

DISCUSSION PAPER SERIES

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ABSTRACT

Spousal Bereavement and Long-Term Care Needs of Older Chinese Adults

Leveraging nationally representative data from the 2011-2018 Chinese Longitudinal Healthy Longevity Study (CLHLS), this study examines the impact of spousal death on long-term care (LTC) needs among Chinese older adults aged 60 and above. Our results show that spousal bereavement significantly increases the probability of LTC needs by 5.0-9.1 percentage points across severity levels (low, medium, and high). Such adverse effects are much stronger among older individuals aged 75+. Our mechanism analysis identifies three key pathways through which spousal bereavement increases LTC needs, including the loss of primary caregiving, worsened emotional stress, and increased healthcare utilization especially for inpatient costs. Our findings highlight the urgent need for targeted LTC policies that support vulnerable widowed populations, particularly older widows.

JEL Classification: J12, J14, H55, I12

Keywords: spousal bereavement, long-term care needs, primary caregiving, emotional stress, healthcare utilization

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1. Introduction

China has the world's largest aging population and is one of the fastest-aging societies worldwide (Chen et al., 2020; Chen et al., 2022; Nie, Li, Zhang, et al., 2021). The number of Chinese adults aged 60 and older is projected to increase to 491.5 million (36.5% of the total population) by 2050 (United Nations, 2020) compared to 310.3 million (22.0%) in 2024 (National Bureau of Statistics, 2025). The resulting substantial increase in the size of the older population is expected to lead to an unprecedented surge in demand for long-term care (LTC) over the next few decades. The number of Chinese people aged 60 years or older with care needs will increase from 20.6 million in 2020 to 29.7 million in 2030, representing an increase of 44% (Gong et al., 2022). Additionally, the economic burden on households with LTC-dependent older members is staggering, with the average annual expenditure on caregiving for individuals in LTC status accounting for 26%-37% of per capita GDP in China (İmrohoroğlu & Zhao, 2018). Unlike in developed countries, the Chinese family shoulders the burden of caring for older people, and the spouse is the number one caregiver, accounting for 42.5% of the total in 2018 (Nie & Zhao, 2023). Yet, widowhood is widespread: 41.48 million Chinese older adults were widowed in 2020 (National Bureau of Statistics, 2020).

A large literature has investigated the adverse effects of spousal bereavement¹ at older ages as an adverse life event on health and healthcare utilization. It has been shown that the death of a spouse increases mortality (Espinosa & Evans, 2008; Simeonova, 2013; Van den Berg et al., 2011), cognitive impairment (Min & Song, 2022), depression and depressive symptoms (Tseng, Petrie, & Leon-Gonzalez, 2017; Yoon et al., 2022), chronic diseases and body pain (Li et al., 2023), probability of hospitalization (Lei et al., 2022), health care expenditure (Goda et al., 2013; Rolden et al., 2014), and medication use (Maura et al., 2024). However, little is known about the potential effects of spousal bereavement on LTC needs. To the best of our knowledge, only three studies address this gap: Li et al. (2023) find that widowhood raises the likelihood of needing help in activities of daily life (ADL) or instrumental activities of daily life (IADL) among Chinese adults aged 45+, while Goda et al. (2013) and Peña-Longobardo et al. (2021) show increased formal/informal care use post-bereavement in the U.S. and Europe. Yet these studies either use ADL/IADL as proxies of health outcomes (Li et al., 2023) or omit an in-depth exploration of the mechanisms underlying the relationship between spousal bereavement and LTC needs.

Therefore, using nationally representative data from the 2011-2018 Chinese Longitudinal Healthy Longevity Study (CLHLS), this study investigates the impact of spousal death on different levels of LTC needs (low, medium, and high) of older Chinese adults aged 60 and above. This study contributes to the existing literature in several dimensions.

First, this study adds to the prior research on the determinants of LTC needs. While previous studies have predominantly focused on individual and household factors (e.g.,

¹ We use spousal bereavement, spousal death, spousal loss, and widowhood interchangeably.

socioeconomic status) (Fu et al., 2017; Ning et al., 2020) as drivers of LTC demand, we examine spousal bereavement – a salient yet understudied shock in rapidly aging societies. China’s unique context, where spouses are the primary providers of elder care and widowhood is widespread, however, the government does not provide social security survivor benefits (Li et al., 2023), offers an interesting case to examine this relationship. Using nationally representative panel data, we provide one of the first studies linking spousal bereavement to LTC needs in the context of unprecedented demographic transition.

Second, this study contributes to the growing literature that points to the adverse consequences of spousal bereavement on physical health, cognitive and mental health, as well as health care use across many domains. Much of the literature to date has focused on general health outcomes such as mortality, cognitive ability, and depression (Min & Song, 2022; Tseng, Petrie, & Leon-Gonzalez, 2017; Van den Berg et al., 2011; Yoon et al., 2022). We attempt to capture the immediate and dynamic effects of spousal death on LTC needs, providing a nuanced and comprehensive picture. Our findings suggest that bereavement raises the probability of all levels of LTC needs, with effects intensifying over time. This temporal pattern suggests that LTC systems should account for both immediate and dynamic effects of widowhood, especially in emerging and developing countries like China.

Lastly, few studies have focused on the possible mechanisms behind the relationship between spousal bereavement and formal/informal care (Goda et al., 2013; Peña-Longobardo et al., 2021). This study goes beyond simply examining the impact of spousal bereavement on LTC needs by unpacking the underlying mechanisms. Our findings confirm that spousal bereavement increases the probability of LTC needs by losing a primary caregiver, increasing emotional stress (i.e. depression and anxiety), and healthcare expenditure (especially inpatient spending). Understanding these mechanisms is particularly important for China, where LTC systems remain underdeveloped and family caregiving is unsustainable amid declining fertility rates.

The remainder of this study is organized as follows. Section 2 presents prior literature and underlying mechanisms. Section 3 describes the data and the empirical strategies. Section 4 presents the results. Section 5 discusses potential mechanisms. Finally, Section 6 discusses key findings and concludes.

2. Prior literature and underlying mechanisms

2.1 Prior literature

Spousal death and health/healthcare use. A substantial body of literature has examined the impacts of spousal bereavement on various health outcomes and healthcare utilization. The literature consistently suggests that widowhood is associated with increased mortality risk (Espinosa & Evans, 2008; Simeonova, 2013; Van den Berg et al., 2011), cognitive decline (Min & Song, 2022), depression (Tseng, Petrie, Wang, et al., 2017; Yoon et al., 2022), and higher incidence of chronic diseases and body pain

(Li et al., 2023). Furthermore, a small body of studies also document elevated healthcare utilization following spousal loss, including a greater probability of hospitalization (Lei et al., 2022), increased healthcare expenditure (Goda et al., 2013; Rolden et al., 2014), and heightened medication use (Maura et al., 2024). However, since individuals experiencing spousal death may selectively differ from those who remain single (Li et al., 2023; Simeonova, 2013), this may lead to potential endogeneity issues. To mitigate this, researchers have employed various strategies, including propensity score matching (PSM) (Peña-Longobardo et al., 2021; Tseng, Petrie, Wang, et al., 2017), fixed-effects models (Li et al., 2023; Simeonova, 2013), and event study designs (Goda et al., 2013), providing more robust causal evidence of spousal bereavement's health consequences.

Spousal death and LTC needs. In contrast to the extensive literature on health outcomes, surprisingly, little research has investigated the association between spousal bereavement and LTC needs. Goda et al. (2013), drawing on data from the 2002-2010 Health and Retirement Study (HRS), show that widowhood among U.S. adults aged 55+ increases home healthcare use by 2-3 percentage points and nursing home utilization by 4-7 nights on average. Similarly, using data from the 2004-2015 Survey of Health, Aging and Retirement in Europe (SHARE), Peña-Longobardo et al. (2021) show that becoming widowed is associated with increased receipt of formal and informal care from outside the home, particularly among men. The Chinese context has received even less attention. The only study by Li et al. (2023), using data from the 2011-2015 China Health and Retirement Longitudinal Study (CHARLS), shows that widowhood has a significant negative impact on health outcomes, especially increasing the probability of needing help in ADL or IADL by 8.0 percentage points among adults aged 45+.

Overall, several key aspects of previous research are worth highlighting. First, although existing studies have predominantly examined the adverse widowhood's health consequences, there remains a gap in the literature on the possible impact of spousal death on LTC needs in developing countries like China. Second, most studies provide associational evidence without adequately addressing endogeneity concerns through rigorous identification strategies. Third, although Goda et al. (2013), Li et al. (2023), and Peña-Longobardo et al. (2021) examine the nexus of spousal death and healthcare utilization and ADL/IADL patterns, the mechanisms underlying the relationship between spousal bereavement and LTC needs remain unclear. Our study addresses these gaps by employing a two-way fixed effects (TWFE) model to estimate the impacts of spousal bereavement on LTC needs among Chinese older adults aged 60+, differentiating various levels of LTC needs, and systematically exploring possible mechanisms including loss of primary caregivers, emotional stress, increased healthcare utilization, and financial strain.

