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Original Study

Chronic Disease in China: Geographic and Socioeconomic Determinants Among Persons Aged 60 and Older

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ABSTRACT

Objectives: This study aimed to reveal the epidemic characteristics of chronic diseases among the Chinese older population and provide empirical strategies for the prevention and management of chronic diseases in the seniors in China.
Design: A national cross-sectional study.
Setting and Participants: A total of 224,640 Chinese residents aged 60 and older were invited, and 222,179 (98.9%) participated in our survey.
Methods: Standardized questionnaires were used to collect socioeconomic information and self-reported physician-diagnosed chronic diseases. The associations between individual socioeconomic status and chronic diseases were estimated using generalized linear mixed-effects models.
Results: The national prevalence of any chronic diseases was 81.1% (95% CI 80.9–81.2), representing 179.9 million Chinese older adults. The prevalence increased with aging and peaked at 80 to 84 years old (87.2, 95% CI 86.7–87.7), this is consistent with studies in developing countries. Women (84.2, 84.0–84.4), rural residents (82.6, 82.4–82.8), and ethnic minorities (82.2, 81.5–82.8) had a higher prevalence than men (77.7, 77.4–77.9), urban residents (79.7, 79.5–79.9), and people of Han ethnicity (81.0, 80.8–81.2), respectively. For provincial prevalence, Tibet had the highest prevalence of chronic diseases (91.8, 91.5–92.0), and Fujian had the lowest (72.7, 72.5–72.9). The absolute differences between the highest and lowest provinces for the specific chronic condition ranged from 2.78% for cancer to 36.3% for cardiovascular diseases.
Conclusions and Implications: Chronic diseases were highly prevalent among older adults in China and varied geographically. Advanced socioeconomic status appeared to have double-edged impacts on the prevalence of chronic diseases. Our findings support that reducing gender and geographic disparities should be prioritized in China's chronic disease prevention and management, and an affordable long-term care services system for older adults should be established urgently in China.

China, the most populated country, is aging at an unprecedented rate.[1] Approximately 1 in 5 people in China was older than 60 in 2020. This figure is projected to increase to 1 in 3 by 2050,[2,3] contributing 25% of the world's population of older people.[4] Chronic diseases are the major cause of premature adult deaths globally, and older adults are more susceptible to most chronic diseases than younger adults.[5,6] According to the World Health Organization's global report, 80% of chronic disease deaths occur in low- and middle-income countries.[7] In China, although an epidemic of chronic diseases has been implicated

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for many years, no studies have adequately quantified their prevalence among this high-risk population, both nationally and subnationally. To date, the 2 largest national surveys of the middle-aged and older Chinese adults, the China Health and Retirement Longitudinal Study[8] and SAGE (the World Health Organization Study on Global Aging and adult health),[9] included only 17,708 (ages ≥ 45 years) and 13,367 (ages ≥50 years) participants, respectively. In the context of China's huge and diverse populations, these samples are unlikely to be sufficient and representative to benchmark the national prevalence of chronic diseases for older adults, especially the "oldest-old" people and subgroups by gender, residence, and ethnicity. The Global Burden of Disease (GBD) provides an alternative approach to estimate the age-specific prevalences by synthesizing available metadata, but given the paucity of data sources for older adults in China,[10] the reliability of this approach warrants external validation.

To address these evidence gaps, we present detailed analyses of the fourth national Urban and Rural Elderly Population (UREP) survey. We aimed to estimate the national and subnational prevalences of common chronic diseases among older Chinese adults, assess how prevalences might vary by age, gender, urbanization, ethnicity, and geographic regions, and investigate the impact of socioeconomic development on chronic disease prevalence.

Methods

Data Source and Sampling Method

This study used data from the fourth UREP study that was conducted in 2015. UREP is a national periodic survey that has been performed every 5 years since 2000. It was launched by the China National Committee on Aging (CNCA).[11]

The fourth UREP survey used a multistage stratified cluster sampling procedure to recruit a nationally representative sample of the entire Chinese population aged 60 years or older. The survey stratified the mainland of China into 31 provinces (autonomous regions or municipalities), and conducted a 3-stage cluster sampling based on the established administrative divisions of China. In stage 1, a random sample of cities or counties (primary sampling units) was selected. In stage 2, a random sample of streets or towns (secondary sampling units) was selected, and in stage 3, a random sample of communities or villages (tertiary sampling units) was selected. A probability proportional to size sampling approach[12] was used to account for the different sampling unit sizes within each stage (Figure 1). The survey then randomly sampled individuals aged 60 years or older from the tertiary sampling unit. The total sample size was targeted to be consistent with the recommended requirements for representation and precision in multistage stratified cluster survey designs (Supplementary Methods).

The UREP survey was approved by the Ethics Committee of the Chinese National Bureau of Statistics. Oral informed consent was obtained from all participants before the interview. The CNCA approved this study and permission was then granted to use these data for the secondary analysis reported here.

