Original Research

# Health of Widowed Elderly and Related Factors in China

Hua Tian[1],*, Jie Chen[2]

[1]College of Life Science, Xinyang Normal University, 464000 Xinyang, Henan, China
[2]School of Marxism, Xinyang Normal University, 464000 Xinyang, Henan, China
*Correspondence: tianhua@xynu.edu.cn (Hua Tian)

## Abstract

**Background**: The widowed elderly are in poor health, but studies mainly focus on their mental health, physiological response, chronic disease, or death. The aim of this study was to investigate the health of the widowed elderly and related factors in China from the three dimensions of self-reported health, objective physical health and mental health. **Methods**: Data were obtained from the Chinese Longitudinal Health Longevity Survey (CLHLS-2018). 3320 participants aged 65 years and older were selected, included 1573 widowed elderly and 1747 non-widowed elderly. A simplified version of the center for epidemiological research depression scale (CES-D-10) was used to assess depressive symptoms. The differences of depression and chronic diseases between widows and widowers were tested by independent sample *t*-test. A fully aligned polygonal graphical indexing method and binary logistic regression analysis were used to explore health and related factors of the widowed elderly. **Results**: Of the 1573 widowed elderly 70.88% were female, 59.19% were aged 80–99, 48.00% and 36.75% were from rural and urban areas respectively, and 92.05% lived with their families. Depressive symptoms were found in 20.15% of widowers and 49.33% of widows, and 60.26% of widowers and 64.75% of widows had more than one chronic disease. Statistically significant differences were found between widowers and widows in the above two. Self-reported health and mental health were slightly better than that of non-widowed elderly, with the exception of objective physical health. The variables of life restriction, physical exercise, life satisfaction and depressive symptoms were significant factors that influenced the widowed elderly health. **Conclusions**: Strengthening the monitoring and management of negative emotions and physiological functions of the widowed elderly, improving their awareness of physical and mental health and then promoting communication were found to be effective intervention measures.

**Keywords:** widowed elderly; self-reported health; objective physical health; mental health; China

## 1. Introduction

There has been an acceleration in the number of the widowed elderly [1,2]. According to China's sixth census, there is estimated to be a population of 47.74 million widowed elderly in China accounting for 26.89% of the population [3]. By 2050, China's elderly widowed population is predicted to reach 118.4 million, 2.5 times that of 2010 [4]. Due to the gap in life expectancy between men and women, many older persons will experience widowhood in the coming decades. In China, the average period of widowhood after the death of a spouse is about 11 years for men and 15 years for women [5]. Spousal death is one of the most stressful life events that seriously affects the psychological health of the widowed elderly [6]. There is a link between widowhood and deterioration of health, including chronic diseases, cognitive decline and depression [7]. The widows or widowers may not only lose a certain degree of economic or social support, but it also brings them spiritual loss, loneliness and many inconveniences in daily life, accompanied by serious health consequences [8]. Widows are at greater risk than widowers for mental health responses related to depression [9]. Widows had a more negative view of retirement and life and were more likely to suffer from loneliness and depression [10]. The impact of widowhood

may vary depending on social and cultural context [11] and the prominence of the different mechanisms linking widowhood to health may depend on gender and local norms [12]. Currently, a large part of the research on the widowed elderly focuses on their mental health, physiological responses, chronic disease and death [13]. Relevant studies are mostly limited to the objective health dimension and there is a lack exploration of subjective health [14]. The comprehensive health of the widowed elderly based on objective and subjective health receives less attention.

A person's health has multiple dimensions, so it is difficult to reflect all its aspects with a single index. Thus, the elderly health status reported here was based on three dimensions: Subjective self-reported health and objective physical health as the indicators of physical health and objective mental health as an indicator of mental health. The aim is to investigate and comprehensively evaluate the health status and related factors of the widowed elderly in China, so as to make targeted health promotion measures to reduce the negative impact of widowhood on the elderly and their families. According to previous research, the factors affecting the health of the widowed elderly can be roughly divided into natural attributes [15], lifestyle [16], social characteristics [17], socio-economic status [18], prevalence of disease [19] and psychological factors [20]. Thus, based

on previous studies and the questionnaire of the Chinese Longitudinal Healthy Longevity Survey in 2018 (CLHLS-2018), the current study investigates the impact of 11 factors (hearing difficulties, sleeping, falling, life restriction, physical exercise, social activities, endurance insurance, type of elderly care, chronic diseases, life satisfaction and negative symptoms) on the health of the widowed elderly from the six aspects of lifestyle, socio-economic status, social characteristics, prevalence of disease and psychological factors. As a special group, their needs were found by analyzing their group health status and mastering their health and related factors. When establishing the old-age security system, aiming at the demand differences of special groups such as the widowed elderly and establishing a multi-level, multi-choice old-age system is of great significance for the improvement of the quality of life of the elderly in society.

