

Research Article

# Social Relationships in Early Life and Episodic Memory in Mid- and Late Life

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## Abstract

**Objectives:** This study examines the longitudinal relationships between retrospective reports of early-life social relationships (i.e., having good friends, parent–child relationship quality, and childhood neighborhood social cohesion) and episodic memory in China.

**Methods:** We analyzed 2 waves of data (2011 and 2015) from the China Health and Retirement Longitudinal Study. The analytical sample included 9,285 respondents aged 45 and older at baseline. A lagged dependent variable approach was used to estimate the associations between measures of early-life social relationships and episodic memory change at the study's 4-year follow-up.

**Results:** Retrospective reports of better early-life social relationships are significantly associated with higher levels of episodic memory performance in 2015 among middle-aged and older Chinese, controlling for episodic memory in 2011, childhood socioeconomic status, adulthood sociodemographic variables, and the history of stroke. Educational attainment accounts for a significant portion of the associations between early-life social relationships and episodic memory. In contrast, mental health and social engagement in adulthood account for a small part of these associations.

**Discussion:** The findings suggest that positive early-life social relationships are beneficial for episodic memory in mid- and late life, and more research is needed to examine the underlying mechanisms.

**Keywords:** Childhood, China, Cognition, Friends, Parent–child relationship

A growing body of research suggests that early-life circumstances can affect cognitive health later in life (Liu & Lachman, 2019a; Richards & Deary, 2005). Studies in both developed and developing countries have consistently shown that higher childhood socioeconomic status (SES) is significantly associated with higher levels of cognitive functioning in later life (Luo & Waite, 2005; Singh-Manoux et al., 2005; Zhang et al., 2018). However, other important aspects of childhood conditions, such as early-life social

relationships, are rarely examined in the literature on life course determinants of cognitive health. Previous research on child development has shown that childhood social experiences can affect children's cognitive and socioemotional development as well as their physical health (Luecken et al., 2013; Umberson & Thomeer, 2020), but whether those social experiences formed in early life have any lasting effect on cognitive health in mid- and late life is an open question. A couple of recent studies have suggested that child-

hood parent–child relationships and interactions may have long-term effects on later-life cognition (Liu & Lachman, 2019a; Sharifian & Zahodne, 2019). Our study extends this line of work by examining the associations of three dimensions of childhood social environment (i.e., parent–child relationship, relationship with friends, and childhood neighborhood social cohesion) with memory performance in later life. Drawing on data from the China Health and Retirement Longitudinal Study (CHARLS) and its supplement, the 2014 Life History Survey, we aimed to investigate whether retrospective reports of early-life social experiences are associated with memory change among Chinese adults aged 45 and older at the study’s 4-year follow-up. In addition, we examined the extent to which the associations between childhood social relationships and mid- and late-life memory change were accounted for by educational attainment, mental health, and social engagement in adulthood.

### Theoretical Framework Linking Early-Life Social Relationships to Later-Life Cognition

The life course perspective has provided a useful theoretical framework to understand how early-life conditions can have long-term effects on multiple health outcomes in later life (Umberson & Thomeer, 2020). It is particularly useful in the study of cognitive outcomes because cognitive function shows “rapid growth and development in the early years rising to a peak or plateau at maturity, and then a gradual decline with age” (Kuh 2007, p. 718). Therefore, what happens in childhood may affect not only the level of the plateau reached but also how long one’s cognition can be maintained at that level (Zhang et al., 2016). Previous research has suggested at least three potential pathways linking early-life social relationships and later-life cognition.

The first explanation suggests that childhood social experiences can affect cognition in later life through educational attainment (Sharifian & Zahodne, 2019; Zahodne et al., 2019). High-quality childhood social interactions such as parent–child relationships can enhance children’s self-esteem, social competence, and self-efficacy and help them develop important skills that facilitate learning in schools. For example, research in Western countries has found that parent–child emotional bond and interaction are beneficial for multiple positive outcomes including school readiness, sleep, health, and school grades (Kiernan & Mensah, 2011; Li et al., 2016). Besides parent–child relationships, researchers have found that children and adolescents benefited from having close relationships with a variety of individuals (e.g., peers, siblings, and grandparents) who could provide them with social support. The perceived social support they received from multiple sources was positively associated with their school performance (Ahmed et al., 2010; Levitt, 2005). In summary, good social relationships with family and friends in early life can

promote academic competence and performance in childhood, adolescence, and young adulthood, which could contribute to higher educational attainment and better socioeconomic conditions over the life course (Zahodne et al., 2019). Many studies have shown that education is one of the most robust predictors of cognitive health in later life across different countries (Huang & Zhou, 2013; Zhang et al., 2020). A higher level of education is often associated with more complex jobs and higher income in adulthood, both of which can be beneficial to cognitive function in later life (Andel et al., 2007).