Statistical Analysis

UREP is a self-weighted survey in which all individuals are equally weighed in the study design. Therefore, no additional weightings were needed for the analyses.[13] We compared the age-gender pyramid of the sampled population with that of the total population based on the 2015 China Statistical Yearbook. We calculated the national prevalence of any and each chronic disease for the overall population and subgroups stratified by age (5 to 90 years in 5-year bands), gender (male or female), urbanization (urban or rural), ethnic subgroups (Han, the largest ethnic group indigenous to China or ethnic minorities). We

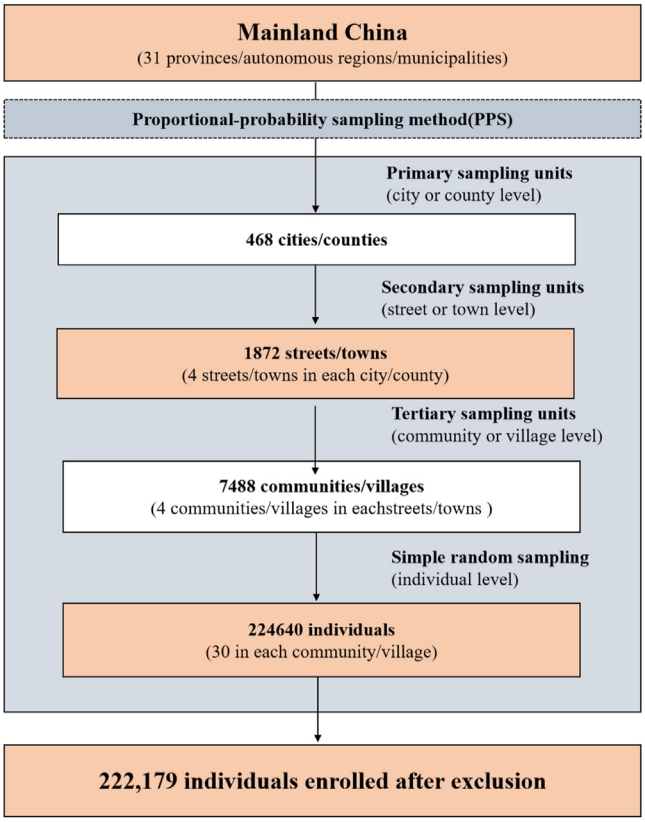

Fig. 1. The national UREP study profile.

calculated age-gender standardized prevalences for each of 31 provinces using the 2015 national population as the reference, and quantified the geographic variation in prevalence using absolute difference (the highest prevalence minus the lowest prevalence) and relative ratio (the highest prevalence divided by the lowest prevalence).

Considering the hierarchical data structure, we estimated the associations of sociodemographic factors with each chronic condition using generalized linear mixed-effects models (GLMM).[14] We constructed a 3-level GLMM with the low-level variables (individual characteristics, fixed effects), a middle-level variable (an index of cities/counties, random effect) and a top-level variable (an index of provinces, random effect). We assumed a contextual effect beyond individual traits on the presence of chronic conditions and that people in the same city, county, or province would have similar unobserved characteristics. We simultaneously adjusted for age (60–64, 65–69, 70–74, 75–79, 80–84, 85–89, and ≥ 90 years), gender (men and women), urbanization (urban and rural), education attainment (illiterate, primary school, junior high school, and senior high school or above), annual household income (<10,000, 10,000–50,000, 50,001–100,000, and >100,000 yuan), marital status (married and single), ethnicity (Han and ethnic minority), and the number of children (0, 1, 2–4, and ≥5). The study presents results as odds ratios and considered $P \leq .05$ to be statistically significant. All statistical analyses were based on complete cases (without missing values for any study variables) using the statistical software package R version 4.0.3 (R Foundation for Statistical Computing).

Results

The fourth UREP sampling selected 222,700 individuals from 31 provinces to participate in the survey, of whom 222,179 (98.9%) had a completed questionnaire. The geographic distribution of primary

sample units is shown in Supplementary Figure 1. The population pyramid of the sampled individuals and the target population was generally comparable (Supplementary Figure 2). The median age was 68.0 years [interquartile range (IQR) 63.0–75.0], 47.8% were men, 47.9% lived in rural areas, and 6.2% belonged to ethnic minorities (Supplementary Table 1).

The national prevalence of any chronic disease among people aged 60 years and older was 81.1% (95% CI: 80.9–81.2). Women (84.2%, 95% CI: 84.0–84.4), rural residents (82.6%, 95% CI: 82.4–82.8), and ethnic minorities (82.2%, 95% CI: 81.5–82.8) had a higher prevalence of chronic disease than men (77.7%, 95% CI: 77.4–77.9), urban residents (79.7%, 95% CI: 79.5–79.9), and people of Han ethnicity (81.0%, 95% CI: 80.8–81.2), respectively. The estimated number of adults aged 60 years or older with any chronic disease was 179,927,603 (95% CI: 179,558,445–180,294,900). Among those, 9,656,335 (95% CI: 9,578,348–9,732,655) belonged to ethnic minorities (Table 1). The most prevalent chronic conditions were arthritis (43.7%, 95% CI: 43.5–43.9), hypertension (36.9%, 95% CI: 36.7–37.1), and cardiovascular diseases (26.0%, 95% CI: 25.8–26.2) (Supplementary Figure 3).

