Vital Surveillances

Trends in the Prevalence of Cognitive Impairment Among Older Adults Aged 65 to 105 Years — China, 2002–2018

Xiaojin Yan[1]; Shiqi Lin[1]; Jiajia Li[1]; Hao Cheng[2]; Xiangguo Liu[1]; Lijun Pei[1,#]

ABSTRACT

Introduction: This study aims to analyze trends and subgroup differences in the prevalence of cognitive impairment among older Chinese adults aged 65–105 years from 2002 to 2018.

Methods: Data were drawn from six waves of the Chinese Longitudinal Healthy Longevity Survey (CLHLS). Cognitive function was measured using the Chinese version of the Mini-Mental State Examination (CMMSE). Cognitive impairment was determined by the total CMMSE score and educational attainment of participants. The generalized estimating equation (GEE) models with a logistic link and binominal distribution were performed to assess the secular trend in the prevalence.

Results: The prevalence of cognitive impairment among older adults aged 65–105 years decreased from 3.44% [95% confidence interval (CI): 3.15%–3.73%] in 2002 to 2.41% (95% CI: 2.17%–2.65%) in 2018 in China. The prevalence was slightly higher in women than in men in 2002 (3.71% *vs.* 3.13%, $P<0.05$), and there was no significant difference between women and men in 2018 (2.60% *vs.* 2.21%, $P=0.12$). Rural older adults had a higher prevalence of cognitive impairment before 2014, but their urban counterparts had a higher prevalence in 2018 (2.75% *vs.* 2.06%, $P<0.05$). The GEE regression model showed that each successive year was associated with a 3% reduction in the odds of the prevalence of cognitive impairment [odds ratio (OR)=0.97; 95% CI: 0.97–0.97; $P<0.05$].

Conclusions: The prevalence of cognitive impairment among Chinese older adults aged 65–105 years declined slowly from 2002 to 2018. The gender, urban-rural, age, and regional differences in the prevalence of cognitive impairment changed over time.

Dementia is a clinical syndrome characterized by cognitive impairment, which is the leading cause of disability in people aged ≥65 years worldwide (*1*). A recent nationwide survey showed that approximately 15.07 million older adults aged ≥60 years had dementia between March 2015 and December 2018 in China, accounting for nearly a quarter of the world's patients (*2*). Cognitive impairment is a transitional stage between being cognitively unimpaired and having dementia (*2*). It is estimated that 10% to 15% of mild cognitive impairment develops into Alzheimer's disease every year (*3*). Since there is no cure for dementia, government and medical departments seek identification of and intervention for people with cognitive impairment to prevent the progression to dementia (*2*). Therefore, this study aimed to investigate the trends and subgroup differences in the prevalence of cognitive impairment among Chinese older adults aged ≥65 years over the past 20 years based on a large national sample.

METHODS

Data were drawn from the Chinese Longitudinal Healthy Longevity Survey (CLHLS), whose study design has been published previously (*4*). The survey was conducted in a randomly selected half of the cities/counties from 22 provincial-level administrative divisions (PLADs) in China, covering 85% of the national population (*4*). Considering the consistency and credibility of the age range, older adults aged 65–105 years were selected as participants between 2002 and 2018 in this study.

Face-to-face interviews were conducted in the homes of participants by trained interviewers. Sociodemographic information including gender, age, residence area, PLAD, and years of education was collected. The participants were divided into 2 age groups: 65–79 and 80–105 years. The residence area was divided into urban and rural groups. Education was divided into 3 levels: never attended school, primary school or less (≤6 years of education), and secondary school or more. Cognitive function of participants was measured using the Chinese version of the Mini-Mental State Examination (CMMSE), which

consists of 24 items and the total score ranges from 0 to 30 points. Cognitive impairment was defined as the total CMMSE score <18 for participants who never attended school, <21 for participants who received 6 years of education or less, and <25 for participants who received more than 6 years of education (5).

This study pooled data from 6 waves to obtain 79,103 observations. Of all the observations, 42.3% had validated CMMSE results, 53.0% had partial items missing, and 4.7% had all items missing. The present study excluded observations with all CMMSE items missing, with missing basic sociodemographic information, or with dementia. Finally, a total of 73,672 observations from 43,956 respondents were included in the analysis. Multiple imputation (5 times) for missing CMMSE items data was performed assuming data were missing at random using chained equations (mice package in R). This study also imputed missing values 10, 15, and 20 times to verify the stability of imputation, and the results showed that the distributions of total CMMSE scores were almost consistent. The prevalence of cognitive impairment was weighted to adjust for sampling probability and nonresponses using weights from the database of each wave. The prevalence showed a 95% confidence interval (CI). The age-standardized prevalence of cognitive impairment was also calculated using national data of adults aged ≥65 years from the 2020 China Statistical Yearbook as the standard population. A chi-square test was used to compare the prevalence between subgroups. In order to address the correlation of repeated measurements of the same participants in different waves, the secular trends in the prevalence of cognitive impairment were assessed using generalized estimating equation (GEE) models with a logistic link and binominal distribution. To examine the overall secular trend in the prevalence, the year was used as a continuous variable in the GEE model (6). The models were adjusted for gender, residence area, PLAD, age, and years of education. All *P*-values <0.05 were considered statistically significant. All analyses were performed using R software (version 4.1.0, R Development Core Team, Vienna, Austria).