2.2 Underlying mechanisms

There are several main underlying mechanisms through which spousal death might

affect LTC needs. We consider each pathway in turn.

Primary caregiver disruption. The first mechanism operates through the loss of the primary caregiver. Within the familial support hierarchies, spouses serve as principal providers of instrumental care (e.g., daily living assistance, medical accompaniment), emotional support, and medical decision-making (Cobb, 1976; Hansen et al., 2023). Their death eliminates this critical support system, heightening reliance on LTC for the surviving partner. Family systems theory conceptualizes spousal bereavement as a systemic shock that destabilizes care structures (Hawley & DeHaan, 2004; Li et al., 2011), generating both an immediate care deficit and a prolonged reorganization period. This disruption is particularly consequential due to three factors: First, marital relationships typically involve LTC expectations, making spouses the most reliable caregivers. Second, secondary caregivers (e.g., adult children) often cannot fully substitute spousal care due to competing obligations or geographic constraints (Guo et al., 2015). Third, as stated before, in Chinese family care mode, where 42.5% of elderly care is spousal (Nie & Zhao, 2023), this loss creates an acute caregiving vacuum that frequently necessitates formal LTC support.

Emotional stress. The second channel involves worsened emotional stress following spousal loss. Widowhood represents a major life stressor linked to significant psychological distress. Within the stress process model (Turner & Lloyd, 1999), bereavement depletes emotional reserves, heightening vulnerability to depression and anxiety. In the Chinese context, where spousal relationships are central to emotional well-being, partner loss leads to intense loneliness and helplessness (Jadhav & Weir, 2018; Yang & Gu, 2021; Zhang et al., 2024). Clinical evidence shows that depression symptoms frequently emerge pre-widowhood and peak within the first six months of spousal loss (Lia et al., 2005; Xu et al., 2019). Critically, emotional stress proves a stronger predictor of functional decline than conventional risk factors like smoking, obesity, or physical inactivity (Holt-Lunstad et al., 2010). Deteriorating mental health reduces preventive care investments, accelerating physical decline, and increasing LTC dependence (Lena, 2000; Wagstaff, 2006). Empirical evidence confirms this pathway, linking depression to higher risks of falls and disability among Chinese older adults (Hu et al., 2022; Zhang et al., 2019).

Increased healthcare utilization. A third avenue operates through increased healthcare utilization after spousal loss. Bereavement frequently triggers health crises that increase hospitalizations and medical service use (Goda et al., 2013; Iwashyna & Christakis, 2003; Tseng, Petrie, & Leon-Gonzalez, 2017; Tseng, Petrie, Wang, et al., 2017). While acute care may address immediate health needs, it often fails to restore long-term functional capacity. Fries's Compression of Morbidity theory posits that medical advances should reduce disability duration. However, empirical evidence shows healthcare expansions have reduced mortality more effectively than disability rates (Crimmins & Beltran-Sanchez, 2010). Consequently, post-bereavement healthcare

utilization may extend survival without restoring independence, ultimately prolonging periods of LTC needs.

Financial strain. A fourth pathway may operate through increased financial strain. Marriage resource theory suggests that widowhood reduces total household resources, imposing significant financial strain on surviving partners (Kung, 2020; Liu, 2012). This strain operates through two channels: (i) directly limiting access to paid care services due to reduced disposal income, and (ii) indirectly worsening health outcomes through constrained healthcare investments (Li et al., 2023). The resulting stress-healthcare trap – where financial limitations exacerbate health decline, which in turn increases care needs – may accelerate dependence on formal LTC systems.

3. Data and Methods

3.1. Data and study population

This study utilizes data from the Chinese Longitudinal Healthy Longevity Surveys (CLHLS), a nationally representative longitudinal survey covering approximately 85% of China's total population. The baseline survey was conducted in 1998, and then seven follow-up surveys carried out in 2000, 2002, 2005, 2008/2009, 2011/2012, 2014, and 2018. Our analysis focuses on three waves of 2011/2012-2018 CLHLS data for several reasons. First, the CLHLS represents the most comprehensive longitudinal dataset on Chinese older adults, making it particularly suitable for examining determinants of LTC needs. Second, the CLHLS provides rich information on demographics, socioeconomic characteristics, and health outcomes, enabling a thorough assessment of the impact of spousal bereavement on LTC needs. Particularly, ADLs include essential physical tasks such as dressing, bathing, eating, transferring from bed to chair, using the toilet, and bladder control. IADLs involve more complex activities necessary for independent living, such as visiting neighbors, shopping, preparing and cooking meals, doing laundry, walking 2 km continuously, carrying 5 kg, squatting and standing up three times, and going out by public transportation. Post-2011 waves further enhance health information by incorporating health indicators such as illnesses, bed-ridden conditions, and blood pressure (Zeng et al., 2017). Third, the CLHLS adopts computer-assisted personal interviews (CAPI) since 2011, minimizing measurement error and significantly improving data reliability (Zeng et al., 2017). Finally, the selected survey waves are ideal for employing a TWFE approach as they capture transitions into widowhood during the study period.

Our analytic sample is constructed as follows. From the baseline 2011 of 9765 respondents, we identify 3,698 individuals who were married or cohabiting. To ensure all instances of spousal death occurred during the observation period, we included only the samples tracked from 2011 to 2018, excluding any new samples and respondents who were already widowed in the baseline wave. We further exclude individuals who became widowed during the survey period but subsequently remarried, as well as 206 nursing home residents to focus on community-dwelling older adults. After removing observations with missing data or outliers, the final analytic sample consists of 6,473

individual-year observations of respondents aged 60+ with complete data on marital status, LTC needs, and various sociodemographic characteristics (a flowchart detailing sample selection is provided in Figure A1).

3.2. Spousal bereavement

The key independent variable in our analysis is spousal bereavement, based on the following question: “What is your current marital status?” with responses including 1 = married and living with a spouse; 2 = married but not living with a spouse; 3 = divorced; 4 = widowed; 5 = never married. To isolate the effect of spousal death, we exclude individuals who were separated, divorced, never married, or widowed prior to 2011. We then create a binary variable where respondents who became widowed during the study period are coded as 1, while those who remained married throughout are coded as 0. This approach ensures that our treatment effect captures only transitions into widowhood occurring within the observation window.

3.3. LTC needs

LTC needs are defined as an individual’s inability to independently perform basic ADLs and IADLs without assistance (Gruber et al., 2023; Kingston et al., 2018; Liu & Wan, 2024). LTC needs primarily arise from the elderly population's inability to self-care and live independently, with a disability, and the need for assistance with ADLs and IADLs serving as key indicators of such needs (Nie & Li, 2025). Moreover, classifying LTC needs levels based on the varying degrees of self-care ability in older adults is crucial in developing a comprehensive and effective elder care system (Fang et al., 2020; Gruber et al., 2023).

We assess LTC needs based on the difficulty in performing six ADLs and eight IADLs, as surveyed in the CLHLS. Following previous studies (Gong et al., 2022; Mou et al., 2024; Nie & Li, 2025), we further categorize LTC needs into three levels: Level 1 (having any difficulty with seven ADL items, including dressing, bathing, eating, getting in or out of bed, using the toilet, maintaining bladder control, and defecating); Level 2 (having any difficulty with ADLs and essential IADLs, including cooking, shopping, and doing laundry); and Level 3 (having any difficulty with ADLs and IADLs, including visiting neighbors, walking 2 km continuously, carrying 5 kg, squatting and standing up 3 times, and going out by public transportation). LTC needs are defined as a respondent’s inability to perform basic ADLs and IADLs on his or her own (Kingston et al., 2018). Basic ADLs are the skills required to perform daily physical tasks, whereas IADLs include more complex activities than ADLs (Gong et al., 2022). Therefore, according to the severity of needs, levels 1, 2, and 3 represent high, medium, and low LTC needs, respectively. Notably, this definition of LTC needs is commonly used in the literature (Gong et al., 2022; Mou et al., 2024; Nie & Li, 2025).

3.4. Covariates

Following existing studies (Fu et al., 2017; Gong et al., 2022; Mou et al., 2024), we control for individual sociodemographic characteristics, including age, age squared,

urban residence (1 = yes, 0 = no), years of schooling, number of chronic illnesses, and self-rated quality of life (measured on a 5-point scale from very bad to very good). Household characteristics encompass access to medical services (1 = yes, 0 = no), household income (in logged form), and household size. Last, we control for year dummies (with 2011 as the reference year).