The second explanation suggests that early-life social experiences can affect mental health outcomes such as depression and anxiety over the life course (Chen & Harris, 2019; Lee et al., 2015; Sharifian et al., 2019), which in turn can affect cognitive health (Diniz et al., 2013; Zahodne et al., 2019). Recent studies suggest that childhood problems with peers and parents can potentially develop into a lifelong pattern of withdrawal and avoidance of others. On the other hand, emotional support from parents in childhood can have lasting positive health implications because children growing up in a loving and supportive environment tend to have better mental health, which is beneficial for the development of high-quality social relationships throughout the life course (Chen & Harris, 2019; Chopik & Edelstein, 2019; Shaw et al., 2004). Specifically, recent research has shown that the quality of early-life family relationships can affect mental health in later life. For instance, using nationally representative longitudinal data, Chen and Harris (2019) found that adolescents who had more positive family relationships had better mental health from early adolescence to midlife compared to their counterparts with less positive family relationships. Moreover, retrospective ratings of low parent–child relationship quality during childhood were related to higher levels of negative emotions in adulthood, including depression and anxiety (Chopik & Edelstein, 2019; Mellers et al., 2010; Shaw et al., 2004). A growing body of literature has found that a history of depressive symptoms is a risk factor for lower cognitive functioning and more rapid cognitive decline in later life (Jorm, 2000; Zahodne et al., 2014). The specific mechanisms linking depression and cognitive health are complex and remain a subject of active research. However, some researchers have suggested a possible neurological pathway such that depression can lead to “chronically elevated glucocorticoid production, which may cause hippocampal atrophy and subsequent cognitive dysfunction” (Hughes & Ganguli, 2009, p. 83). Others suggest that depression may be linked with poor cognitive outcomes through behavior mechanisms including less exercise and less healthy eating (Zahodne et al., 2019). In short, mental health can be an important pathway linking early-life social relationships and memory in later life.

The third explanation suggests that above and beyond intimate relationships with family and friends in childhood, growing up in a socially cohesive neighborhood where

neighbors are engaged, friendly, and helpful may have additional long-term beneficial health effects. Part of the reason is that neighborhood social cohesion in early life may lead to more active social involvement with neighbors, friends, and community activity over the life course (Lenzi et al., 2013). For example, researchers found that neighborhood social connectedness (measured by neighborhood trust and reciprocity, relationship with neighbors, neighborhood friendships, etc.) was associated with a higher level of civic engagement among adolescents in an Italian city (Lenzi et al., 2013). One recent study in China found that older adults who grew up in a more cohesive neighborhood (i.e., one with close-knit, helpful neighbors) were more likely to engage in socially productive activities such as volunteering, taking part in community organizations, or providing help to friends, neighbors, or a non-resident family member in adulthood (Ko & Yeung, 2019). Mounting research has shown that social engagement in later life has a positive association with cognitive health in later life (Dong et al., 2014; Feng et al., 2014). For older adults, social engagement is cognitively stimulating, promotes social and emotional well-being, and creates opportunities to engage in physical activity (Hughes & Ganguli, 2009; Seeman et al., 2011), all of which help slow down cognitive decline.