RESULTS

The total number of observations in this study was 73,672. The proportions of adults aged more than 80 years exceeded 60% in all waves. Women, rural residents, and those never attending school took a preponderance of this study's sample across all waves (Table 1).

The prevalence of cognitive impairment among adults aged 65–105 years decreased from 3.44% (95% CI: 3.15%–3.73%) in 2002 to 2.41% (95% CI: 2.17%–2.65%) in 2018 in China. The prevalence of cognitive impairment was slightly higher in women than in men in 2002 (3.71% *vs.* 3.13%, *P*<0.05), with the largest difference between genders in 2011 (5.82% *vs.* 2.47%, *P*<0.05), while there was no significant difference between genders in 2018 (2.60% *vs.* 2.21%, *P*=0.12). The prevalence of cognitive impairment among older adults in rural areas was higher than that in urban areas before 2014, while prevalence among rural older adults was lower than their urban counterparts in 2018 (2.06% *vs.* 2.75%, *P*<0.05). The

TABLE 1. Characteristics of the sample from six waves of CLHLS.

Subgroups	2002 N=15,307	2005 N=13,959	2008 N=14,521	2011 N=8,703	2014 N=6,386	2018 N=14,696
Women, n (%)	8,659 (56.57)	7,745 (55.48)	8,059 (55.50)	4,633 (53.23)	3,355 (52.54)	8,104 (55.14)
Rural, n (%)	8,279 (54.09)	7,771 (55.67)	8,679 (59.77)	4,582 (52.65)	3,487 (54.60)	6,535 (44.47)
80–105 years, n (%)	10,492 (68.54)	9,079 (65.04)	10,296 (70.90)	5,615 (64.52)	4,099 (64.19)	9,414 (64.06)
Regions, n (%)						
Eastern	7,371 (48.15)	6,431 (46.07)	6,696 (46.11)	4,172 (47.94)	3,093 (48.43)	7,321 (49.82)
Central	3,812 (24.90)	3,520 (25.22)	3,957 (27.25)	2,430 (27.92)	1,844 (28.88)	3,696 (25.15)
Western	4,124 (26.94)	4,008 (28.71)	3,868 (26.64)	2,101 (24.14)	1,449 (22.69)	3,679 (25.03)
Education, n (%)						
Never attended school	9,365 (61.18)	8,314 (59.56)	8,820 (60.74)	4,919 (56.52)	3,535 (55.36)	6,484 (44.12)
Primary school or less	4,404 (28.77)	4,120 (29.52)	4,205 (28.96)	2,769 (31.82)	2,100 (32.88)	5,567 (37.88)
Secondary school or more	1,538 (10.05)	1,525 (10.92)	1,496 (10.30)	1,015 (11.66)	751 (11.76)	2,645 (18.00)
Age, $\bar{x} \pm s$	85.83±11.45	84.94±11.33	86.03±11.00	84.72±10.62	84.48±9.67	84.71±11.22

Abbreviation: CLHLS=Chinese Longitudinal Healthy Longevity Survey.

prevalence among adults aged 80–105 years was always higher than that among those aged 65–79 years, and differences between the 2 age groups decreased from 2002 to 2018. The prevalence among older adults in the eastern region was lower than that in the western and central regions in 2002 (2.85% *vs.* 3.54% *vs.* 4.39%, $P<0.05$), while in 2018, the western was lower than the central and eastern regions (1.74% *vs.* 2.55% *vs.* 2.66%, $P<0.05$). Trends and subgroup differences in the age-standardized prevalence were similar to those in the crude prevalence (Figures 1–2).

The GEE regression model showed that each successive year was associated with a 3% reduction in the odds of the prevalence of cognitive impairment [odds ratio (OR)=0.97; 95% CI: 0.97–0.97; $P<0.05$] after adjusting for gender, residence area, PLAD, age, and years of education. The decreasing trends in the prevalence over time were similar across subgroups (Table 2).