## 2. Materials and Methods

### 2.1 Participants

The participants were aged 65 and above from the CLHLS-2018. Respondents were asked to self-determine their marital status as (a) married and living with their spouse; (b) married, not living with spouse; (c) divorced; (d) widowed; (f) never married. After removing the participants with missing and invalid data, 3320 participants aged 65 years and older were selected, including 1573 widowed elderly and 1747 non-widowed elderly, the former as participants and the latter as a control. The CLHLS-2018 was carried out by the Chinese Center for Disease Control and Prevention and the Research Center for healthy aging and development of the National Development Research Institute of Peking University [21]. A total of 15,874 participants are elderly aged 65 and above from more than 500 investigations in 22 provinces in China, including rural and urban areas. The aim was to evaluate the health status and influencing factors of the elderly in a variety of aspects through a basic health status questionnaire, so as to find potential health problems and better understand the social, behavioral, environmental and biological factors affecting human aging health, to provide information for scientific research, aging work and health policy.

### 2.2 Study Variables

Participants completed questions concerning their sex, age, residence, type of elderly care, hearing difficulties, sleeping, falling, life restriction, physical exercise, social activities, endowment insurance, chronic diseases, life satisfaction and depressive symptoms (Table 1). Based on previous literature research and the CLHLS questionnaire, the foregoing variables that may be closely related to the health of the widowed elderly were included in this study. For chronic diseases, the CLHLS-2018 lists 24 specific chronic diseases diagnosed by doctors (0 = No, 1 = Yes). If one item was yes, a participant was considered to have a chronic disease and recorded as "1 = Yes". For life satisfaction,

the item "What do you think of your life now?" was used to evaluate the participants' perceptions of life satisfaction. Participants were asked to answer the item on a 5-point Likert scale that ranged from 1 (very good) to 5 (very poor), excluding the answer of "I don't know".

Self-reported health, objective physical health and mental health are three dimensions of the widowed elderly, based on three questions ("What do you think of your own health?" "Do you feel energetic?" "Are you full of hope for your future life?") in the CLHLS-2018. There are six answers of "very good", "good", "general", "bad", "very bad" and "I don't know" for each question. When screening potential participants, the elderly who answered "I don't know" were eliminated. A fully aligned polygonal graphical indexing method [22] was used to analyze the health status of the elderly from three dimensions.

Depressive symptoms were measured using the Center for Epidemiologic Studies Depression Scale (CES-D-10) in the CLHLS-2018, which had been validated with elderly respondents in China [23]. CES-D-10 shows good internal consistency and reliability in the general population, the elderly and the multi-ethnic population [24]. The response scale for the CES-D-10 includes 10 questions (Appendix Table 6). There are five answers of "always", "often", "sometimes", "seldom" and "never". Among them, "always" and "often" were merged. Thus, there are four answers. 3, 2, 1 and 0 points are given respectively for the four answers, of which questions 5, 7 and 8 are scored in reverse. Total scores range from 0 to 30. A cut-off score of ten or higher indicates the presence of depressive symptoms ($\geq 10$), and a score of less than 10 indicates no depression ($<10$) [25].

Variable assignment was required when logistic binary regression models were used to analyze the influencing factors of the widowed elderly health. For self-reported health, objective physical health and mental health, for the answers of "very good" and "good", the health of the participant was recorded as "1 = Yes", or "0 = No". The detailed descriptive statistics of variables were shown in Table 1.

### 2.3 Data Analysis

Data are presented by descriptive statistics (mean, standard deviation, frequency, percentage), according to the nature of the quantitative variables. The statistical differences of depressive symptoms and chronic diseases between widowed and non-widowed elderly, widowers and widows were determined by independent sample *t*-test. Logistic binary regression models were used to analyze the influencing factors of the widowed elderly health. Because the binary logistic regression model is a common analytic method, it will not be described in detail. The following mainly introduces the analytic principles and steps of the fully aligned polygonal graphical indexing method.

The fully aligned polygonal graphical indexing method is an objective comprehensive evaluation method.

**Table 1. Descriptive statistics of variables (n = 1573).**

| Variables | Variable definition |
|---|---|
| Self-reported health | 0 = Unhealthy, 1 = Healthy |
| Objective physical health | 0 = Unhealthy, 1 = Healthy |
| Mental health | 0 = Unhealthy, 1 = Healthy |
| Hearing difficulties | 0 = No, 1 = Yes |
| Sleeping | 0 = <6 h, 1 = ≥6 h |
| Falling | 0 = No, 1 = Yes |
| Chronic diseases | 0 = No, 1 = Yes |
| Life restriction | 0 = No, 1 = Yes |
| Physical exercise | 0 = No, 1 = Yes |
| Social activities | 0 = No, 1 = Yes |
| Endowment insurance | 0 = No, 1 = Yes |
| Type of elderly care | 0 = Institutional care, 1 = Living with family, 2 = living alone |
| Life satisfaction | 0 = No, 1 = Yes |
| Depressive symptoms | 0 = No, 1 = Yes |

It does not need to determine the weighted value of each index subjectively in the evaluation process, which can reduce the impact of subjective factors on the evaluation results and make the evaluation results more objective and accurate.

