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Childhood adversity and depressive symptoms among middle-aged and older Chinese: results from China health and retirement longitudinal study

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ABSTRACT

Objectives: A number of studies have established the link between childhood adversity (CA) and depression across the life span. This association can be culturally specific, and it remains unclear whether and how different aspects of CA affect depressive symptoms in later life in non-Western societies.

Method: Data were from the China Health and Retirement Longitudinal Study in 2011, 2013, 2014 (Life Event History survey) and 2015 (N = 13,710). Depressive symptoms were measured repeatedly in 2011, 2013, and 2015 using the ten-item Centre for Epidemiologic Studies Depression Scale (CES-D-10). CA was assessed in 2014 by parental physical abuse, maternal emotional neglect, early parental death, parental mental health problems, poor quality of parental relationship, and childhood socioeconomic disadvantage. Multilevel linear models were used to analyse the data.

Results: Parental physical abuse was associated with 0.51 (95% confidence interval [CI]: 0.28, 0.74) and 0.59 (95% CI: 0.31, 0.88) higher CES-D-10 scores compared to those without such abuse experience for men and women, respectively. Emotional neglect predicted 0.30 (95% CI: 0.07, 0.51) and 0.33 (95% CI: 0.08, 0.58) higher CES-D-10 scores for men and women. Elevated CES-D-10 scores were also found among men and women whose parents had poor mental health and poor relationship, and those who experienced food inadequacy (men: 0.78, 95% CI: 0.54, 1.01; women: 1.15, 95% CI: 0.90, 1.41). Early parental death nevertheless was not associated with CES-D-10 scores.

Conclusion: CA exerts long-term detrimental effects on mental health in mid- and late-life among Chinese adults. The findings are consistent with those from Western societies, except for early parental death.

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Childhood adversity; mid- and late-life depressive symptoms; CHARLS; childhood abuse

Introduction

Depression is one of the leading causes of disability worldwide which accounts for 2.5% of global disability adjusted life years in 2010 (Ferrari et al., 2013). Numerous studies have demonstrated that early life negative experiences and exposures affect mental disorders among adults (Benjet, Borges, & Medina-Mora, 2010; Gilman, Kawachi, Fitzmaurice, & Buka, 2003; Sadowski, Ugarte, Kolvin, Kaplan, & Barnes, 1999; Scott et al., 2011). From the life-course perspective, evidence has been piled showing that childhood adversity (CA), such as maltreatment, exposure to domestic violence, and parental death or divorce, is linked to depressive symptoms in later life (Comijs et al., 2007; Comijs et al., 2013; Kamiya, Doyle, Henretta, & Timonen, 2013; Kivela, Luukinen, Koski, Viramo, & Pahkala, 1998; Kraaij and de Wilde, 2001).

CA is an umbrella term that covers various types of traumatic events or circumstances in the early developmental stage of life, including sudden events (e.g. parental loss, divorce, or natural disasters) and circumstances that are chronic in nature (e.g. repeated physical or sexual abuse, long-term poverty) (Shaw and Krause, 2002; Wheaton, 1996). CA was generally conceptualised as psychosocial negative experiences at both micro- and macro-level, consisting of negative caregiving environment (e.g. childhood maltreatment, caregiver psychopathology, death, and depriving care environment), family context (e.g. familial conflict, domestic violence, addiction, and marital dissolution), community environment (e.g. violence/crime and poor infrastructure), and societal environment (e.g. overt discrimination, gender inequality, and political and economic exclusion) (Berens, Jensen, & Nelson, 2017). Exposure to such adverse events or environment in childhood could be particularly harmful as early childhood is an exceptionally salient period for further development of psychological wellbeing (McDaniel, 1980). A number of studies from Western societies have demonstrated that specific subtypes of and severity of CA exert detrimental effects on mental health among middle-aged and older adults (Kraaij and de Wilde, 2001; Niina, Routasalo, Tilvis, Strandberg, & Pitkälä, 2006; Springer, Sheridan, Kuo, & Carnes, 2007). For example, history of childhood sexual abuse (Afifi et al.,

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2008), being a witness to inter-parental violence and poor quality of the relationship between parents (Roustit et al., 2009), and experience of parental emotional neglect in childhood (Kraaij, Arensman, & Spinhoven, 2002) are shown to be associated with an increased risk of lifetime depressive symptoms.