### The Effects of Early-Life Social Relationships on Cognition in Later Life: Initial Empirical Evidence

To the best of our knowledge, only a handful of previous studies have presented initial evidence that childhood social relationships may have enduring effects on late-life cognition, and most of them have focused on parent–child relationships. Two studies have focused on the effects of mother–child relationships on cognitive function in later life in the United States. In one study using three waves of data (2008–2014) from the Health and Retirement Study (HRS), researchers found that retrospective reports of higher mother–child relationship quality in childhood were associated with less memory decline for a period of 2 years through socioemotional pathways (Sharifian et al., 2019). Another study using data from sibling respondents to the Wisconsin Longitudinal Study found that retrospective reports at baseline (1993–1994; T1) of positive mother–child interactions during the first 16 years of life were associated with better episodic memory assessed at the follow-up (2004–2007; T2) and a slower memory decline from T2 to T3 (2011). On the other hand, retrospective reports of negative mother–child interactions at baseline were associated with better memory scores at T2 but not with memory change from T2 to T3 (Sharifian & Zahodne, 2019). The third study used three waves of the Midlife in the United States study, which included respondents' recall of their mothers' and fathers' parenting styles. The findings showed that only paternal affection was associated with less cognitive decline in mid- and later life (Liu & Lachman, 2019a).

The present study aims to extend prior work on childhood social relationships and later-life cognitive function

by going beyond parent–child interactions and examining the effects of a broader range of childhood social relationships (i.e., peer relationships and childhood neighborhood social cohesion) on cognitive health in mid- and later life. We will test the following two hypotheses: (a) Better early-life social relationships are associated with less memory decline in later life; (b) The association between early-life social relationships and memory decline can be partially explained by educational attainment, mental health, and social engagement in adulthood.

## Method

### Data

We used two waves (2011 and 2015) of the CHARLS and its supplement, the 2014 Life History Survey. The CHARLS is modeled after the HRS in the United States. It is a nationally representative longitudinal study that surveys community-dwelling adults aged 45 and older in China every 2 years. If the respondents are married, their spouses are also interviewed. A multistage cluster sampling method was used to obtain the sampling frame of CHARLS at baseline (2011), and interviewers were assigned to 23,422 dwellings. After excluding empty or nonresident dwellings, interviews were completed with 17,708 respondents from 150 counties in 28 provinces in China. Face-to-face computer-assisted interviews were conducted, with a response rate of 80.5% at baseline. In 2014, the supplementary Life History Survey was conducted to collect detailed information about respondents' childhood circumstances, educational and occupational history, and health. Detailed information on CHARLS sampling procedures, recruitment strategy, and follow-up surveys can be found elsewhere (<http://charls.pku.edu.cn>). Our analysis showed that about 82% of baseline respondents participated in the supplementary survey ( $n = 14,436$ ), and 14,049 of them were 45 years and older. We excluded 1,476 respondents (10.5% of age-eligible respondents) who were raised by single parents or non-parent caregivers during most of their childhood, and an additional 2,021 respondents who did not participate in memory tests at baseline. We further excluded 1,267 respondents who did not have memory scores, dropped out, or were deceased in 2015, which resulted in an analytic sample of 9,285 respondents. Additional analysis showed that the excluded respondents were more likely to be older, male, unmarried, and with no schooling.

## Measures

### Dependent variable

#### *Episodic memory*

Episodic memory is an important dimension of cognitive function and is crucial for reasoning and daily functioning. List learning tests are commonly used by neuropsychologists to measure episodic memory (Gavett & Horwitz,

2012; Lachman et al., 2010). Respondents in CHARLS were asked to recall 10 simple Chinese nouns right after the nouns were read to them (immediate recall) and then 4 min later (delayed recall). Following previous studies, we averaged the scores of immediate and delayed recall to create a measure of episodic memory in both 2011 and 2015 (Huang & Zhou, 2013).

### Independent variables

Childhood social relationships were measured by respondents' retrospection of their relationships with parents, peers, and neighbors before age 17. *Had good friends* (1 = yes) is based on the respondent's answer to the question, "When you were a child, did you have a good friend?" Respondents were also asked to assess the quality of their relationships with their female and male guardians, respectively, in their childhood. Because we restricted our sample to those who were raised by both parents (i.e., biological, step or adoptive parents), the guardians refer to mothers and fathers. Responses included excellent (1), very good (2), good (3), fair (4), and poor (5). We collapsed the last two categories because very few respondents reported poor relationships with their parents, and we reverse coded the variables so that a higher value represents better relationship quality. The ratings of mother-child and father-child relationships were highly correlated ( $r = 0.75$ ), and we averaged the two ratings to create a variable called *parent-child relationship quality*, ranging in value from 1 to 4.