$$F(x) = \frac{b}{ax + c} \tag{1}$$

$$F(x) = \frac{(U - L)(x - T)}{(U + L - 2T)x + UT + LT - 2UL} \tag{2}$$

$$S_i(x) = \frac{(U_i - L_i)(x_i - T_i)}{(U_i + L_i - 2T_i)x + U_iT_i + L_iT_i - 2U_iL_i} \tag{3}$$

$$S(x) = \frac{\sum_{i \neq j}^{i,j} (S_i + 1)(S_j + 1)}{2n(n - 1)} \tag{4}$$

The specific calculation process is as follows. Firstly, the standardization of indexes, as shown in Eqn 1. Where a, b and c are the parameters of F(x). Secondly, according to the above conditions, the hyperbolic normalized function F(x) can be obtained, as shown by Eqn 2. In F(x), u represents the upper limit of the index x, L represents the lower limit, T represents the critical value (usually the mean value), and F(x) satisfies F(U) = 1, F(L) = −1, f (T) = 0. F(x) maps the index value between L~U to −1~1, and the growth rate changes after mapping. Thirdly, the standardization process of index $x_i$ is shown in Eqn 3. Where $S_i$ is the standardized value of the index, and $U_i$, $L_i$, $T_i$ are the maximum, minimum and average values of index xi respectively. Finally, calculation of composite index through Eqn 4. Where, $S_i$ is the index value of item i, $S_j$ is the index value of item j (i≠j), and n is the number of the indices.

Thus, the $S_i(x)$ was in [−1, 1], and S(x) was in [0, 1]. The smaller the S(x), the better the overall health status of the elderly.

## 3. Results

### 3.1 Demographic Characteristics

From Table 2, the widowed elderly (n = 1573) were mostly female (1115, 70.88%), aged 80–99 (931, 59.19%), 48.00% were from rural areas (755, 48.00%) and 36.75% were from urban areas (578, 36.75%). Up to 92.05% widowed elderly lived with family (1448, 92.05%). For the non-widowed elderly, the majority of the participants were male (60.79%), aged 65–79 (66.57%), mainly from rural (49.11%) and urban (38.41%) areas and lived with their families (98.68%). Comparing the two groups, the widowed elderly have an obvious characteristic, they are female, older and living with family.

### 3.2 Depressive Symptoms of the Widowed Elderly

Analyzed the depressive symptoms scores of the widowed elderly (Table 3), the mean and standard deviation were 12.40 and 5.68 respectively, which was higher than the mean and standard deviation of non-widowed elderly 11.41 ± 5.52. Especially, up to 69.49% of the widowed elderly had depressive symptoms. For non-widowed elderly, the figure was 63.48%. Independent sample *t*-test showed that there were significant differences in depression symptoms scores (≥10 and 0–30) between widowed and non-widowed elderly ($p < 0.001$) respectively, but there was no significant difference in depression symptoms scores (<10) between the two groups ($p = 0.193$). For the widowed elderly, there was a significant difference in depression symptoms scores (≥10) between widows and widowers ($p < 0.001$). Specifically, 20.15% widowers and 49.33% widows had depressive symptoms. In short, the prevalence of depressive symptoms in the widowed elderly was up to 69.49%. The depression rate of widows was significantly higher than

**Table 2. Descriptive statistics of the sample (n = 3320).**

| Characteristics | | Widowed elderly (n = 1573) | | Non-widowed elderly (n = 1747) | |
|---|---|---|---|---|---|
| Sex | Male | 458 | 29.12% | 1062 | 60.79% |
| | Female | 1115 | 70.88% | 685 | 39.21% |
| Age | 65–79 | 244 | 15.51% | 1163 | 66.57% |
| | 80–99 | 931 | 59.19% | 562 | 32.17% |
| | ≥100 | 398 | 25.30% | 22 | 1.26% |
| Residence | City | 240 | 15.26% | 218 | 12.48% |
| | Urban | 578 | 36.75% | 671 | 38.41% |
| | Rural | 755 | 48.00% | 858 | 49.11% |
| Type of elderly care | Living with family | 1448 | 92.05% | 1724 | 98.68% |
| | Living alone | 121 | 7.69% | 23 | 1.32% |
| | Institution care | 4 | 0.25% | 0 | 0 |

**Table 3. Depressive symptoms of the widowed elderly.**

| Depressive symptoms scores | Widowed elderly (n = 1573) | | Non-widowed elderly (n = 1747) | | *p* value |
|---|---|---|---|---|---|
| Mean ± Standard deviation | 12.40 ± 5.68 | | 11.41 ± 5.52 | | - |
| <10 | 480 | 30.51% | 638 | 36.52% | 0.193 |
| ≥10 | 1093 | 69.49% | 1109 | 63.48% | $p < 0.001$ |
| 0–30 | 1573 | 100% | 1747 | 100% | $p < 0.001$ |
| Depressive symptoms scores | Widowers | | Widows | | *p* value |
| <10 | 141 | 8.96% | 339 | 21.55% | 0.456 |
| ≥10 | 317 | 20.15% | 776 | 49.33% | $p < 0.001$ |
| 0–30 | 458 | 29.12% | 1115 | 70.88% | 0.029 |

that of widowers. The depressive symptoms of the widowed elderly, especially the widows, can't be ignored and needs further research.
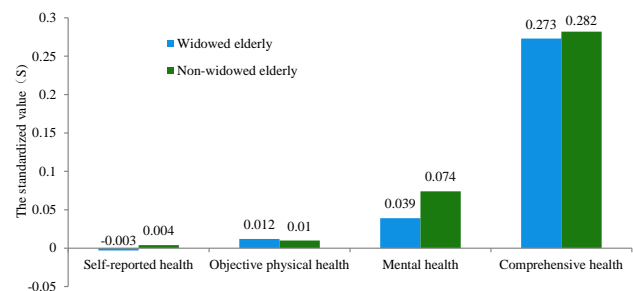
### 3.3 Chronic Diseases of the Widowed Elderly