Two hypotheses linking CA to life-course mental health have been proposed. The first is the biological hypothesis which theorises that CA experiences trigger strong and long-lasting activation of the stress response system that leads to physiological and biological changes of the body (e.g. decreases in grey matter volume and density of neuron connections, increasing levels of stress hormones and inflammatory cytokines, and epigenetic changes associated with stress response genes) not only in early life but also persisting into later life (Colman and Ataullahjan, 2010). The second is the sociological hypothesis – cumulative disadvantage hypothesis – which posits that early social inequality originated from childhood adversity sets individuals on diverse life-course pathways in adolescence and exposes them differentially to various acquisition of resources (e.g. lower education and occupation) and different deteriorating experiences (e.g. unfavourable health behaviours) that could accelerate morbidity in adulthood and later life (O'Rand and Hamil-Luker, 2005).

Although the relationship between CA and depressive symptoms in later life has been shown in many Western societies, it is unclear whether this holds in the Chinese social context. For example, unlike in many Western countries, parental corporal punishment of children in China has been widely accepted as a norm of child-bearing and discipline practices, in particular a few decades ago (Korbin, 1991; Liao, Lee, Roberts-Lewis, Hong, & Jiao, 2011; Shaw and Krause, 2002). It may therefore be plausible that physical punishment in childhood affects Chinese adults' mental health later in life differently than it does among Western adults, but evidence on this is scant.

Child maltreatment and violence were not recognised as a social problem until the law protecting the rights of children had been enacted in 1991 in China (Liao et al., 2011). Thus, we hypothesised that CA may have similar effects on mental health of middle-aged and older adults (born in 1952–1966: aged 45–59 vs. born before 1952: aged 60+). In addition, China has witnessed huge and rapid social and economic transitions with fast urbanisation and modernisation in the past few decades, which have eroded the traditional function and stability of the family (Yeung and Gu, 2016). This change has resulted in an increased number of Chinese families at risk, with a growing proportion of families without co-residing parents (e.g. rural parents migrate to cities for better job opportunities and leave their children behind), and families in which the parents have poor mental health or a poor relationship (e.g. domestic violence) (Repetti, Taylor, & Seeman, 2002).

Chinese adults have undergone very different changes in their lifetime given the rapid social and economic transitions compared to their Western counterparts, which may strengthen or mitigate the detrimental effects of CA on mental health. As a result, China provides a unique context for assessing the robustness of the relationship between CA and mental health from the life-course perspective. To our knowledge, no studies have examined how different aspects of CA were associated with depressive symptoms simultaneously among Chinese older adults except two cross-sectional studies examining the effects of famine, parental death, and poor childhood health on depressive symptoms (Yang & Lou, 2016) and cardiovascular risk (Schooling et al., 2011). In this study, we investigated three aspects of CA, covering childhood abuse and neglect, caregiver's characteristics, and childhood socioeconomic status (SES), in relation to depressive symptoms among 13,710 middle-aged and older Chinese men and women.

Data and methods

Study design

We used data from the China Health and Retirement Longitudinal Study (CHARLS), a nationally representative study of Chinese community-dwelling adults aged 45 years and older and their spouse (Zhao, Hu, Smith, Strauss, & Yang, 2014). The sample was randomly selected from 150 counties of 28 provinces through multistage probability sampling (Zhao et al., 2014). The baseline survey (wave 1) was conducted in 2011–2012, and three follow-up surveys were carried out in 2013 (wave 2), 2014 (wave 3, Life Event History survey) and 2015 (wave 4). All data were collected by face-to-face computer-assisted personal interviews with a response rate over 80% at baseline (Zhao et al., 2014). Comprehensive information on health status, physical and cognitive functioning, socio-demographic characteristics, and health care and insurance were collected at waves 1, 2, and 4. The CHARLS study was approved by the Ethical Review Committee of Peking University, and all participants signed the written informed consent. We excluded 5,083 respondents (total sample size 18,888, 26.9%) who did not participate the Life Event History survey (wave 3). The final analytical sample thus included 13,710 men and women aged 45–98 years at baseline.

Depressive symptoms

Depressive symptoms were measured repeatedly using the 10-item Centre for Epidemiological Studies Depression Scale (CES-D-10) questionnaire (Andresen, Malmgren, Carter, & Patrick, 1994) at waves 1, 2, and 4. The CES-D-10 was validated previously in an older Chinese population (Chen and Mui, 2014) and widely used in Chinese studies (He et al., 2019; Yang & Lou, 2016). The response for each CES-D-10 item was on a four-scale metric: rarely, in some days (1–2 days per week), occasionally (3–4 days per week), and most of the time (5–7 days per week), coded from 0 to 3, respectively. The coding was reversed for the positive items. We summed up all items to derive a CES-D-10 score (0–30, a higher score indicating more depressive symptoms), and calculated such scores for respondents who had no more than one missing item(Andresen et al., 1994). For respondents who had one missing item, the value of the missing item was imputed by the mean of the participant's nine non-missing items.