The prevalence of any chronic disease varied among provinces, in which provinces closer to each other had similar prevalences when compared with geographically distant ones. For example, the 5 adjacent inland provinces of Tibet (91.8%), Ningxia (88.7%), Gansu (88.5%), Inner Mongolia (87.9%), and Qinghai (87.6%) had the highest prevalence of any chronic disease, whereas coastal provinces such as Fujian (72.6%), Guangdong (74.8%), and Jiangsu (75.3%) had the lowest prevalence. However, Hainan, located on the south China coast, was an exception, with a high prevalence of 88.1% (Figure 2 & Supplementary Table 2).

Considerable geographical variation in prevalence was also observed for each specific chronic disease (Figure 3). For example, arthritis was most prevalent in Hainan (65.3%) and Gansu (63.4%), and least prevalent in Jiangsu (30.3%) and Shanghai (30.3%). Hypertension was most prevalent in Tibet (54.3%) and least prevalent in Guangxi (26.0%). Cardiovascular diseases were most prevalent in Jilin (48.6%), Inner Mongolia (45.2%), and Heilongjiang (43.5%), and least prevalent in Guangxi (12.2%), Guangdong (13.1%), and Guizhou (13.2%).

Most socioeconomic factors were associated with the prevalence of chronic diseases, but the effect direction differed by the disease type. For instance, older age was positively associated with most chronic conditions but negatively and linearly associated with gastric diseases. Women, compared with men, were associated with higher prevalences of cataracts, hypertension, diabetes, cardiovascular diseases, gastric diseases, and arthritis, but with lower prevalences of chronic lung diseases, asthma, and reproductive system diseases than women. Urbanization, education attainment, and income had similar patterns: more urbanization, extended education, and higher income were all negatively associated with cataracts, hypertension, diabetes, and cancer (Figure 4).

Discussion

Using large-scale data from a nationally and subnationally representative survey of adults aged 60 years and older, the present study showed that 81.1% of older adults had at least 1 common chronic disease in China, representing 179.9 million people in 2015. Women had a higher prevalence of chronic diseases than men, but the prevalences were comparable between urban and rural residents and between Han and ethnic minorities. At the provincial level, the chronic diseases prevalences varied substantially. In general, northwest China (less affluent regions) had higher prevalences than southeast China (more affluent regions). Individual advanced socioeconomic status (SES) (obtaining a higher education and having a higher income) was associated with a lower prevalence of all chronic diseases but higher prevalences for specific chronic conditions, including hypertension, cardiovascular diseases, diabetes, and cancer.

Male-Female, Urban-Rural, and Han-Ethnic Minorities Differences

Understanding subpopulations' difference in the prevalence of chronic diseases is crucial to inform health policies development, but the most available evidence is from Western countries.[15] In China, few studies have shown women had evident poorer health than men and suggested the inequality in individual incomes could largely explain this disparity.[16,17] The gender difference was also observed in our study, with women more susceptible to most chronic diseases, including arthritis, hypertension, and cardiovascular diseases. However, the disparity remained after controlling for socioeconomic factors, such as income, suggesting other sources of contributors. This is consistent with patterns in some Western countries.[18,19] Moreover, 2 respiratory diseases, such as asthma and chronic diseases, were less prevalent in women, which is likely due to the considerable difference in smoking rate between women and men in China.[20]

In contrast to the notable gender disparity, the differences between urban and rural residents and Han and minorities were less apparent. Since 2002, reducing the rural-urban gap in health outcomes has been a primary focus of the Chinese government's health reform, and significant improvements in insurance coverage and health services access have been made, especially for people living in rural areas.[21] Although the gap persists in some provinces,[22] our results showing minor differences nationally between urban and rural areas highlight phased achievements of the health reform. Data are scarce regarding ethnicity-related disparities in chronic diseases. One recent analysis of the China Survey of Social Change found that 39.5% of older Han Chinese and 29.6% of older ethnic minorities reported their health as

Table 1
National Prevalence of and the Number of People With Any Chronic Diseases in the Older Population in China in 2015