Respondents were also asked about their childhood neighborhoods. First, respondents were asked, "Were the neighbors of the place where you lived as a child willing to help each other out?" Responses included very willing (1), somewhat willing (2), not very willing (3), and not willing at all (4). Respondents were then asked, "Were the neighbors of the place where you lived as a child very close-knit?" Responses included very close-knit (1), somewhat close-knit (2), not very close-knit (3), and not close-knit at all (4). We reverse coded the variables so that a higher value represents more cohesive relationships among neighbors. Based on factor analysis, we found that these two items loaded on one factor, and therefore we took the average of the two variables and called the resulting measure *childhood neighborhood social cohesion*. All the variables of childhood social relationships were derived from the 2014 supplementary survey.

Measures of adulthood conditions were collected at the baseline survey in 2011 and included educational attainment, mental health, and social engagement. *Educational attainment* was coded into five categories: no schooling (= reference), less than elementary school, elementary school, middle school, and high school or more.

The *depressive symptoms* variable reflected mental health and was measured by the 10-item Center for Epidemiologic Studies Depression scale (CESD-10), which was previously validated among older Chinese in Hong

Kong (Cheng & Chan, 2005). In CHARLS, respondents were asked how often they felt depressed, lonely, happy, fearful, and hopeful, as well as how often they had restless sleep, were bothered by things that do not usually bother them, had trouble keeping their minds on what they were doing, felt everything was an effort, and could not get going. The sum of the CESD-10 scores ranged from 0 to 30, with higher scores indicating more depressive symptoms.

*Social engagement* was measured by participation in one or more social activities (e.g., visiting neighbors/friends, playing mahjong/cards, going to dance or exercise in parks or other places, and going to a sports or social club) in the last month. We dichotomized the variable (1 = participated in one or more activities) because the level of social engagement was quite low in our sample.

### Control variables

We included age, gender (1 = female), marital status (1 = unmarried), current residence (1 = rural), coresidence status (1 = live with children), childhood SES, stroke before baseline, (1 = yes), and new stroke between 2011 and 2015 (1 = yes). Childhood SES has three indicators: mother's education (1 = received 1+ years of schooling), father's education (1 = received 1+ years of schooling), and childhood residence (1 = rural). All control variables were derived from the baseline survey (2011) except for the mother's and father's education which came from the 2014 supplementary survey, and new stroke that combined information from the baseline and the 2015 wave. We controlled for the history of stroke because it is a risk factor for cognitive decline and dementia (Pinkston et al., 2009).

### Analytic Strategy

We began by calculating descriptive statistics of the analytic sample. Then we used a lagged dependent variable (LDV) approach to examine the longitudinal associations between childhood social relationships and episodic memory in 2015, controlling for episodic memory at baseline. The LDV models are commonly used to estimate changes in health between two points in time. Thus, a positive coefficient would indicate a smaller decline in episodic memory, while a negative coefficient would indicate a greater decline in episodic memory over the observation period (Grundy et al., 2012; Liu & Lachman, 2019b; Luo et al., 2019).

We estimated a series of models to understand the longitudinal associations between childhood social relationships and episodic memory change in 4 years during middle and later adulthoods. In Model 1, we controlled for sociodemographic variables, childhood SES, experience with stroke, and baseline episodic memory. In Model 2, we added educational attainment. Likewise, we added depressive symptoms in Model 3 and social engagement in Model 4 to the covariates included in Model 1. Model 5 is the

full model and included all the covariates. To adjust for sample selection, we used baseline individual-level weights provided by the CHARLS team. Most of our independent variables in the analytic sample had relatively few missing data (<6%). We used multiple imputation method to handle missing data in the analyses. The results were based on 10 random, multiple-imputed replicates.

We conducted formal mediation analysis using the Karlson–Holm–Breen (KHB) method to examine whether education, depressive symptoms, and social engagement mediate the associations between childhood social relationships and episodic memory change. The KHB method decomposes the total effects of a predictor variable on the outcome variable into direct and indirect effects (mediation) in both linear and nonlinear probability models (Hsieh & Waite, 2019; Karlson & Holm, 2011). We conducted all analyses using Stata 16.