Table 1. Distribution of childhood adversity, CES-D-10 score, and covariates at baseline.

	Men		Women		*p* value
	%	Mean CES-D-10 score (sd)	%	Mean CES-D-10 score (sd)	(men vs. women on CES-D-10)
Total	6,578	7.3 (5.8)	7,132	9.4 (6.6)	<0.000
Child abuse and neglect					
Parental physical abuse					
Yes	33.1	8.0 (6.0)	22.2	10.3 (6.8)	<0.000
No	57.1	6.9 (5.6)	68.3	9.1 (6.5)	<0.000
Missing	9.8	7.8 (5.9)	9.5	10.3 (6.7)	
Maternal emotional neglect					
Yes	30.6	7.4 (5.8)	32.9	9.6 (6.7)	<0.000
No	62.9	7.2 (5.7)	61.0	9.2 (6.5)	<0.000
Missing	6.5	8.6 (6.4)	6.1	10.8 (7.1)	
Caregiver's characteristics					
Parental mental health (tertiles)					
Good	40.6	6.1 (5.2)	40.1	8.2 (6.2)	<0.000
Medium	14.2	7.5 (5.7)	14.7	9.4 (6.6)	<0.000
Poor	22.7	8.7 (6.2)	22.7	10.8 (6.8)	<0.000
Missing	23.5	8.1 (6.0)	22.5	10.2 (6.7)	
Parent's relationship (tertiles)					
Good	37.1	6.9 (5.6)	42.2	8.8 (6.5)	<0.000
Medium	21.1	7.1 (5.7)	19.2	8.9 (6.5)	<0.000
Poor	27.1	7.8 (5.9)	25.4	10.2 (6.7)	<0.000
Missing	14.7	8.0 (6.1)	13.2	10.4 (6.6)	
Parental death before age 17					
Yes	16.4	7.7 (5.9)	13.9	9.7 (6.5)	<0.000
No	50.6	7.1 (5.7)	47.4	8.9 (6.5)	<0.000
Missing	33.0	7.6 (5.8)	38.7	10.1 (6.8)	
Childhood SES					
Father's education					
Illiterate	56.1	7.8 (5.9)	54.4	9.8 (6.6)	<0.000
Literate	37.5	6.6 (5.5)	35.6	8.7 (6.5)	<0.000
Missing	6.4	8.1 (6.1)	10.0	9.6 (5.6)	
Father's occupation					
Non-agricultural	16.3	6.3 (5.3)	17.3	7.6 (6.1)	<0.000
Agricultural	77.3	7.6 (5.9)	75.9	9.8 (6.6)	<0.000
Missing	6.4	7.6 (5.9)	6.8	9.8 (6.6)	
Adequacy of food					
Yes	25.3	6.5 (5.5)	30.7	8.1 (6.3)	<0.000
No	73.8	7.6 (5.8)	68.3	10.0 (6.7)	<0.000
Missing	0.9	8.1 (6.6)	1.0	9.8 (6.8)	
Respondent's characteristics					
Educational attainment					
Illiterate	12.4	8.7 (6.1)	41.9	10.4 (6.9)	<0.000
Can read and write	19.1	8.7 (6.2)	18.5	10.0 (6.6)	<0.000
Primary	26.7	7.6 (5.7)	16.8	9.0 (6.2)	<0.000
Junior, high and university	41.8	6.1 (5.3)	22.8	7.4 (5.8)	<0.000
Residential area					
Rural	64.3	7.9 (5.9)	62.8	10.2 (6.7)	<0.000
Urban	35.7	6.4 (5.4)	37.2	8.1 (6.1)	<0.000
Marital status					
Married	91.4	7.1 (5.6)	84.9	9.1 (6.5)	<0.000
Unmarried	8.6	10.0 (6.7)	15.1	10.9 (6.8)	0.01
ADL limitation					
Yes	13.3	11.7 (6.6)	18.1	13.8 (6.8)	<0.000
No	85.4	6.7 (5.3)	80.2	8.4 (6.1)	<0.000
Missing	1.3	5.4 (3.9)	1.7	7.1 (5.8)	
Current smoking status					
Yes	74.0	7.5 (5.8)	8.0	10.4 (7.0)	<0.000
No	25.6	6.9 (5.7)	91.4	9.3 (6.6)	<0.000
Missing	0.4	6.8 (5.6)	0.6	7.5 (6.0)	
Current drinking status					
Yes	56.6	7.0 (5.6)	11.8	9.9 (6.7)	<0.000
No	43.0	7.8 (6.0)	87.6	9.3 (6.6)	<0.000
Missing	0.4	6.8 (5.6)	0.6	7.5 (6.0)	
Childhood self-rated health					
Healthy	35.3	6.6 (5.5)	34.1	8.5 (6.2)	<0.000
Average	51.8	7.6 (5.8)	51.4	9.5 (6.6)	<0.000
Less healthy	12.3	8.7 (6.2)	13.6	11.2 (7.0)	<0.000
Missing	0.6	8.7 (6.2)	0.9	11.0 (7.0)	
Hypertension					
Yes	24.6	8.0 (6.1)	27.7	10.0 (6.7)	<0.000
No	74.5	7.1 (5.7)	71.2	9.2 (6.6)	<0.000
Missing	0.9	7.7 (5.7)	1.1	11.9 (7.0)	
Diabetes or high blood sugar					
Yes	5.8	7.9 (6.1)	6.9	10.1 (6.7)	<0.000
No	93.0	7.3 (5.8)	91.6	9.4 (6.6)	<0.000
Missing	1.2	7.5 (5.2)	1.5	10.2 (5.6)	
Cancer					
Yes	0.7	9.6 (6.6)	1.1	8.9 (6.6)	<0.000

