


General Psychiatry Prevalence of dementia and the attributable contributions of modifiable risk factors in China

Hui Chen ,¹ Yuhui Huang,¹ Xiaozhen Lv,² Xin Xu,¹ Yuan Ma,³ Huali Wang,² Changzheng Yuan^{1,4}

To cite: Chen H, Huang Y, Lv X, *et al.* Prevalence of dementia and the attributable contributions of modifiable risk factors in China. *General Psychiatry* 2023;**36**:e101044. doi:10.1136/gpsych-2023-101044

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/gpsych-2023-101044>).

HC and YH are joint first authors.

Received 27 February 2023
Accepted 25 May 2023



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¹School of Public Health, the Second Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, Zhejiang, China

²Beijing Dementia Key Lab, National Clinical Research Center for Mental Disorders, NHC Key Laboratory of Mental Health, Peking University Institute of Mental Health (Sixth Hospital), Beijing, China

³Department of Epidemiology, Harvard T. H. Chan School of Public Health, Boston, Massachusetts, USA

⁴Department of Nutrition, Harvard T. H. Chan School of Public Health, Boston, Massachusetts, USA

Correspondence to
Dr Changzheng Yuan;
chy478@zju.edu.cn

INTRODUCTION

With the largest ageing population in the world, China is faced with the huge challenge of dementia.^{1–4} However, previously reported estimates on the prevalence of dementia among Chinese older adults were inconsistent, varying from 2% to 13%.^{5,6} It is crucial for dementia prevention to determine the number of cases that could be delayed or prevented, but how to do this remains unclear. To address these research gaps, we aimed to provide population estimates of the prevalence of dementia in China and estimate the population attributable fractions (PAFs) of potentially modifiable risk factors.

METHODS

Study population

Commenced in 2011, the China Health and Retirement Longitudinal Study (CHARLS) is an ongoing nationally representative survey of residents in mainland China aged 45 and older. The current study was based on the Harmonized Cognitive Assessment Protocol (HCAP) substudy of CHARLS 2018 in 28 provinces of China.⁷ A total of 10 740 participants aged 60 years or above were eligible for the CHARLS-HCAP. Of them, we included 8 546 (79.6%) participants who attended the respondent interview themselves and whose informants finished the informant interview.

Dementia ascertainment

A battery of neuropsychological tests⁸ was administered to the respondents, and respective informants were interviewed by trained staff in Mandarin (42.6%) and other Chinese dialects. We adopted the diagnostic strategy for dementia used in the Health and Retirement Study-HCAP,⁹ which followed the criteria of the National Institute on Aging

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Dementia poses substantial social, economic, and family burdens to the worldwide aging population.
- ⇒ China is faced with a huge challenge of dementia, but reported estimates on prevalent dementia among Chinese older adults were inconsistent, varying from 2% to 13% among older adults.

WHAT THIS STUDY ADDS

- ⇒ Among 8 546 participants aged 60 or above from the Harmonized Cognitive Assessment Protocol substudy for the China Health and Retirement Longitudinal Study in 2018, the weighted prevalence rate of dementia was 7.1%.
- ⇒ The overall weighted population attributable fraction (PAF) of 12 modifiable risk factors was 60.1%. Less education had the largest PAF (11.3%), followed by physical inactivity (7.6%), hypertension (7.4%), air pollution (6.9%), and hearing loss (6.4%).

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ Our findings highlighted the challenging burden of dementia in China (~17 million cases in 241 million older adults), and more than half of the cases could be potentially prevented or delayed by targeting 12 modifiable risk factors.

and Alzheimer's Association's workgroups. The test scores in the neuropsychological battery were standardised and mapped to five domains—memory, executive functioning, language, visuospatial and orientation (online supplemental eTable 1)—and confirmative factor analysis derived five factor scores for each individual. A diagnosis of dementia required the coexistence of two or more impaired cognitive domains (defined as a score lower than the mean by more than 1.5 standard deviation (SD) in each education category) and an informant report of functional impairment indicated by the Informant Questionnaire on Cognitive Decline in the Elderly (IQCODE).⁹ We adopted the criteria

