Children's Geographic Proximity and Older Parents' Depressive Symptoms in China

Di Liang, PhD,[1] and Donglan Zhang, PhD[2]

Abstract

Objective: This study examined the association between children's proximity and older parents' depressive symptoms, and whether living with grandchildren modified this association. **Method:** Study sample was from the 2011 China Health and Retirement Longitudinal Study (*N* = 5,261). Elders' depressive symptoms were measured using the 10-item Center for Epidemiologic Studies Depression Scale. Children's proximity was measured by the geographic distance from an adult child to elders' residence. Linear and logit regressions were performed. **Results:** Elders who had their nearest child living 100 km away were 9% more likely to experience severe depressive symptoms (95% CI: [1%, 16%]) than those living together with children. Among those living far away from adult children, living with a grandchild in the same household increased the likelihood of having severe depressive symptoms by 23% (95% CI: [12%, 34%]). **Discussion:** Relationships between children's proximity and parents' health were identified and modified by whether living with grandchildren.

Keywords

Introduction

Depression is one of the most common mental health problems in later life. Both diagnosable depression and self-reported depressive symptoms were common among elders in China: The prevalence of diagnosable depression was 6.0% among those aged 60 and older in rural communities of Anhui province (Chen et al., 2005); and the pooled prevalence of self-reported depressive symptoms was 23.6% among the elderly, as reported by a recent systematic review (Li, Zhang, Shao, Qi, & Tian, 2014). Many elders with depressive symptoms may not meet the diagnostic criteria of major depressive disorders. However, a large body of literature has shown that self-reported depressive symptoms among the elders predicted a higher risk of major depression and poor physical health outcomes (Ariyo et al., 2000; Katon, 2003; Luppa et al., 2013; Zhang et al., 2005).

Depressive symptoms in later life are closely associated with a variety of individual characteristics, family dynamics, and community-level factors (Cheng, Chen, McBride, & Phillips, 2016; Lei, Sun, Strauss, Zhang, & Zhao, 2014; Yu, Li, Cuijpers, Wu, & Wu, 2012). Children's geographic proximity is an important determinant for intergenerational contacts and supports (Rossi, 1990), thus the role of children's proximity in elder's health was widely studied in developed countries. Studies

have shown that co-residence with adult children may have psychological benefits for the older parents, and living close to children may have positive effects on elder's psychological well-being (Ha, Yoon, Lim, & Heo, 2016). In Asian countries, a Japan-based study reported that among older people whose spouse had serious illness, those who had all children living more than 30 miles away had poorer self-rated health than those who lived with children (Saito, Wakui, & Kai, 2016). Geographic proximity was a significant predictor of parent–child relationship among widowed older people in South Korea (Ha et al., 2016).

Little is known about the association between children's geographic proximity and their older parents' mental well-being in China during its rapid process of urbanization and other social changes. In Modern Chinese context, owing to the massive rural-to-urban migration, a large number of elders became "empty-nesters" and could not contact their children regularly

[1]University of California, Los Angeles, CA, USA
[2]University of Georgia, Athens, GA, USA

Corresponding Author:
Donglan Zhang, Department of Health Policy and Management, College of Public Health, University of Georgia, 205D Wright Hall, 100 Foster Road, Athens, GA 30677, USA.
Email: dzhang@uga.edu

(e.g., till 2014, there were about 273.95 million migrant workers in China; National Health and Family Planning Commission, 2015. But as the generation impacted by the "one-child" policy turned to their 60s, elders in China are expected to have fewer children living together or nearby. It was found that 41% of the Chinese people aged 60 and above co-reside with an adult child, and 34% had at least one adult child living in the same neighborhood but not the same household (Lei, Strauss, Tian, & Zhao, 2015). Previous studies have focused on the impact of co-residence with children on the elderly's health (Silverstein, Cong, & Li, 2006). But because proximate residence, instead of co-residence, seemed to be an increasingly popular living arrangement among the elderly in China, more research is warranted to understand the associations between co-residence/proximate residence/distant residence and elders' well-being, and how this relationship may be modified by the intergenerational family support between parents and children.

In the present study, we focused particularly on the relationship between adult children's geographic proximity and their elder parents' depressive symptoms. The hypothesis was that elders with all children living far away experienced more depressive symptoms, because they received less functional and emotional support from their adult children. In addition, as living with and caring for grandchildren was a common living arrangement among elders in China, we also tested whether living with a grandchild can potentially moderate the relationship between elders' depressive symptoms and children's proximity, because caring for grandchildren may not only be beneficial to the elder's health but may also be a burden. Finally, we stratified the sample by rural/urban status, marital status, and gender, as the relationship may differ in different subpopulations.