(*continued*)

Table 1. Continued.

	Men		Women		*p* value
	%	Mean CES-D-10 score (sd)	%	Mean CES-D-10 score (sd)	(men vs. women on CES-D-10)
No	98.4	7.3 (5.8)	97.9	9.5 (6.6)	0.45
Missing	0.9	8.9 (6.8)	1.0	9.9 (6.2)	
Heart problems					
Yes	10.3	8.4 (6.1)	14.2	11.6 (7.0)	<0.000
No	88.8	7.2 (5.7)	84.7	9.1 (6.5)	<0.000
Missing	0.9	9.4 (6.8)	1.1	10.9 (6.1)	
Stroke					
Yes	2.7	10.4 (6.6)	2.4	12.5 (7.0)	<0.000
No	96.7	7.3 (5.7)	96.9	9.4 (6.6)	0.03
Missing	0.6	7.8 (5.3)	0.7	9.8 (8.3)	
Dyslipidaemia					
Yes	8.9	7.6 (6.1)	10.2	10.2 (6.7)	<0.000
No	88.9	7.3 (5.8)	87.1	9.3 (6.6)	<0.000
Missing	2.2	7.0 (5.7)	2.7	10.7 (6.6)	

Childhood adversity

Three aspects of the CA experienced before age 17, namely childhood abuse and neglect, caregiver's characteristics, childhood SES, were captured in the study. Childhood abuse and neglect was assessed by parental physical abuse and maternal emotional neglect. Caregiver's characteristics were measured by parental mental health, quality of parents' relationship, and early parental death. We used father's education (illiterate/literate), paternal occupation (agricultural/non-agricultural), and childhood food inadequacy (yes/no, a measure of severe deprivation) to reflect childhood SES.

Specifically, parental physical abuse was measured by whether the respondent was physically abused by their father or mother. Two questions – "How often did your female guardian give you love and affection while you were growing up?" and "How much effort did your female guardian put into watching over you?" – assessed maternal emotional neglect.

Parental mental health was measured by summed scores of six questions (0–14, a higher score indicating poorer mental health), including the frequency of male and female supporters feeling nervous and anxious, getting upset easily or feeling panicky, and showing continued signs of sadness or depression. The quality of the parents' relationship was assessed using summed scores of three questions (0–9, a higher score indicating worse relationship) on how frequent the parents quarrelled, the father was physically abused by the mother, and the mother was physically abused by the father. Parental mental health and the quality of their relationship were divided into tertiles, separately. Early parental death was determined by whether the father or mother died before the respondent turned 17 years old. Detailed questions and measurements of CA can be found in Appendix Table 1, supplementary material.