DISCUSSION

This study found that the prevalence of cognitive impairment among Chinese older adults aged ≥65 years showed a slow decline from 2002 to 2018, with the prevalence ranging from 2.41% to 4.17%. A study showed a similar decline trend of over 50% among adults aged 65 years and older in the UK from 1991 to 2011 (*7*). However, a study in Brazil has shown an increase in the prevalence of cognitive impairment among people aged 60 years and older from 2000 to 2015 (*8*). The differences in trends of prevalence across countries may be related to their respective social contexts and testing measures, which requires further analysis in future research. One important finding in this study was that the prevalence among older adults aged over 80 years continuously decreased from 2002 to 2018, which may be attributed primarily to generational differences (*9*).

The prevalence of cognitive impairment from this study (2.41%–4.17%) was much lower than that of Guo et al. (10.4%–14.7%) and Kuang et al. (7.06%–11.56%) (*10*–*11*). There are three potential reasons. First, cognitive impairment was defined as the CMMSE score <24 by Guo and <18 by Kuang et al. CMMSE score <24 could overestimate the prevalence, and the score <18 could underestimate it, compared with this study. Second, the unweighted sample would overestimate the prevalence due to the oversampling of older adults aged ≥80 years in the CLHLS. Third, there were differences in the data processing. "Unable to answer" in the questionnaire was considered as incorrect answers for CMMSE items so that the total CMMSE score of observations tended to be lower,

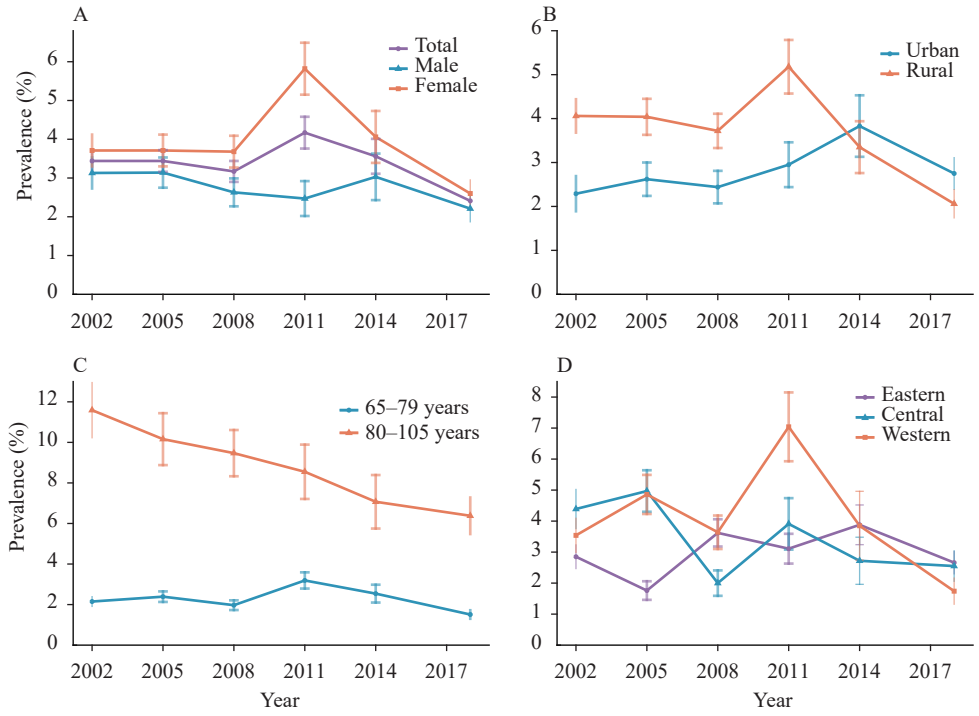

FIGURE 1. Trends in the prevalence of cognitive impairment among Chinese older adults aged 65–105 years by (A) gender, (B) residence area, (C) year group, and (D) region from 2002 to 2018.