	Prevalence of Any Chronic Diseases (95% CI)	Number of People 60 y or Older in 2015 in China (Proportion, %)*	Number of People With Any Chronic Diseases (95% CI)
Overall	81.1 (80.9–81.2)	221,950,627 (100)	179,927,603 (179,558,445–180,294,900)
Gender			
Men	77.7 (77.4–77.9)	107,834,769 (48.6)	83,787,615 (83,464,111–84,003,285)
Women	84.2 (84.0–84.4)	114,115,793 (51.4)	96,085,497 (95,857,266–96,313,729)
Urbanization			
Urban	79.7 (79.5–79.9)	110,544,296 (49.8)	88,093,404 (87,833,586–88,351,547)
Rural	82.6 (82.4–82.8)	111,406,331 (50.2)	92,036,873 (91,775,037–92,296,624)
Ethnicity			
Han	81.0 (80.8–81.2)	165,840,757 (93.4)	134,322,828 (134,037,650–134,606,527)
Ethnic minorities	82.2 (81.5–82.8)	11,753,683 (6.6)	9,656,335 (9,578,348–9,732,655)

*The overall population and subgroups by urbanization were based on the 2015 China Statistical Yearbook. Sizes of the ethnic subgroups were based on the 2010 Chinese Population Census.

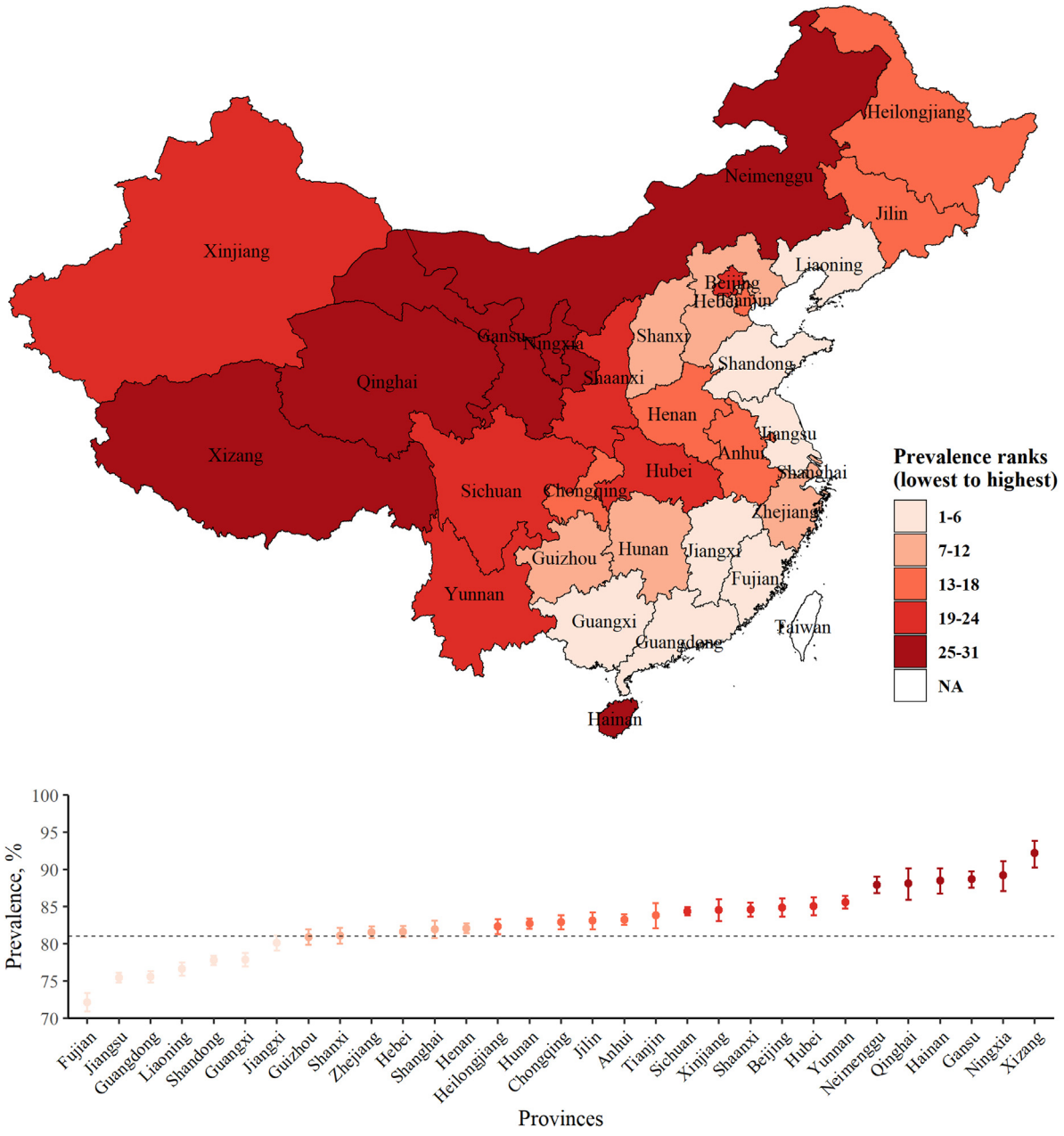

Fig. 2. Prevalence of any chronic condition in people older than 60 years in each province of mainland China, with provinces ranked from lowest (1) to highest (31) prevalence.

poor in Western China.[23] Given that the data used were collected in 2010, this finding may not be valid in the current context. In our study, even though some chronic diseases were more prevalent in the ethnic minorities, no statistically significant associations were observed between Han vs ethnic minorities and prevalence of chronic disease after adjustment for age and sex.