Covariates

Respondents' socio-demographic covariates included age at each wave, educational attainment at baseline (illiterate, can read and write, primary school, junior school and above), residential area (rural vs. urban), marital status (married vs. unmarried), activities of daily living (ADLs) limitation (any limitation in dressing, bathing, eating, getting in/out of bed, using the toilet, and controlling urination), current smoking status (yes vs. no), current drinking status (yes vs. no), and six self-reported chronic diseases based on doctor diagnoses (hypertension, dyslipidaemia, diabetes, cancer, heart problems, and stroke) and childhood self-rated health (healthy, average, and less healthy). All covariates were time-varying except educational attainment.

Statistical methods

We applied multilevel linear model with random intercepts to analyse the relationship between CA and depressive symptoms, in which repeated measurements of CES-D-10 scores (level 1) were nested within individuals (level 2). The covariates with missing information (0.4%–30%) were categorised as a separate group given the uncertainty of the missingness mechanisms. Sensitivity analyses using inverse probability weights were also performed to account for missingness. Three models were estimated separately for each aspect of CA in relation to depressive symptoms (Model 1: child abuse and neglect; Model 2: caregiver's characteristics; Model 3: childhood SES). Model 4 included all aspects of CA simultaneously. All covariates were adjusted in all models. Given the large gender difference in depressive symptoms, all analyses were conducted for men and women separately (Tables 2 and 3). Results of the analyses stratified by gender and birth cohorts (born in 1952–1966 vs. born before 1952) are presented in Table 4. Sensitivity analyses pooling men and women together are showed in Appendix Table 2, supplementary material.

Results

The description of sample characteristics at baseline is shown in Table 1. The distribution of CA among men and women was largely similar. For instance, the proportion of men who ever experienced parental physical abuse in their childhood was 33.1% and the number for women was 22.2%. Around 30.6% of men and 32.9% of women had a history of maternal emotional neglect in their early life. 16.4% of men reported parental death before age 17 while 13.9% of women experienced early parental death. A high percentage of respondents reported food inadequacy (male: 68.3% vs. female: 73.8%). Both men and women who experienced physical abuse or emotional neglect had higher CES-D-10 scores than those who had no such experience. Similarly, men and women who lived in an

Table 2. Associations between childhood adversity and CES-D-10 score among men.

	Model 1 (β, 95% CI)	Model 2 (β, 95% CI)	Model 3 (β, 95% CI)	Model 4 (β, 95% CI)
Total observations	16,972	16,972	16,972	16,972
Childhood abuse and neglect				
Parental physical abuse (no)				
Yes	0.81 (0.59, 1.04)			0.51 (0.28, 0.74)
Maternal emotional neglect (no)				
Yes	0.28 (0.05, 0.50)			0.30 (0.07, 0.51)
Caregiver's characteristics				
Parent's relationship (tertiles: good)				
Medium		0.24 (−0.04, 0.51)		0.20 (−0.07, 0.48)
Poor		0.71 (0.45, 0.97)		0.56 (0.29, 0.82)
Parental mental health (tertiles: good)				
Medium		0.88 (0.57, 1.19)		0.84 (0.53, 1.15)
Poor		1.88 (1.61, 2.15)		1.78 (1.51, 2.05)
Parental death before age 17 (no)				
Yes		−0.12 (−0.43, 0.19)		−0.13 (−0.44, 0.18)
Childhood SES				
Father's education (literate)				
Illiterate			0.27 (0.05, 0.50)	0.35 (0.13, 0.57)
Father's occupation (non-agricultural)				
Agricultural			−0.14 (−0.43, 0.16)	−0.10 (−0.39, 0.19)
Adequacy of food (yes)				
No			0.78 (0.54, 1.01)	0.53 (0.29, 0.76)
-Log likelihood	51101.58	51007.23	51108.15	50972.10

Model 1: childhood abuse and neglect + covariates; Model 2: caregiver's characteristics + covariates.
Model 3: childhood SES + covariates; Model 4: all childhood adversity variables + covariates.
β, coefficient estimated in the mixed linear regression models; CI, confidence interval; Reference groups were in parentheses.
Covariates included age, educational attainment at baseline, residential area, marital status, ADL limitations, current smoking, current drinking, chronic diseases, childhood self-rated health; SES, socioeconomic status.
Results for categories of missing and covariates were not shown in the table due to the space.

insecure family environment (i.e., poor mental health of the parents, poor parental inter-relationship), had experienced early parental death, or had lower childhood SES reported higher CES-D-10 scores compared to their counterparts.

