Journal of Youth and Adolescence*, 53(6), 1383–1395. <https://doi.org/10.1007/s10964-024-01976-x>
- Li, N., Elashoff, R. M., Li, G., & Tseng, C. (2012). Joint analysis of bivariate longitudinal ordinal outcomes and competing risks survival times with nonparametric distributions for random effects. *Statistics in Medicine*, 31(16), 1707–1721. <https://doi.org/10.1002/sim.4507>
- Ma, Y., Guo, H., Guo, S., Jiao, T., Zhao, C., Ammerman, B. A., Gazimbi, M. M., Yu, Y., Chen, R., Wang, H., & Tang, J. (2021). Association of the labor migration of parents with nonsuicidal self-injury and suicidality among their offspring in China. *JAMA Network Open*, 4(11), e2133596. <https://doi.org/10.1001/jamanetworkopen.2021.33596>

- Millen, A. E., Meyers, K. J., Liu, Z., Engelman, C. D., Wallace, R. B., LeBlanc, E. S., Tinker, L. F., Iyengar, S. K., Robinson, J. G., Sarto, G. E., & Mares, J. A. (2015). Association between vitamin D status and age-related macular degeneration by genetic risk. *JAMA Ophthalmology*, 133(10), 1171–1179. <https://doi.org/10.1001/jamaophthalmol.2015.2715>
- National Bureau of Statistics. (2021). Bulletin of the seventh national census (in Chinese).
- Qu, G. B., Wu, W., Wang, L. L., Tang, X., Sun, Y. H., Li, J., & Wang, J. (2018). Systematic review and meta-analysis found higher levels of behavioural problems in male left-behind children aged 6-11 years. *Acta Paediatrica*, 107(8), 1327–1334. <https://doi.org/10.1111/apa.14199>
- Qu, G., Liu, H., Han, T., Zhang, H., Ma, S., Sun, L., Qin, Q., Chen, M., Zhou, X., & Sun, Y. (2024). Association between adverse childhood experiences and sleep quality, emotional and behavioral problems and academic achievement of children and adolescents. *European Child & Adolescent Psychiatry*, 33(2), 527–538. <https://doi.org/10.1007/s00787-023-02185-w>
- Robins, J. M., & Greenland, S. (1992). Identifiability and exchangeability for direct and indirect effects. *Epidemiology*, 3(2), 143–155. <https://doi.org/10.1097/00001648-199203000-00013>
- Rosado, J. I., Ramirez, A., Montgomery, J., Reyes, E., & Wang, Y. (2021). Adverse childhood experiences and its association with emotional and behavioral problems in U.S. children of Latino immigrants. *Child Abuse & Neglect*, 112, 104887. <https://doi.org/10.1016/j.chiabu.2020.104887>
- Sameroff, A. J. (2000). Dialectical processes in developmental psychopathology. In A. J. Sameroff, M. Lewis, & S. M. Miller (Eds.), *Handbook of developmental psychopathology* (pp. 23–40). Springer US. http://doi.org/10.1007/978-1-4615-4163-9_2
- Scatliffe, N., Casavant, S., Vittner, D., & Cong, X. (2019). Oxytocin and early parent-infant interactions: A systematic review. *International Journal of Nursing Sciences*, 6(4), 445–453. <https://doi.org/10.1016/j.ijnss.2019.09.009>
- Shangguan, M., Ao, C., & Zhao, J. (2023). Parent-child cohesion and college students' positive/negative affect: The moderating roles of sympathetic nervous system activity and parent-child separation experience. *Journal of Youth and Adolescence*, 52(6), 1301–1312. <https://doi.org/10.1007/s10964-023-01768-9>
- Smith, L., & Hamer, M. (2018). Sedentary behaviour and psychosocial health across the life course. In M. F. Leitzmann, C. Jochem, & D. Schmid (Eds.), *Sedentary behaviour epidemiology* (pp. 311–318). Springer International Publishing. http://doi.org/10.1007/978-3-319-61552-3_12
- Sokołowski, A., Folkierska-Żukowska, M., Jednoróg, K., Moodie, C. A., & Dragan, W. A. (2020). The relationship between early and recent life stress and emotional expression processing: A functional connectivity study. *Cognitive, Affective, & Behavioral Neuroscience*, 20(3), 588–603. <https://doi.org/10.3758/s13415-020-00789-2>
