Journal of Demographic Economics (2026), **92**, 52–74
doi:10.1017/dem.2025.10006

CAMBRIDGE UNIVERSITY PRESS

RESEARCH PAPER

Widowhood and cognitive function among older Chinese

Qin Li[1], Zisen Chen[1] and Tonglong Zhang[2,3]

[1]College of Economics and Management, South China Agricultural University, Guangzhou, China, [2]International Business School, Hainan University, Haikou, China and [3]Department of Economics, Swedish University of Agricultural Sciences (SLU), Uppsala, Sweden
Corresponding author: Tonglong Zhang; Email: ztl3@sina.com

(Received 16 January 2024; revised 8 May 2025; accepted 8 May 2025; first published online 25 July 2025)

Abstract
Using three waves (2011–15) of CHARLS data, we analyze the short-term effects of widowhood on cognitive function among older Chinese. Fixed-effect models show that widowhood has significant adverse effects on cognition for rural elders but not for urban ones. Furthermore, compared to rural men, rural women exhibit greater declines in cognition, especially in fluid cognition. We explore the possible mechanism from the neighborhood perspective. The results show that community sports and entertainment facilities and public services can effectively mitigate the negative impact of widowhood on cognitive function for rural widows. Sports and entertainment facilities can mainly enhance word recall ability, especially delayed word recall. Public services such as elderly health centers focusing on the healthcare function for the elderly can also improve the word recall ability of rural widows. On the other hand, family-based elderly care centers mainly increase the cognition ability of mental intactness.

Keywords: Widowhood; cognitive function; older Chinese

JEL classification: I12; J14; I18

1. Introduction

With declining fertility and growing life expectancy, population ageing poses significant challenges for developing countries. Ageing is closely linked to cognitive decline, which profoundly impacts critical aspects of older adults' lives, including financial decisions (Banks and Oldfield, 2010), household management (Smith *et al.*, 2010), and medication adherence (Ownby, 2006). Progressive cognitive impairment can ultimately lead to dementia and disability, incurring substantial economic and caregiving burdens (Langa *et al.*, 2017; Weir *et al.*, 2014).

© The Author(s), 2025. Published by Cambridge University Press in association with Université catholique de Louvain. This is an Open Access article, distributed under the terms of the Creative Commons Attribution licence (https://creativecommons.org/licenses/by/4.0/), which permits unrestricted re-use, distribution and reproduction, provided the original article is properly cited.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Research in cognitive neuroscience confirms that cognitive abilities naturally deteriorate with age, influenced by genetic predispositions and critical life transitions. Extensive research has explored the cognitive implications of retirement and unemployment during later life stages (Lei and Liu, 2018; Coe *et al.*, 2012; Atalay *et al.*, 2019; Bonsang *et al.*, 2012; Mazzonna and Peracchi, 2012; Freise *et al.*, 2022). Widowhood, parallel to retirement, could be another potential trigger for cognitive decline. Spousal bereavement can challenge many aspects of an older adult's life, including stress, lifestyle, and living environment, which may negatively affect their cognitive ability.

Empirical findings on widowhood and cognitive decline are mixed. Most studies show that widowhood is associated with a decline in cognition (Ward *et al.*, 2007; Perkins *et al.*, 2016; Xavier *et al.*, 2002; Aartsen *et al.*, 2005; Berg *et al.*, 2011). However, some find insignificant effect on cognitive function (Rosnick *et al.*, 2010; Trentini *et al.*, 2009; Lee *et al.*, 2019). These inconsistent results likely arise from data limitations and methodological differences. Building on panel data, we break through the constraints of viewing widowhood as a static state and delve into the effects and mechanisms of different temporal phases on cognitive abilities after the death of a spouse.

This paper contributes to existing literature in three ways. First, this is the one of few studies to estimate the effect of bereavement with longitudinal data from the China Health and Retirement Longitudinal Study (CHARLS) in developing countries. Most prior studies focus exclusively on developed countries (Yu and Lee, 2022; Zhang *et al.*, 2023; Jain *et al.*, 2022). The CHARLS is a unique panel data source that allows us to extend our study to developing countries. Our dynamic fixed-effect approach tracks cognitive changes pre- and post-widowhood, providing a detailed understanding of when cognitive decline emerges and facilitating targeted interventions.

Second, we identify key vulnerable populations through study on Hukou (household registration) status and gender heterogeneity, thus allowing for more targeted policy responses. Previous research highlights gender differences in cognitive outcomes linked to educational disparities (Lei *et al.*, 2012; Wörn *et al.*, 2020), yet little attention has been given to rural-urban disparities defined by Hukou. Rural and urban elderly differ significantly in income, infrastructure access, social security support, and living arrangements, influencing their ability to cope with bereavement-related stress. From the perspective of public financial inputs, more adequate allocation of public resources and more well-established social security tend to favor urban areas. This results in significant differences in social support among regions for the elderly. Moreover, differences in economic status and centralized versus decentralized residential patterns create differences in the lifestyles of urban and rural residents, resulting in different adaptations in the perceptions of the elderly's lives in the face of unforeseen shocks. Heterogeneity analyses based on Hukou could therefore better identify vulnerable groups that are in greater need of social support and make policy suggestions more targeted.

Third, we emphasize on providing feasible solutions from a policy perspective. Existing studies have tended to focus only on intra-household dynamics or individual risk factors, and have yet to focus on the impact of neighborhoods on individual encounters. Yet, neighborhood environment is widely recognized as relevant to differences in cognition (Besser *et al.*, 2019; Wu *et al.*, 2015; Brown *et al.*, 2018; Finlay *et al.*, 2021). Moreover, given that the postulated mechanisms linking widowhood and cognition are social, it seems reasonable to expect that the neighborhood conditions of the bereaved elderly may buffer the social processes that make widowhood a critical risk factor for cognitive function. In developing countries with limited public resources, it is

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

difficult to mitigate the cognitive impact of widowhood through long-chain (root) pathways such as education or holistic social care. The construction of e.g. sports facilities, recreational facilities, health care centers, etc. that we propose in our policy insights have stronger feasibility and faster effectiveness. Our study emphasizes their important role in mitigating the cognitive decline due to widowhood shock. At the same time, it is also hinting to some extent at the underlying mechanisms of the impact on cognitive ability.

The following section reviews relevant literature on bereavement's cognitive effects, and explores potential underlying mechanisms. We then outline the data and methodology, followed by empirical findings and concluding remarks.

2. Literature review and mechanism

2.1. Literature review

Most studies focus on the effects of widowhood status on the elderly's health. The consistent findings suggest that the elderly have higher mortality rates (Lillard and Panis, 1996; Lillard and Waite, 1995; Hu and Goldman, 1990; Subramanian *et al.*, 2008), lower weight (Umberson *et al.*, 2009; Sobal *et al.*, 2003), more chronic diseases (Hughes and Waite, 2009; Zhang and Hayward, 2006) and more depression symptoms after becoming widowed (Waite and Hughes, 1999; Simon, 2002; Elwert and Christakis, 2016; Li *et al.*, 2005).

A large part of the literature studying the relationship between spousal loss and cognition is in the developed countries (e.g. US, UK, and Netherlands) and gets mixed results. Most studies show that widowhood negatively affects different aspects of cognition in adults (Ward *et al.*, 2007; Yu and Lee, 2022; Jain *et al.*, 2022). Whereas some literature finds that widowhood has no significant effect on cognition (Rosnick *et al.*, 2010). However, only few studies have examined the association between widowhood and cognition in Asian settings. Fan *et al.* (2015), based on 10,432 residents in Taiwan, both show that bereaved individuals are more likely to encounter an increased risk for dementia. A similar study in South Korea also finds that widowed older Koreans had a higher risk of Alzheimer's disease than married couples (Bae *et al.*, 2015). Zhang et al. (2006), based on 34,807 individuals aged 55 and above in four districts (Beijing, Chengdu, Shanghai, Xi'an) in China, found that widowhood faced a higher risk of Alzheimer's disease compared to the married.