Tables 2 and 3 present the results on the associations between CA and depressive symptoms among men and women, respectively. Physical abuse and emotional neglect were associated with 0.81 (95% confidence interval [CI]: 0.59, 1.04) and 0.28 (95% CI: 0.05, 0.50) higher CES-D-10 scores respectively among men, and with 0.97 (95% CI: 0.70, 1.25) and 0.33 (95% CI: 0.08, 0.57) higher scores among women (Model 1). In Model 2, men who reported poor parental mental health and poor quality of the parents' relationship in their childhood had 1.88 (95% CI: 1.61, 2.15) and 0.71 (95% CI: 0.45, 0.97) higher CES-D-10 scores, respectively; the elevated scores were 1.94 (95% CI: 1.64, 2.25) and 1.08 (95% CI: 0.79, 1.38) among women. Early parental death was not associated with depressive symptoms for either men or women. In Model 3, father's occupation was associated with a heightened CES-D-10 score among women but not among men. 0.78 (95% CI: 0.54, 1.01) and 1.15 (95% CI: 0.90, 1.41) higher CES-D-10 scores were found among men and women who reported food inadequacy at childhood, respectively, compared to those who had adequate food during childhood. When all aspects of CA were simultaneously controlled for in Model 4, the coefficients of CA were attenuated by 5–41%, except for maternal emotional neglect among both men and women and for father's education among men. Interaction tests between gender and CA variables produced non-significant results (p values = 0.17–0.83).

In Table 4, parental physical abuse was associated with 0.39–0.89 higher CES-D-10 scores for both men and women from different birth cohorts. However, for the birth cohort who were born before 1952, maternal emotional neglect was not associated with depressive symptoms. Moreover, poor mental health of the parents, poor quality of the parents' relationship, and food inadequacy remained to be associated with a higher CES-D-10 score for both birth cohorts. Results from the pooled sample produced consistent conclusions (Appendix Table 2, supplementary material). Sensitivity analyses using inverse probability weights to account for missingness generated largely consistent results (results are available upon request).

Discussion

The present study investigated the associations between three aspects of CA and depressive symptoms among middle-aged and older adults in the Chinese context using data from a large and nationally representative cohort study. We found that childhood parental physical and emotional neglect, being raised up by parents with poor mental health and poor quality of inter-parental relationship, and experiences of food inadequacy in childhood were consistently associated with more depressive symptoms in mid- and late-life among both Chinese men and women. More specifically, among all the aspects of CA, parental physical abuse, poor mental health of the parents, and food inadequacy in childhood had the largest effects on mid- and late-life depressive symptoms with an increase of the CES-D-10 score by 0.78–1.94 points, indicating that older Chinese with such adverse experiences are at an elevated risk of major depressive disorder. In addition, our findings were not substantially different between men and women or between birth cohorts, which confirms the robustness of the association between CA and mid- and late-life depression. The attenuation of this association when mutually controlling for all aspects of CA, except maternal emotional neglect, suggested both independent and shared pathways linking CA to mid- and late-life depression.

Our study provides new insights on the effects of CA on mid- and late-life depressive symptoms in a non-Western society. In line with previous studies from Western countries (Anda et al., 2006; Lindert et al., 2014; Springer et al.,

Table 3. Associations between childhood adversity and CES-D-10 score among women.

	Model 1 (β, 95% CI)	Model 2 (β, 95% CI)	Model 3 (β, 95% CI)	Model 4 (β, 95% CI)
Total observations	18,078	18,078	18,078	18,078
Childhood abuse and neglect				
Parental physical abuse (no)				
Yes	0.97 (0.70, 1.25)			0.59 (0.31, 0.88)
Maternal emotional neglect (no)				
Yes	0.33 (0.08, 0.57)			0.33 (0.08, 0.58)
Caregiver's characteristics				
Parent's relationship (tertiles: good)				
Medium		0.33 (0.02, 0.65)		0.29 (−0.02, 0.60)
Poor		1.08 (0.79, 1.38)		0.86 (0.56, 1.16)
Parental mental health (tertiles: good)				
Medium		0.80 (0.45, 1.15)		0.70 (0.35, 1.05)
Poor		1.94 (1.64, 2.25)		1.77 (1.46, 2.07)
Parental death before age 17 (no)				
Yes		−0.02 (−0.38, 0.35)		−0.04 (−0.40, 0.42)
Childhood SES				
Father's education (literate)				
Illiterate			0.14 (−0.11, 0.40)	0.16 (−0.09, 0.42)
Father's occupation (non-agricultural)				
Agricultural			−0.60 (−0.93, −0.26)	−0.56 (−0.88, −0.23)
Adequacy of food (yes)				
No			1.15 (0.90, 1.41)	0.90 (0.64,1.15)
-Log likelihood	56780.32	56681.72	56761.20	56634.17