Geographic Variations

For the first time, our study presents a complete picture of geographic variations and spatial clusters in the prevalence of chronic diseases across all provinces of mainland China, which extends current knowledge in several ways. For instance, based on 12 cardiovascular risk factors, Li et al.[24] predicted that cardiovascular disease risk was highest in northeast China and relatively low in south China for people aged 35 to 75 years. Our study corroborated their predictions by showing that 37.1% and 14.8% of older adults had self-reported cardiovascular diseases in these 2 regions, respectively. The differences in eating habits and ambient temperature between these regions may be important reasons.[25] For example, Jilin province has been reported to have more meat consumption and lower external ambient temperature than other regions. Tang et al.[26] analyzed data from the China Health and Retirement Longitudinal Study and found that southwest China had the highest prevalence of arthritis among middle-aged and older people. More specifically, in our study, Yunnan, one of the provinces located in southwest China, had the highest prevalence of arthritis nationwide. Using the 2018 American Diabetes Association diagnostic criteria, previous studies estimated that the national prevalence of diabetes was approximately 11% and 20% in general adults and adults aged 60 years or older, respectively.[27,28]

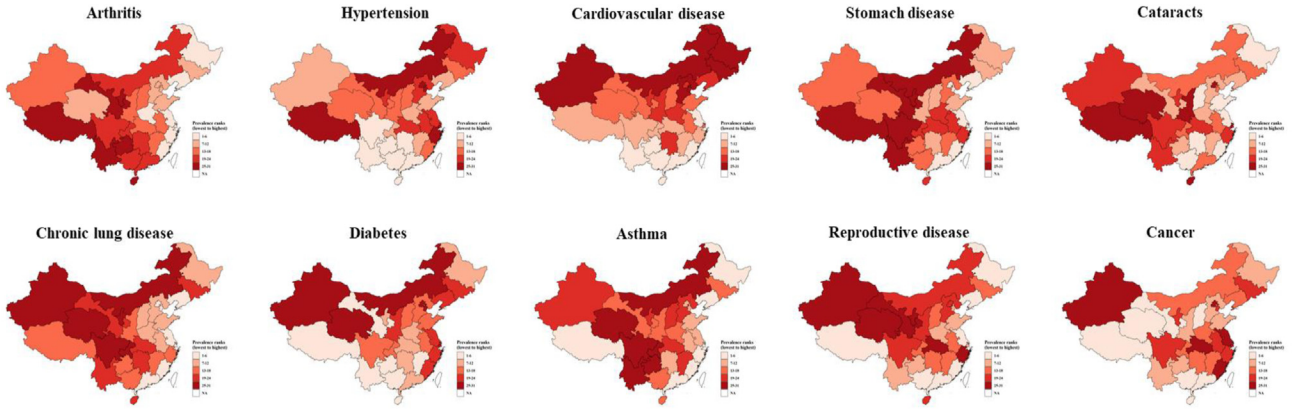

Fig. 3. Maps comparing the age-gender standardized prevalence (%) of the chronic conditions: arthritis, hypertension, cardiovascular disease, gastric disease, cataracts, chronic lung disease, diabetes, asthma, reproductive disease, and cancer among people older than 60 years in each province of mainland China.

However, only 9.4% of older adults self-reported diabetes in the survey, which partially confirmed a statement that the average rate of undiagnosed diabetes in China was approximately 50%.[29] For chronic respiratory diseases, Fang et al.[30] reported that spirometry-defined prevalence of chronic inflammatory lung disease was highest in southwest China for individuals aged 40 years or older. Similarly, both chronic lung diseases and asthma in our study were highly prevalent in the southwest regions. A recent systematic review[31] suggested that the highest prevalence of cataracts observed in south China was likely due to the greater levels of ultraviolet-B. Our study supports this hypothesis, with data showing that Hainan, China's southernmost province, had the second-highest prevalence of cataracts, and Tibet, the province with the most ultraviolet radiation exposure in China,[32] had the highest. Significant geographic differences in cancer incidence and mortality have been previously reported in China. In 2014, Chen et al.[33] analyzed the National Central Cancer Registry of China and suggested that unequal access to medical resources might contribute to this disparity. Our findings showing that Beijing and Shanghai, the 2 most developed provinces, had the highest prevalence of self-reported cancer, whereas Tibet and Gansu, the 2 least developed provinces, had the lowest prevalence, provide sound evidence on the argument. No study has examined the national profile of gastric disease epidemiology. A seeming geographic cluster in the prevalence of gastric diseases was notable in our study (most prevalent in northwest China, less prevalent in central China, and least prevalent in southwest China) and warrants more detailed research to investigate underlying drivers.