## Results

### Sample Characteristics

The weighted descriptive statistics are reported in Table 1. The average scores of episodic memory were 3.68 in 2011 and 3.36 in 2015 (range: 0–10). Approximately 53% of middle-aged and older Chinese adults reported that they had good friends in their childhood. On average, they also recalled good relationships with their parents (2.75 on a scale of 1–4) and rated their childhood neighborhood as very cohesive (3.36 on a scale of 1–4). The education level of respondents was low: Almost 23% had no schooling, about 18% went to elementary school but did not finish, 22% finished elementary school, 23% attended middle school, and only about 14% had gone to high school or beyond. The average score for depressive symptoms was approximately 8 (on a scale of 0–30). About 49% of respondents participated in one or more social activities. The average age of the respondents was about 58 years old, and 52% of the sample were female. Most respondents were married (89%) and lived with their children (62%). About 57% lived in rural areas. At baseline, about 2.09% of respondents had suffered from a stroke, and 1.78% experienced a stroke between the baseline and the follow-up.

### Childhood Social Relationships and Episodic Memory Change

We then examined whether childhood social relationships were associated with the change in episodic memory between 2011 and 2015. Results from LDV models are reported in Table 2. We estimated five models and had several important findings. First, as indicated by Model 1 in Table 2, all three indicators of childhood social relationships were significantly associated with episodic memory in 2015, controlling for episodic memory in 2011,

**Table 1.** Weighted Descriptive Statistics of Chinese Adults Aged 45 and Older, CHARLS, 2011–2015

	Mean or percent
Cognitive function	
Episodic memory 2011 (0–10)	3.68 (0.03)
Episodic memory 2015 (0–10)	3.36 (0.03)
Childhood social relationships	
Had good friends (%)	53.13
Parent–child relationship quality (1–4)	2.75 (0.01)
Childhood neighborhood social cohesion (1–4)	3.36 (0.01)
Adulthood conditions (2011)	
Educational attainment (%)	
No schooling (reference)	22.49
Less than elementary school	18.02
Elementary school	22.44
Middle school	23.38
High school or more	13.66
Depressive symptoms (0–30)	8.00 (0.09)
Social engagement (%)	48.99
Controls	
Age (years)	57.72 (0.14)
Female (%)	52.30
Unmarried (%)	11.02
Current rural residence (%)	56.61
Live with children (%)	62.05
Mother had 1+ years of schooling (%)	11.83
Father had 1+ years of schooling (%)	42.63
Grew up in rural area (%)	88.76
Stroke before baseline (%)	2.09
New stroke between 2011 and 2015 (%)	1.78

Notes: CHARLS = China Health and Retirement Longitudinal Study. Values in parentheses are standard errors of means. *N* = 9,285.

sociodemographic characteristics, childhood SES, stroke before baseline, and new stroke between 2011 and 2015. Specifically, we found that older adults who reported that they had good friends in childhood had significantly higher episodic memory scores in 2015 than those who said that they had no good friends ( $b = 0.15, p < .01$ ). Those who had better relationships with their parents in childhood ( $b = 0.10, p < .01$ ) and lived in more cohesive neighborhoods ( $b = 0.11, p < .01$ ) also had better episodic memory in 2015. In other words, better social relationship quality in childhood was associated with less decline in episodic memory.

We then added educational attainment (Model 2). As expected, higher educational attainment was significantly associated with better episodic memory in 2015. More importantly, the coefficients of all three indicators of childhood social relationships were reduced relative to Model 1—the coefficient of having good friends in childhood became statistically nonsignificant, although the effects of parent–child relationship quality ( $b = 0.08, p < .01$ ) and childhood neighborhood social cohesion ( $b = 0.09,$