An analysis of the chronic diseases of the widowed elderly (Table 4) showed that 63.45% of the widowed elderly and 70.12% of the non-widowed elderly suffered from one or more chronic diseases. Compared with the non-widowed elderly, the proportion of the widowed elderly without chronic diseases (36.55%) is higher than that of the non-widowed elderly (29.88%). For the elderly widows, 17.55% of widowers and 45.90% of widows suffered from one or more chronic diseases. Generally, the prevalence of chronic diseases in elderly widows was higher than that in the elderly widowers, the non-widowed elderly were also higher than the widowed elderly and the prevalence of chronic diseases among different number of disease groups all showed significant differences ($p < 0.001$).

### 3.4 Health Evaluation of the Widowed Elderly

A fully aligned polygonal graphical indexing method was used to evaluate the health of the widowed elderly, such as self-reported health, objective physical health, mental health and comprehensive health after calculation by the fully aligned polygonal graphical indexing method (Fig. 1). Comparing the three dimensions, there were great differences between the widowed and non-widowed elderly. For the widowed elderly, self-reported health, mental health and comprehensive health were all better than that of the non-widowed elderly, except for the objective physical health, using analysis by the fully aligned polygonal graphical indexing method. However, there were no statistical differences in the three dimensions between the two. Because the $S_i(x)$ was in [–1, 1], and $S(x)$ was in [0, 1], health can be evaluated by S. Thus, whether widowed or not, $S_i(x)$ of self-reported health, objective physical health and mental health were all far from –1, indicating that they were not optimistic about their health status. For comprehensive health, $S(x)$ was in [0, 1]. The health of the widowed elderly was slightly better than that of the non-widowed elderly. On the whole, health status was not optimistic whether widowed or not.



**Fig. 1. Three dimensions of elderly health.**

**Table 4. Chronic Diseases of the widowed elderly.**

| Numbers | Widowed elderly (n = 1573) | | | | p value | Widowed elderly (n = 1573) | | Non-widowed elderly (n = 1747) | | p value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Widowers (n = 458) | | Widows (n = 1115) | | | | | | | |
| 0 | 182 | 11.57% | 393 | 24.98% | $p < 0.001$ | 575 | 36.55% | 522 | 29.88% | $p < 0.001$ |
| 1 | 150 | 9.54% | 353 | 22.44% | $p < 0.001$ | 503 | 31.98% | 562 | 32.17% | $p < 0.001$ |
| ≥1 | 126 | 8.01% | 369 | 23.46% | $p < 0.001$ | 495 | 31.47% | 663 | 37.95% | $p < 0.001$ |

**Table 5. Binary regression equation of three dimensions of the widowed elderly health (n = 1573).**

| Variables | | Exp(B) | | |
|---|---|---|---|---|
| | | Self-reported health | Objective physical health | Mental health |
| Hearing difficulties | | 1.007 | 1.108 | 1.071 |
| Sleeping | | 0.573*** | 0.829 | 0.828 |
| Falling | | 1.167 | 0.958 | 1.240 |
| Chronic diseases | | 1.430*** | 1.080 | 0.877 |
| Life restriction | | 2.074*** | 1.676*** | 1.363*** |
| Physical exercise | | 0.676*** | 0.585*** | 0.557*** |
| Social activities | | 0.923 | 0.634 | 0.816 |
| Endowment insurance | | 1.072 | 0.811 | 0.774 |
| Type of elderly care | Living with family | 1.243 | 1.283 | 0.330 |
| Type of elderly care | Living alone | 1.079 | 0.942 | 1.459 |
| Life satisfaction | | 0.152*** | 0.401*** | 0.385*** |
| Depressive symptoms | | 2.319*** | 3.255*** | 3.327*** |

Note. *** indicates statistically significant at the level of 0.1%.

### 3.5 Related Factors Affecting the Health of the Widowed Elderly

This work established three logistic binary regression models to analyze the influencing factors of the widowed elderly health (Table 5). The models were the regression models of self-reported health, objective physical health and mental health of the widowed elderly (n = 1573). The results of the self-reported health model showed that the variables of sleeping, chronic diseases, life restriction, physical exercise, life satisfaction and depressive symptoms were significant influencing factors on the widowed elderly ($p < 0.001$). The variables of life restriction, physical exercise, life satisfaction and depressive symptoms were significant influencing factors on the objective physical health and mental health of the widowed elderly ($p < 0.001$). The variables of sleeping and chronic diseases were extremely important for self-rated health, but not for the objective physical health and mental health of the widowed elderly. In short, the four variables of life restriction, physical exercise, life satisfaction and depressive symptoms were important factors for the health of the elderly widowed.