SES and Chronic Disease Prevalence

Since the implementation of China's reform and opening-up policies in 1978, China's gross domestic product has expanded by overall 30-fold.[34] At their younger ages, the contemporary older adults should be the first generation experiencing the economic boom and its

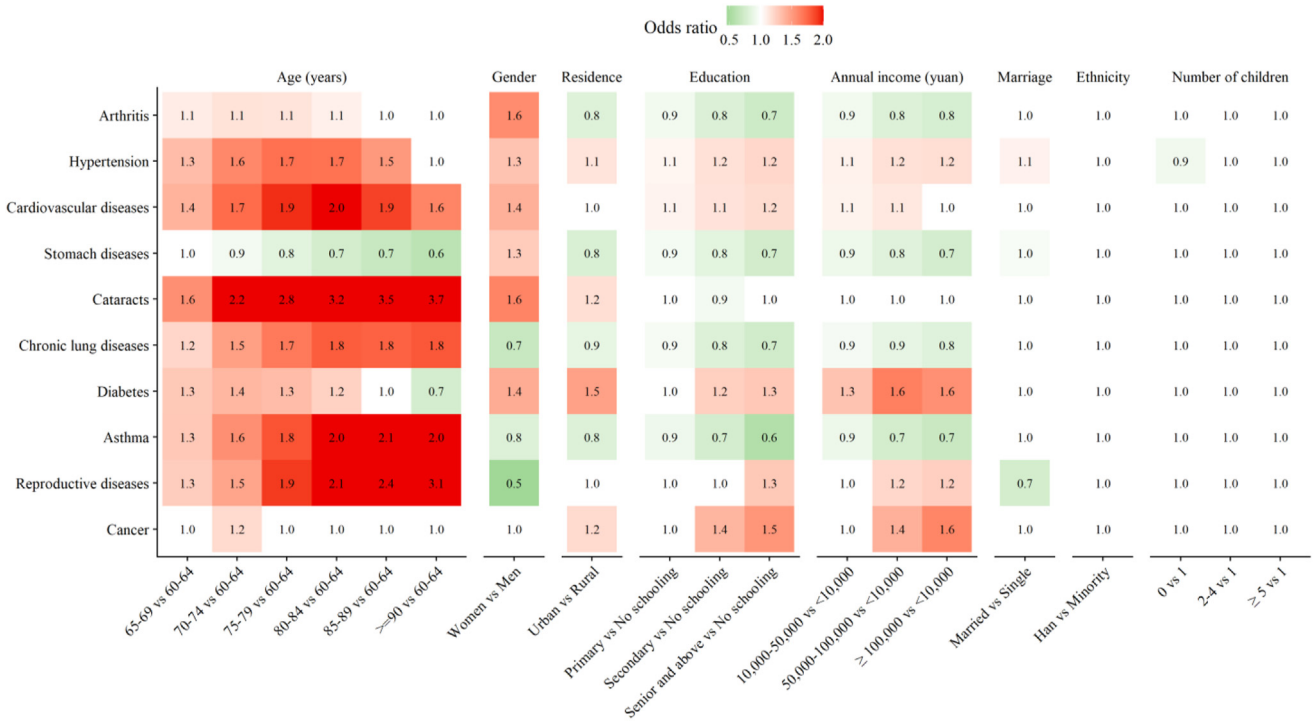

Fig. 4. Associations of individual socioeconomic factors with 10 specific chronic conditions in people 60 years and older in mainland China.

related lifestyle changes. Previous studies have shown that people in some low- and middle-income countries with higher education levels are more likely to get a professional job with a decent salary in more urbanized cities, resulting in changes in behavior associated with greater risk for chronic diseases, such as sedentary work, fatty diet, and overweight.[35] In contrast, in high-income countries, lower chronic disease prevalence was usually in persons with higher SES, suggesting the potential protective effects of SES through a healthier lifestyle, better living conditions, and improved health services.[36] In our study, advanced individual SES was consistently associated with higher prevalences of multiple chronic diseases, such as type 2 diabetes, hypertension, cardiovascular disease, and cancer, supporting a call for more active interventions to offset the health cost of urbanization and greater attention to the pitfall of "illnesses of affluence" in the coming waves of the older population in China.

Comparisons With GBD Estimates

Our estimates for prevalences of arthritis, asthma, and cancer are similar to those reported in the GBD (Supplementary Figure 4). Same chronic diseases, especially the symptomatic ones, such as cataracts and gastric diseases, consistently presented a higher prevalence in our study than the GBD did, and, inversely, diabetes showed a lower prevalence. However, there was a considerable divergence in the prevalence of cardiovascular and chronic lung diseases among adults aged ≥70 years between our and the GBD study. GBD used a Bayesian meta-regression method to estimate prevalence by gathering summary data from various sources, including systematic reviews, gray literature, and reports. Although different study methods might have contributed to this disagreement, a lack of information on people aged 70 and older in previous publications may have undermined the credibility of the GBD's estimates for this specific population. More research is needed to clarify this discrepancy, given that the GBD ranked those 2 chronic diseases as the top 2 leading causes of death and disability-adjusted life years in China.