3.5. Mechanism variables

We examine four potential pathways linking spouse bereavement to LTC needs: (i) primary caregiver, (ii) emotional stress, (iii) healthcare utilization, and (iv) financial strain. First, the primary caregiver is assessed based on the question: "Who primarily takes care of you when you are unwell or sick?" with a binary variable of 1 indicating spousal caregiving, and 0 otherwise. Second, emotional stress is proxied by depression and anxiety. Depression is assessed using the 10-item Center for Epidemiology Studies Depression Scale (CESD-10), ranging from 0 to 30, with higher scores indicating more severe symptoms. Based on the literature (Andresen et al., 1994; Hu et al., 2022; Nie, Li, & Sousa-Poza, 2021), a score greater than 10 is considered indicative of depressive symptoms. Anxiety is measured using the 7-item Generalized Anxiety Disorder (GAD-7), with scores ranging from 0 to 21—higher scores indicating greater anxiety severity (Cheng et al., 2022). A score above 10 is also considered indicative of anxiety symptoms (Kroenke et al., 2010).² Third, healthcare utilization is measured by inflation-adjusted inpatient and outpatient expenditures. Inpatient expenditures refer to total hospitalization costs (including tests, surgeries, non-surgical treatments, medications, and hospital stays), while outpatient expenditures cover non-hospitalization-related medical costs (e.g., registration fees, tests, medications, and treatments). Finally, financial strain is defined as a dummy of whether an individual's income is sufficient to maintain their quality of life, which is based on the question: "Is your total income sufficient to meet your needs?" (1 = adequate income, 0 = insufficient income). This variable captures post-spousal death economic resilience erosion (OECD, 2019).

3.6. Methods

Identifying the causal effect of spousal death on LTC needs is challenging due to potential selection bias. Individuals who experience widowhood may systematically differ from those who do not in terms of pre-existing health conditions, socioeconomic status, and unobserved resilience factors. To address this concern, we employ two-way fixed effects (TWFE) estimation. Our identification strategy compares changes in LTC needs between individuals who experienced spousal death between 2011 and 2018 and those who remained continuously married during the study period. The baseline specification is:

$$LTC_{it} = \beta_0 + \beta_1 SP_{it} + \beta_2 X_{it} + \beta_3 LTC_{i,2011} + \beta_4 P_j t + \delta_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where LTC_{it} denotes different levels of LTC needs (low, medium, or high) for individual i in year t . SP_{it} is a dummy variable equal to 1 if individual i experienced

² Only the CLHLS 2018 wave includes the information of depression and anxiety.

widowhood in year t . The coefficient of interest is β_1 , capturing the average treatment effect of spousal bereavement on LTC needs. X_{it} is a vector of individual- and household-level characteristics. To account for potential divergence in health trajectories, we interact the baseline LTC needs ($LTC_{i,2011}$) with a linear time trend. P_j is provincial dummies, and t represents linear time trends. We interact province dummies with a linear time trend to absorb time-varying regional confounders such as regional economic shocks and changes in healthcare infrastructure. δ_i denotes individual fixed effects. λ_t denotes year fixed effects. Since we employ a two-way fixed effects model, it is impossible to introduce gender. However, we perform the heterogeneity analysis by gender in 4.5. *Heterogeneity analysis*. ε_{it} is an error term. Standard errors (SEs) are clustered at the individual level to address within-person correlation.

The impact of spousal bereavement may vary over time. For instance, individuals may suffer a sudden shock after bereavement but may adapt to these changes over time. To detect this possibility, we employ an event study design to explore the dynamic treatment effects of spousal bereavement:

$$LTC_{it} = \alpha_0 + \sum_{j=-2}^J \beta_j L_j + \sum_{k=0}^K \beta_k H_k + \alpha_2 X_{it} + \alpha_3 LTC_{i,2011} t + \alpha_4 P_j t + \delta_i + \lambda_t + \mu_{it} \quad (2)$$

where X_{it} represents individual and household factors; δ_i is individual fixed effects. λ_t denotes year fixed effects. μ_{it} is an unobserved error term; L_j ($j = -2, -1$) represents lead terms capturing pre-treatment trends, and H_k ($k = 0, 1, 2$) indicates lags measuring post-treatment effects. The year after bereavement ($j = 0$) is the omitted category. The definitions of other variables are the same as for equation (1).

To detect the possible mechanisms through which spousal bereavement affects LTC needs, we substitute the dependent variable in equation (1) with four mechanism variables of interest, including primary caregiver disruption, emotional stress, healthcare utilization, and financial strain. The model is specified as follows:

$$MV_{it} = \beta_1 SP_{it} + \beta_2 X_{it} + \beta_3 P_j t + \varepsilon_{it} \quad (3)$$

MV_{it} represent our mechanism variables. β_1 is estimated coefficient of our interest. The definitions of other variables are same to those in equation (1). For depression and anxiety, we use a TWFE approach, while for binary variables such as primary caregiver and financial strain, we use a random-effects logit (RE-logit) model³ and calculate marginal effects of spousal bereavement. For healthcare utilization such as inpatient and outpatient expenditures, we employ a random-effects two-part (RE-TPM) model, which is commonly used in the literature (Nie & Li, 2024; Olsen & Schafer, 2001).⁴ Since data on depression and anxiety are only available in the 2018 CLHLS, we employ

³ We employ random effects (RE) estimates for primary caregiver status and financial strain due to their limited within-individual variation during the study period of 2011-2018.

⁴ A detailed introduction of RE-TPM is available in Nie and Li (2024).

OLS regression to estimate depression and anxiety scores and a logit model for depressive symptoms and anxiety symptoms, calculating the marginal effects of spousal bereavement.

4. Results

4.1. Descriptive statistics

Table 1 presents descriptive statistics of our study sample. In the full sample, the proportions of respondents requiring level 1, level 2, and level 3 LTC needs are 34.0%, 43.6%, and 49.8%, respectively. Approximately 5.5% of respondents experienced spousal bereavement, which is consistent with Li et al. (2023) for China, with about 6% of the experiencing spouse bereavement. Interestingly, the bereaved, on average, exhibit much higher rates of all three LTC needs compared to the non-bereaved. Notably, females experience spousal bereavement at a rate of 23.7 percentage points higher than males. The bereaved, on average, are 6 years older and have 1.4 fewer years of schooling than the non-bereaved, which is well in line with Tseng, Petrie, Wang, et al. (2017) for the Taiwanese elderly.

Table 1 Descriptive statistics: 2011-2018 CLHLS

Variables	Full Sample		Spousal		No spousal		Mean differen
	Mean/proporti	S.D.	Min.	Max.	Mean/propor	Mean/proport	
Explained variable							
Level 1 needs	0.133	0.340	0	1	0.252	0.126	0.126**
Level 2 needs	0.255	0.436	0	1	0.476	0.242	0.234**
Level 3 needs	0.461	0.498	0	1	0.700	0.447	0.253**
Explanatory variable							
Spousal bereavement (1=yes,	0.055	0.227	0	1			
Individual characteristics							
Age	78.887	8.222	60	114	84.465	78.566	5.899**
Gender	0.666	0.472	0	1	0.442	0.679	-
Urban residence	0.493	0.500	0	1	0.550	0.490	0.060**
Years of schooling	3.777	3.960	0	22	2.439	3.854	-
Number of chronic illnesses	1.378	1.571	0	15	1.436	1.375	0.061
Quality of life	3.805	0.806	1	5	3.921	3.798	0.122**
Household characteristics							
Access to medical services	0.972	0.166	0	1	0.969	0.972	-0.003
Log (household income)	9.634	1.557	0	11.51	10.187	9.602	0.585**
Household size	3.166	1.777	1	25	3.870	3.126	0.744**
Observations	6473		353		6120		

Notes: Different levels of LTC needs are defined as Level 1 needs, which is difficulty with any of the six ADL items. Level 2 needs: difficulty with any ADL items and essential daily IADLs, including cooking, shopping, and doing laundry. Level 3 needs: difficulty with any of the six ADLs or eight IADLs. The mean difference was assessed using t-tests. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.2. Spousal bereavement and LTC needs

Figure 1 illustrates the results from the TWFE estimates of our interest. We begin by estimating a reduced version of the specification, controlling for demographics, provincial time trends, and year fixed effects (Model 1). Model 2 further adds the interaction between 2011 LTC needs and time trends. Model 3 incorporates the full set of covariates, provincial time trends, and year fixed effects, as well as model 4 adjusts for all covariates along with the interaction between 2011 LTC needs and a linear time trend. The results demonstrate that spousal bereavement significantly increases the probability of LTC needs across all three levels (Figure 1a-Figure 1c). The statistical links are very robust to controlling for sociodemographic characteristics, province fixed effects, and the interaction between 2011 LTC needs and a linear time trend, with the effect sizes of the TWFE estimates remaining remarkably stable across different specifications.