Method

Data Source and Sample

Data for this study were from the China Health and Retirement Longitudinal Study (CHARLS) 2011-2012, the most up-to-date and nationally representative survey for aging studies in China. CHARLS sampled households with members aged 45 years and above. To facilitate cross-country comparisons, CHARLS was modeled after several country-specific aging surveys such as the Health and Retirement Study, the English Longitudinal Study of Aging, and the Survey of Health, Aging and Retirement in Europe. The CHARLS 2011-2012 national survey covered 450 villages/urban communities in 150 countries/districts across the country. A total of 17,708 individuals in 10,257 households were interviewed to represent the Chinese middle-aged and elderly population. Detailed information about CHARLS can be found elsewhere (Zhao, Hu, Smith, Strauss, & Yang, 2012).

The units of this analysis were elderly parents. Our study sample included older parents aged 60 years and above. The CHARLS 2011-2012 was used because the distance measures for children's proximity were only available in the baseline survey, but not in the CHARLS 2013. We set the cutoff age at 60, rather than 65, based on the definition of "old age" in the contemporary Chinese society. Although in many developed countries, the "older population" refers to those aged 65 and above, the United Nations and the National Bureau of Statistics in China defined older people as those aged 60 years and above. In addition, as the primary predictor of interest was children's geographic proximity to their parents, a small proportion (2.5% of those aged 60 years and above) of the elders who had no child or had no information on children were excluded. The final analytic sample consisted of 5,261 respondents.

Outcome Variable

We used the 10-item Center for Epidemiologic Studies Depression Scale (CES-D) to measure elders' depressive symptoms. CES-D is one of the most commonly used screening approaches to identify depressive symptoms in the general population (Kohout, Berkman, Evans, & Cornoni-Huntley, 1993). Studies have shown that the 10-item CES-D has acceptable reliability and validity compared with the original 20-item scale (Andersen, Malmgren, Carter, & Patrick, 1994; Irwin, Artin, & Oxman, 1999). The Chinese-translated CES-D has been reported to have good reliability and validity among both rural and urban populations (Chen & Mui, 2014; Han & Jia, 2012). The 10-item CES-D included the following questions: (a) "I was bothered by things that don't usually bother me"; (b) "I had trouble keeping my mind on what I was doing"; (c) "I felt depressed"; (d) "I felt everything I did was an effort"; (e) "I felt hopeful about the future"; (f) "I felt fearful"; (g) "My sleep was restless"; (h) "I was happy"; (i) "I felt lonely"; and (j) "I could not get 'going.'" The answers for CES-D were on a four-scale metric, from "rarely or none of the time (<1 day)," to "some or little of the time (1-2 days)," to "occasionally or a moderate amount of the time (3-4 days)," to "most or all of the time (5-7 days)." These answers were appropriately scored (Radloff, 1977), and if a CES-D score equals to or is higher than 10, we categorized it as having severe depressive symptoms. Both the continuous CES-D score and the binary variable indicating severe depressive symptoms were used in this study. We conducted sensitivity analysis by using 12 as the cutoff point as was proposed by Chen and Mui (2014).

Predictors of Interest

Children's geographic proximity was measured by the geographic distance between an elder respondent and his or her nearest child. For each nonresident child (a child

who did not live with the respondent in the same house-hold or a child who lived in the household but was economically independent), the respondent was asked about where the child lived. Answers to this question included (a) this household, but economically independent; (b) the same or adjacent dwelling/courtyard with me; (c) another household in this village/neighborhood; (d) another village/neighborhood in this county/city; (e) another county/city in this province; (f) another province; (g) abroad. For each nonresident child who lived outside of the respondents' village/neighborhood but still in China, the respondent was asked to specify the geographic distance between the child's residential location and his or her own residence. We created two variables indicating children's geographic proximity. One variable was created based on administrative divisions, with four categories: (a) the respondent lived with at least one child in the same household (including those who were economically independent); (b) the respondent's nearest child lived in the same village/community (including those who lived in the same or adjacent dwelling/courtyard), but not in the same household; (c) the respondent's nearest child lived in the same county/city, but not in the same village/community; (d) the respondent's nearest child did not live in the same county/city. The other variable was created based on reported-distance with three categories: (a) the respondent lived with at least one child in the same household; (b) the respondent's nearest child lived within 100 km, but not in the same household; (c) the respondent's nearest child lived at least 100 km away, because some villages/communities/counties/cities are much larger and geographically dispersed than others. For both variables, the first level (co-residence with at least one child) was the reference level.

Covariates

We controlled for variables that may influence children's proximity and parents' mental well-being, including elders' gender, rural/urban status, age, marital status, region, physical health status, socioeconomic status (SES), children's SES, the number of female/male children, and whether they lived with grandchildren in the same household. The respondent's rural/urban status was measured by whether living in rural areas and whether registered as a rural resident. The respondent's marital status was a variable with three categories—currently married and living with spouse, currently married but separated with spouse, and currently unmarried (including those widowed, never married, and divorced). The variable residential region had four categories: east, middle, west, and northeast. This variable was included because different regions across China were likely to have different levels of urbanization, economic development, and social norms. Whether having grandchildren in the household was a binary variable that indicated whether the respondent lived with at least one grand-child in the same household.