Cross-sectional data cannot eliminate unobservable heterogeneous characteristics, for example, personality traits (e.g., neuroticism). With data available, more and more studies have tried to use panel data (Aartsen *et al.*, 2005; Zhang *et al.*, 2019; Mousavi-Nasab *et al.*, 2012; Vidarsdottir *et al.*, 2014). Most of the studies mentioned earlier, except Vidarsdottir *et al.* (2014), display the adverse effects of spousal loss on cognitive ability over time. Zhang *et al.* (2019), using 2011 and 2013 CHARLS data, investigate the impact of widowhood on a 2-year change in cognitive function among Chinese adults aged 55 and older. The results show that continuous widows had lower episodic memory than continuously married. However, newly widowed adults were not significantly different from continuously married adults. Though these studies use longitudinal data, most of them use multivariable logistic regressions or Analysis of Covariance (ANCOVA) methods, which cannot eliminate the unobservable heterogeneity effects and solve the reverse causality problem (Vidarsdottir *et al.*, 2014; Mousavi-Nasab *et al.*, 2012). Berg *et al.* (2011) use LASA longitudinal data, allowing for potential endogeneity

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

of timing of bereavement, and find significant adverse effects of bereavement on cognition. However, this study mainly focuses on the impacts of bereavement on mortality, and analyzing the effect of losing a spouse on cognition is only a secondary product. The recent study by Zhao *et al.* (2021), using two-way fixed effects with dynamic treatment effects, analyzes the effects of spousal bereavement on the cognitive health of older adults in the United States. They consider gender heterogeneity and potential endogeneity, but their analysis mainly points to the United States.

2.2. Mechanisms

Two predominant theoretical frameworks have been proposed. The "mental-exercise hypothesis" considers cognition a form of human capital maintained through social interaction and mental stimulation. Widowhood disrupts these cognitive stimuli by removing spousal social support, intensifying isolation, and reducing mental engagement (Van Gelder *et al.*, 2006; Mazzonna & Peracchi, 2012; Feng *et al.*, 2014). Alternatively, another hypothesis suggests that cognition is maintained as a result of health investment. Grossman's (1972) health capital model argues that cognitive health depends on economic resources allocated to health investments. Widowed individuals, facing reduced household income and resources, typically invest less in healthcare, indirectly contributing to cognitive decline (Waite and Gallagher, 2000; Killewald &Gough, 2013; Liu, 2012).

Additional explanatory factors identified include depressive symptoms, loss of broader social networks, and elevated stress (Wörn *et al.*, 2020). Zhao *et al.* (2021) further elaborate on social vulnerability, emphasizing the role of familial proximity and support dynamics.

The aforementioned risk factors – such as stress, negative emotions, and social isolation – are also influenced by neighborhood conditions. Poorly designed environments and limited community resources can exacerbate these stressors. This paper investigates the possible channels from the perspective of neighborhood concentration, categorized into compositional measures (e.g., socioeconomic status, deprivation index) and contextual measures (e.g., built environment features like green spaces and street quality, and social aspects like community organizations and crime rates). Contextual factors have gained prominence due to their objectivity and reduced "same-source bias" (Wu *et al.*, 2015). Research consistently links neighborhood environment to cognitive outcomes, with studies finding that infrastructure density (Besser *et al.*, 2017; 2019), greenery (Brown *et al.*, 2018), park access (Finlay *et al.*, 2021), and availability of community centers (Clarke *et al.*, 2015) are associated with better cognitive function. This study focuses on ageing infrastructure and support services, examining their potential to buffer the cognitive decline associated with bereavement.

3. Data

Our data come from the China Health and Retirement Longitudinal Survey (CHARLS) and the China Life History Survey (CHARLS-LHS). CHARLS is a nationally representative panel survey targeting individuals aged 45 and above. The baseline survey, conducted in 2011-2012, employed a multistage stratified probability proportional to size sampling strategy, covering 17,708 respondents from 10,257 households across 150 counties in 28 provinces. Subsequent waves were

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

collected in 2013 and 2015, with sample sizes of 18,604 and 19,667 respondents, respectively. Detailed sampling methods and data quality assessments are described in Zhao *et al.* (2013).[1] The three waves of data span a five-year period, which is generally sufficient to capture the immediate and short-term effects of major life events such as widowhood. Unlike chronic or gradually progressing conditions, widowhood is a sudden and traumatic event that induces an acute shock. Given this nature, its short-term effects are more readily observable. This characteristic strengthens the suitability of our three-wave panel in detecting distinct and measurable changes following widowhood.

In the initial sample of 17,708 respondents to the 2011 survey, 15,417 were married, 1,869 were widowed, 389 were single, and 33 did not report marital status. Of the singles, 159 were never married, 147 were divorced, and 83 were separated. Cognitive impairment is more common among older adults. In this study, we focus on the impact of spousal loss on the cognitive abilities of adults aged 60 and older by looking to capture the dynamics of the sample as they move from being married to experiencing the shock of widowhood. Therefore, our final main estimation sample includes those who were "continuously married" during 2011–2015 and those who experienced widowhood (also referred to as "becoming widowhood") during 2011–2015.[2,3] The sample of 4010 people who were continuously married and 464 people who experienced widowhood, with 245 people who were widowed in 2011-13 and 219 people who were widowed in 2013–15.

3.1. Becoming widowed

Table 1 presents the probability of becoming widowed between survey waves, which was 2.3% from 2011 to 2013 and 2.7% from 2013 to 2015. The probability of becoming widowed for women was nearly twice that of men.

Figure 1 presents the probabilities of becoming widowed, differentiated by gender and Hukou status. The graphs illustrate a consistently higher incidence of widowhood among females compared to males across all age groups, with the gap notably expanding with increasing age. Additionally, individuals with rural Hukou experience a higher probability of becoming widowed than their urban counterparts at most age intervals, particularly in the older age brackets. Moreover, the disparity in widowhood probabilities is more pronounced between genders than between rural and urban Hukou statuses. Overall, the situation at all ages does not contradict the general pattern found in Table 1.

[1]Although CHARLS conducted an additional wave in 2018, structural changes in the questionnaire render it unsuitable for our research. Therefore, our analysis is restricted to the three waves (2011, 2013, and 2015), where survey instruments remained consistent and comparable across all relevant variables.

[2]The observations that experienced a divorce were excluded to reduce confounders affecting causal identification, and the observations that were widowed prior to 2011 (as indicated by reporting widowhood in the 2011, 2013, and 2015 surveys) was excluded from all of the main regressions, and only served as a control group in one of the robustness tests.

[3]We did a test for attrition in Appendix Table A1. The sample contains all married observations that appeared in CHARLS 2011. The dependent variable is a dummy variable for observations interviewed in 2011 and 2013 but absent in 2015. The independent variable is a dummy variable for those who reported being widowed in 2013. A range of control variables are consistent with the main regression. The results showed that the experience of being widowed was not significant for respondents to withdraw from the survey.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Table 1. Distributions of marital status by gender and Hukou

	All		by gender		by Hukou	
	Mean	N	Female	Male	Rural	Urban
Marriage status						
Continuously in marriage	0.851	34,035	0.800	0.910	0.850	0.858
Continuously widowed	0.098	3,954	0.137	0.055	0.101	0.089
Marital status transition						
Becoming widowed	0.050	1,989	0.063	0.034	0.049	0.054
Between 2011-2013	0.023	903	0.030	0.014	0.021	0.029
Between 2013-2015	0.027	1,086	0.033	0.020	0.028	0.025
N	39,978	39,978	21,478	18,500	32,315	7,663

Source: CHARLS 2011, 2013, 2015.

3.2. Cognition

We measure cognitive ability using two widely accepted indicators: episodic memory includes immediate and delayed word recall (Lei *et al.*, 2012). Episodic memory, reflecting fluid intelligence, is assessed via immediate and delayed recall tasks. Participants recall as many words as possible immediately after reading a list of 10 nouns, followed by another recall five minutes later. Scores range from 0 to 20, summing both recall tasks. (McArdle *et al.*, 2007; Smith *et al.*, 2010).

Mental intactness, reflecting crystallized intelligence, is evaluated through the Telephone Interview for Cognitive Status, comprising serial 7s subtractions, date orientation tasks, and drawing exercises. In the serial 7s test, respondents are asked to subtract 7 from 100 and 7 from each subsequent number. This test is repeated five times, and each correct response is scored as one point (0–5). Following Lei and Liu (2018), we sum the scores (0–11) to reflect the mental status of the elderly. The mental status reflects crystallized cognition (Smith *et al.*, 2010). Fluid intelligence is the innate cognitive ability, while crystallized intelligence is what people learn in their lifetime (using their fluid intelligence). Therefore, when we use word recall and mental status, we can comprehensively measure cognitive function, which is in line with many economic papers (Rohwedder and Willis, 2010; Celidoni *et al.*, 2017; Mazzonna and Peracchi, 2012; Coe *et al.*, 2012).