## 4. Discussion

With the rapid development of an aging population, the health problems of the widowed elderly had attracted the attention of the international community. Widowhood not only means losing a spouse, but also has negative impacts on health [26] and emotional cognition [27]. There is considerable consistency in the study of widowhood, the widowed elderly have lower morale and a higher incidence of mental problems when compared with the married elderly [28]. A possible explanation for the negative impact of widowhood on mental health may be the increased stress caused by the loss of a spouse, resulting in decreased emotional support and lack of financial support [29,30]. The widowed elderly reported increased anxiety, grief, depression [31] and emotional and social loneliness. Depression is a mental state characterized by a loss of interest or happiness, accompanied by other symptoms, such as inattention or decision-making errors, fatigue, sleeping problems, alterations in appetite or body weight, feelings of worthlessness or excessive guilt, or thoughts of death or suicide, nearly every day [32,33]. The studies of widowhood and its consequences in different gender groups showed that the impact of widowhood on widows and widowers was different. In terms of the effect of widowhood on depression, van Grootheest *et al.* [34] found widowhood had a stronger effect on depressive symptoms in elderly widowers than in elderly widows. In contrast, some studies found that there was no gender difference in the effect of widowhood on depressive symptoms [35,36]. In this study, the prevalence of depressive symptoms was up to 66.33% (aged 65 or older). Specifically, 63.48% of the non-widowed elderly and 69.49% of the widowed elderly had depressive symptoms, including 20.15% of widowers and 49.33% of widows. These numbers were higher than 33.4% (aged 60 or older) conducted among 3637 elderly people in Taiyuan,

China [37]. It was also found that widowed middle-aged and elderly people had a higher risk of depression than married people [38]. The widowed elderly may have more severe depressive symptoms as they grow older. By ensuring adequate sleep, relieving pain and improving life satisfaction, it is possible to alleviate the depressive symptoms of the widowed elderly [39]. Living with family can alleviate the depression of the widowed elderly [40]. Social networks also help with psychological adjustment after the death of a spouse [41].

Chronic diseases are defined as diseases that last for one or more years and have no obvious communicable biological cause, including cardiovascular and cerebrovascular diseases (such as hypertension, stroke, coronary heart disease), cancer, chronic respiratory diseases and diabetes [42]. Chronic diseases bring negative emotions and emotional distress to the elderly. Chronic diseases also lead to a decline of body function and significantly affect quality of life for the elderly, especially stroke and have been found to be important predictors of poor health [43]. An Indian study confirmed older widows with two or more chronic diseases and older widows with any one disease were somewhat more likely to believe that their health was poor or average [44]. With a lower number or no chronic disease, the optimistic health assessment index of the widowed elderly would be increased [45].

From the perspective of medicine and public health, self-reported or self-rated health is the respondent's self-perceived health. It is a common measure of subjective perceived health and provides comprehensive measures of an individual's physical and mental state [46]. Even considering the objective health status, self-rated health can still better represent the comprehensive health status of a population [47]. In the field of medicine, special attention is paid to the self-reported health of the elderly. For the widowed elderly, this study found that self-reported health performance was the best, followed by objective physical health and mental health (Fig. 1). Other studies have shown that the self-rated health status of widowed older adults was worse than non-widowed peers, with worse health status for widowers than widows [48].

Through the binary regression equation analysis of the widowed elderly health, this study also found that physical exercise, life restriction, life satisfaction and depressive symptoms were important factors affecting the health of the widowed elderly, indicating that their health status was closely related to their quality of life, which has also been mentioned in other relevant studies [49–51]. Mobility impairment was a common problem of the elderly population, which was related to the difficulty of engaging in activities of daily living, resulting in the restrictions and degradation of the living standard of the elderly. Life restriction in this work referred to physical limitations, that is the restriction of daily activities (i.e., difficulties in trying to perform personal tasks or actions). According to the

International Classification of Functioning, Disability, and Health (WHO-ICF) framework, life restriction is a type of disability [52]. Improving the life quality of the elderly is one of the primary tasks of modern countries and society, the application of elderly assistive technology is one of the most promising and interesting scenarios of intelligent technology for the elderly with limited life at present and in the near future [53]. Life satisfaction is particularly important in the study of elderly well-being, because it is an important part of old age [54]. As an important indicator of the happiness of the elderly, life satisfaction directly reflects the quality of life of the elderly [55]. Relevant research shows that the greater the happiness of the elderly, the easier it is for them to integrate into social life and maintain good health [56,57]. For example, the life satisfaction of the elderly living with their family is significantly higher than that of those living alone. Individuals with superior economic conditions and maintaining physical activity and social relations show higher life satisfaction than others [58]. The more chronic diseases the elderly have, the lower their life satisfaction [59]. The current study showed that widowhood had a significant physical and psychological impact on the elderly, community workers, friends, nurses and family members should timely identify the impact and related factors of widowhood on the elderly, taking the initiative to provide the widowed elderly and their families with targeted health guidance services. When the mental health of the widowed elderly was poor, enriching their psychological and cultural life, providing social support for exercise, information exchange and emotional communication to improve their sense of health, then promoting communication were all effective intervention measures.