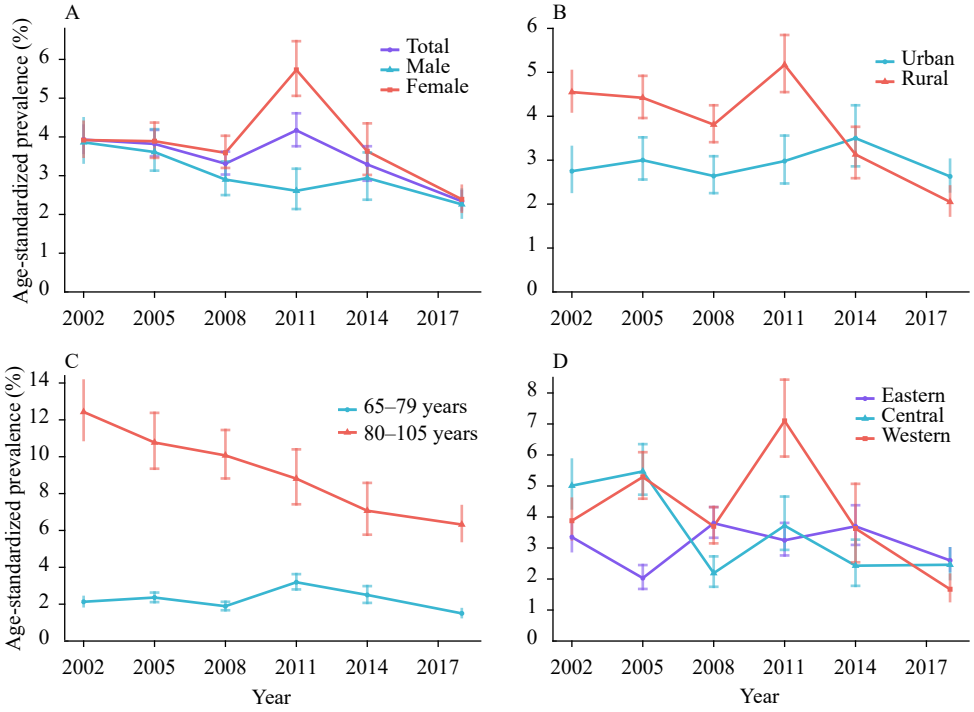

FIGURE 2. Trends in the age-standardized prevalence of cognitive impairment among Chinese older adults aged 65–105 years by (A) gender, (B) residence area, (C) year group, and (D) region from 2002 to 2018.

TABLE 2. OR and 95% CI of cognitive impairment related to year in different subgroups from generalized estimating equation models.

Subgroups	OR (95% CI)	*P* value
Total *	0.97 (0.97–0.97)	<0.001
Gender †		
Male	0.97 (0.97–0.97)	<0.001
Female	0.97 (0.97–0.97)	<0.001
Area §		
Urban	0.98 (0.98–0.98)	<0.001
Rural	0.96 (0.96–0.96)	<0.001
Age group ¶		
65–79 years	0.98 (0.98–0.98)	0.002
80–105 years	0.97 (0.97–0.97)	<0.001
Region **		
Eastern	0.98 (0.98–0.98)	<0.001
Central	0.96 (0.96–0.96)	<0.001
Western	0.96 (0.96–0.96)	<0.001

Abbreviation: OR=odd ratio; CI=confidence interval; PLAD=provincial-level administrative divisions.
* Adjusted for gender, area, age, PLAD, and years of education.
† Adjusted for area, age, PLAD, and years of education.
§ Adjusted for gender, age, PLAD, and years of education.
¶ Adjusted for gender, area, PLAD, and years of education.
** Adjusted for gender, area, age, and years of education.

resulting in an overestimation of the prevalence.

Consistent with a previous study (*12*), this study found that the prevalence of cognitive impairment among women was higher than that among men, possibly related to the lack of estrogen in older women (*13*). In addition, the difference in educational attainment between men and women in the past may also be an important reason for the gender difference in the prevalence of cognitive impairment (*9*). The prevalence among rural older adults was higher than that among urban adults before 2014, which was consistent with a previous study (*12*). Yet the prevalence among urban older adults was higher than that among rural older adults in 2018. The potential reasons need to be explored in future studies. In accordance with previous studies (*12*, *14*), this study also observed that the prevalence among older adults aged 80–105 years was higher than that among those aged 65–79 years — since the incidence of cognitive impairment usually rises with age (*15*). A previous review showed that the prevalence of cognitive impairment among older adults in the western region was higher than that in the eastern region (*12*), which was echoed by this investigation's findings of east-west differences before 2014. Moreover, this study also found a rapid decline in the prevalence in the western region from 2011 to 2018 and thus a higher prevalence

in the eastern region than that in the western region in 2018. As only four western provinces were included in analysis, it may not be representative of the older population in the entire western region. The regional differences in the prevalence need further research.

This study has several limitations. First, as mentioned above, the findings from this study may not be representative enough for older adults in the western region, because eight provinces in the western region were not included in the CLHLS. Second, the measurement of cognitive impairment was only screening based on the CMMSE rather than clinical diagnosis, which may overestimate the prevalence of cognitive impairment (*14*). Third, although multiple imputation could be used to provide unbiased estimates with improved efficiency based on the assumption of missing at random (*16*), this study could not ensure that all variables related to missingness were included in the imputation models.

In conclusion, the present study found that the prevalence of cognitive impairment among Chinese older adults aged 65–105 years declined slowly from 2002 to 2018. The gender, urban-rural, age, and regional differences in the prevalence changed over time. However, with an aging population, there are still heavy disease burdens of cognitive impairment in China. How to prevent and intervene in the occurrence and development of cognitive impairment, and improve the life quality of older adults deserves serious consideration by government personnel and researchers.

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[#] Corresponding author: Lijun Pei, peilj@pku.edu.cn.

[1] Institute of Population Research, Peking University, Beijing, China; [2] National Academy of Innovation Strategy, China Association for Science and Technology, Beijing, China.

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