of IQCODE ≥ 3.6 according to previous definitions in the Chinese population.¹⁰

Risk factors

We included the 12 potentially modifiable risk factors proposed by the Lancet Commission for Dementia Prevention, Intervention and Care.² The early-life (<45 years) risk factor was less education (no formal education or primary school only); midlife (45–64 years) risk factors included hypertension, obesity, hearing impairment, traumatic brain injury (TBI) and excessive alcohol intake; and late-life (≥ 65 years) risk factors included diabetes, air pollution, smoking, depression, social isolation and physical inactivity. We identified prevalent hypertension from physical examinations ($\geq 140/90$ mm Hg), medication history and self-reported diagnoses. Obesity was defined as a body mass index of 28.0 kg/m² or above. Hearing impairment was identified by self-reported deafness or half-deafness, hearing aid usage, and self-reported ‘poor’ hearing ability. TBI was defined as self-reported severe brain injury after the age of 18. Excessive alcohol intake was defined as >21 units/week¹¹ (1 unit=10 mL of pure alcohol). Diabetes was identified from blood assays (random blood glucose ≥ 200 mg/mL, fasting glucose ≥ 126 mg/mL or hemoglobin A1c, HbA1c $\geq 6.5\%$), medication history and self-reported diagnoses. Air pollution was defined as the yearly average particulate matter (PM_{2.5}) of ≥ 35 $\mu\text{g}/\text{m}^3$, according to China’s national air-quality standards. Depression status was measured using the 10-item Center for Epidemiological Studies-Depression Scale, with a score higher than 20 indicating depression.¹² Social isolation was defined as a lack of contact with her/his children, parents and friends.² Physical inactivity was defined as moderate-to-vigorous physical activity <150 min/week.

Statistical analysis

The prevalence of dementia was estimated by accounting for sampling weights. Survey weighted logistic regression was applied to calculate the odds ratios (ORs) for the associations of gender and residence with dementia. PAF calculation involved synthesised relative risk of dementia,^{2,13} prevalence and communality for each risk factor. We estimated the prevalence of risk factors in the overall population of CHARLS 2018 (N=19 751). To obtain communality, we performed principal component analysis of the risk factors and summed the square of the first five factor loadings for each risk factor. Using P_e as the prevalence of each risk factor, RR_e as the relative risk of dementia and w_e as (1–communality), the calculations were as follows:

$$\text{Individual unweighted PAF (PAF}'_e) = \frac{P_e(RR_e - 1)}{1 + P_e(RR_e - 1)},$$

$$\text{Overall weighted PAF} = 1 - \prod(1 - w_e \text{PAF}'_e),$$

$$\text{Individual weighted PAF (PAF}'_e) = \frac{\text{PAF}'_e}{\sum \text{PAF}'_e} \times \text{Overall weighted PAF},$$

All statistical analyses were performed using R V.4.2.0 (R Foundation).

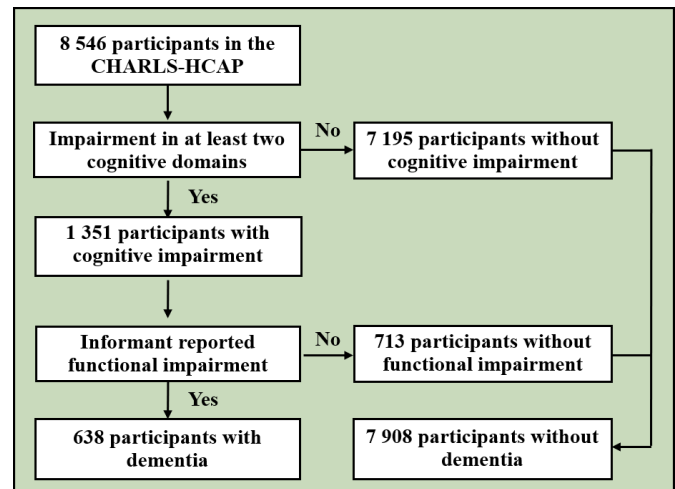


Figure 1 Procedure of dementia diagnosis in the China Health and Retirement Longitudinal Study-Harmonized Cognitive Assessment Protocol (CHARLS-HCAP), 2018.

RESULTS

Among the 8 546 participants of this study (figure 1), the weighted mean (SD) age was 69.0 (6.9) years; 49.8% were female and 51.9% were rural residents (online supplemental eTable 2).

Among the study participants, we identified 638 individuals with dementia, including 131 out of 2 826 participants aged 60–64 years, 146 out of 2 559 participants aged 65–69 years, 139 out of 1 561 participants aged 70–74 years, 99 out of 951 participants aged 75–79 years, and 123 out of 649 participants aged 80+ years. The weighted prevalence rate was 7.1% (95% CI: 6.5% to 7.6%), which increased persistently with age; the corresponding values were 4.5% for 60–64 years, 5.3% for 65–69 years, 7.7% for 70–74 years, 9.9% for 75–79 years and 16.1% for 80+ years (figure 2). The prevalence was higher in women (8.7%, 8.5%–8.9%) than in men (5.4%, 5.3%–5.6%) and in rural residents (9.8%, 9.5%–10.0%) than in urban residents (4.2%, 4.0%–4.3%). The OR was 1.68 (95% CI: 1.37 to 2.05) for women versus men and 2.61 (95% CI: 2.07 to 3.30) for rural versus urban residents.