Figure 2 presents cognitive ability trends by age, gender, and urban-rural status. Cognitive performance declines consistently with age across all groups, with a slower decline in mental intactness compared to episodic memory. Women scored lower than men, with the gender gap widening with age, particularly in mental intactness. Urban respondents performed better on cognitive tests than rural respondents, and the gender gap was narrower in urban areas. Cognitive decline appeared smoother among rural individuals, while urban respondents experienced sharper declines around age 70.

Table 2 presents summary statistics of the key dependent variables and channel variables. Consistent with Figure 2, women generally scored lower than men, and widowed individuals scored lower than continuously married individuals across all cognitive tests. The average age of becoming widowed was 70–72, slightly older than in the continuously married sample.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

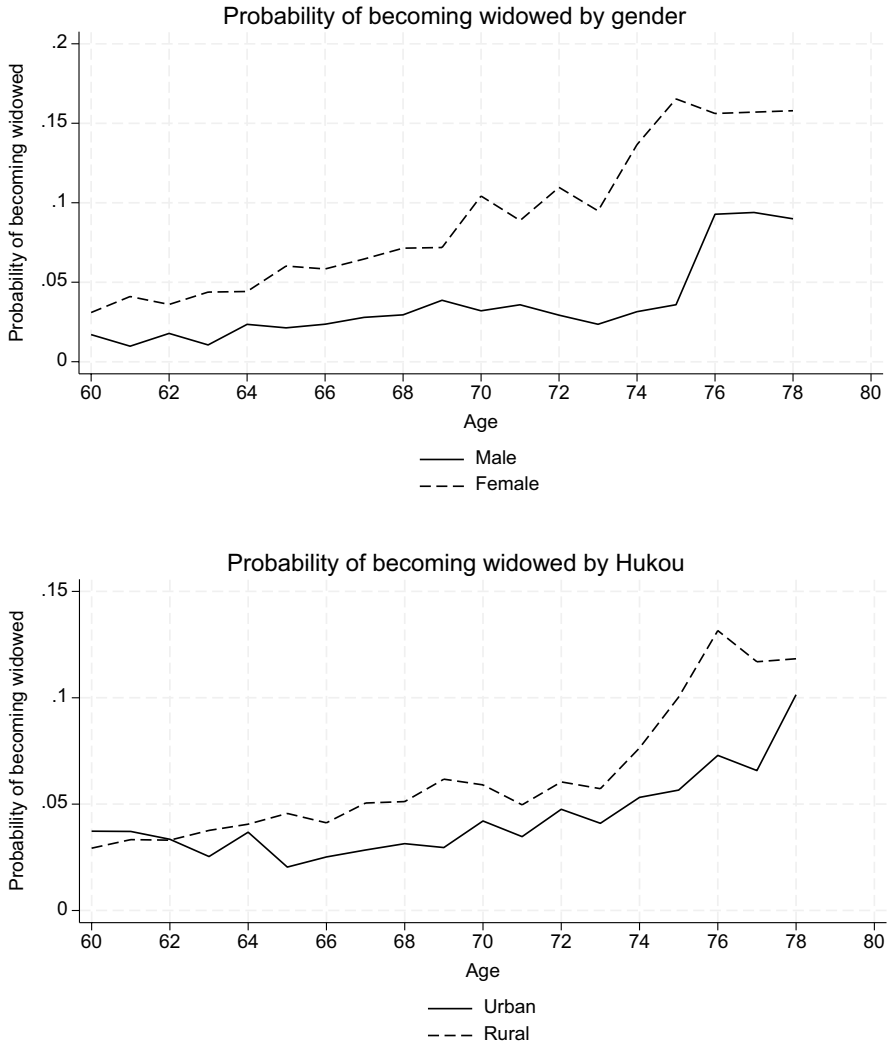


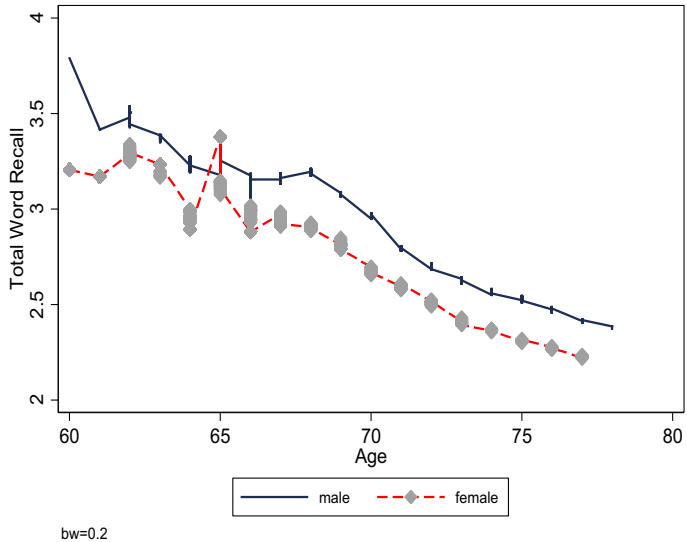
Figure 1. The probability of becoming widowed by gender and Hukou. *Note:* Data Source: CHARLS 2011, 2013, 2015. The left panel shows the probability of becoming widowed by age and gender; the right panel shows the probability of becoming widowed by age and Hukou status. The x-axis represents age, and the y-axis represents the probability of becoming widowed (in %).

We also constructed additional measures using data from the 2011 community questionnaire to capture individuals' neighborhood environments, which could influence the relationship between widowhood and cognition. These neighborhood measures are categorized into two main dimensions: public infrastructure and social services. Public infrastructure consists of sports and recreational facilities. Sports infrastructure includes amenities such as basketball courts, swimming pools, outdoor exercise equipment, table tennis tables, and spaces designated for dance or exercise groups. Communities with at least one of these amenities are coded as having sports

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

(1) Word recall test

(1.1) Rural



(1.2) Urban

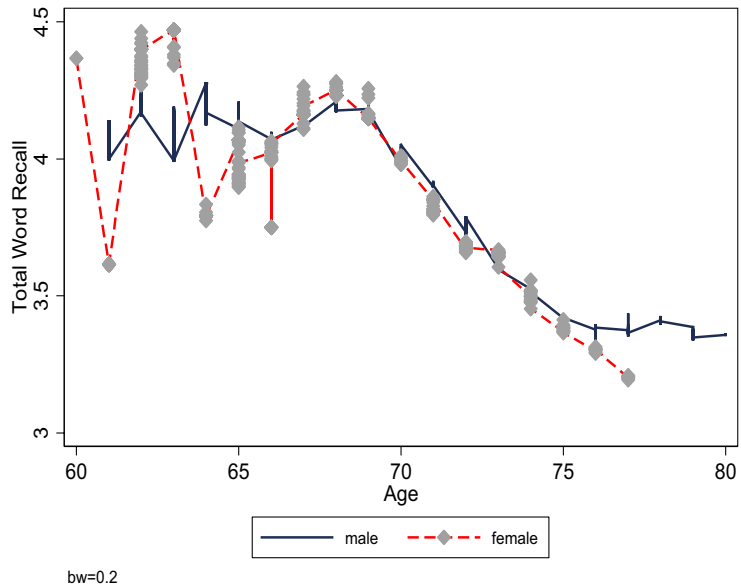
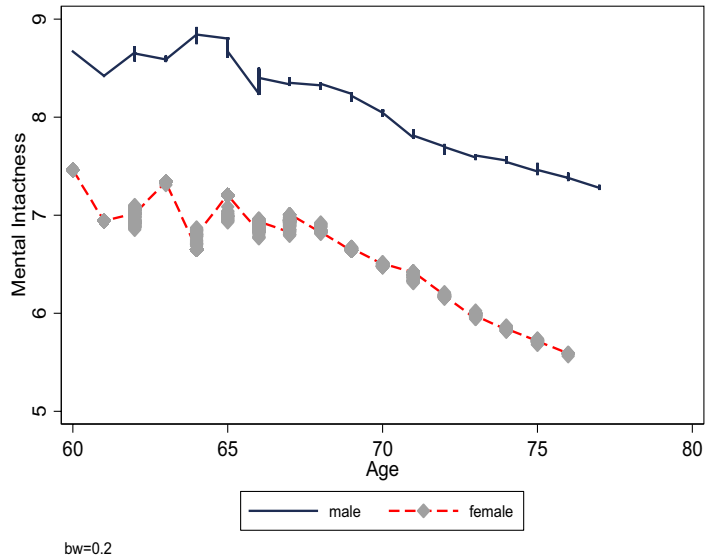


Figure 2. Distributions of cognitive tests of the elderly by gender and Hukou properties. *Note:* Data Source: CHARLS 2011, 2013, 2015. The x-axis represents age, and the y-axis represents the test scores.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