Chronic Disease and Long-Term Care Needs

Our research showed that more than 80% of the residents aged ≥60 years suffered from at least 1 chronic disease in China, and ample evidence shows that chronic disease is a decisive risk factor for residents' life with disability, such as stroke, cardiovascular diseases, diabetes, hypertension, and Alzheimer's disease or related dementias.[37,38] As the population ages, the number of people with chronic disease-related disabilities also increases. It is estimated that there are 42.7 million (24%) older people (aged ≥60 years) with disabilities based on data from the 2010 census in China.[39] The estimated number of older people (aged ≥60 years) living with dementia was 9.6 million, which is projected to reach 23.3 million by 2030.[40] Thus, it is foreseeable that long-term care needs and services in China will be demanding in the coming years in parallel with the aging population and more prevalent chronic diseases.

Limitations

Our study has several limitations. First, although the UREP survey used a multistage stratified cluster sampling procedure to obtain a nationally and subnationally representative cohort of older adults, we cannot guarantee its representativeness beyond basic demographic indicators, such as age, gender, and residential areas. Second, this study was subjected to the underdiagnosis of cases inherent in self-reported data (poor access to services, therefore their health status is not known),[41] which may compromise the attempt to precisely quantify prevalence for each specific disease, particularly for the asymptomatic ones such as diabetes. However, given that the UREP was a centrally coordinated survey with stringent quality control for data collection, the underestimation is expected to be nondifferential across provinces and would have minimal impact on evaluating the geographic variation in prevalence. Third, our study did not allow for inferring trends in the prevalence of chronic diseases among the Chinese older persons. The former 3 UREP surveys, conducted in 2000, 2005, and 2010, were pilot programs that only included a small number of participants from a few provinces. Nevertheless, the fifth UREP survey is currently being conducted with the consistent protocols as the fourth, enabling future assessment of disease trends.

Conclusions and Implications

Chronic diseases were highly prevalent among older adults in China, particularly women, and varied geographically. Advanced SES appeared to have double-edged impacts on the prevalence of chronic diseases, depending on specific types. Our findings support that reducing gender and geographic disparities should be prioritized in China's chronic disease prevention and management, especially those conditions associated with economic development. In addition, China should strive to develop a more affordable health system for long-term care to meet the rapidly growing numbers of the older population requiring long-term care services.

In conclusion, UREP represents the largest survey of the older population of China ever conducted. It provides up-to-date evidence for national health care planning and preventive efforts in China. Using UREP data, we have shown that chronic conditions were highly prevalent among older Chinese adults. Their prevalence varied significantly by gender and geographic region. Economic development has had both positive and negative effects on prevalence, depending on the specific chronic condition. These findings call for prioritized national strategies to prevent further escalation of gender differences and geographic variations in prevalence of chronic diseases among the older population in China.