Our primary findings from model 4 indicate that, becoming widowed significantly increases the probability of having LTC needs for level 1, level 2, and level 3 by 7.0, 9.1, and 5.0 percentage points, respectively (columns 4, 8, and 12 of Appendix Table A2), representing increases of 20.6% (0.078/0.340), 20.9% (0.091/0.436), and 10.0% (0.050/0.498) over the mean prevalence of level 1, level 2, and level 3 LTC needs in the full sample. This finding suggests that spousal bereavement has an immediate and significant impact on LTC needs, which is consistent with Li et al. (2023), showing a positive association between widowhood and ADL/IADL needs among Chinese middle-aged and older adults.

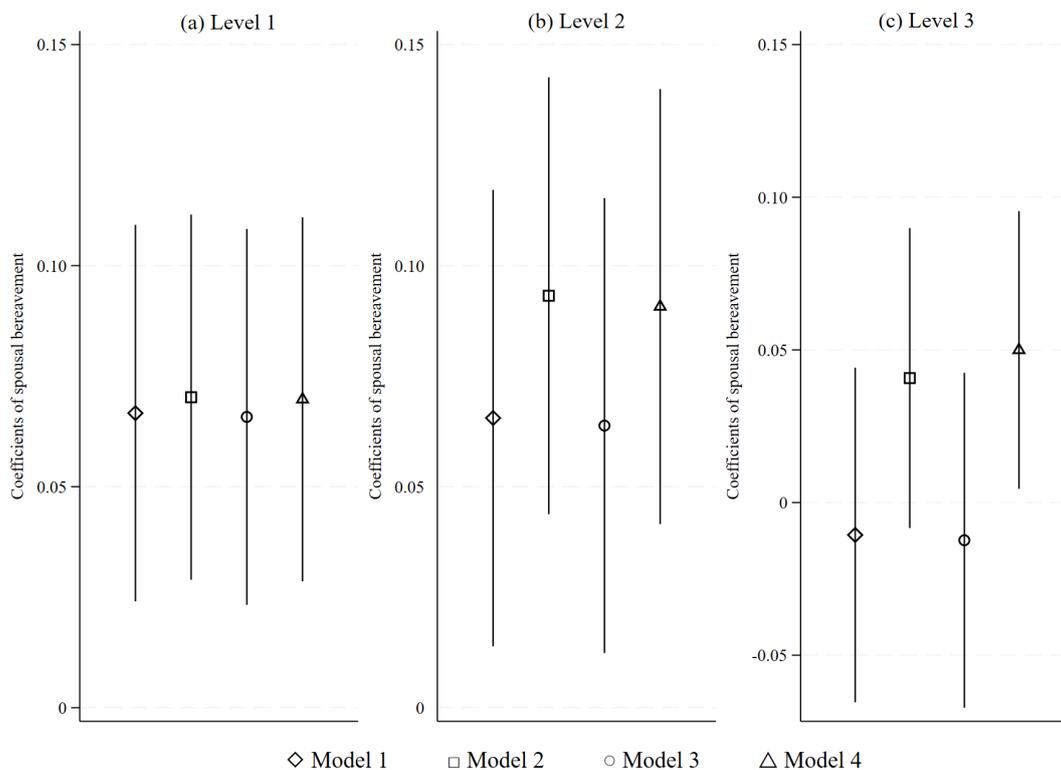


Figure 1 Impact of spousal bereavement on LTC needs: TWFE estimates

Notes: Model 1 (hollow diamond) provides baseline estimates, controlling for age, age squared/100, gender, provincial time trends, and year-fixed effects. Model 2 (hollow square) incorporates further adjustments, accounting for the interaction between 2011 LTC needs and temporal trends. Model 3 (hollow circle) offers a more comprehensive model, which includes a broader set of controls: age, age squared, gender (1 = male, 0 = female), urban residency (1 = yes, 0 = no), years of schooling, number of chronic conditions, quality of life (ranging from 1 = poor to 5 = excellent), access to medical services (1 = yes, 0 = no), logged household income, household size, along with provincial time trends and year-fixed effects. Finally, Model 4 (hollow triangle) presents the fully adjusted model, which includes all covariates along with the interaction between 2011 LTC needs and a linear time trend. The 90% confidence intervals are also showed. Standard errors are clustered at the individual level.

4.3. The dynamic effects of spousal bereavement on LTC needs

Figure 2 shows the dynamic effects of spousal bereavement on different levels of LTC needs. We observe that the impact of spousal death on the probability of LTC needs intensifies over time, especially medium- and high-level LTC needs (Figures 2a and 2b). Specifically, in the first wave post-bereavement, the probability of medium- and high-level LTC needs increases by 13.8 and 6.1 percentage points, respectively (columns 1 and 2, Appendix Table A3). In the second wave following widowhood, the probability of medium- and high-level LTC needs grow further to 15.0 and 8.5 percentage points, suggesting that the consequences of spousal bereavement on LTC needs, particularly medium- and high-levels, persist over time.

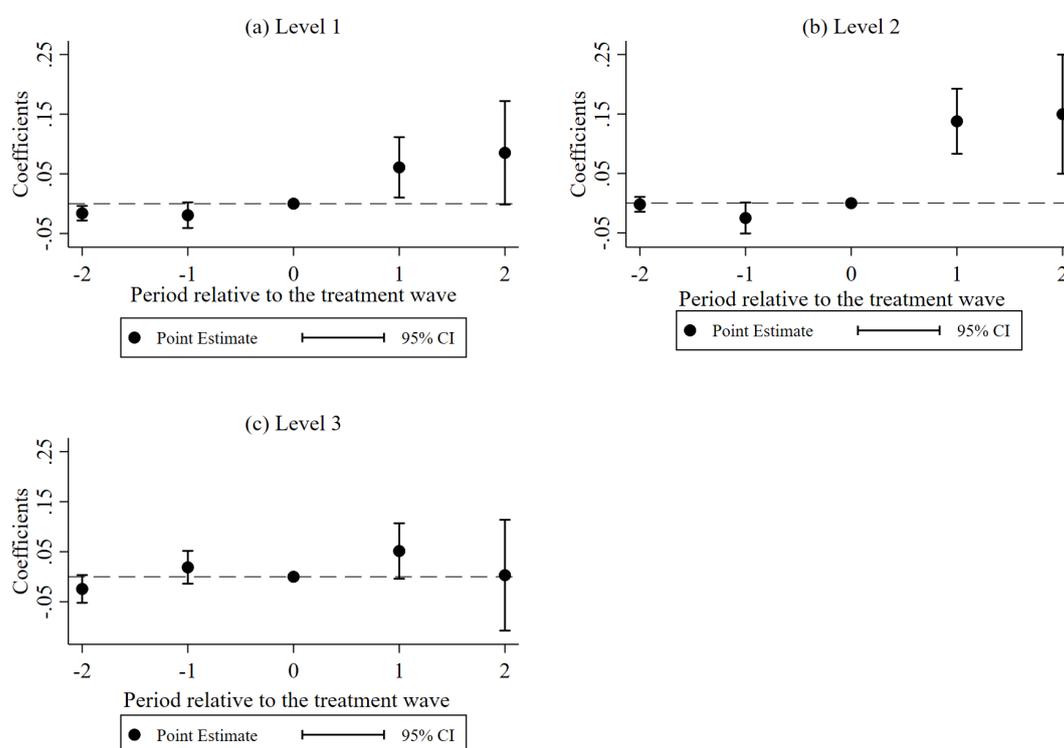


Figure 2 Event study estimates the dynamic effects of spousal bereavement on LTC needs

Notes: This figure presents the dynamic effects of spousal death on LTC needs using an event study design (Equation 2). The horizontal axis indicates years relative to spousal death, with $j = -2, -1$

representing pre-treatment periods, and $k=0,1,2$ representing post-treatment periods. The reference period is $j = 0$. Controls include age, age squared, gender (1 = male, 0 = female), urban residential area (1 = yes, 0 = no), years of schooling, number of chronic illnesses, quality of life (from 1 = poor to 5 = excellent), access to medical services (1 = yes, 0 = no), logged household income, and household size, province time trends, year fixed effects, and the interaction between the 2011 LTC needs and a linear time trend. Solid lines indicate 95% confidence intervals. Standard errors are clustered at the individual level.

4.4. Robustness checks

We conduct several additional estimates to test the robustness of our results.