This study explored the health and associated factors of the widowed elderly based on the fully aligned polygonal graphical indexing method and binary logistic regression analysis. Compared with elderly widowers, elderly widows had higher rates of depression and chronic diseases. The comprehensive health of the widowed elderly was not optimistic. Physical exercise, life restriction, life satisfaction and depressive symptoms were the important factors affecting their health. This study provides a method to evaluate the health of elderly widows and widowers and the associated health factors from the different perspectives of depressive symptoms and chronic diseases. The limitations of this study should also be acknowledged. Firstly, due to data limitations, life satisfaction was assessed with a single item. Future research should adopt a more comprehensive life satisfaction scale. Secondly, chronic diseases have not been studied in depth, only comparative statistical analysis based on gender and the number of chronic diseases. Despite these limitations, the findings are usually valuable as they clarify the health status and related factors of the widowed elderly from three dimensions: self-rated health, objective physical health and mental health.

**Table 6. 10 questions regarding participants experience during the past week, up to two weeks (CES-D-10).**

| | |
|---|---|
| (1) Do you worry about little things? | Answer: |
| (2) Is it hard for you to concentrate now? | (1) Always |
| (3) Do you feel sad or depressed? | (2) Sometimes |
| (4) Do you feel that the older you are, the less useful you are? And it's hard to do anything. (3) Seldom | 3, 2, 1 and 0 points will be given |
| (5) Are you full of hope for your future life? | (4) Never | respectively for the four answers. |
| (6) Are you nervous or afraid? | Questions 5, 7 and 8 will be sco- |
| (7) Do you feel as happy as when you were young? | red in reverse. |
| (8) Do you feel lonely? | |
| (9) Do you feel unable to continue your life? | |
| (10) My sleep quality is good. | |

## 5. Conclusions

In this study, 3320 participants aged 65 years and older were selected, including 1573 widowed elderly and 1747 non-widowed elderly. The widowed elderly were mostly female (70.88%), aged 80–99 (59.19%), from rural (48.00%) and urban (36.75%) areas and lived with families (92.05%). Results showed that 66.33% of the elderly and 69.49% of the widowed elderly had depressive symptoms, and 63.45% of the widowed elderly suffered from one or more chronic diseases. Depressive symptoms were found in 20.15% of widowers and 49.33% of widows, and 60.26% of elderly widowers and 64.75% of elderly widows had more than one chronic disease. There were statistically significant differences between widowers and widows. The self-reported health and mental health of the widowed elderly were slightly better than that of the non-widowed elderly, except for the case of objective physical health, but there was no statistical difference in three dimensions between the two groups. The variables of life restriction, physical exercise, life satisfaction and depressive symptoms were significant influencing factors from three health dimensions on the health of the widowed elderly. Strengthening the monitoring and management of negative emotions and physiological functions of the widowed elderly, improving their awareness of physical and mental health and then promoting their communication were effective intervention measures.

## Author Contributions

HT performed the statistical analysis and drafted the manuscript. JC revised the manuscript. Both authors read and approved the final manuscript.

## Ethics Approval and Consent to Participate

This study was performed in compliance with the Helsinki Declaration guidelines and approved by the Ethical Review Committee of Peking University (IRB00001052–13074). Each participant was voluntary, who was informed of the study objective and context and provided their written informed consent regarding privacy and information management policies.

## Conflict of Interest

The authors declare no conflict of interest.

## Appendix

See Table 6.

## References

[1] Stein J, Bar JM, Konig HH, Angermeyer M, Riedel-Heller SG. Social Loss Experiences and their Association with Depression in Old Age - Results of the Leipzig Longitudinal Study of the Aged (LEILA 75+). Psychiatrische Praxis. 2019; 46: 141–147.

[2] Yu J, Kahana E, Kahana B, Han C. Depressive symptoms among elderly men and women who transition to widowhood: comparisons with long term married and long term widowed over a 10-year period. Journal of Women & Aging. 2021; 33: 231–246.

[3] Cheng Y, Gao S, Li S, Zhang Y, Rosenberg M. Understanding the spatial disparities and vulnerability of population aging in China. Asia & the Pacific Policy Studies. 2019; 6: 73–89.

[4] Xiang N, Liu E, Li H, Qin X, Liang H, Yue Z. The Association between Widowhood and Cognitive Function among Chinese Elderly People: Do Gender and Widowhood Duration Make a Difference? Healthcare. 2021; 9: 991.

[5] Jiang Q, Li X, Sánchez-Barricarte JJ. Elderly widowhood in China. Asian Population Studies. 2014; 11: 7–16.

[6] Chen C, Chow AYM, Tang S. Trajectories of depression symptoms in Chinese elderly during widowhood: a secondary analysis. Aging & Mental Health. 2020; 24: 1254–1262.

[7] Bennett KM. A longitudinal study of wellbeing in widowed women. International Journal of Geriatric Psychiatry. 1997; 12: 61–66.

[8] Wu-Chung EL, Leal SL, Denny BT, Cheng SL, Fagundes CP. Spousal caregiving, widowhood, and cognition: a systematic review and a biopsychosocial framework for understanding the relationship between interpersonal losses and dementia risk in

older adulthood. Neuroscience & Biobehavioral Reviews. 2022; 134: 104487.

[9] Padayachey U, Ramlall S, Chipps J. Depression in older adults: prevalence and risk factors in a primary health care sample. South African Family Practice. 2017; 59: 61–66.

[10] Delbes C, Gaymu J, Chimere-Dan O. The Shock of Widowhood on the Eve of Old Age: Male and Female Experiences. Population. 2002; 57: 885–913.