(2) Mental intactness tests

(2.1) Rural



(2.2) Urban

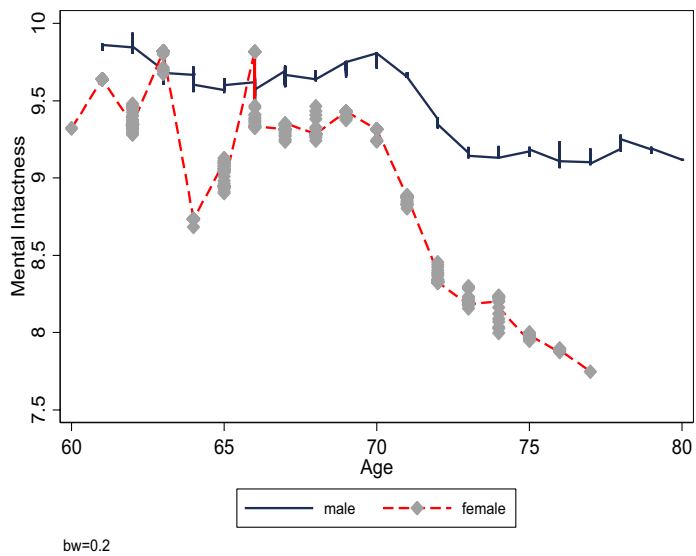


Figure 2. (*Continued.*)

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Table 2. Summary statistics

	Become widowed			Continuous married		
	Female	Male	F-M Diff	Female	Male	F-M Diff
Dependent Variable						
Total word recall	3.034	2.961	0.073	3.079	3.341	−0.262***
Immediate word recall	3.616	3.626	−0.01	3.628	3.893	−0.265***
Delay word recall	2.811	2.805	0.006	2.921	3.118	−0.197***
Mental intactness	6.916	8.134	−1.218***	7.186	8.572	−1.385***
Serial 7 subtraction	2.428	3.223	−0.796***	2.586	3.357	−0.770***
Identify Days test	2.568	3.198	−0.630***	2.938	3.564	−0.626***
Covariates						
Age	70.496	72.031		66.679	67.719	
Rural Hukou	0.827	0.772		0.825	0.739	
Sport infrastructure	0.54	0.58		0.61	0.62	
Entertainment infrastructure	0.51	0.52		0.53	0.55	
Health center	0.23	0.18		0.21	0.26	
Elder-care center	0.017	0.03		0.02	0.02	

Source: CHARLS 2011, 2013, 2015.

infrastructure. Recreational facilities encompass rooms for card and chess games, clubs for calligraphy and painting, and social organizations specifically catering to the elderly and disabled populations. Communities containing any of these amenities are considered to have recreational infrastructure. Social services are measured by the presence of health care centers and family-based elder-care centers. Health care centers provide essential health services, including monitoring blood pressure and glucose levels, weight management, mental health support, and regular medication assistance. Family-based elder-care centers typically offer services such as senior dining, residential care, and daytime care activities. Communities possessing these centers are indicated accordingly in our analysis.

4. Empirical approach

We first examine the effects of marital status and health outcomes, especially the duration of widowhood, and analyze the results of marital transitions on health outcomes. Losing a spouse is a substantial life change, we then analyze the dynamic impact of marital transitions from a short-term perspective.

We use the fixed-effect model to identify the effect of widowhood. Our baseline health equation is

$$cognition_{ijt} = \alpha Widowed_{it} + \beta_{\alpha} A_{it} + \beta_{\gamma} cognition_{i,11}.t + \beta_c C_j.t + u_i + \gamma_t + \varepsilon_{ijt} \quad (1)$$

where $cognition_{ijt}$ represents cognitive functioning for individual i in county j year

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

t. $Widowed_{it}$ equals 1 if the individual experienced widowhood. The coefficient α measures the effect of bereavement on cognition. A_{it} denotes age. u_i captures individual-specific fixed effects; and γ_t is a year effect. ε_{ijt} is a stochastic error term.

One advantage of the fixed-effect model is that it can control unobserved characteristics that do not vary within individuals over time. For example, factors such as poor local infrastructure or a household's shared health behaviors—like diet or exercise routines—may influence both the likelihood of spousal death and cognitive outcomes for the surviving partner (Simeonova, 2013). By using individual fixed effects, we mitigate bias from these time-invariant confounders by effectively differencing them out of the estimation.

To further account for time-varying unobserved heterogeneity, we introduce two interaction terms. First, we interact individuals' baseline (2011) cognitive status $Cognition_{i,11}$ with a linear time trend *t*to control for persistent, unobserved traits that might simultaneously influence cognitive decline and the probability of widowhood. Second, we interact county fixed effects C_j with time trends to adjust for changing county-level factors such as evolving healthcare policies or access to services that might affect cognition over time.

Additionally, we consider two potential sources of measurement error in Equation (1). First, widowed individuals may underreport their cognitive ability to justify welfare eligibility, introducing systematic bias. Second, cognitive test scores may suffer from random measurement error, potentially attenuating estimated effects. However, because our cognitive measures are based on objective test performance rather than self-reports, they are less prone to such biases (Lei & Liu, 2018).

To detect the route change of cognitive functioning, we construct the short-term dynamic model:

$$cognition_{ijt} = \sum\nolimits_k \beta_k Wid_{ik} + \beta_\alpha\, A_{it} + \beta_\gamma\, cognition_{i,11}.t + \beta_c\, C_j\, .t + u_i + \gamma_t + \varepsilon_{ijt} \tag{2}$$

k indicates time re-centered around the time of widowhood (when $k = 0$). Wid_{ik} is an indicator variable taking value 1 if the person becomes widowed in that year. The coefficient β_k captures the effects associated with the year of bereavement. The time skeleton contains two waves before widowhood, the current period of becoming widowhood, and one wave after widowhood ($k = -2,-1,0,1$). The first wave before widowhood ($k = -1$) is regarded as the reference and is dropped from the regression. The other variables' definitions are the same as for Equation (1). Because the CHARLS is biennial, every wave of the CHARLS ranges roughly two years.

5. Results

5.1. Basic results

Both OLS and fixed-effects models is used to estimate the effect of widowhood on cognitive function, with fixed-effects models being the primary estimator given that they effectively control for unobserved individual characteristics. Table 3 reports the basic results. The fixed-effects estimates indicate that widowhood significantly decreases the total word recall score by 0.346 points (11.69%). Specifically, delayed recall performance is notably poorer among widowed individuals, decreasing by 0.263 points compared to continuously married individuals at the 1% significance level. The total negative impact on memory is larger than either immediate or delayed recall individually, suggesting

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Table 3. Short-term effect of widowhood on cognition

	Word Recall			Mental intactness		
	Overall	Immediate word recall	Delayed word recall	Overall	Serial 7 subtraction	Identify Days test
	(1)	(2)	(3)	(4)	(5)	(6)
OLS						
Being Widowed	−0.184**	−0.035	−0.161*	−0.546***	−0.344***	−0.250***
	(0.079)	(0.077)	(0.091)	(0.155)	(0.099)	(0.078)
Observations	10,271	9,827	8,584	8,990	9,392	10,848
R-squared	0.257	0.191	0.182	0.170	0.078	0.167
Fixed effect						
Being Widowed	−0.346***	−0.148*	−0.263***	−0.425***	−0.412***	−0.464***
	(0.081)	(0.081)	(0.096)	(0.129)	(0.101)	(0.075)
Observations	13,025	12,606	10,913	11,693	12,458	16,775
R-squared	0.184	0.206	0.313	0.125	0.176	0.134

Note: ***p < 0.001, **p < 0.01, *p < 0.05; robust standard errors are in parentheses. The sample includes continuously married and becoming widowed people. We also control age, rural Hukou, the interactions of 2011 dependent health condition with time trend, and the interactions of counties dummies with time trend, but not reported.

cumulative deterioration. Columns four to six report the results of the mental intactness test. Widowhood significantly reduces the total score by 0.425 points at the 1% significance level. On the sub-item tests, both the Serial 7 subtraction and Identify Days subtests show similar declines, with scores falling by 0.412 and 0.464 points respectively.