**Table 2.** Regression Coefficients for Episodic Memory Among Chinese Adults Aged 45 and Older, CHARLS, 2011–2015

	Episodic memory 2015				
	Model 1	Model 2	Model 3	Model 4	Model 5
Childhood social relationships					
Had good friends	0.15 (0.04)**	0.06 (0.04)	0.14 (0.04)**	0.14 (0.04)**	0.05 (0.04)
Parent–child relationship quality	0.10 (0.02)**	0.08 (0.02)**	0.09 (0.02)**	0.10 (0.02)**	0.08 (0.02)**
Childhood neighborhood social cohesion	0.11 (0.03)**	0.09 (0.03)**	0.10 (0.03)**	0.11 (0.03)**	0.08 (0.03)*
Adulthood conditions					
Educational attainment (no schooling)					
Less than elementary school		0.38 (0.07)**			0.38 (0.07)**
Elementary school		0.69 (0.07)**			0.68 (0.07)**
Middle school		0.95 (0.08)**			0.94 (0.08)**
High school and above		1.29 (0.10)**			1.26 (0.10)**
Depressive symptoms			–0.02 (0.00)**		–0.01 (0.00)**
Social engagement				0.12 (0.04)**	0.08 (0.04)*
Controls					
Age	–0.05 (0.00)**	–0.04 (0.00)**	–0.05 (0.00)**	–0.05 (0.00)**	–0.04 (0.00)**
Female	–0.08 (0.04)*	0.19 (0.04)**	–0.05 (0.04)	–0.08 (0.04)*	0.21 (0.04)**
Unmarried	–0.15 (0.07)*	–0.10 (0.07)	–0.13 (0.07)	–0.15 (0.07)*	–0.09 (0.07)
Current rural residence	–0.29 (0.05)**	–0.16 (0.05)**	–0.27 (0.05)**	–0.29 (0.05)**	–0.14 (0.05)**
Live with children	–0.10 (0.04)*	–0.09 (0.04)*	–0.11 (0.04)*	–0.10 (0.04)*	–0.09 (0.04)*
Mother had 1+ years of schooling	0.24 (0.07)**	0.17 (0.06)**	0.24 (0.07)**	0.24 (0.07)**	0.16 (0.06)*
Father had 1+ years of schooling	0.20 (0.05)**	0.13 (0.05)*	0.20 (0.05)**	0.20 (0.05)**	0.12 (0.05)*
Grew up in rural area	–0.57 (0.07)**	–0.36 (0.07)**	–0.55 (0.07)**	–0.56 (0.07)**	–0.35 (0.07)**
Stroke before baseline	–0.27 (0.11)*	–0.28 (0.11)*	–0.23 (0.12)	–0.28 (0.11)*	–0.26 (0.11)*
New stroke between 2011 and 2015	–0.33 (0.13)**	–0.30 (0.13)*	–0.31 (0.13)*	–0.32 (0.13)*	–0.28 (0.13)*
Episodic memory 2011	0.35 (0.01)**	0.30 (0.01)**	0.34 (0.01)**	0.35 (0.01)**	0.29 (0.01)**
Constant	4.95 (0.23)**	3.78 (0.24)**	5.13 (0.23)**	4.92 (0.23)**	3.90 (0.25)**
R <sup>2</sup>	0.301	0.336	0.304	0.302	0.338

Notes: CHARLS = China Health and Retirement Longitudinal Study. Unstandardized regression coefficients and robust standard errors are presented.  $N = 9,285$ . \* $p < .05$ , \*\* $p < .01$ .

$p < .01$ ) remained statistically significant. To examine whether mental health accounted for the associations between childhood social relationships and episodic memory, we added depressive symptoms to Model 1 (Model 3). As expected, those who had more depressive symptoms had lower episodic memory in 2015 ( $b = -0.02$ ,  $p < .01$ ). Compared to Model 1, the coefficients of the three indicators of childhood social relationships were reduced slightly, though they remained significant at  $p < .01$ . In Model 4, we added social engagement to Model 1, which was statistically significant ( $b = 0.12$ ,  $p < .01$ ). Results showed that the coefficient of having good friends was reduced slightly, but the coefficients of the other two indicators of childhood social relationships did not change. Finally, we included educational attainment, depressive symptoms, social engagement, and all the other covariates in the same model (Model 5, the full model). Results of the full model showed that both parent–child relationships and childhood neighborhood social cohesion were associated with less decline in episodic memory. However, having good friends in childhood was not significantly associated with memory decline.

We conducted mediation tests for educational attainment, depressive symptoms, and social engagement using the KHB method, and the results are presented in Table 3. We found that the effects of all three indicators of social relationships in childhood on episodic memory change were partially mediated by educational attainment. Specifically, educational attainment accounted for 61% ( $=0.091/0.149$ ) of the effect of having good friends, 19% of the effect of parent–child relationships, and 19% of the effect of childhood neighborhood social cohesion on episodic memory change. In comparison, the mediating effects of depressive symptoms and social engagements were quite small. For example, depressive symptoms accounted for about 5% of the effect of having good friends, 4% of the effect of parent–child relationships, and 9% of the effect of childhood neighborhood social cohesion. As for social engagement, it accounted for 5% of the effect of having good friends but did not mediate the effects of parent–child relationship or childhood neighborhood social cohesion.