Respondents' physical health status was measured by their self-reported health status, and the number of difficulties in activities of daily living (ADLs) and instrumental activities of daily living (IADLs). Self-reported health status was grouped into five categories: very good, good, fair, poor, and very poor. Respondents were asked whether they had difficulties in six ADLs (dressing, bathing, eating, getting into or out of bed, toileting, and controlling urination and defecation) and four IADLs (doing household chores, preparing hot meals, shopping, and managing assets). If respondents reported that they needed help or could not complete an activity, they were coded as having difficulties in this ADL or IADL. The total numbers of difficult ADLs and IADLs were used as covariates in the analysis.

Elders' SES was measured by their education and per capita household expenditure. A categorical variable was created to represent elders' educational attainment—primary school education or no formal education, middle school education, and high school and above, according to the International Standard Classification of Education (ISCED) code (UNESCO Institute for Statistics [UIS], 2012). We used per capita household expenditure to measure elder's income levels, because expenditure was measured with less error in CHARLS and better represented long-run resources (Huang, Lei, Ridder, Strauss, & Zhao, 2013). Children's SES was measured by the number of children who had some college education or more, and the number of children whose annual total income exceeded 20,000 yuan (≈US$3,175) in 2011. As the majority of parents in our sample had more than one child, we used the number of children with relatively higher SES to capture the overall resources of all children.

Statistical Analysis

We used linear regression model to estimate the association between children's proximity and elders' depressive symptoms measured by CES-D scores, and logit regression model to estimate the association between children's proximity and having severe depressive symptoms (CES-D ≥ 10). Covariates included elders' gender, rural/urban status, age, marital status, region, physical health status, elders' SES, the number of female/male children, children's SES, and whether living with grandchildren in the same household. We included the presence of grandchildren in the household, as it might confound the relationship between children's proximity and elders' depressive symptoms. Also, we included an interaction term to model the moderator effect of living with grandchildren. In addition, we further stratified our sample by respondents' rural/urban status, and gender and marital status, and performed separate linear and logit regressions for each subsample. For each regression model, we reported predicted marginal effects (ME) and 95% confidence intervals (CI).

Table 1. Sample Characteristics From the China Health and Retirement Longitudinal Survey 2011-2012 (N = 5,261).

	Total population
Outcome	
CES-D score, M	8.82 [8.50, 9.14]
Having severe depressive symptoms (CES-D ≥ 10), %	40.07 [37.81, 42.37]
Children's geographic proximity	
Measured by administrative divisions, %	
Living in the same household	47.62 [44.86, 50.40]
Living in the same village/community	32.96 [30.61, 35.40]
Living in the same county/city	14.71 [13.07, 16.51]
Not living in the same county/city	4.71 [3.90, 5.68]
Measured by distance, %	
Living in the same household	47.62 [44.86, 50.40]
Living within 100 km but not in the same household	48.56 [45.87, 51.25]
Living 100 km away	3.82 [3.13, 4.65]
Demographics	
Female, %	50.67 [49.34, 52.00]
Age, M	68.95 [68.66, 69.24]
Marital status, %	
Currently married and living with spouse	75.36 [73.41, 77.22]
Married by separated with spouse	2.52 [1.49, 4.23]
Currently unmarried (widowed, divorced, never married)	22.12 [20.52, 23.80]
Having grandchildren in the household, %	39.84 [37.13, 42.61]
Residential regions, %	
Eastern China	29.86 [25.29, 34.88]
Central China	27.98 [23.56, 32.87]
Western China	33.67 [28.88, 38.83]
Northeastern China	8.49 [5.98, 11.92]
Living in rural regions, %	54.31 [49.04, 59.48]
Registered as rural residents, %	70.11 [65.69, 74.18]
Health and socioeconomic status	
Number of difficult ADLs	0.17 [0.14, 0.20]
Number of difficult IADLs	0.41 [0.37, 0.45]
Self-reported health status, %	
Very good health	5.16 [4.34, 6.11]
Good health	14.48 [13.19, 15.87]
Fair health	47.89 [45.88, 49.91]
Poor health	27.01 [25.41, 28.67]
Very poor health	5.47 [4.68, 6.37]
Educational attainment, %	
Primary school or no formal education	53.94 [51.14, 56.71]
Middle school	36.92 [34.74, 39.15]
High school and above	9.15 [7.56, 11.02]
Per capita household annual expenditures, M	13,895.47 [12,296.34, 15,494.61]
Number of children having at least some college education	0.29 [0.24, 0.33]
Number of children having a yearly income more than 20,000 yuan	0.99 [0.92, 1.07]

Note. Sampling weights adjusted in all statistics; 95% confidence intervals in parentheses. CES-D = 10-item Center for Epidemiologic Studies Depression Scale; ADLs = activities of daily living; IADL = instrumental activities of daily living.