To enhance interpretability, we standardized the cognitive test scores (Appendix Table A2). Experiencing widowhood had a greater effect on mental integrity than on word recall test. Word recall scores were 0.194 standard deviations lower for the widowed than for the continuously married, which corresponds to a drop in the test scores from the median to about the 42.3% quartile, roughly a 7.7 percentage point drop. On the other hand, the widowed had a test score of 0.264 standard deviations lower on the mental integrity test than the continuously married. This corresponds to a decline in the test scores from the median to the 39.6% quartile, a decline of about 10.4 percentage points. Of all the tests, widowhood hit the Identify Days test the hardest, dropping 0.277 percentage points from those who were continually married.

These findings highlight widowhood's significant negative effects on both episodic memory and mental intactness, potentially increasing the risk of Alzheimer's disease (Bae *et al.*, 2015). Next, we will use dynamic fixed-effect models to identify at which stage cognition performance declines rapidly so that we can adopt some intervention measures to moderate these adverse effects.

5.2. Dynamic effects

To explore the dynamic effects and validate the parallel trends assumption, we employ fixed-effects event study models, using the first pre-widowhood wave as a reference (Table 4, Appendix Figure A1).

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Table 4. Short-term dynamic effect of widowhood on cognition

	Word Recall			Mental Intactness		
	Overall	Immediate word recall	Delayed word recall	Overall	Serial 7 subtraction	Identify Days test
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Wave −2	−0.157	−0.082	−0.117	−0.393**	−0.153	−0.162
	(0.125)	(0.121)	(0.134)	(0.179)	(0.138)	(0.106)
Wave 0	−0.407***	−0.147	−0.335***	−0.680***	−0.500***	−0.514***
	(0.111)	(0.109)	(0.122)	(0.187)	(0.135)	(0.110)
Wave +1	−0.684***	−0.474***	−0.430**	−0.869***	−0.624***	−0.890***
	(0.167)	(0.168)	(0.185)	(0.259)	(0.198)	−0.145
Observations	13,025	12,606	10,913	11,693	12,458	16,775
R-squared	0.184	0.207	0.313	0.126	0.176	0.136

Note: ***p < 0.001, **p< 0.01, *p < 0.05; robust standard errors are in parentheses. The sample includes continuously married and becoming widowed people. We also control age, rural Hukou, the interactions of 2011 dependent health condition with time trend, and the interactions of counties dummies with time trend, but not reported.

Overall, results support parallel trends, with insignificant pre-treatment effects and significantly negative cognitive outcomes following widowhood. It should be noted that we have observed a significant negative effect in the pre-2 period in the regression of experiencing widowhood on the mental intactness test, possibly due to caring responsibilities for a sick spouse. Nevertheless, we can observe that the magnitude of the negative effect of the coefficients in both periods after experiencing widowhood is significantly larger than the magnitude in the prior period by about double. This can be considered a reliable shock to mental integrity from experiencing widowhood. For word recall, declines are significant and growing in magnitude over time, with scores dropping by 0.407 immediately and 0.684 two years after widowhood, similar to the findings of Lei *et al.* (2012). Immediate recall significantly declines only in the post-widowhood wave, while delayed recall consistently deteriorates in both waves. The negative effect on mental intactness also intensifies over time, particularly for the Identify Days test, declining by 0.514 initially and 0.890 subsequently.

We offer several potential explanations for the decline in cognitive ability. First, widowhood is considered to be a huge life shock that may profoundly affect the individual mentally. Widowed older people tend to be emotionally depressed, which leads to reduced cognitive ability. Second, a spouse is a frequent communicator in relationships and contributes to stimulating the central nervous system (Rauers *et al.*, 2011). Third, losing a spouse may cause loneliness and is likely to reduce cognitive stimulation. The results show that the cognitive impact of losing a spouse is persistent. Next, we further explore this decline of cognition after widowhood from the perspective of neighborhood concentration and examine whether community support can offset the shock of bereavement.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Table 5. Placebo test: advance the shock by one wave ahead

	Word Recall			Mental Intactness		
	Overall	Immediate word recall	Delayed word recall	Overall	Serial 7 subtraction	Identify Days test
Being widowed	−0.078	−0.013	−0.038	−0.094	−0.066	−0.097
	(0.132)	(0.128)	(0.142)	(0.186)	(0.154)	(0.108)
Observations	13,025	12,606	10,913	11,693	12,458	16,775
R-squared	0.134	0.124	0.248	0.105	0.158	0.109

Note: ***p < 0.001, **p < 0.01, *p < 0.05; robust standard errors are in parentheses. The sample includes continuously married and becoming widowed people.

5.3. Robustness test

To further validate our findings, we conducted several robustness checks. First, we performed a placebo test to mitigate concerns regarding the potential biases stemming from our relatively short panel. We artificially shifted the timing of widowhood one survey wave earlier (i.e., two years ahead), and re-estimated the model specified in Equation (1). As shown in Table 5, the placebo widowhood effects on cognitive ability are both statistically insignificant and much smaller in magnitude, indicating that the observed decline in cognitive outcomes is not driven by any systematic pre-existing trends unrelated to actual widowhood. These results confirm the validity of the common trends assumption and support the interpretation that the shock captured in the main analysis reflects the exogenous onset of widowhood.

Next, we employ a matching-based regression approach—specifically, the Doubly Robust Inverse Probability Weighting (DRIPW) method in the Callaway and Sant'Anna Difference-in-Differences framework. First, it calculates propensity scores that balance observed covariates—including age, gender, Hukou status, and baseline cognitive ability—between treated and untreated groups. It then predicts counterfactual outcomes using outcome regression based on these same covariates. Finally, the two steps are combined, ensuring that the estimator remains unbiased as long as either the propensity score model or the outcome model is correctly specified. This doubly robust property makes DRIPW both efficient and reliable for causal inference in staggered DID settings. In Table 6, we show that while the magnitude of the coefficients becomes smaller compared to the main fixed-effects results, the signs and statistical significance remain largely consistent, demonstrating the robustness of our conclusions.

In addition, we explored more basic regressions, reported in Table 7, to verify that our main results are not unduly driven by additional controls such as baseline cognitive ability or region-specific trends. In Panel A, excluding the control for 2011 cognitive scores yields effect estimates that remain directionally similar to those in the main results (Table 3), although the magnitudes are generally smaller. In Panel B, we replaced county-level time trends with province-level time trends, which yields even more pronounced negative effects of widowhood on cognition. In Panel C, omitting both initial cognitive ability and region-specific time trends in a simpler fixed-effects model produces an even stronger negative impact of widowhood. Overall, the consistency of results across these different model specifications supports the conclusion that the observed impact of widowhood on cognition is not an artifact of model selection.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Table 6. The effect of widowhood on cognition (propensity score weighting approach)

	Word Recall			Mental Intactness		
	Overall	Immediate word recall	Delayed word recall	Overall	Serial 7 subtraction	Identify Days test
Being widowed	−0.256*	−0.166	−0.364**	−0.342**	0.318**	−0.350**
	(0.141)	(0.143)	(0.173)	(0.140)	(0.143)	(0.140)
Observations	6656	6434	5338	5484	5860	7462

Note: ***p < 0.001, **p < 0.01, *p < 0.05; robust standard errors are in parentheses. The sample includes continuously married and becoming widowed people. All the results are estimated by the Doubly Robust Inverse Probability Weighting (DRIPW) method in the Callaway and Sant'Anna Difference-in-Differences framework.

Table 7. Robustness test on reduced model

	Word Recall			Mental Intactness		
	Overall	Immediate word recall	Delayed word recall	Overall	Serial 7 subtraction	Identify Days test
Panel A Omitted cognitive ability in 2011						
Being widowed	−0.255***	−0.095	−0.176	−0.231*	−0.261**	−0.218***
	(0.087)	(0.090)	(0.118)	(0.135)	(0.113)	(0.085)
Observations	14,600	13,889	11,924	12,957	13,608	16,775
R-squared	0.084	0.042	0.075	0.049	0.035	0.034
Panel B Province-level time trend						
Being widowed	−0.362***	−0.152*	−0.262***	−0.432***	−0.419***	−0.463***
	(0.082)	(0.082)	(0.096)	(0.130)	(0.099)	(0.076)
Observations	13,025	12,606	10,913	11,693	12,458	16,775
R-squared	0.164	0.193	0.303	0.098	0.161	0.121
Panel C Omitted cognitive ability in 2011 & region-specific time trend						
Being widowed	−0.379***	−0.173**	−0.289***	−0.444***	−0.422***	−0.464***
	(0.083)	(0.081)	(0.097)	(0.130)	(0.099)	(0.076)
Observations	13,025	12,606	10,913	11,693	12,458	16,775
R-squared	0.150	0.184	0.295	0.092	0.156	0.117

Note: ***p < 0.001, **p < 0.01, *p < 0.05; robust standard errors are in parentheses. The sample includes continuously married and becoming widowed people. In Panel A, we omitted the interactions of 2011 cognition with time trend. In Panel B, we change the region-specific time trend from county level to province level. In Panel C, we omitted the interactions of 2011 cognition with time trend and region-specific time trend. The rest of the setup remains the same as Table 3.