Model 1: childhood abuse and neglect + covariates; Model 2: caregiver's characteristics + covariates.
Model 3: childhood SES + covariates; Model 4: all childhood adversity variables + covariates.
Covariates included age, educational attainment at baseline, residential area, marital status, ADL limitations, current smoking, current drinking, chronic diseases, childhood self-rated health; SES: socioeconomic status.
β; coefficient estimated in the mixed linear regression models; CI; confidence interval; Reference groups were in parentheses.
Results for categories of missing and covariates were not shown in the table due to the space.

Table 4. Associations between childhood adversity and CES-D-10 score by gender and birth cohorts.

	Male		Female	
	born in 1952–1966 (β, 95% CI)	born before 1952 (β, 95% CI)	born in 1952–1966 (β, 95% CI)	born before 1952 (β, 95% CI)
Total observations	9,289	7,683	10,821	7,257
Childhood abuse and neglect				
Parental physical abuse (no)				
Yes	0.52 (0.24, 0.81)	0.52 (0.16, 0.89)	0.39 (0.04, 0.75)	0.89 (0.41, 1.37)
Maternal emotional neglect (no)				
Yes	0.51 (0.23, 0.80)	−0.01 (−0.36, 0.33)	0.36 (0.05, 0.67)	0.30 (−0.10, 0.69)
Caregiver's characteristics				
Parent's relationship (tertiles: good)				
Medium	0.04 (−0.30, 0.39)	0.49 (0.05, 0.93)	0.35 (−0.03, 0.74)	0.25 (−0.28, 0.78)
Poor	0.59 (0.25, 0.92)	0.53 (0.12, 0.95)	1.00 (0.63, 1.37)	0.64 (0.15, 1.13)
Parental mental health (tertiles: good)				
Medium	0.69 (0.30, 1.09)	1.05 (0.56, 1.53)	0.53 (0.14, 0.99)	0.97 (0.39, 1.55)
Poor	1.88 (1.54, 2.23)	1.61 (1.18, 2.04)	1.62 (1.24, 2.01)	1.99 (1.49, 2.50)
Parental death before age 17 (no)				
Yes	−0.39 (−0.84, 0.05)	0.01 (−0.43, 0.45)	−0.33 (−0.82, 0.16)	0.39 (−0.18, 0.96)
Childhood SES				
Father's education (literate)				
Illiterate	0.36 (0.07, 0.64)	0.31 (−0.04, 0.66)	0.15 (−0.17, 0.46)	0.14 (−0.29, 0.57)
Father's occupation (non-agricultural)				
Agricultural	−0.14 (−0.51, 0.24)	−0.07 (−0.52, 0.39)	−0.68 (−1.07, −0.28)	−0.46 (−1.04, 0.11)
Adequacy of food (yes)				
No	0.72 (0.41, 1.03)	0.21 (−0.16, 0.59)	0.91 (0.59, 1.23)	0.63 (0.19,1.07)
-Log likelihood	27671.40	23241.29	33659.04	22928.79

Models were adjusted for all childhood adversity and covariates.
β: coefficient estimated in the mixed linear regression models; CI: confidence interval; Reference groups were in parentheses.
Covariates included age, educational attainment at baseline, residential area, marital status, ADL limitations, current smoking, current drinking, chronic diseases, childhood self-rated health; SES: socioeconomic status; Results for categories of missing and covariates were not shown in the table due to the space.

2007), parental physical abuse and maternal emotional neglect during childhood were associated with mid- and late-life depressive symptoms after controlling for a set of sociodemographic factors, health status, and other aspects of CA in China. This suggests that these detrimental effects are not mitigated by the Chinese social context where parental physical punishment is deemed as a social norm and a widely accepted practice of parenting. Attachment theory proposes that the quality of early attachment with parents is a source of security and protection to individual's personality functioning and mental health (Bowlby, 1984). Childhood abuse, in particular maternal abuse and neglect, affects parent-child interactions and the establishment of secure affectional bonds with other important persons in

life (Riggs, 2010). Compared to children who were not abused or neglected, maltreated children were more likely to be insecurely attached to others and to be depressed throughout their life course (Carlson, Cicchetti, Barnett, & Braunwald, 1989; Egeland, Carlson, & Sroufe, 1993). There is also biological evidence demonstrating that early adverse exposure causes long-lasting changes in multiple brain circuits and dysregulation of hypothalamic-pituitary-adrenal (HPA) axis that is highly related to individual's emotional and stress response (Anda et al., 2006; Bremner, 2003; Sanchez, Ladd, & Plotsky, 2001), as well as increasing the cortisol levels and HPA axis activity (Carpenter et al., 2009).