In sensitivity analysis, we used CES-D scores ≥12 instead of 10 to define whether the respondent had severe depressive symptoms, and ran all the regression analyses to test the robustness of the findings. Individual-level survey weights were used in all descriptive and regression analyses, to adjust for household and individual nonresponse bias and account for complex survey design and clustering within each village/neighborhood. Stata 14.2 was used to perform the data analyses (College Station, TX: StataCorp LP).

Results

Descriptive Results

Table 1 presents the sample characteristics. The average CES-D score was 8.82 and 40.07% of the older parents

Table 2. Association Between Children's Geographic Proximity and Predicted Probability of Parents' Depressive Symptoms, China Health and Retirement Longitudinal Survey 2011-2012 (*N* = 5,261).

Marginal effects (95% CI)	CES-D score	CES-D ≥ 10
Measured by administrative divisions		
Living with children	Ref	Ref
Having the nearest child in the same community/village	−0.05 [−0.58, 0.48]	−0.03 [−0.07, 0.01]
Having the nearest child in the same city/county	0.02 [−0.63, 0.68]	−0.02 [−0.08, 0.03]
Having the nearest child outside the city/county	1.05* [0.07, 2.03]	0.06 [−0.01, 0.13]
Living with grandchildren	−0.42 [−0.92, 0.08]	−0.05* [−0.09, −0.01]
Measured by distance		
Living with children	Ref	Ref
The nearest child lived within 100 km but not in the same household	−0.02 [−0.529, 0.484]	−0.03 [−0.067, 0.011]
The nearest child lived 100 km away	1.24* [0.13, 2.36]	0.09* [0.01, 0.16]
Living with grandchildren	−0.43 [−0.92, 0.07]	−0.05* [−0.09, −0.01]

Note. Models adjusted for age, residential region, registered rural residence, self-reported health, elder's SES, and children's SES. CI = confidence interval; CES-D = 10-item Center for Epidemiologic Studies Depression Scale; CES-D ≥ 10 was defined as having severe depressive symptoms; SES = socioeconomic status.
*p < .05. **p < .01. ***p < .001.

reported having severe depressive symptoms (CES-D ≥10). Among all elders in the analytic sample, 47.62% of them had at least one child living in the same household, 32.96% living in the same village/community, 14.71% living in the same county/city, and 4.71% living outside of the county/city. If children's proximity was measured by distance, 48.56% of respondents had at least one child living within 100 km but not in the same household, and 3.82% living more than 100 km away. In the full sample, a half (50.67%) of the respondents were women and were 69 years old on average. In all, 75.36% of them were married and lived with spouse, and 54.31% were living in rural areas, while 70.11% of the respondents were registered as rural residents.

Regression Results

Table 2 reports the predicted probabilities of having a higher CES-D score and having severe depressive symptoms, associated with children's proximity measured by administrative divisions and distances. The results showed that compared with elders who lived with children, those who did not have a child living in the same city/county had 1.05 points higher in CES-D score (p < .05). Compared with elders who did not live with grandchildren, those living with grandchildren were less likely to experience severe depressive symptoms (ME = −0.05, 95% CI: [−0.09, −0.01]). Measured by distances, compared with elders living with children, elders who had their nearest child living 100 km away had 1.241 points higher in CES-D score (p < .05) and also a higher risk of having severe depressive symptoms (ME = 0.09, 95% CI: [0.01, 0.16]).

Table 3 shows the results from the regressions assessing the moderator effect of having grandchildren in the same household on the association between elders' mental well-being and children's proximity. Compared with the reference group (co-resident with both children and grandchildren), among those who lived with at least one grandchild, elders who had their nearest child in the same city/county but not in the same community/village had higher CES-D scores (ME = 1.39, 95% CI: [0.09, 2.69], p < .05), and those who had their nearest child outside of the same city/county had higher CES-D scores (ME = 3.34, 95% CI: [1.47, 5.22], p < .01) and were more likely to experience severe depressive symptoms (ME = 0.21, 95% CI: [0.098, 0.319]). Among those who did not live with any grandchildren, elders who lived with at least one child in the same household had higher CES-D scores (ME = 1.02, 95% CI: [0.41, 1.64], p < .01) and were more likely to experience severe depressive symptoms (ME = 0.09, 95% CI: [0.04, 0.13], p < .01). In addition, those who had the nearest child in the same city/county but did not have a grandchild had higher CES-D scores (ME = 0.55, 95% CI: [0.01, 1.08], p < .05), compared with the reference group.

Table 4 shows the associations by elder respondents' rural/urban status. Among rural elders, compared with those living with children, elders who had their nearest child living 100 km away had 1.48 points higher in CES-D score (p < .05) and also a higher risk of severe depressive symptoms (ME = 0.10, 95% CI: [0.02, 0.19]). The analysis among the urban subsample did not reveal the same results.