Placebo test. If spousal death is endogenously determined by unobserved characteristics associated with health, our estimates may be biased. To account for this possibility, we perform a placebo test that randomly assigns spousal death status to individual respondents. This process is repeated 1,000 times to generate a distribution of estimated coefficients, as illustrated in Figure 3, where the vertical line indicates the mean of our baseline estimates. The distribution of the simulated coefficients, showing a central tendency around zero and resembling a normal distribution pattern, demonstrates the stability of our baseline results against random fluctuations, thereby reinforcing the reliability of our main findings.

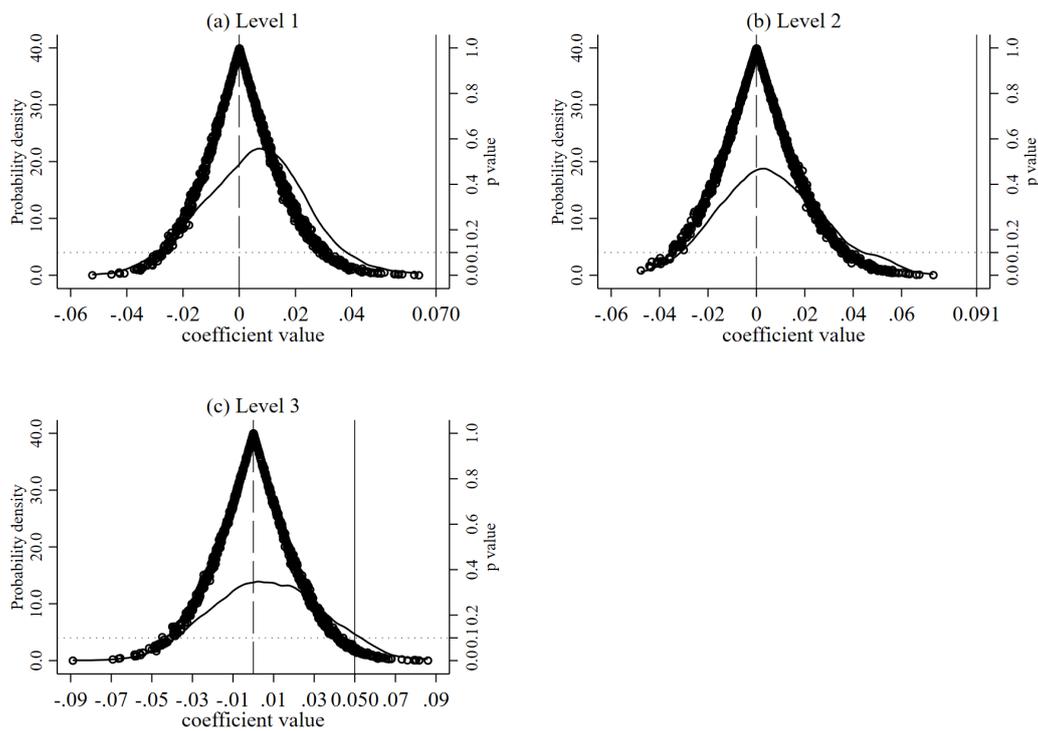


Figure 3 Distribution of estimated coefficients of falsification test

Notes: This figure presents results from a placebo test where spousal bereavement is randomly assigned to individuals who did not experience widowhood during the study period (2011 – 2018). The vertical solid line indicates the estimated treatment effect from the original TWFE model. The distribution of placebo coefficients is centered around zero. Controls and standard error clustering follow the baseline specification in Equation 1.

Sample selection bias. Although our baseline results satisfy the assumption of parallel trends, spousal death may not be fully exogenous, as it could correlate with sociodemographic factors such as age, education, and income, which also influence LTC needs. To address potential sample selection bias, we implement a PSM approach with radius matching. Post-matching diagnostics confirm that covariates are well-balanced (Appendix Figure A2) and the results confirm the robustness of our key findings (Panel A, Table A4).

Redefine study sample. Additionally, older adults, particularly centenarians, may exhibit better health genetics (Shadyab & LaCroix, 2015), potentially bias our results. To address this longevity bias, we restrict our sample to individuals aged 60 to 90 and re-estimate our models, confirming that our key findings are not driven by extreme longevity (Panel B, Table A4).

Attrition bias. Attrition bias may arise if individuals with poorer health are more likely to drop out of the CLHLS panel. To address this possible concern, we employ multiple linear imputations imputes missing data due to attrition by predicting plausible values for unobserved outcomes (Little & Rubin, 2002). Specifically, we employ multiple imputation by chained equations (MICE) to predict missing values based on observed data patterns. This approach preserves the full dataset while mitigating potential biases from dropouts. This imputation model incorporates variables associated with both attrition and the outcomes of interest, ensuring consistency with the underlying data structure. Once again, our key finding remains quite robust (Panel C, Table A4).

Alternative identification strategies. To address the binary nature of our LTC needs, we utilize a RE logit model, accounting for unobserved heterogeneity that may influence LTC needs. By incorporating a random intercept for each participant, the RE logit model corrects intrapersonal correlations for longitudinal data due to repeated measurements (Bland & Cook, 2018). Our results confirm the robustness of our key findings to alternative specifications (Panel D, Table A4).

Excluding the impact of long-term care insurance (LTCI). LTCI alleviates financial strain on elderly households by covering long-term care services and disability-related medical expenses, with prior research confirming its role in reducing care-related financial burdens (Lei et al., 2022). To isolate our analysis from the possible influence of LTCI implemented since 2016, we leverage data from the 2011-2014 CLHLS and re-estimate Equation 1. Our results (Panel E, Table A4) show that our main findings remain robust even after accounting for LTCI effects.

Alternative measure of LTC needs. Given the lack of consensus on LTC needs definitions, we redefine LTC needs by using the number of ADLs and IADLs (Gruber et al., 2023; Liu & Wan, 2024) to explore whether the effect of spousal death varies with the intensity of LTC needs. Once again, our main findings are quite robust (Panel F, Table A4).

4.5. Heterogeneity analysis

To provide more pragmatic guidance for spousal bereavement and varying levels of LTC needs, we use the TWFE estimation to conduct heterogeneity analyses by gender, age group, and residential location (urban versus rural).⁵

Figure 4a shows the estimated results of widowhood by gender. For all three levels of LTC needs, the coefficients for males are consistently and higher than those for females, but the differences are no statistically significant according to a Chow test ($p > 0.05$).

We also detect whether the adverse effects of spousal bereavement differ by age groups (60-74 and 75+). Figure 4b reveals that those individuals aged 75+ are more likely to require LTC needs following bereavement, irrespective of different levels of LTC needs (see Panel B of Table A5). The Chow test further confirms that the difference is statistically significant ($p < 0.001$). This finding may suggest that, compared to younger older adults aged 60-74, those senior ones (aged 75+) are more vulnerable to require LTC needs following widowhood. On one hand, individuals in the 75+ group experience greater physiological fragility, as they often have multiple chronic conditions and more severe physical decline. Following the death of a spouse, who is typically the primary caregiver, their ability to maintain self-care diminishes sharply. On the other hand, alternative caregiving options are limited. The children of the 75+ group are often elderly themselves ("the aging of the next generation") or unable to provide care due to geographical distance. In contrast, individuals aged 60-74 are more likely to have younger children who can offer support. Furthermore, in China, family caregiving is primarily provided by the spouse, and for the 75+ group, the shrinking of their social circle makes it more difficult to find alternative caregiving through the community or friends.

Finally, our heterogeneity analysis by residential location reveals that the negative impact of spousal bereavement on the likelihood of long-term care is stronger for urban older adults than for their rural counterparts (Figure 4c), however, the difference is not statistically significant based on a Chow test ($p > 0.05$).

⁵ The full results are available in Appendix Table A5.