With regard to control variables, we found in Model 5 that being female and having parents who had some schooling were associated with less decline in episodic

**Table 3.** KHB Mediation Analysis of Educational Attainment, Depressive Symptoms, and Social Engagement

	Had good friends	Parent-child relationship quality	Childhood neighborhood social cohesion
<b>Educational attainment</b>			
Total effect	0.149**	0.098**	0.108**
Direct effect	0.059	0.080**	0.087**
Indirect effect	0.091**	0.019**	0.021**
<b>Depressive symptoms</b>			
Total effect	0.149**	0.098**	0.108**
Direct effect	0.142**	0.094**	0.099**
Indirect effect	0.007*	0.004**	0.010**
<b>Social engagement</b>			
Total effect	0.149**	0.098**	0.108**
Direct effect	0.141**	0.101**	0.106**
Indirect effect	0.008**	-0.002*	0.002

Notes: KHB = Karlson-Holm-Breen.  $N = 9,285$ .

\* $p < .05$ , \*\* $p < .01$ .

memory. On the other hand, older age, living in a rural area, living with children, growing up in a rural area, having a stroke before the baseline, and new stroke at the follow-up were associated with greater declines in episodic memory.

### Sensitivity Analysis

We conducted a series of sensitivity analyses to test the robustness of the results. First, we tested whether our results can be extended to those who were raised by a single parent ( $n = 1,092$ ). When we added these respondents to our sample and used the respondents' assessment of their childhood relationship with the single parent as an indicator of parent-child relationship, results were similar to the main findings reported in the article. Second, we excluded middle-aged respondents (between age 45 and 60) from our analysis, and the results remained largely the same. We have also tested whether the effects of childhood social relationships vary by age and did not find any significant age interaction effects.

### Discussion

Understanding early-life determinants of cognitive functioning will help health professionals screen for older adults at high risk of cognitive decline and design interventions to mitigate the effects of childhood adversity on cognitive health. Previous research has shown that early-life conditions (e.g., childhood SES, childhood health and nutrition) have long-term effects on cognitive health (Horvat et al., 2014; Maurer, 2010; Zhang et al., 2018). However, few studies have focused on the effects of early-life social relationships on cognitive health in mid- and late life. This study contributes to this line of research by examining

whether the quality of multiple dimensions of childhood social relationships affects memory change during 4 years among a nationally representative sample of older Chinese adults aged 45 and older.

Our findings extend the limited literature on childhood social relationships and cognitive health in later life in several ways. First, we found that higher quality of multiple dimensions of childhood social relationships was associated with less memory decline during a 4-year period, controlling for basic sociodemographic characteristics, childhood SES, and the history of stroke (Hypothesis 1). This result is largely consistent with two recent studies that found mother-child relationships were positively associated with slower memory decline among older Americans (Sharifian et al., 2019; Sharifian & Zahodne, 2019). The major contribution of our study is that we went beyond mother-child relationships and incorporated other important dimensions of childhood social relationships including peer relationships and childhood neighborhood social cohesion. Previous research in childhood development has found that peer relationships have significant effects on children's emotional well-being and academic performance (Ahmed et al., 2010; Wentzel, 2009). Our results suggest that having good friends in childhood can also have long-term effects on cognitive health in later life. Furthermore, we also found that even after we controlled for peer relationships and parent-child relationships, childhood neighborhood social cohesion had independent effects on memory decline in later life. As far as we know, we are among the first to look at the effect of childhood neighborhood social cohesion on later-life memory functioning, and our findings open up new avenues for future research on the long-term health effects of childhood neighborhoods.

Second, we hypothesized that educational attainment, mental health, and social engagement may partially explain the associations between early-life social relationships and later-life episodic memory decline (Hypothesis 2). Our results are mixed. We found some evidence that educational attainment was a major pathway linking all three indicators of childhood social relationships and memory decline. These results echo the findings of a recent study by Sharifian and Zahodne (2019) that higher educational attainment partially mediated the effects of mother-child relationships on episodic memory in later life, as well as those of other studies that point to adulthood socioeconomic resources as important mediators between early-life conditions and later-life cognitive function (Singh-Manoux et al., 2005; Zhang et al., 2019). Prior studies also have found that socioemotional pathways (i.e., depressive symptoms, loneliness, and network size) linked childhood maternal relationship quality and episodic memory among older adults (Sharifian et al., 2019). Our analysis suggests that the mediating effects of adult depressive symptoms were statistically significant, but the magnitude was small. We found that social engagement accounted for some of the effects of having good friends in childhood but did not mediate the

effects of parent–child relationship and childhood neighborhood social cohesion on change in episodic memory.