Table 5 reports the estimated associations between elders' mental well-being and children's proximity by marital status and gender. Among women, compared with the married women living with children in the same household, married women who had their nearest child within 100 km but not in the same household had a lower risk of having severe depressive symptoms (ME = −0.09, 95% CI: [−0.15, −0.03]). In addition, compared with married women who did not live with grandchildren, those living with grandchildren also had a lower risk of severe depressive symptoms (ME = −0.08, 95% CI: [−0.14, −0.02]). Compared with unmarried women living with children, unmarried women who had their nearest child living 100 km away had 4.53 points higher in CES-D score (p < .05) and a higher risk of severe depressive symptoms (ME = 0.23, 95% CI: [0.01, 0.45]). Compared with unmarried women who did not live with grandchildren, unmarried women living with grandchildren had 1.21 points lower in CES-D score (p < .05). Among men,

Table 3. The Moderator Effect of Living With a Grandchild on the Association Between Children's Geographic Proximity and Predicted Probability of Parents' Depressive Symptoms, China Health and Retirement Longitudinal Survey 2011-2012 (*N* = 5,261).

Marginal effects (95% CI)	CES-D score	CES-D ≥ 10
Measured by administrative divisions		
Living with both children and grandchildren	Ref	Ref
Having the nearest child in the same community/village × Living with grandchildren	0.32 [−0.57, 1.20]	−0.01 [−0.08, 0.06]
Having the nearest child in the same city/county × Living with grandchildren	1.39* [0.09, 2.69]	0.06 [−0.05, 0.17]
Having the nearest child outside the city/county × Living with grandchildren	3.34** [1.47, 5.22]	0.21*** [0.10, 0.32]
Living with children × Not living with grandchildren	1.02** [0.41, 1.64]	0.09** [0.04, 0.13]
Having the nearest child in the same community/village × Not living with grandchildren	0.55* [0.01, 1.08]	0.03 [−0.01, 0.07)
Having the nearest child in the same city/county × Not living with grandchildren	0.39 [−0.24, 1.03]	0.02 [−0.04, 0.08]
Having the nearest child outside the city/county × Not living with grandchildren	0.85 [−0.03, 1.72]	0.06 [−0.02, 0.13]
Measured by distance		
Living with both children and grandchildren	Ref	Ref
The nearest child lived within 100 km but not in the same household × Living with grandchildren	0.74 [−0.07, 1.56]	0.02 [−0.05, 0.08]
The nearest child lived 100 km away × Living with grandchildren	3.55** [1.56, 5.55]	0.23*** [0.12, 0.34]
Living with children × Not living with grandchildren	1.03** [0.41, 1.64]	0.09** [0.04, 0.3]
The nearest child lived within 100 km but not in the same household × Not living with grandchildren	0.51* [0.01, 1.01]	0.03 [−0.02, 0.07]
The nearest child lived 100 km away × Not living with grandchildren	0.92* [−0.05, 1.90]	0.08* [0.002, 0.16]

Note. Models adjusted for age, residential region, registered rural residence, self-reported health, elder's SES, and children's SES. CI = confidence interval; CES-D = 10-item Center for Epidemiologic Studies Depression Scale; CES-D ≥ 10 was defined as having severe depressive symptoms; SES = socioeconomic status.
*p < .05. **p < .01. ***p < .001.

compared with married men living with children, those who had their nearest child living 100 km away had a higher risk of severe depressive symptoms (ME = 0.10, 95% CI: [0.004, 0.19]).

In sensitivity analysis, using the CES-D score ≥12 to define severe depressive symptoms did not change the main findings (results not shown).

Discussion

We found in a national elderly sample that Chinese elders living far away from their adult children were more likely to experience severe depressive symptoms, compared with co-residence with children. This pattern was particularly significant among rural residents and unmarried women. When considering the moderating role of having grandchildren in this relationship, although in general living with grandchildren in the same household may be related with better mental health, elders living far away from their adult children but were left to take care of their grandchildren had a much higher probability of having severe depressive symptoms.

The overall finding about the associations between children's proximity and elder's mental well-being was consistent with a number of previous studies. For example, some have reported the negative effects of living with children or with grandchildren only (Ren & Treiman, 2015; Silverstein et al., 2006). A U.S.-based study observed that among older people with ADL limitations, those who had all children living more than 30 miles were more likely to go to a nursing home than those who had a child living close by (Deane, Spitze, Ward, & Zhuo, 2015). In Netherlands, a study found that older parents were more likely to move to a care facility if they had all children living more than 40 km away (Van Der Pers, Kibele, & Mulder, 2015). Elders who lived alone without a child were found most likely to have adverse health outcomes in Myanmar and Vietnam (Teerawichitchainan, Knodel, & Pothisiri, 2015). The prevalence of severe depressive symptoms identified in this study was also close to the prevalence among people aged 55 or older in the Chinese Elderly Mental Health Survey (39.86%) using the 20-item CES-D instrument (Yu et al., 2012).

Table 4. Association Between Children's Geographic Proximity and Predicted Probability of Parents' Depressive Symptoms by Rural/Urban Residence, China Health and Retirement Longitudinal Survey 2011-2012.