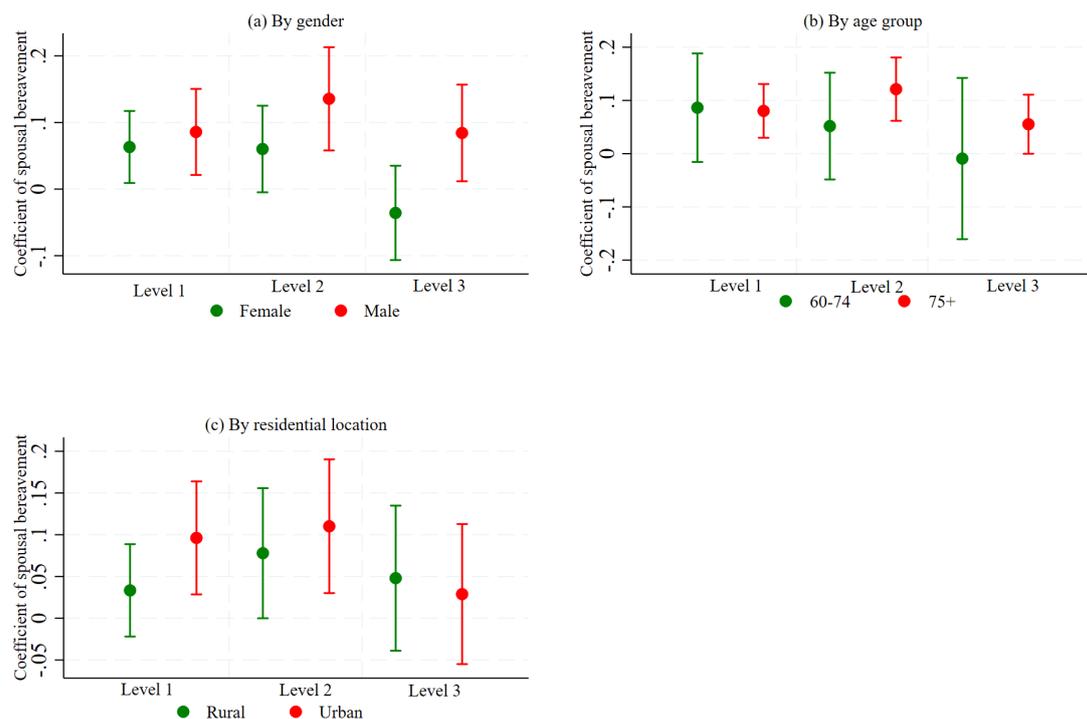


Figure 4 Heterogeneous effects of spousal bereavement on different levels of LTC needs

Notes: Estimates are derived from the baseline model (Equation 1) using CLHLS 2011 – 2018 data. Controls include age, age squared, gender (1 = male, 0 = female), urban residential area (1 = yes, 0 = no), years of schooling, number of chronic illnesses, quality of life (from 1 = poor to 5 = excellent), access to medical services (1 = yes, 0 = no), logged household income, and household size, province time trends, year fixed effects, and the interaction between the 2011 LTC needs and a linear time trend. We report estimates along with 90% confidence intervals. Standard errors are clustered at the individual level.

5. Underlying mechanisms

To unpack the underlying mechanisms through which spousal death affects LTC needs, we investigate four key channels: (i) primary caregiver disruption, (ii) emotional stress, (iii) healthcare utilization, and (iv) financial strain.⁶

5.1. Primary caregiver disruption

The results demonstrate that widowhood is significantly associated with a 73.8 percentage points reduction in the probability of having a primary caregiver (Panel A, Figure 4). This finding reflects China’s unique caregiving context where the spouses serve as the primary caregivers while formal care (hired caregiver or facilities) remains limited (only 1.6%) (Nie & Zhao, 2023). The abrupt loss of spousal care results in an acute caregiving vacuum that significantly increases reliance on formal LTC systems for surviving partners.

5.2. Emotional stress

⁶ The full results are available in Appendix Table A6.

Next, we investigate emotional stress as another possible channel. The results reveal significant psychological consequences following bereavement (Panel B, Figure 4). More specifically, spousal bereavement increases depression scores by 1.33 (14.5%) and anxiety scores by 0.67 (54%). These findings align with the stress process model (Pearlin et al., 1981), demonstrating how the psychological burden of widowhood contributes to greater LTC needs.

5.3. Healthcare utilization

To capture healthcare utilization, we introduce inpatient and outpatient expenditures. Results show that spousal death leads to significantly increased healthcare expenditures, particularly for inpatient costs (Panel C, Figure 4). This observation supports the existing evidence that spousal bereavement leads to health crises that increase hospitalizations and medical service use (Goda et al., 2013; Iwashyna & Christakis, 2003; Tseng, Petrie, & Leon-Gonzalez, 2017). Importantly, while acute medical interventions address immediate health issues, they frequently fail to restore pre-bereavement functional capacity. Such mismatch between medical care and long-term functional recovery may explain the increased LTC needs following widowhood.

5.4. Financial strain

Contrary to expectations, we find no significant evidence that spousal bereavement is linked with financial strain (Panel D, Figure 4). One possibility is that China's strong traditions of filial piety ensure that adult children often assume financial and caregiving responsibilities for widowed parents (Zhang et al., 2024). Older survivors are more likely to seek support from their family members (Li et al., 2011). Additionally, recent expansion of China's social welfare systems including resident pension programs and minimum living guarantees has mitigated economic shocks following widowhood (Zhang et al., 2023).

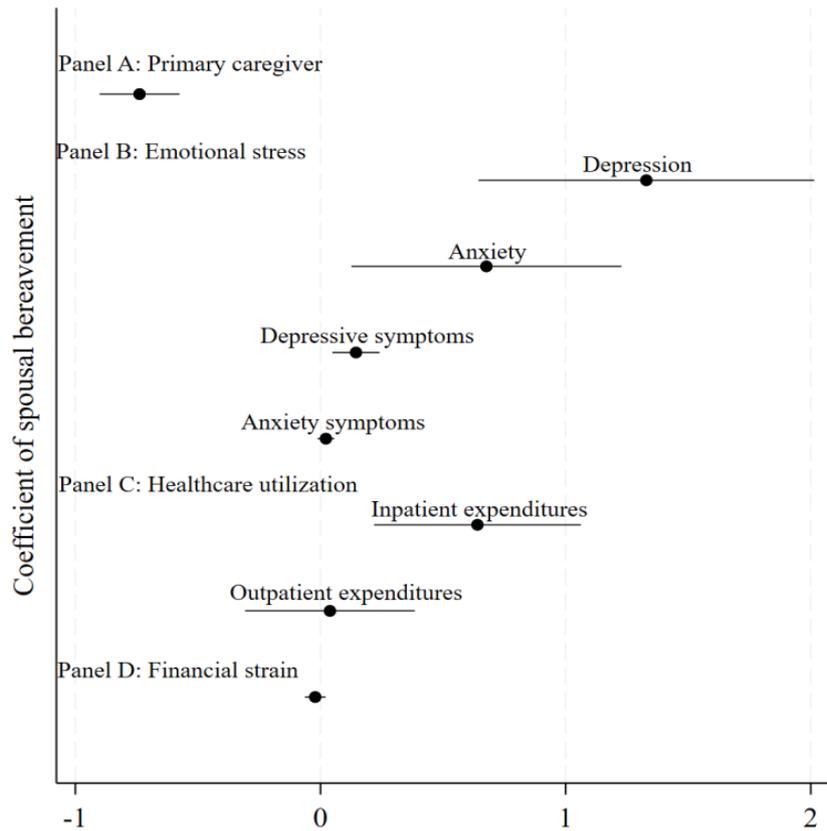


Figure 5 Mechanism analysis

Note: The results are based on the estimation of equation (3). Controls include age, age squared, gender (1 = male, 0 = female), urban residency (1 = yes, 0 = no), years of schooling, number of chronic illnesses, quality of life (ranging from 1 = poor to 5 = excellent), access to medical services (1 = yes, 0 = no), logged household income, and household size. Standard errors are clustered at the individual level. The solid lines indicate 95% confidence intervals.

6. Discussion and conclusion

Using nationally representative data from the 2011-2018 Chinese Longitudinal Healthy Longevity Study (CLHLS), this study provides one of the first comprehensive studies linking spousal bereavement to LTC needs in the China's unique context, where spouses serve as primary caregivers and widowhood is widespread yet unsupported by social security survivor benefits. Additionally, this study attempts to capture the immediate and dynamic effects of spousal death on LTC needs, offering a nuanced and comprehensive picture. Finally, this study goes beyond simply examining the impact of spousal bereavement on LTC needs by exploring the underlying mechanisms.

Our findings demonstrate that spousal bereavement has immediate and persistent adverse consequences on LTC needs. Widowhood significantly increases the probability of requiring LTC care across all three levels (low, medium, and high). This finding suggests that spousal bereavement has an immediate and significant impact on LTC needs, regardless of the severity of LTC needs. Furthermore, heterogeneity analyses reveal that the adverse effects of spousal bereavement are particularly

pronounced among older individuals aged 75+. These results highlight the important heterogeneity in vulnerability to widowhood's consequences.

Mechanism analysis confirms three key pathways through which spousal bereavement increase LTC needs: the loss of primary caregiving, heightened emotional stress, and increased healthcare utilization. The abrupt loss of spousal care leads to an acute caregiving vacuum, increasing reliance on LTC needs for surviving partners. Additionally, spousal loss triggers loneliness and depression (Yang & Gu, 2021; Zhang et al., 2024), thereby exacerbating functional decline and increasing LTC needs (Zhang et al., 2019). Widowhood may result in health crises that increase hospitalizations and medical service use (see, for instance, Goda et al., 2013; Tseng et al., 2017).