5.4. Heterogeneity test

The results above suggest that the effects of widowhood on cognition are persistent. We next explore whether these effects vary based on individual characteristics, focusing specifically on gender and Hukou status. Literature shows that older women, on average, exhibit lower measured cognitive abilities than men, which may reflect multiple factors, including historical disparities in educational access, life-course socioeconomic

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Table 8. Heterogeneous effect of widowhood on cognition

	Word Recall			Mental Intactness		
	Overall	Immediate word recall	Delayed word recall	Overall	Serial 7 subtraction	Identify Days test
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A Gender heterogeneity						
Being widowed	−0.167	0.027	−0.139	−0.283	−0.380**	−0.159
	(0.131)	(0.128)	(0.154)	(0.180)	(0.155)	(0.117)
Being widowed*Female	−0.298*	−0.290*	−0.204	−0.269	−0.060	−0.482***
	(0.162)	(0.159)	(0.191)	(0.253)	(0.198)	(0.148)
Observations	13,025	12,606	10,913	11,693	12,458	16,775
R-squared	0.184	0.207	0.313	0.125	0.176	0.135
Panel B Hukou heterogeneity						
Being widowed	−0.048	0.087	−0.035	0.163	−0.118	−0.524***
	(0.168)	(0.149)	(0.180)	(0.229)	(0.207)	(0.190)
Being widowed*Rural	−0.371*	−0.295*	−0.298	−0.798***	−0.388*	0.075
	(0.189)	(0.173)	(0.210)	(0.273)	(0.234)	(0.204)
Observations	13,025	12,606	10,913	11,693	12,458	16,775
R-squared	0.184	0.207	0.313	0.126	0.176	0.134

Note: ***p < 0.001, **p < 0.01, *p < 0.05; robust standard errors are in parentheses. The sample includes continuously married and becoming widowed people. We also control age, rural Hukou, the interactions of 2011 dependent health condition with time trend, and the interactions of counties dummies with time trend, but not reported.

experiences, cultural norms, and potentially biological characteristics (Lei *et al.*, 2012). In addition, individuals with different Hukou statuses receive varying levels of social welfare benefits – such as pensions, medical insurance, and other socioeconomic resources – which can also influence cognitive outcomes. Therefore, we estimate the heterogeneous effects of widowhood by gender and Hukou status to determine how these two dimensions may shape the cognitive consequences of spousal loss.

Table 8 shows the results. Panel A examines gender differences. Widowed females score 0.298 points lower on overall cognition, significant at the 10% level, mainly due to poorer performance in immediate word recall. No significant differences are found in delayed recall. In terms of mental intactness, females perform significantly worse than males on the Identify Days test. Panel B analyzes differences by Hukou status. Rural individuals experience significantly greater cognitive decline following widowhood than their urban counterparts. The disparity in memory is driven by immediate word recall, while the difference in mental intactness stems primarily from the Serial 7 subtraction test. Appendix Table A3 further estimates gender interactions within rural and urban subsamples. Significant negative effects are found mainly among rural widowed women, while effects in urban areas are generally insignificant. Taken gender and Hukou attributes together, the most vulnerable group responding to the experience of widowhood is rural women.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Uneven distribution of education across gender and rural-urban groups may confound the observed heterogeneity. To assess whether education confounds the heterogeneous effects of widowhood on cognitive function, we split education at the sample median and included it as a dummy in interaction terms. Results in Appendix Table A4 show that adding education does not significantly alter the widowhood–gender or widowhood–Hukou effects. Moreover, the combined effects of the original interaction terms and the triple interactions are of a similar magnitude to our previous findings (Table 8). This suggests that educational attainment is not a key confounding factor in explaining subgroup differences in the cognitive impact of widowhood.

We can propose some possible explanations for the fact that widowhood hits rural women harder. First, losing a spouse makes the person lose social support. In rural China, many of the elderly and their spouses stay behind in the countryside, with adult children migrating to urban areas. Once widowed, the elderly will lose much of their financial support and spiritual companionship. This will increase economic poverty and lead to a lack of medical resources and health inputs (Foster and Smetherham, 2013; McGarry and Schoeni, 2005). Second, losing mental support will make the elderly feel lonely, bored, and stressed, decreasing cognition ability (Zhao *et al.*, 2021; Mourao-Miranda *et al.*, 2009; Andrew and Rockwood, 2010). Third, especially in developing countries, widows are more likely to be discriminated against (Lloyd-Sherlock, 2000). Thus, they may reduce their social activity, negatively affecting their cognitive ability. Subramanian *et al.* (2008)pointed out that in the United States, neighborhood structural contexts that provide opportunities for widowed people to interact with others or favor new social engagements can offset the widowhood effects. We will investigate whether neighborhood environments such as public infrastructure and social services can function similarly in China.

5.5. Policy responses: What can we do

The above findings have shown that the negative impact on the cognition of rural women is significantly higher than other groups. Furthermore, we explore the cognitive impact of widowhood on different subsamples by introducing two policy directions, four ways, of public infrastructure (sports and recreational facilities) and social services (elderly health and care centers) to propose policy responses that effectively mitigate the shock of widowhood. Table 9 shows the regression results for public infrastructure and social services on elderly cognition.

Panel A and B show the results for public infrastructure, then Panel C and D show the results for social services.[4] The infrastructure of public facilities appears to have better outcomes than social services for the vulnerable group we are most concerned about – women in rural areas. Sports and recreational infrastructure have a significant positive impact on word recall, improving scores by 0.374 and 0.432, respectively (at a 10% significance level). However, in terms of overall mental intactness performance, there is a significant positive effect of sport infrastructures only on urban females.

Regarding public social service, having an elderly health center in the community significantly improves the word recall of urban women. Health centers in the community, such as regular monitoring of blood pressure and blood sugar or adherence to lifestyle modifications and medicine, can help individuals prevent chronic diseases (Ding *et al.*, 2021) and correspondingly relieve cognitive decline. On the other hand,

[4]Due to the sample of urban residents involved in elder care centers in the survey being too small to regress, we dropped the regressions for the urban sample in Panel D.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Table 9. Effect of public infrastructure and services on cognition

	Word Recall (overall)				Mental Intactness (overall)			
Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sport infrastructure	rural female	rural male	urban female	urban male	rural female	rural male	urban female	urban male
Being widowed	−0.688***	−0.215	−0.323	−0.548	−0.794***	−0.502	1.797**	−0.179
	(0.157)	(0.261)	(0.540)	(0.347)	(0.283)	(0.322)	(0.910)	(0.566)
Being widowed*Sport	0.374*	−0.004	−0.164	0.844*	0.210	0.210	1.842*	−0.512
	(0.223)	(0.321)	(0.611)	(0.467)	(0.417)	(0.416)	(0.997)	(0.671)
Observations	4,815	5,232	1,105	1,873	3,630	5,094	1,072	1,897
R-squared	0.218	0.198	0.297	0.268	0.186	0.146	0.216	0.214
Panel B	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Recreational infrastructure	rural female	rural male	urban female	urban male	rural female	rural male	urban female	urban male
Being widowed	−0.712***	−0.307	0.944***	−1.093	−0.921***	−0.596**	−0.134	−1.374**
	(0.162)	(0.207)	(0.359)	(0.807)	(0.288)	(0.278)	(0.950)	(0.546)
Being widowed*Recreat	0.432*	0.226	−1.559***	1.091	0.453	0.488	0.434	0.904
	(0.222)	(0.310)	(0.449)	(0.864)	(0.414)	(0.409)	(1.032)	(0.661)
Observations	4,815	5,232	1,105	1,873	3,630	5,094	1,072	1,897
R-squared	0.218	0.199	0.301	0.269	0.186	0.147	0.209	0.215