[11] Jadhav A, Weir D. Widowhood and Depression in a Cross-National Perspective: Evidence from the United States, Europe, Korea, and China. The Journals of Gerontology: Series B. 2018; 73: e143–e153.

[12] Carr D, Bodnar-Deren S. Gender, Aging and Widowhood. International Handbook of Population Aging. 2009; 27: 705–728.

[13] Ho S, Hung W. The Impacts of Widowhood, Chronic Disease, and Physical Function on Mortality among Older People. Journal of Nursing Research. 2013; 21: 110–119.

[14] Huang GG, Chen TH, Chen G, Guo F. A Study of Elderly Healthy Life Expectancy of China-A New Examination from the Subjective Dimension. Population and Development. 2021; 27: 74–84.

[15] Angel JL, Douglas N, Angel RJ. Gender, Widowhood, and Long-Term Care in the Older Mexican American Population. Journal of Women & Aging. 2003; 15: 89–105.

[16] Yang C, Sun X, Duan W. Widowhood and Life Satisfaction Among Chinese Elderly Adults: The Influences of Lifestyles and Number of Children. Frontiers in Public Health. 2022; 9: 754681.

[17] Kung CSJ. Health in widowhood: the roles of social capital and economic resources. Social Science & Medicine. 2020; 253: 112965.

[18] Srivastava S, Debnath P, Shri N, Muhammad T. The association of widowhood and living alone with depression among older adults in India. Scientific Reports. 2021; 11: 21641.

[19] Agrawal G, Keshri K. Morbidity patterns and health care seeking behavior among older widows in India. PLoS ONE. 2014; 9: e94295.

[20] Reyes-Rodriguez MF, Cujino-Medrano MA, Cano-Santana D, Orozco-Barragan S, Pereira-Morales A, Diaz-Trujillo MC. Coping and widowhood in the older adulthood: Mixed methods study in Colombian population. Interdisciplinaria. 2020; 37: 13–14.

[21] Lee YH, Chang YC, Shelley M, Liu CT. Factors Associated with Preventive Care Utilisation among Chinese Older Adults: Evidence from the 2018 Chinese Longitudinal Healthy Longevity Survey. Social Policy and Society. 2022.

[22] Liu XN, Fang W, Li HM, Han XD, Xiao H. Is Urbanization Good for the Health of Middle-Aged and Elderly People in China?—Based on CHARLS Data. Sustainability. 2021; 13: 4996.

[23] Jiang C, Zhu F, Qin T. Relationships between Chronic Diseases and Depression among Middle-aged and Elderly People in China: a Prospective Study from CHARLS. Current Medical Science. 2020; 40: 858–870.

[24] Gonzalez P, Nuñez A, Merz E, Brintz C, Weitzman O, Navas EL, et al. Measurement properties of the Center for Epidemiologic Studies Depression Scale (CES-D 10): Findings from HCHS/SOL. Psychological Assessment. 2017; 29: 372–381.

[25] Zhang W, O'Brien N, Forrest JI, Salters KA, Patterson TL, Montaner JS, et al. Validating a shortened depression scale (10 item CES-D) among HIV-positive people in British Columbia, Canada. PLoS ONE. 2012; 7: e40793.

[26] Narayanasamy N, Das A, Narayanasamy A, Prusty R. Self reported health status and its determinants among elderly widows in Puducherry, India. Indian Journal of Community Medicine. 2021; 46: 606–609.

[27] Bi T, Kou H, Kong Y, Shao B. Widowhood Impairs Emotional Cognition Among Elderly. Frontiers in Aging Neuroscience. 2022; 13: 808885.

[28] Greene RW, Feld S. Social Support Coverage and the well-being of Elderly Widows and Married Women. Journal of Family Issues. 1989; 10: 33–51.

[29] Ansari S, Muhammad T, Dhar M. How Does Multi-Morbidity Relate to Feeling of Loneliness among Older Adults? Evidence from a Population-Based Survey in India. Population Ageing. 2021; 8.

[30] Srivastava S, Shaw S, Chaurasia H, Purkayastha N, Muhammad T. Feeling about living arrangements and associated health outcomes among older adults in India: a cross-sectional study. BMC Public Health. 2021; 21: 1322.

[31] Singham T, Bell G, Saunders R, Stott J. Widowhood and cognitive decline in adults aged 50 and over: a systematic review and meta-analysis. Ageing Research Reviews. 2021; 71: 101461.

[32] Battle DE. Diagnostic and Statistical Manual of Mental Disorders (DSM). Codas. 2013; 25: 191–192.

[33] Brouwer A, van de Ven PM, Kok A, Snoek FJ, Beekman ATF, Bremmer MA. Symptoms of depression and insomnia in older age: A within-individual analysis over 20 years. Journal of the American Geriatrics Society. 2022.

[34] van Grootheest DS, Beekman ATF, Broese van Groenou MI, Deeg DJH. Sex differences in depression after widowhood. do men suffer more? Social Psychiatry and Psychiatric Epidemiology. 1999; 34: 391–398.

[35] Li L, Liang J, Toler A, Gu S. Widowhood and depressive symptoms among older Chinese: do gender and source of support make a difference? Social Science & Medicine. 2005; 60: 637–647.