Previous studies have shown that an insecure family environment not only hinders physical and psychological development in childhood, but also affects mental health in adolescence and adulthood (Lieb, Isensee, Höfler, Pfister, & Wittchen, 2002; Repetti et al., 2002; Weissman, Warner, Wickramaratne, Moreau, & Olfson, 1997). This observation was replicated in our study, and the childhood insecure family environment (e.g. parental mental disorders and domestic violence) was linked to mid- and late-life depression. Family dysfunction was found to be associated with risky health behaviours in adulthood such as smoking and heavy alcohol drinking (Felitti et al., 1998). A prior study also showed that adverse childhood experiences and events, such as mental illness in the household, and parental separation or divorce, was related to alcohol misuse and abuse later in life, in particular for individuals with a parental history of alcoholism (Dube, Anda, Felitti, Edwards, & Croft, 2002). Moreover, childhood family violence also affects how individuals establish social network and receive social support from the partner and friends in adulthood and later life (Kessler and Magee, 1994). However, unlike in many Western studies (Kivela et al., 1998; Niina et al., 2006), we did not observe any association between early parental death and mid- and late-life depression. It is possible that individuals who survived from early parental death are actually healthier and develop better coping mechanisms with stressors than those who did not undergo such adverse event (Yang & Lou, 2016). In addition, children who experienced early parental death might be taken care of by other family members and extended kin which was common decades ago in China when multiple generations tended to live together (Yang & Lou, 2016). This may act as a buffer for mental health over the life course among Chinese who lost their parent(s) when they were young.

Consistent with previous studies (Gilman, Kawachi, Fitzmaurice, & Buka, 2002; Yang & Lou, 2016), we also found an association between poor childhood SES (food inadequacy and low paternal education) and poor mental health among older Chinese adults. It was proposed that there were "critical periods" for the development of certain organ systems or physiologic processes where changes were irreversible (Ben-Shlomo and Kuh, 2002). Thus adverse experiences during the critical periods could have long-lasting effects on subsequent health later in life. Children in adverse situations, such as poverty or malnutrition, may acquire less self-control and develop difficulties in forming intimate relationships and thus increasing their vulnerability of depression in adulthood (Gilman et al., 2002).

The strengths of the study are that we used a large nationally representative sample of older Chinese and multiple measurements of CA. CA was divided into three modules and included into the models step by step to examine how different aspects of CA affected mid- and late-life depressive symptoms. However, potential limitations of the study should also be acknowledged. First, the respondents may have difficulties in recalling certain childhood events or may choose not to disclose those adverse experiences, possibly leading to an underestimated association between CA and mid- and late-life depression. Second, we were not able to include some possible protective factors (e.g. resilience and stress adaptation) due to the lack of such data. Third, recent epigenetic studies found that genetic factors may confound the relationship between early-life stress and depression later in life, although the findings were not conclusive (Brown and Harris, 2008; Risch et al., 2009). The role of genetic traits and expression could not be further explored due to data restriction and further studies are thus needed. Fourth, previous studies suggested that social support or other coping resources such as spirituality may mediate the association between childhood adverse experiences and mental health (Maschi, Viola, Morgen, & Koskinen, 2015; Skarupski, Parisi, Thorpe, Tanner, & Gross, 2016; Toth, Gravener-Davis, Guild, & Cicchetti, 2013), which needs further investigations in the Chinese context to identify effective interventions for child maltreatment.

In conclusion, this study showed that CA was associated with more depressive symptoms among middle-aged and older Chinese men and women. These effects were as robust in China as in Western countries, where most of the prior evidence comes from. The main difference was that early parental death was not associated with depressive symptoms among either men or women in the Chinese context. Since childhood is a window of vulnerability, we should enact social policies targeted at helping families at a high risk to provide a secure environment and to reduce physical and emotional abuse from the parents, in order to enable their children to enjoy a mentally healthy life in China.

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Authors contributors

LY conceived the study, prepared the dataset, analysed the data, interpreted the findings, and drafted the manuscript. YH, KS, and PM advised the data analytical strategy, interpreted the findings and critically reviewed the manuscript.

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