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

	Word Recall (overall)				Mental Intactness (overall)			
Panel C	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Health center	rural female	rural male	urban female	urban male	rural female	rural male	urban female	urban male
Being widowed	−0.544	−0.248	−1.193***	0.319	−1.287	0.213	−0.784*	−1.458***
	(0.457)	(0.597)	(0.247)	(0.353)	(0.805)	(0.579)	(0.473)	(0.218)
Being widowed*Health	0.036	0.034	0.763**	−0.532	0.639	−0.651	1.067*	0.893**
	(0.471)	(0.618)	(0.355)	(0.466)	(0.830)	(0.619)	(0.601)	(0.409)
Observations	4,815	5,232	1,105	1,873	3,630	5,094	1,072	1,897
R-squared	0.217	0.198	0.297	0.268	0.186	0.147	0.210	0.214
Panel D	(25)	(26)			(27)	(28)		
Elder care center	rural female	rural male			rural female	rural male		
Being widowed	−0.506***	−0.218			−0.713***	−0.337		
	(0.120)	(0.160)			(0.218)	(0.210)		
Being widowed*Care	0.263	0.053			1.542***	−1.642		
	(0.968)	(0.818)			(0.388)	(0.891)		
Observations	4,815	5,232			3,630	5,094		
R-squared	0.217	0.198			0.186	0.147		

Note: Due to the sample of urban residents involved in elder care centers in the survey being too small to regress, we dropped the regressions for the urban sample in Panel D. ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$; robust standard errors are in parentheses. The sample includes continuously married, and becoming widowed people. We also control age, rural Hukou, the interactions of 2011 dependent health condition with time trend, and the interactions of counties dummies with time trend, but not reported.

having a family-based elder-care center in the community significantly improves the mental intactness of rural women, while not affecting their word recall performance. In addition, the family-based elder-care center often provides free dining tables and daycare for the elderly, which can satisfy nutrition intake and social communication.

6. Conclusions

Using CHARLS data, this paper analyzes the short-term effects of spousal bereavement on cognitive outcomes among older adults in China. Fixed-effects estimates show that widowhood significantly reduces cognitive function, and this decline is persistent over time. We further examine heterogeneous effects and find that rural residents, particularly rural women, experience greater cognitive decline, especially in fluid cognition. These effects may stem from stress, loneliness, and reduced economic security following spousal loss. As such, gender-sensitive interventions – such as grief counseling, targeted subsidies, and cognitive training – should be prioritized for rural widows.

We also explore potential moderating mechanisms from the neighborhood perspective, focusing on public infrastructure and social services. The results show that sports and recreational facilities can buffer the negative cognitive impacts of widowhood, particularly improving word recall. Similarly, health-focused elderly care centers enhance cognitive function, while family-based elder-care centers improve both memory and mental intactness.

By introducing a neighborhood perspective, this study highlights the importance of local environments in shaping cognitive resilience after bereavement. Community infrastructure that facilitates physical activity, social interaction, and healthcare access may help mitigate the adverse cognitive consequences of widowhood. From a policy standpoint, our findings suggest the need to enhance infrastructure and expand public services for the rural elderly. This includes investing in recreational spaces, outdoor exercise facilities, and community care services such as senior dining programs, health check-ups, and in-home nursing support.

Supplementary material. The supplementary material for this article can be found at https://doi.org/10.1017/dem.2025.10006

Competing interests. All authors declare no conflict of interest.

Reference

Aartsen, M. J., Van Tilburg, T., Smits, C. H. M., Comijs, H. C., & Knipscheer, K. C. P. M. (2005). Does widowhood affect memory performance of older persons? *Psychological Medicine*, 35(2), 217–226.

Andrew, M., K., & Rockwood, K. (2010). Social vulnerability predicts cognitive decline in a prospective cohort of older Canadians. *Alzheimers Dement*, 6(4), 319–325.

Atalay, K., Barrett G. F., & Staneva A. (2019). the effect of retirement on elderly cognitive functioning. *Journal of Health Economics*, 66, 37–53.

Bae, J. B., Kim, Y. J., Han, J. W., Kim, T. H., & Kim, K. W. (2015). Incidence of and risk factors for Alzheimer's disease and mild cognitive impairment in Korean Elderly. *Dementia and Geriatric Cognitive Disorders*, 39(1-2), 105–111.

Banks, J., & Oldfield, Zoë. (2010). Understanding pensions: cognitive function, numerical ability and retirement saving. *Fiscal Studies*, 28(2), 143–170.

Berg, G. J. V. D., Lindeboom, M., & Portrait, F. (2011). Conjugal bereavement effects on health and mortality at advanced ages. *Journal of Health Economics*, 30(4), 774–794.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Besser, L. M., McDonald, N. C., Song, Y., Kukull, W. A., & Rodriguez, D. A. (2017). Neighborhood environment and cognition in older adults: a systematic review. *American Journal of Preventive Medicine*, 53(2), 241–251.

Besser, L., Galvin, J. E., Rodriguez, D., Seeman, T., Kukull, W., Rapp, S. R., & Smith, J. (2019). Associations between neighborhood built environment and cognition vary by apolipoprotein E genotype: multi-ethnic study of atherosclerosis. *Health and Place*, 60(C), 102188.

Bonsang, E., Adam, S., & Perelman, S. (2012). Does retirement affect cognitive functioning? *Journal of Health Economics*, 31(3), 490–501.

Brown, S., Perrino, T., Lombard, J., Wang, K., Toro, M., Rundek, T., Gutierrez, C., Dong, C., Plater-Zyberk, E., Nardi, M., Kardys, J., & Szapocznik, J. (2018). Health disparities in the relationship of neighborhood greenness to mental health outcomes in 249, 405 U.S. medicare beneficiaries. *International Journal of Environmental Research and Public Health*, 15(3), 430–440.

Celidoni, M., Dal Bianco, C., & Weber, G. (2017). Retirement and cognitive decline. a longitudinal analysis using SHARE data. *Journal of Health Economics*, 56, 113–125.

Coe N. B., Gaudecker H. M. V., Lindeboom M., & Maurer J. (2012). The effect of retirement on cognitive functioning. *Health Economics*, 21(8), 913–927.

Clarke, P. J., Weuve, J., Barnes, L., Evans, D. A., & Mendes de Leon, C. F. (2015). Cognitive decline and the neighborhood environment. *Annals of Epidemiology*, 25(11), 849–854.

Ding, H., Chen, Y., Yu, M., Zhong, J., Hu, R., Chen, X., Wang, C., Xie, K., & Eggleston, K. (2021). The effects of chronic disease management in primary health care: evidence from Rural China. *Journal of Health Economics*, 80, 102539.

Elwert, F., & Christakis N. A. (2016). Widowhood and race. *American Sociological Review*, 71(1), 16–41.

Fan, L. Y., Sun, Y., Lee, H.J., Yang, S. C., Chen, T. F., Lin, K. N., Shu-Chien, Y., Ta-Fu, C., & Ker-Neng, L. (2015). Marital status, lifestyle and dementia: a nationwide survey in Taiwan. *Plos One*, 10(9), e0139154.

Feng, L., Ng, X. T., Yap, P., Li, J., Lee, T. S., & Hkansson, K. (2014). Marital status and cognitive impairment among community-dwelling Chinese Older Adults: the role of gender and social engagement. *Dementia and Geriatric Cognitive Disorders Extra*, 4(3), 375–384.

Finlay, J., Esposito, M., Li, M., Colabianchi, N., Zhou, H., Judd, S., & Clarke, P. (2021). Neighborhood active aging infrastructure and cognitive function: a mixed-methods study of Older Americans. *Preventive Medicine*, 150, 106669.

Foster, L., & Smetherham, J. (2013). Gender and pensions: an analysis of factors affecting women's private pension scheme membership in the United Kingdom. *Journal of Aging & Social Policy*, 25(3), 197–217.

Freise, D., Schmitz, H., & Westphal, M. (2022). Late-career unemployment and cognitive abilities. *Journal of Health Economics*, 86, 102689.

Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political Economy*, 80(2), 223–255.

Hughes, M. E., & Waite, L. J. (2009). Marital biography and health at mid-life. *Journal of Health and Social Behavior*, 50(3), 344–358.

Hu, Y., & Goldman, N. (1990). Mortality differentials by marital status: an international comparison. *Demography*, 27(2), 233–250.

Jain, U., Liu, H., Langa, K. M., Farron, M., Kabeto, M., & Lee, J. (2022). Widowhood and cognition among Older Women in India: new insights on widowhood duration and mediators. *SSM-Population Health*, 19, 101242.

Killewald, A. & Gough, M. (2013). Does specialization explain marriage penalties and premiums?. *American Social Review*, 78(3), 477–502.

Langa, K. M., Larson, E. B., Crimmins, E. M., Faul, J. D., Levine, D. A., Kabeto, M. U., Weir D. R. (2017). A comparison of the prevalence of dementia in the United States in 2000 and 2012. *JAMA Internal Medicine*, 177(1), 51–58.