Marginal effects (95% CI)	CES-D score	CES-D ≥ 10
Rural areas (n = 3,243)		
Living with children	Ref	Ref
The nearest child lived within 100 km but not in the same household	0.08 [−0.57, 0.74]	−0.02 [−0.07, 0.03]
The nearest child lived 100 km away	1.48* [0.22, 2.75]	0.10* [0.02, 0.19]
Living with grandchildren	−0.52 [−1.16, 0.12]	−0.04 [−0.09, 0.01]
Urban areas (n = 2,018)		
Living with children	Ref	Ref
The nearest child lived within 100 km but not in the same household	−0.16 [−0.96, 0.65]	−0.03 [−0.09, 0.03]
The nearest child lived 100 km away	0.77 [−1.19, 2.72]	0.05 [−0.09, 0.18]
Living with grandchildren	−0.34 [−1.12, 0.45]	−0.06 [−0.12, 0.01]

Note. Models adjusted for age, residential region, registered rural residence, self-reported health, elder's SES, and children's SES. CI = confidence interval; CES-D = 10-item Center for Epidemiologic Studies Depression Scale; CES-D ≥ 10 was defined as having severe depressive symptoms; SES = socioeconomic status.
*p < .05. **p < .01. ***p < .001.

However, the present study provided a more nuanced understanding of the living arrangements, children's distance, and elder's depressive symptoms. Living far away from adult children may have negative impact on elder's mental health especially in the China-specific setting, as financial support, informal care, and emotional support from adult children were often considered essential for meeting the needs of the Chinese elders. In fact, this was not only because of "filial piety" in Chinese culture, a virtue of respect for one's parents, but also due to the lack of support for elders from the public and private sectors, especially in rural areas (Cai, Giles, O'Keefe, & Wang, 2012). For instance, according to a report from the National School of Development at Peking University, despite 83.6% of the urban elders had pension plans, only 43.1% of the rural elders had any pension plans in 2011. In addition, living far away from children but together with grandchildren had an even larger detrimental impact on elder's mental well-being. This may be partly explained by the elders' overwhelmed burden of caring for grandchildren. This finding challenged the previous assumption that the elder's living arrangements were predominantly determined by their needs for assistance, whereas children's needs for assistance from their older parents were also important determinants of the elder's living arrangements. In fact, healthy elders were more often caregivers than caretakers (Xu, 2013).

Exploring the determinants of living arrangements, albeit beyond the scope of the current study, may help explain the negative impacts of living with offspring under certain circumstances. The elder's caregiving behaviors, for example, and its consequences on mental health is a particularly important field to investigate in future studies.

There may be gender difference in providing emotional support to the elderly. As similar in other countries, daughters in China are usually the main caregivers of older parents. A China-based study did found that having daughters was significantly associated with higher cognitive functions and lower mortality risk than having sons in Chinese elderly (Zeng, Brasher, Gu, & Vaupel, 2016). If this is the case, those solo-living elderly with only sons who lived far away are most vulnerable to develop adverse mental problems.

As shown in our results, the effects of proximate residence (i.e., living within 100 km or in the same town/village), an emerging form of elder's living arrangement in Contemporary China, may have similar supporting functions as co-residence, with which the prevalence has been declining in the past decades. Living in a multi-generational household was believed to be beneficial to the elders' overall well-being, whereas proximate residence relative to one's children may be similar to co-residence with one's children. In other words, as in many other countries, elders did not necessarily receive insufficient support when they lived separately from but close to their children. It is reasonable to assume that the elders are better off living independently if they have pensions and if they are healthy (Wong, Yoo, & Stewart, 2006). To our knowledge, no previous study has reported the effects of proximate residence in China. Due to data limitations in this study, we were not able to explore the dynamics of geographic distance and relevant determinants in the elders' later life. Thus, the causal relationship between proximate residence and depressive symptoms cannot be ascertained.

The study has several limitations. First, measurement for geographic proximity was based on self-reported information. The estimates of geographic distance may not be precise and may be susceptible to recall bias. The follow-up panel of CHARLS 2013 did not ask the distance question but asked respondents if their children lived in the same village/neighborhood. We did a cross-check and found in CHARLS 2013 that there were above 90% respondents who had at least one child living in the same village/neighborhood, which gave us some confidence on the accuracy of the distance estimate in the CHARLS 2011-2012. Second, prior to this analysis, we suspected if geographic proximity was endogenous to elder's mental health, as children's relocation decisions may be determined by parent's health conditions (Jolanki, 2015), or it may be an indicator of parent–child relationship that they choose to live close due to emotional closeness (Gillespie & Treas, 2017). Although it is likely, many studies have shown that young adults in

Table 5. Association Between Children's Geographic Proximity and Predicted Probability of Parents' Depressive Symptoms by Marital Status and Gender, China Health and Retirement Longitudinal Survey 2011-2012 (*N* = 5,261).