The PAFs are reported in table 1. The overall weighted PAF for the risk factors studied was 60.1%. Less education had the largest PAF (11.3%), followed by physical inactivity (7.6%), hypertension (7.4%), air pollution (6.9%) and hearing loss (6.4%). Other risk factors all had a weighted PAF $<5\%$.

DISCUSSION

In this national survey among Chinese adults aged 60 and above, the weighted prevalence of dementia was 7.1% (~17 million cases in 241 million older adults). The prevalence was higher in women and rural residents. Our estimates are slightly higher than previously reported estimates in the Chinese population (~6%),^{5,6} potentially due to differences in diagnostic criteria. Featuring a broad sample from 28 provinces, this study also included

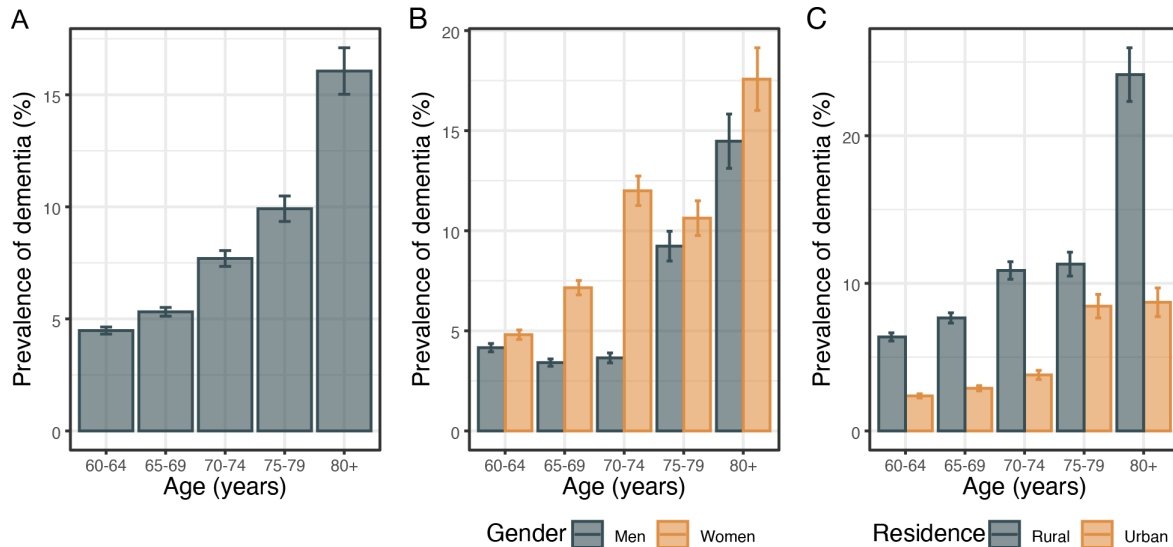


Figure 2 Weighted prevalence and 95% CI of dementia by age (A), gender (B) and residence (C) in the China Health and Retirement Longitudinal Study-Harmonized Cognitive Assessment Protocol, 2018.

more under-represented groups, which may inform the prevention of dementia.

We also reported that 60.1% of the dementia cases could be attributable to 12 identified risk factors, which sheds light on potentially preventing dementia cases by eliminating the risk factors. In two previous studies in China,^{14 15} the PAFs of certain dementia risk factors were both ~55%. We extended the literature by incorporating

more risk factors and providing more representative estimates. While improved educational levels and better access to medical care may predict a lower incidence of dementia in the future, the ageing population in China means that the burden of dementia is expected to continue to rise. Therefore, effective preventive strategies are urgently needed. Our findings imply that a large number of dementia cases could be delayed or prevented

Table 1 Population attributable fractions of 12 modifiable risk factors in CHARLS 2018 (N=19 751)