- Song, C., Yao, L., Chen, H., Zhang, J., & Liu, L. (2024). The relationship between adverse childhood experiences and depressive symptoms in rural left-behind adolescents: A cross-sectional survey. *Heliyon*, 10(4), e26587. <https://doi.org/10.1016/j.heliyon.2024.e26587>
- Spruijt, A. M., Dekker, M. C., Ziermans, T. B., & Swaab, H. (2018). Attentional control and executive functioning in school-aged children: Linking self-regulation and parenting strategies. *Journal of Experimental Child Psychology*, 166, 340–359. <https://doi.org/10.1016/j.jecp.2017.09.004>
- Su, S., Li, X., Lin, D., Xu, X., & Zhu, M. (2013). Psychological adjustment among left-behind children in rural China: The role of parental migration and parent-child communication. *Child Care Health and Development*, 39(2), 162–170. <https://doi.org/10.1111/j.1365-2214.2012.01400.x>
- Tamhane, A. R., Westfall, A. O., Burkholder, G. A., & Cutter, G. R. (2016). Prevalence odds ratio versus prevalence ratio: Choice comes with consequences. *Statistics in Medicine*, 35(30), 5730–5735. <https://doi.org/10.1002/sim.7059>
- von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gøtzsche, P. C., & Vandenbroucke, J. P. (2007). The Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) statement: Guidelines for reporting observational studies. *Plos Medicine*, 4(10), e296. <https://doi.org/10.1371/journal.pmed.0040296>
- Wang, W., Liu, Y., Yang, Y., Jiang, W., Ni, Y., Han, X., Lu, C., & Guo, L. (2023). Adverse childhood and adulthood experiences and risk of new-onset cardiovascular disease with consideration of social support: A prospective cohort study. *BMC Medicine*, 21(1), 297. <https://doi.org/10.1186/s12916-023-03015-1>
- Wang, Y., Yang, S., Wang, F., & Liu, Z. (2022). Long-term effects of left-behind experience on adult depression: Social trust as mediating factor. *Frontiers in Public Health*, 10, 957324. <https://doi.org/10.3389/fpubh.2022.957324>
- Wen, S., Zhu, J., Han, X., Li, Y., Liu, H., Yang, H., Hou, C., Xu, S., Wang, J., Hu, Y., Qu, Y., Liu, D., Aspelund, T., Fang, F., Valdimarsdóttir, U. A., & Song, H. (2024). Childhood maltreatment and risk of endocrine diseases: An exploration of mediating pathways using sequential mediation analysis. *BMC Medicine*, 22(1), 59. <https://doi.org/10.1186/s12916-024-03271-9>
- World Health Organization (WHO). (2022). *Older adolescent (15 to 19 years) and young adult (20 to 24 years) mortality*. Retrieved May 2, 2024, from <https://www.who.int/news-room/fact-sheets/detail/levels-and-trends-in-older-adolescent-%2815-to-19-years%29-and-young-adult-%2820-to-24-years%29-mortality>
- Xiang, Z., Liu, Z., Cao, H., Wu, Z., & Long, Y. (2021). Evaluation on long-term test-retest reliability of the short-form childhood trauma questionnaire in patients with schizophrenia. *Psychology Research and Behavior Management*, 14, 1033–1040. <https://doi.org/10.2147/PRBM.S316398>
- Yuan, P., & Wang, L. (2016). Migrant workers: China boom leaves children behind. *Nature*, 529(7584), 25. <https://doi.org/10.1038/529025a>
- Zhou, Y., Zhao, C., Qi, Y., Fan-He, Huang, X., Tian, X., Sun, J., & Yi-Zheng. (2020). Emotional and behavioral problems of left-behind children in impoverished rural China: A comparative cross-sectional study of fourth-grade children. *Journal of Adolescent Health*, 67(5), S48–S54. <https://doi.org/10.1016/j.jadohealth.2020.06.016>
- Zhu, Z., Wang, Y., & Pan, X. (2023). Health problems faced by left-behind children in low/middle-income countries. *BMJ Global Health*, 8(8), e013502. <https://doi.org/10.1136/bmjgh-2023-013502>