[36] Sasson I, Umberson DJ. Widowhood and Depression: New Light on Gender Differences, Selection, and Psychological Adjustment. the Journals of Gerontology Series B: Psychological Sciences and Social Sciences. 2014; 69B: 135–145.

[37] Zhang C, Chang Y, Yun Q, Lu J, Zheng X, Xue Y, et al. The impact of chronic diseases on depressive symptoms among the older adults: the role of sleep quality and empty nest status. Journal of Affective Disorders. 2022; 302: 94–100.

[38] Yan X, Huang S, Huang C, Wu W, Qin Y. Marital Status and Risk for Late Life Depression: a Meta-Analysis of the Published Literature. Journal of International Medical Research. 2011; 39: 1142–1154.

[39] Pan L, Li L, Peng H, Fan L, Liao J, Wang M, et al. Association of depressive symptoms with marital status among the middle-aged and elderly in Rural China–Serial mediating effects of sleep time, pain and life satisfaction. Journal of Affective Disorders. 2022; 303: 52–57.

[40] Hung YC, Chen YH, Lee MC, Yeh CJ. Effect of Spousal Loss on Depression in Older Adults: Impacts of Time Passing, Living Arrangement, and Spouse's Health Status before Death. International journal of environmental research and Public Health. 2021; 18 :13032.

[41] King BM, Carr DC, Taylor MG. Loneliness Following Widowhood: the Role of the Military and Social Support. The Journals of Gerontology: Series B. 2021; 76: 403–414.

[42] Centers for Disease Control and Prevention. About Chronic Diseases. 2021. Available at: https://www.cdc.gov/chronicdisease/about/index.htm (Accessed: 27 May 2022).

[43] Govindaraju T, Owen AJ, McCaffrey TA. Past, present and future influences of diet among older adults – a scoping review. Ageing Research Reviews. 2022; 77: 101600.

[44] Narayanasamy N, Das A, Narayanasamy A, Prusty R. Self reported health status and its determinants among elderly widows in Puducherry, India. Indian Journal of Community Medicine. 2021; 46: 606–609.

[45] Carvalho ML, Barbosa CNS, Bezerra VP, Santos AMRD, Silva

CRDT, Brito CMS, *et al*. Health situation in the perception of elderly widows assisted by primary health care. Revista Brasileira de Enfermagem. 2019; 72: 199–204.

[46] He L, Zhang ZX, Wang JY, Wang YT, Li TY, Yang TY, *et al*. Effects of Serving as a State Functionary on Self-Rated Health: Empirical Evidence From China. Frontiers in Public Health. 2022; 10: 757036.

[47] Idler EL, Benyamini Y. Self-Rated Health and Mortality: a Review of Twenty-Seven Community Studies. Journal of Health and Social Behavior. 1997; 38: 21–37.

[48] HO S. Correlations among Self-Rated Health, Chronic Disease, and Healthcare Utilization in Widowed Older Adults in Taiwan. Journal of Nursing Research. 2018; 26: 308–315.

[49] Pinto JM, Fontaine AM, Neri AL. The influence of physical and mental health on life satisfaction is mediated by self-rated health: a study with Brazilian elderly. Archives of Gerontology and Geriatrics. 2016; 65: 104–110.

[50] Dai H, Jia G, Liu K. Health-related quality of life and related factors among elderly people in Jinzhou, China: a cross-sectional study. Public Health. 2015; 129: 667–673.

[51] Fernández-Portero C, Alarcón D, Barrios Padura Á. Dwelling conditions and life satisfaction of older people through residential satisfaction. Journal of Environmental Psychology. 2017; 49: 1–7.

[52] LIU JYW. The severity and associated factors of participation restriction among community-dwelling frail older people: an application of the International Classification of Functioning, Disability and Health (who-ICF). BMC Geriatrics. 2017; 17: 43.

[53] Tsuji T, Mozos OM, Chae H, Pyo Y, Kusaka K, Hasegawa T, et al. An informationally structured room for robotic assistance. Sensors. 2015; 15: 9438–9465.

[54] Frias-Luque MD, Toledano-González A.Determinants of quality of life and well-being in cognitively unimpaired older adults: a systematic review. PeerJ. 2022; 10: e12900.

[55] Liu Y, Sangthong R, Ingviya T, Wan C. Nothing like living with a family: a qualitative study of subjective well-being and its determinants among migrant and local elderly in Dongguan, China. International Journal of Environmental Research and Public Health. 2019; 16: 4874.

[56] Gutiérrez M, Tomás JM, Galiana L, Sancho P, Cebrià MA. Predicting life satisfaction of the Angolan elderly: a structural model. Aging & Mental Health. 2013; 17: 94–101.

[57] Gutierrez M, Tomas JM, Sancho P, Galiana L, Francisco EH. Perception of quality of life in an elderly Angolan sample. International Journal of Social Psychology. 2014; 29: 346–370.

[58] Roh M, Weon S. Living Arrangement and Life Satisfaction of the Elderly in South Korea. Social Indicators Research. 2022; 160: 717–734.

[59] Jelicic M, Kempen GIJM. Short report: Chronic medical conditions and life satisfaction in the elderly. Psychology & Health. 1999; 14: 65–70.

**IMR Press**