Lei, X., Hu, Y., Mcardle, J. J., Smith, J. P., & Zhao, Y. (2012). Gender differences in cognition among Older Adults in China. *Journal of Human Resources*, 47(4), 951–971.

Lei, X., & Liu, H. (2018). Gender difference in the impact of retirement on cognitive abilities: evidence from Urban China. *Journal of Comparative Economics*, 46(4), 1425–1446.

Lee, Y., Chi, I., & Palinkas, L. (2019). Widowhood, leisure activity engagement, and cognitive function among older adults. *Aginge& Mental health*, 23(6), 771–780.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Lillard, L. A., & Waite, L. J. (1995). Til death do us part: marital disruption and mortality. *American Journal of Sociology*, 100(5), 1131–1156.

Liu, H. (2012). Marital dissolution and self-rated health: age trajectories and birth cohort variations. *Social Science & Medicine*, 74(7), 1107–1116.

Li, L., Liang, J., Toler, A., & Gu, S. (2005). Widowhood and depressive symptoms among Older Chinese: do gender and source of support make a difference? *Social Science & Medicine*, 60(3), 637–647.

Lloyd-Sherlock, P. (2000). Old age and poverty in developing countries: new policy challenges. *World Development*, 28(12), 2157–2168.

Lillard, L. A., & Panis C. W. (1996). Marital status and mortality: the role of health, *Demography*, 33(3), 313–327.

Mazzonna, F., & Peracchi, F. (2012). Aging, cognitive abilities and retirement. *European Economic Review*, 56(4), 691–710.

McGarry, K., & Schoeni, R. F. (2005). Widow(er) poverty and out-of-pocket medical expenditures near the end of life. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 60(3), S160–168.

McArdle, J. J., Fisher, G. G., & Kadlec, K. M. (2007). Latent variable analyses of age trends of cognition in the health and retirement study, 1992-2004. *Psychology and Aging*, 22(3), 525–545.

Mousavi-Nasab, S.-M.-H., Kormi-Nouri, R., Sundström, A. & Nilsson, L.-G. (2012). The effects of marital status on episodic and semantic memory in healthy middle-aged and old individuals. *Scandinavian Journal of Psychology*, 53, 1–8.

Mourao-Miranda, J., Ecker, C., Sato, J. R., & Brammer, M. (2009). Dynamic changes in the mental rotation network revealed by pattern recognition analysis of fMRI data. *Journal of Cognitive Neuroscience*, 21(5), 890–904.

Ownby, R. L. (2006). Medication adherence and cognition medical, personal and economic factors influence level of adherence in older adults. *Geriatrics*, 61(2), 30–35.

Perkins, J. M., Lee, H. Y., James, K. S., Oh, J., Krishna, A., & Heo, J., Lee, J. K., & Subramanian, S. V. (2016). Marital status, widowhood duration, gender and health outcomes: a cross-sectional study among older adults in India. *BMC Public Health*, 16 (1), 1032–1035.

Rohwedder, S., & Willis, R. J. (2010). Mental retirement. *Journal of Economic Perspectives*, 24(1), 119–138.

Rosnick, C., Small, B., & Burton, A. (2010). the effect of spousal bereavement on cognitive functioning in a sample of older adults. *Aging Neuropsychology & Cognition*, 17(3), 257–269.

Rauers, A., Riediger, M., Schmiedek, F., & Lindenberger, U. (2011). With a little help from my spouse: does spousal collaboration compensate for the effects of cognitive aging? *Gerontology*, 57(2), 161–166.

Simeonova E. (2013). Marriage, bereavement and mortality: the role of health care utilization. *Journal of Health Economics*, 32(1), 33–50.

Simon, R. W. (2002). Revisiting the relationships among gender, marital status, and mental health. *American Journal of Sociology*, 107(4), 1065–1096.

Smith, J. P., McArdle, J. J., & Willis, R. (2010). Financial decision making and cognition in a family context. *The Economic Journal*, 120(548), 363–380.

Sobal, J., Rauschenbach, B., & Frongillo E. A. (2003). Marital status changes and body weight changes: a US longitudinal analysis. *Social Science & Medicine*, 56(7), 1543–1555.

Subramanian, S. V., Elwert, F., & Christakis N. (2008). Widowhood and Mortality among the Elderly: The Modifying Role of Neighborhood Concentration of Widowed Individuals, *Social science & medicine*, 66(4), 873–884.

Trentini, C. M., Werlang, B. S. G., Xavier, F. M. D., Argimon, I. I. D.(2009). The relation among variables of mental health and cognition in Widowed Elders. *Psychology: Reflection and Criticism*, 22(2), 236–243.

Umberson, D., Liu, H., & Powers D. (2009). Marital status, marital transitions, and body weight. *Journal of Health and Social Behavior*, 50(3), 327–343.

Van Gelder B. M.,Tijhuis M.A., Kalmijn S, Giampaoli S., Nissinen A., Kromhout D. (2006). Marital status and living situation during a 5-year period are associated with a subsequent 10-year cognitive decline in older men: the fine study. *Journal of Gerontology B Psychological Science and Social Sciences*, 61(4), 213–219.

Vidarsdottir H., Fang, F., Chang M. L., Aspelund T., Fall K., & Jonsdottir, M. K., et al. (2014). Spousal loss and cognitive function in later life: a 25-year follow-up in the ages-reykjavik study. *American Journal of Epidemiology*, 6, 674–683.

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press

Waite, L., & Gallagher, M. (2000). *The case for marriage: why married people are healthier, happier, and better-off financially*. Westminster, MD: Broadway Books.

Waite, L. J., & Hughes M. E. (1999). At risk on the cusp of old age: living arrangements and functional status among black, white and hispanic adults, *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 54(3), 136–144.

Ward, L., Mathias, J. L., & Hitchings, S. E. (2007). Relationships between bereavement and cognitive functioning in older adults. *Gerontology*, 53(6), 362–372.

Weir, D., Lay, M., & Langa, K. (2014). Economic development and gender inequality in cognition: a comparison of China and India, and of SAGE and the HRS sister studies. *Journal of the Economics of Ageing*, 4, 114–125.

Wu, Y. T., Prina, A. M., Brayne, C. (2015). The Association Between Community Environment and Cognitive Function: A Systematic Review, *Social Psychiatry Epidemiology*, 20, 351–362.

Wörn, J., Comijs, H., & Aartsen, M. (2020). Spousal loss and change in cognitive functioning: an examination of temporal patterns and gender differences. *The Journals of Gerontology. Series B, Psychological Sciences and Social Sciences*, 75(1),195–206.

Xavier, F. M. F., Ferraz, M. P. T., Trentini, C. M., Freitas, N. K., & Moriguchi, E. H. (2002). Bereavement-related cognitive impairment in an oldest-old community-dwelling Brazilian sample. *Journal of Clinical & Experimental Neuropsychology*, 24(3), 294–301.

Yu, X., & Lee, H. J. (2022, November). Longitudinal associations between spousal loss, religious involvement, and cognitive health in later life. *Innovation in Aging*, 6(1), 658.

Zhang, X., & Hayward D. O. (2006). Applications of microwave dielectric heating in environment-related heterogeneous gas-phase catalytic systems. *Inorganica Chimica Acta*, 359(11), 3421–3433.

Zhang Z., Li L.W., Xu H. W, & Liu J. Y. (2019). Does Widowhood Affect Cognitive Function among Chinese Older Adults? *SSM - Population Health*.

Zhang, Z., Liu, H., & Hsieh, N. (2023). Widowhood and cognitive decline: the roles of friends and gender. *Innovation in Aging*, 7(1), 483–483.

Zhao, Y. H., Strauss, J., Yang, G., Giles, J., Hu, P., Hu, Y., Lei, X., Liu, M., Park, A., Smith, J. P., & Wang, Y. (2013). China Health and Retirement Longitudinal Study- 2011–2012 National Baseline User's Guide. School of National Development, Peking University: http://charls.ccer.edu.cn/en/page/documentation/2011_national_baseline.

Zhao, Y., Inder, B., & Kim, J. S. (2021). Spousal bereavement and the cognitive health of Older Adults in the US: new insights on channels, single items, and subjective evidence. *Economics & Human Biology*, 43, 101055.

Cite this article: Li, Q., Chen, Z., & Zhang, T. (2026). Widowhood and cognitive function among older Chinese. *Journal of Demographic Economics* **92**, 52–74. https://doi.org/10.1017/dem.2025.10006

https://doi.org/10.1017/dem.2025.10006 Published online by Cambridge University Press