Our findings have several important policy implications. Although the family is the dominant source for providing financial and physical care to older people in China, relying on family support is unsustainable due to not only the dwindling number of children but also their outmigration (Nie & Zhao, 2023). Additionally, Chinese security pension system is fragmented, not only by employment status but by region. Therefore, given the adverse consequences of spousal bereavement, a comprehensive pension system integrating the government, market, and societal resources is urgently needed. Furthermore, building an LTC system to guarantee equality especially meeting the care needs of bereaved older adults is preferable. Particularly, targeted interventions should prioritize older seniors (aged 75+). Finally, the central and local government should address the significant psychological consequences following bereavement. Initiatives to maintain social engagement among widowed older adults could help mitigate some of widowhood's negative effects on LTC requirements.

Declaration of competing interest

The authors declare that they have no known competing interests.

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Appendix

Table A1 Variable definitions

Variable	Definition
Explained variable	
Level 1 LTC needs	1 if a person has difficulty reported by oneself six activities of daily living (ADLs), 0 if not.
Level 2 LTC needs	1 if a person has difficulty reported by oneself difficulty with both ADLs and essential IADLs of cooking, shopping, and doing laundry, or cognitive impairment, 0 if not.
Level 3 LTC needs	1 if a person has difficulty reported by oneself with six ADLs or eight IADLs, 0 if not.
Explanatory variable	
spousal bereavement	1 if widowed, 0 otherwise
Individual characteristics	
Age	Age of the respondent
Gender	1=male, 0=female.
Urban residence	The current residence category of the elderly respondent. 1 if urban residence, 0 if rural residence.
Years of schooling	The number of years of schooling has received.
Number of chronic illnesses	The number of chronic diseases reported by oneself.
Quality of life	Self-reported on a 5-point Likert scale. 1 if self-reported quality of life is very bad, 2 if bad; 3 if fair, 4 if good, 5 if very good.
Household characteristics	
Access to medical services	1 if receive timely treatment for serious illness, 0 if not.
Log (household income)	The total income of the family in the past year (in yuan).
Household size	Number of household members who live together.

Notes: ADL=activities of daily life; IADL=instrumental activities of daily life.

Table A2 Estimation of the impact of spouse death on LTC needs

	Level 1				Level 2				Level 3			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Spousal bereavement	0.067**	0.070***	0.066**	0.070***	0.066**	0.093***	0.064**	0.091***	-0.011	0.041	-0.012	0.050*
	(0.026)	(0.025)	(0.026)	(0.025)	(0.031)	(0.030)	(0.031)	(0.030)	(0.033)	(0.030)	(0.033)	(0.028)
Age	-0.100***	-0.130***	-0.100***	-0.129***	-0.140***	-0.231***	-0.140***	-0.228***	-0.081***	-0.224***	-0.086***	0.041***
	(0.023)	(0.022)	(0.023)	(0.021)	(0.028)	(0.029)	(0.028)	(0.028)	(0.030)	(0.030)	(0.030)	(0.007)
Age squared/100	0.066***	0.088***	0.065***	0.088***	0.097***	0.155***	0.096***	0.153***	0.055***	0.150***	0.057***	-0.018***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)	(0.018)	(0.017)	(0.005)
Urban residence			0.001	0.004			0.026*	0.028**			-0.009	-0.000
			(0.011)	(0.011)			(0.015)	(0.014)			(0.018)	(0.009)
Number of chronic illnesses			0.009**	0.009**			0.018***	0.015***			0.028***	0.027***
			(0.005)	(0.004)			(0.006)	(0.005)			(0.006)	(0.003)
QoL			-0.023***	-0.020***			-0.041***	-0.033***			-0.043***	-0.039***
			(0.007)	(0.006)			(0.009)	(0.008)			(0.010)	(0.006)
Access to medical services			-0.052	-0.037			-0.041	-0.024			-0.118**	-0.055***
			(0.043)	(0.038)			(0.046)	(0.041)			(0.048)	(0.021)
Log (household income)			0.000	-0.004			-0.000	-0.002			0.011*	0.004
			(0.004)	(0.004)			(0.005)	(0.005)			(0.006)	(0.003)
Household size			0.004	0.005			0.010*	0.015***			-0.002	0.005*
			(0.004)	(0.003)			(0.006)	(0.005)			(0.006)	(0.003)
2011 LTC × time trend	No	Yes										
Province dummy × time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes											
Year FE	Yes											
R-squared	0.101	0.483	0.131	0.489	0.185	0.498	0.220	0.507	0.206	0.490	0.254	0.503
N	6473	6473	6473	6473	6473	6473	6473	6473	6473	6473	6473	6473

Notes: LTC=long-term care, and QoL=quality of life. Individual-level adjusted standard errors are in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A3 Estimation of the dynamic impacts of spousal bereavement on LTC needs

	(1) Level 1	(2) Level 2	(3) Level 3
Year bereaved-2 indicator	-0.016** (0.006)	-0.002 (0.006)	-0.024* (0.014)
Year bereaved-1 indicator	-0.019* (0.011)	-0.025* (0.013)	0.019 (0.017)
Year bereaved+1 indicator	0.061** (0.026)	0.138*** (0.028)	0.051* (0.028)
Year bereaved+2 indicator	0.085* (0.044)	0.150*** (0.051)	0.003 (0.056)
2011 LTC × time trend	Yes	Yes	Yes
Province dummy × time trend	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R-squared	0.488	0.572	0.503
N	6473	6473	6473

Notes: LTC=long-term care. Individual-level adjusted standard errors are in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

Table A4 Robustness checks

	(1)	(2)	(3)
	Level 1	Level 2	Level 3
Panel A: PSM-DID			
Spousal bereavement	0.059** (0.025)	0.080*** (0.030)	0.024 (0.030)
Controls	Yes	Yes	Yes
2011 LTC × time trend	Yes	Yes	Yes
Province dummy × time trend	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	6082	6082	6082
Panel B: Using the sample aged 60-90			
Spousal bereavement	0.052** (0.026)	0.074** (0.032)	0.025 (0.034)
Controls	Yes	Yes	Yes
2011 LTC × time trend	Yes	Yes	Yes
Province dummy × time trend	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	5867	5867	5867
Panel C: Attrition bias			
Spousal bereavement	0.043** (0.020)	0.063*** (0.023)	0.048** (0.023)
Controls	Yes	Yes	Yes
2011 LTC × time trend	Yes	Yes	Yes
Province dummy × time trend	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	7,311	7,311	7,311
Panel D: Using RE-logit estimates (ORs reported)			
Spousal bereavement	2.029*** (0.439)	2.143*** (0.404)	1.495** (0.298)
Controls	Yes	Yes	Yes
2011 LTC × time trend	Yes	Yes	Yes
Province dummy × time trend	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes
Observations	6473	6473	6473
Panel E: Excluding the impact of long-term care insurance (LTCI)			
Spousal bereavement	0.039 (0.033)	0.100*** (0.038)	0.103*** (0.037)
Controls	Yes	Yes	Yes
2011 LTC × time trend	Yes	Yes	Yes
Province dummy × time trend	Yes	Yes	Yes

Individual FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	5310	5310	5310
Panel F: Alternative measure of LTC needs	Number of	Number of	
	ADLs	IADLs	
Spousal bereavement	0.159** (0.081)	0.512*** (0.184)	
Controls	Yes	Yes	
2011 LTC × time trend	Yes	Yes	
Province dummy × time trend	Yes	Yes	
Individual FE	Yes	Yes	
Year FE	Yes	Yes	
Observations	6,473	6,469	

Notes: RE=random effect, LTC=long-term care, ADLs=activities of daily living, and IADLs=instrumental activities of daily living. The controls include age, age squared divided by 100, gender (1 = male, 0 = female), urban residential area (1 = yes, 0 = no), years of schooling, number of chronic illnesses, quality of life (from 1 = poor to 5 = excellent), access to medical services (1 = yes, 0 = no), logged household income, and household size. Standard errors clustered at individual levels are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A5 Estimates of the heterogenous impact of spousal bereavement on LTC needs

	Level 1		Level 2		Level 3	
	(1)	(2)	(4)	(5)	(7)	(8)
Panel A: By gender	Female	Male	Female	Male	Female	Male
Spousal bereavement	0.063*	0.086**	0.060	0.136***	-0.036	0.084*
	(0.033)	(0.039)	(0.039)	(0.047)	(0.043)	(0.044)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
2011 LTC × time trend	Yes	Yes	Yes	Yes	Yes	Yes
Province dummy× time trend	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Chow test	0.34		2.11		0.68	
P-value	0.5572		0.1468		0.4086	
Observations	2159	4314	2159	4314	2159	4314
Panel B: By age group	60-74	75+	60-74	75+	60-74	75+
Spousal bereavement	0.086	0.080***	0.052	0.121***	-0.009	0.055
	(0.062)	(0.031)	(0.061)	(0.036)	(0.092)	(0.034)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
2011 LTC × time trend	Yes	Yes	Yes	Yes	Yes	Yes
Province dummy× time trend	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Chow test	6.35		21.15		10.19	
P-value	0.0018		0.0000		0.0000	
Observations	2145	4328	2145	4328	2145	4328
Panel C: By location type	Rural	Urban	Rural	Urban	Rural	Urban
Spousal bereavement	0.033	0.096**	0.078	0.110**	0.048	0.029
	(0.034)	(0.041)	(0.047)	(0.049)	(0.053)	(0.051)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
2011 LTC × time trend	Yes	Yes	Yes	Yes	Yes	Yes
Province dummy× time trend	Yes	Yes	Yes	Yes	Yes	Yes
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Chow test	1.41		2.82		0.11	
P-value	0.2451		0.0596		0.8930	
Observations	3283	3190	3283	3190	3283	3190

Notes: LTC = long-term care. The controls include age, age squared divided by 100, gender (1 = male, 0 = female), urban residential area (1 = yes, 0 = no), years of schooling, number of chronic illnesses, quality of life (from 1 = poor to 5 = excellent), access to medical services (1 = yes, 0 = no), logged household income, and household size. Individual-level adjusted standard errors are in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01. The above Chow test findings are consistent with Bootstrap test results.