Marginal effects (95% CI)	CES-D score	CES-D ≥ 10
Married women (*n* = 1,878)		
Living with children	Ref	Ref
The nearest child lived within 100 km but not in the same household	−0.53 [−1.32, 0.25]	−0.09** [−0.15, −0.03]
The nearest child lived 100 km away	−0.18 [−1.76, 1.39]	−0.02 [−0.13, 0.10]
Living with grandchildren	−0.76 [−1.55, 0.03]	−0.08* [−0.14, −0.02]
Married men (*n* = 2,332)		
Living with children	Ref	Ref
The nearest child lived within 100 km but not in the same household	0.05 [−0.57, 0.67]	−0.002 [−0.05, 0.05]
The nearest child lived 100 km away	1.14 [−0.10, 2.38]	0.10* [0.004, 0.19]
Living with grandchildren	0.05 [−0.58, 0.67]	−0.005 [−0.06, 0.05]
Unmarried women (*n* = 746)		
Living with children	Ref	Ref
The nearest child lived within 100 km but not in the same household	0.32 [−0.95, 1.59]	−0.03 [−0.12, 0.06]
The nearest child lived 100 km away	4.53* [1.01, 8.05]	0.23* [0.01, 0.45]
Living with grandchildren	−1.21* [−2.38, −0.03]	−0.12 [−0.21, −0.03]
Unmarried men (*n* = 305)		
Living with children	Ref	Ref
The nearest child lived within 100 km but not in the same household	0.35 [−1.13, 1.84]	0.08 [−0.04, 0.20]
The nearest child lived 100 km away	2.87 [−0.72, 6.45]	0.19 [−0.07, 0.45]
Living with grandchildren	−0.31 [−1.95, 1.34]	−0.002 [−0.13, 0.13]

Note. Models adjusted for age, residential region, registered rural residence, self-reported health, elder's SES, and children's SES. CI = confidence interval; CES-D = 10-item Center for Epidemiologic Studies Depression Scale; CES-D ≥ 10 was defined as having severe depressive symptoms; SES = socioeconomic status.
*p < .05. **p < .01. ***p < .001.

China moved to other regions for working opportunities and better education rather than caring for parents. Third, as we focused on the relationship between children's geographic distance and elderly's mental well-being, we did not include the respondents with no child. But this group may be the ones who were most likely to develop mental disorders. Excluding them may underestimate the current prevalence of self-reported depressive symptoms among those aged 60 and over. Future studies on estimating the prevalence and understanding other triggers of elderly's mental disorders in China could look at the entire elderly population.

In conclusion, adult children's proximity may be related with elder parents' reported depressive symptoms in China. More research is warranted to understand the relationship of intergenerational relationship, mutual support between parents and children, and living arrangements with elder's health. Furthermore, China needs to set mental health among elders as a policy priority. Advocating strengthening "filial piety" alone will not be the panacea for improving the well-being of the elderly in Contemporary China, as social changes such as domestic migration will exacerbate the impact of long distance between parents and adult children on the well-beings of the Chinese aging population.

References

Andersen, E. M., Malmgren, J. A., Carter, W. B., & Patrick, D. L. (1994). Screening for depression in well older adults:

Evaluation of a short form of the CES-D. *American Journal of Preventive Medicine*, *10*, 77-84.

Ariyo, A. A., Haan, M., Tangen, C. M., Rutledge, J. C., Cushman, M., Dobs, A., & Furberg, C. D. (2000). Depressive symptoms and risks of coronary heart disease and mortality in elderly Americans. *Circulation*, *102*, 1773-1779.

Cai, F., Giles, J., O'Keefe, P., & Wang, D. (2012). *The elderly and old age support in rural China*. Washington, DC: World Bank Publications.

Chen, R., Wei, L., Hu, Z., Qin, X., Copeland, J. R., & Hemingway, H. (2005). Depression in older people in rural China. *Archives of Internal Medicine*, *165*, 2019-2025.

Chen, H., & Mui, A. C. (2014). Factorial validity of the Center for Epidemiologic Studies Depression Scale short form in older population in China. *International psychogeriatrics*, *26*(1), 49-57.

Cheng, H. G., Chen, S., McBride, O., & Phillips, M. R. (2016). Prospective relationship of depressive symptoms, drinking, and tobacco smoking among middle-aged and elderly community-dwelling adults: Results from the China Health and Retirement Longitudinal Study (CHARLS). *Journal of Affective Disorders*, *195*, 136-143.

Deane, G., Spitze, G., Ward, R. A., & Zhuo, Y. (2015). Close to you? How parent–adult child contact is influenced by family patterns. *Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, *71*, 344-357.

Gillespie, B. J., & Treas, J. (2017). Adolescent intergenerational cohesiveness and young adult proximity to mothers. *Journal of Family Issues*, *38*, 798-819.

Ha, J. H., Yoon, H., Lim, Y. O., & Heo, S. Y. (2016). The effect of widowhood on parent–child relationships in Korea: Do parents' filial expectations and geographic proximity to children matter? *Journal of Cross-Cultural Gerontology*, *31*, 73-88.

Han, M., & Jia, C. X. (2012). Reliability and validity of Center for Epidemiological Studies Depression Scale in different rural populations. *Chinese Journal of Public Health*, *10*, 002.