Among the three dimensions of the social environment that we have examined in the article, the parent–child relationship is the most intimate and can affect children’s daily activities, emotions, health behaviors, and social networks in a myriad of ways. Moreover, for most individuals, their relationships with their parents will last throughout their lives. In this sense, it is not surprising that parent–child relationship in early life has long-term effects on adulthood memory, net of all the controls examined. In comparison, peer relationships are more fluid. Having good friends in childhood may be very important while the individual is still in school, and it affects academic performance. However, as individuals step into society, friends may change and current social networks may exert a stronger influence on their cognitive health. The long-term health-enhancing effect of childhood neighborhood social cohesion is intriguing. It is possible that the pleasant memory of neighbors helping and trusting each other in early life may influence the way adults act in their new neighborhoods and thereby increase their adulthood neighborhood social cohesion. There is research showing that living in a socially cohesive environment is associated with various domains of cognitive function (e.g., episodic memory and executive function), partly because such neighborhoods not only encourage social interactions and social support but also increase residents’ feelings of belonging and sense of control, all of which may promote cognitive health (Lee & Waite, 2018; Zhang et al., 2019).

### Limitations

Similar to most studies in this area, our study has limitations. First, our sample of older adults represents “healthy survivors” because we excluded those who could not participate in memory tests in 2011 and 2015 as well as those who did not participate in the supplementary survey in 2014. Thus, those who were too sick or felt that they might not be able to answer the memory questions were likely excluded from our analytic sample. These exclusions may lead to underestimation of the effects of childhood social relationships on episodic memory, as previous studies have found that adolescents who had poor social relationships were more likely to have poor adult health (Chen & Harris, 2019). Second, like most previous studies, our measures of childhood social relationships were based on recall and thereby subject to social desirability bias and recall errors. On the other hand, recent studies have suggested that age and depression are not related to the consistency of the recall of childhood events, providing support for the validity and reliability of using retrospective assessment of early-life experiences (Lee et al., 2015; Yancura & Aldwin, 2009). However, a caveat here is that we cannot rule out the possibility that respondents with better cognitive health may have more positive appraisal of childhood social relationships, and thus the results should be interpreted cautiously.

Future studies need to examine the prospective effects of children’s and adolescents’ assessment of their social relationships on their cognitive trajectories throughout the life span.

Third, our mediators did not fully explain the effects of parent–child relationship quality and childhood neighborhood social cohesion on memory change. Future research should explore other underlying mechanisms. For example, previous research suggested that the effects of early-life social relationships may affect later-life cognition via exposure and reactivity to stress, multisystem biological risks (e.g., metabolic syndrome, high cholesterol, and peripheral inflammation), and health behaviors (e.g., physical activity; Bherer et al., 2013; Liu & Lachman, 2019b; Umberson et al., 2010; Zahodne et al., 2019). Our data also did not include any indicators of adulthood relationship quality, which is potentially another important mediator. For instance, one previous study found that adulthood marital quality partially mediated the association between early-life positive mother–child interaction and episodic memory in later life (Sharifan & Zahodne, 2019). Future research should examine additional adulthood relationship factors, including intergenerational relationship quality and adulthood social ties with friends and neighbors, which may explain the associations between childhood social relationship quality and cognitive health in later life.

Despite these limitations, our study extends previous findings on the impact of childhood social relationships on cognitive health in later life by using longitudinal data from a nationally representative sample of middle-aged and older Chinese. Our results show that positive early-life social relationships may be important protective factors of cognitive health in later life. Future research should investigate the multiple biopsychosocial mechanisms underlying the effects of childhood social relationships on later-life cognition.

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### Conflict of Interest

None declared.

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## Author Contributions

Z. Zhang conceptualized the study, carried out the data analysis, and wrote the article with input from all authors. H. Xu, L. W. Li, and J. Liu provided critical feedback on statistical analyses and interpretation of results. S. E. Choi participated in data cleaning and contributed to revising the article.

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