Risk factor	Relative risk* for dementia (95% CI)	Risk factor prevalence (%)	Community (%)	Unweighted PAF (%)	Weighted PAF (%)
Early-life†					
Less education	1.6 (1.3 to 2.0)	66.1	34.4	28.4	11.3
Midlife‡					
Traumatic brain injury	1.8 (1.5 to 2.2)	5.5	1.3	4.2	1.7
Hypertension	1.6 (1.2 to 2.2)	38.2	88.2	18.6	7.4
Excessive alcohol (>21 units/week)	1.2 (1.1 to 2.3)	11.5	10.4	2.2	0.9
Obesity	1.6 (1.3 to 1.9)	17.5	8.2	9.5	3.8
Hearing loss	1.9 (1.4 to 2.7)	21.3	92.8	16.1	6.4
Late-life§					
Diabetes	1.5 (1.3 to 1.8)	20.4	10.1	9.3	3.7
Air pollution (PM _{2.5} ≥35 µg/m ³)	1.3 (1.2 to 1.4)	69.5	79.9	17.3	6.9
Smoking	1.6 (1.2 to 2.2)	23.1	72.6	12.2	4.8
Depression	1.9 (1.6 to 2.3)	7.3	1.1	6.2	2.5
Social isolation	1.6 (1.3 to 1.9)	14.2	1.3	7.9	3.1
Physical inactivity	1.4 (1.2 to 1.7)	59.4	99.3	19.2	7.6
Overall	–	–	–	–	60.1

*Synthesised by previous meta-analyses.

†Calculated from overall participants in CHARLS 2018.

‡Calculated from participants aged 45–64 years in CHARLS 2018.

§Calculated from participants aged 65 years or above in CHARLS 2018.

CHARLS, China Health and Retirement Longitudinal Study; CI, confidence interval; PAF, population attributable fraction.

by adopting risk factor-targeted preventive strategies in public health practice.

The strengths of this study include a relatively large sample size, an established diagnostic model and a standardised protocol for cognitive assessments. However, our study has several limitations. First, although comprehensive, the neuropsychological battery may result in misclassifications compared with the gold-standard diagnoses in clinical settings, and dementia subtypes could not be assessed. Second, survival bias and selection bias may still be possible, as adults who had a high risk of mortality or did not provide data may be under-represented. Third, we could not include more emerging risk factors such as diet because CHARLS did not assess these factors, and the relative risks were generated by previous studies not exclusively in the Chinese population. Furthermore, the association of some risk factors with dementia might not be causal. For example, although less education is a well-established risk factor of dementia, participants' performance in the cognitive assessment might be affected by their educational level. Therefore, the PAFs might be overestimated, and future studies are needed to validate our findings.

CONCLUSIONS

From this nationally representative cross-sectional study in 2018, we estimated that 7.1% of adults aged 60–108 years in China had dementia and that 60.1% of the cases could be attributable to 12 socioeconomic, lifestyle and clinical risk factors. The leading attributable factors included less education, physical inactivity and hypertension. In conclusion, these findings highlight the heavy burden of dementia in China and the importance of effective prevention strategies in an ageing society.

Contributors Concept and design: HC, YH, CY. Acquisition, analysis or interpretation of data: HC, YH, CY. Drafting of the manuscript: HC, YH. Critical revision of the manuscript for important intellectual content: YH, XL, XX, YM, HW, CY.

Funding The study was supported by the National Key R&D Program of China (2022YFC2010106) and the Chinese Nutrition Society (CNS-NNSRG2021-61). The funder had no role in the design and conduct of the study; collection, management, analysis and interpretation of the data; preparation, review or approval of the manuscript; and decision to submit the manuscript for publication.

Competing interests None declared.

Patient consent for publication Obtained.

Ethics approval This study involves human participants. The CHARLS-HCAP obtained ethical approval from the Institutional Review Board (IRB) of Peking University (IRB00001052-11015) and participants provided written informed consent. Use of data for the current study was approved by the IRB of Zhejiang University School of Public Health (ZGL202112-4). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data for the China Health and Retirement Longitudinal Study and the Harmonized Cognitive Assessment Protocol are publicly available at <http://charls.pku.edu.cn/>.

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ORCID iD

Hui Chen <http://orcid.org/0000-0003-2866-7811>

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Hui Chen is a doctoral student at the School of Public Health, Zhejiang University School of Medicine in China. He obtained a bachelor's degree from Zhejiang University in 2021. His main research interests include nutritional cognitive epidemiology and the risk factors and the prevention of dementia using data from large-scale cohort studies across countries.



Yuhui Huang is a doctoral student at the School of Public Health, Zhejiang University School of Medicine in China. He obtained a bachelor's degree from Southeast University, China, in 2020. His main research interests include nutritional cognitive epidemiology and the risk factors and predictors of dementia.