Huang, W., Lei, X., Ridder, G., Strauss, J., & Zhao, Y. (2013). Health, height, height shrinkage, and SES at older ages: Evidence from China. *American Economic Journal: Applied Economics*, *5*, 86-121.

Hui, F. (2015). *China's migrant population to reach 300 million by 2030*. National Health and Family Planning Commission. Retrieved from http://en.nhfpc.gov.cn/2015-07/23/c_46695.htm

Irwin, M., Artin, K. H., & Oxman, M. N. (1999). Screening for depression in the older adult: Criterion validity of the 10-item Center for Epidemiological Studies Depression Scale (CES-D). *Archives of Internal Medicine*, *159*, 1701-1704.

Jolanki, O. (2015). Elderly parents' need for help and adult children's moving decisions. *Journal of Housing for the Elderly*, *29*, 77-91.

Katon, W. J. (2003). Clinical and health services relationships between major depression, depressive symptoms, and general medical illness. *Biological Psychiatry*, *54*, 216-226.

Kohout, F. J., Berkman, L. F., Evans, D. A., & Cornoni-Huntley, J. (1993). Two shorter forms of the CES-D depression symptoms index. *Journal of Aging and Health*, *5*, 179-193.

Lei, X., Strauss, J., Tian, M., & Zhao, Y. (2015). Living arrangements of the elderly in China: Evidence from the CHARLS national baseline. *China Economic Journal*, *8*, 191-214.

Lei, X., Sun, X., Strauss, J., Zhang, P., & Zhao, Y. (2014). Depressive symptoms and SES among the mid-aged and elderly in China: Evidence from the China Health and Retirement Longitudinal Study national baseline. *Social Science & Medicine*, *120*, 224-232.

Li, D., Zhang, D. J., Shao, J. J., Qi, X. D., & Tian, L. (2014). A meta-analysis of the prevalence of depressive symptoms in Chinese older adults. *Archives of Gerontology and Geriatrics*, *58*(1), 1-9.

Luppa, M., König, H. H., Heider, D., Leicht, H., Motzek, T., Schomerus, G., & Riedel-Heller, S. G. (2013). Direct costs associated with depressive symptoms in late life: A 4.5-year prospective study. *International Psychogeriatrics*, *25*, 292-302.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*, 385-401.

Ren, Q., & Treiman, D. J. (2015). Living arrangements of the elderly in China and consequences for their emotional well-being. *Chinese Sociological Review*, *47*, 255-286.

Rossi, P. P. H. (1990). *Of human bonding: Parent-child relations across the life course*. Chicago, IL:Transaction Publishers.

Saito, T., Wakui, T., & Kai, I. (2016). Effects of spousal illness on self-rated health in older couples: Role of sex and proximity to adult children. *Geriatrics & Gerontology International*, *16*, 1332-1338.

Silverstein, M., Cong, Z., & Li, S. (2006). Intergenerational transfers and living arrangements of older people in rural China: Consequences for psychological well-being. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, *61*, S256-S266.

Teerawichitchainan, B. P., Knodel, J., & Pothisiri, W. (2015). What does living alone really mean for older persons? A comparative study of Myanmar, Vietnam, and Thailand. *Demographic Research*, *32*, 1329-1360.

UNESCO Institute for Statistics. (2012). *International standard classification of education: ISCED 2011*. Montreal, Quebec, Canada: Author.

Van Der Pers, M., Kibele, E. U., & Mulder, C. H. (2015). Intergenerational proximity and the residential relocation of older people to care institutions and elsewhere. *Ageing & Society*, *35*, 1429-1456.

Wong, S. T., Yoo, G. J., & Stewart, A. L. (2006). The changing meaning of family support among older Chinese and Korean immigrants. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, *61*(1), S4-S9.

Xu, L. (2013). *Intergenerational support between grandparents and grandchildren in rural China and its effect on the psychological well-being of older adults*. Los Angeles, CA: University of Southern California.

Yu, J., Li, J., Cuijpers, P., Wu, S., & Wu, Z. (2012). Prevalence and correlates of depressive symptoms in Chinese older adults: A population-based study. *International Journal of Geriatric Psychiatry*, *27*, 305-312.

Zeng, Y., Brasher, M. S., Gu, D., & Vaupel, J. W. (2016). Older parents benefit more in health outcome from daughters' than sons' emotional care in China. *Journal of Aging and Health*, *28*, 1426-1447.

Zhang, X., Norris, S. L., Gregg, E. W., Cheng, Y. J., Beckles, G., & Kahn, H. S. (2005). Depressive symptoms and mortality among persons with and without diabetes. *American Journal of Epidemiology*, *161*, 652-660.

Zhao, Y., Hu, Y., Smith, J. P., Strauss, J., & Yang, G. (2012). Cohort profile: The China Health and Retirement Longitudinal Study (CHARLS). *International Journal of Epidemiology*, *43*, 61-68.