Table A6 Mechanism analysis

	(1)	(2)	(3)	(4)
Panel A: Primary caregiver	RE-logit (marginal effects)			
Spousal bereavement	-0.738*** (0.083)			
Controls	Yes			
Province dummy× time trend	Yes			
Observations	4267			
Panel B: Emotional stress	OLS		Logit (marginal effect)	
	Depression	Anxiety	Depressive symptoms	Anxiety symptoms
Spousal bereavement	1.329*** (0.349)	0.677** (0.281)	0.145*** (0.049)	0.022 (0.017)
Controls	Yes	Yes	Yes	Yes
Province dummy× time trend	Yes	Yes	Yes	Yes
Year FE	Yes	Yes		
Observations	1,141	1,147	1141	765
Panel C: Healthcare utilization	RE-TPM (marginal effects)			
	Inpatient expenditures	Outpatient expenditures		
Spousal bereavement	0.640*** (0.215)	0.039 (0.177)		
Controls	Yes	Yes		
Observations	5858	6150		
Panel D: Financial strain	RE-logit (marginal effect)			
Spousal bereavement	-0.021 (0.022)			
Controls	Yes			
Province dummy× time trend	Yes			
Observations	6450			

Notes: FE = fixed effects, RE = random effects, RE-TPM = random-effects two-part model. Inpatient and outpatient expenditures are in logarithms. The controls include age, age squared divided by 100, gender (1 = male, 0 = female), urban residential area (1 = yes, 0 = no), years of schooling, number of chronic illnesses, quality of life (from 1 = poor to 5 = excellent), access to medical services (1 = yes, 0 = no), logged household income, and household size. Individual-level adjusted standard errors are in parentheses. * p < 0.1, ** p < 0.05, *** p < 0.01.

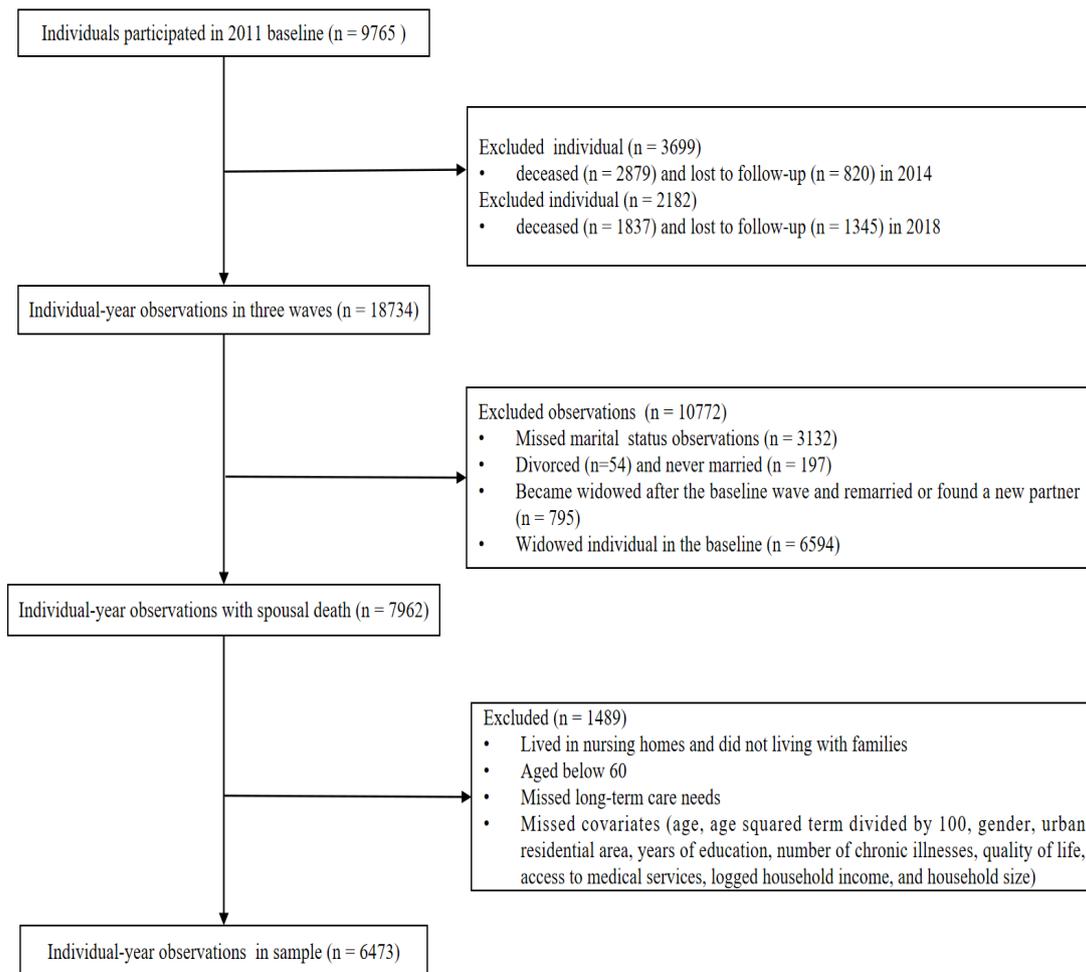


Figure A1 Flow chart of study samples

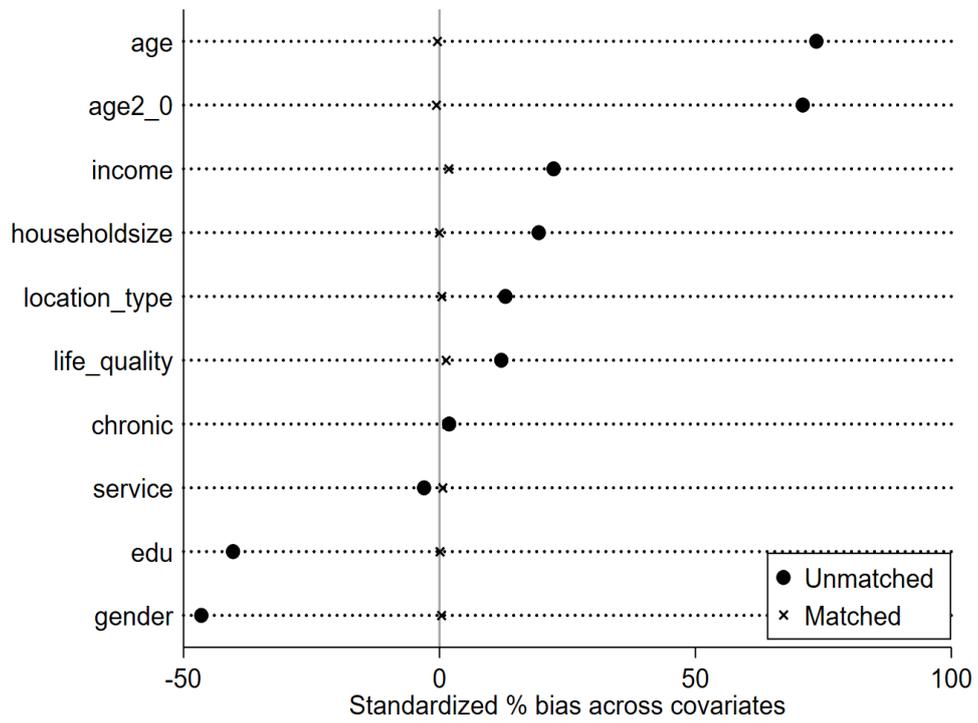


Figure A2 Standardized differences in control variables before and after radius matching