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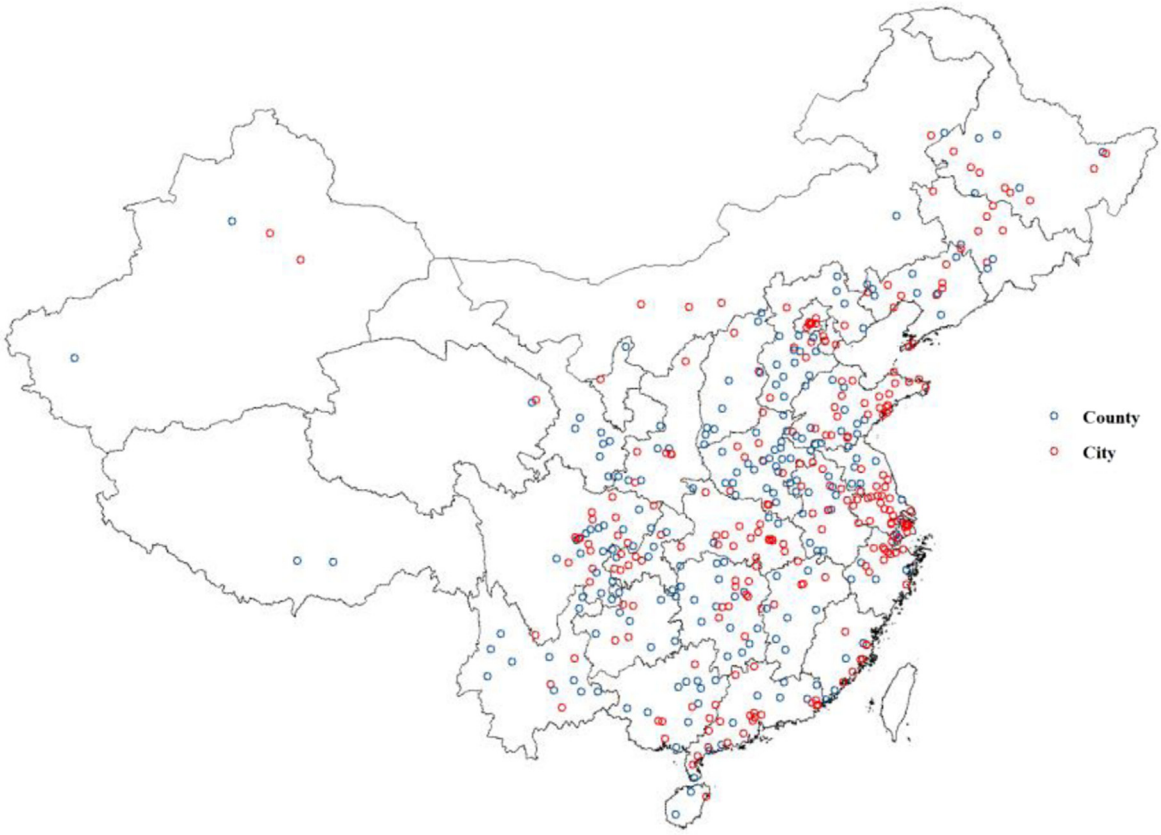
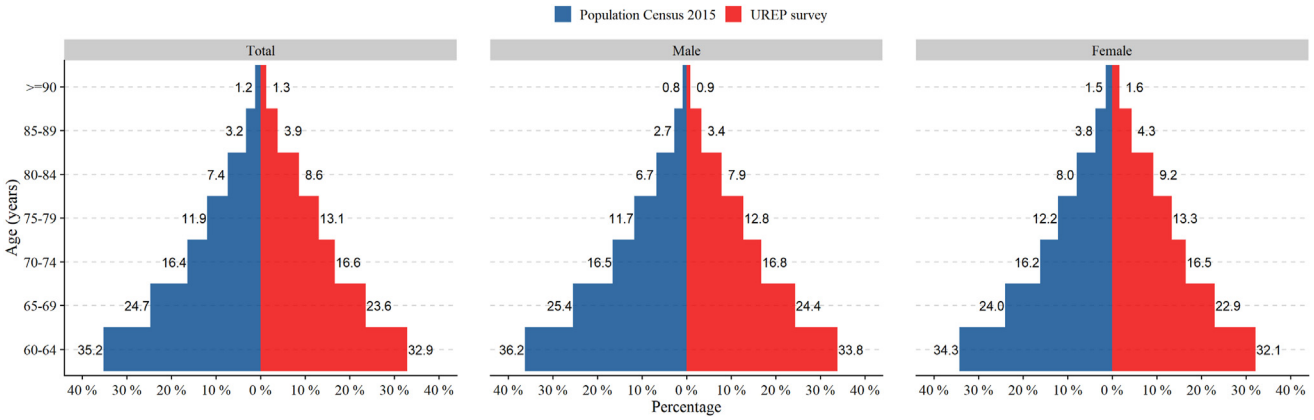
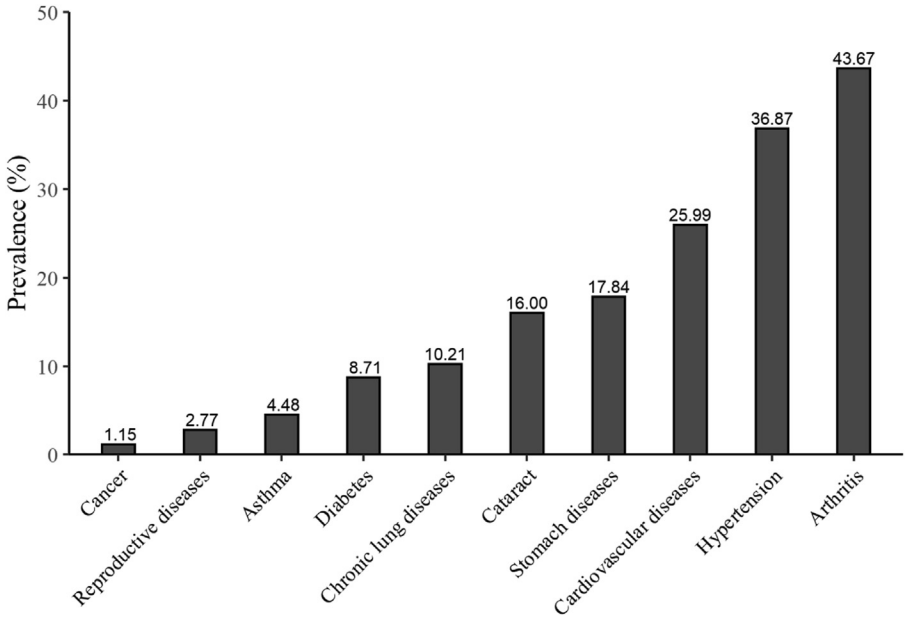


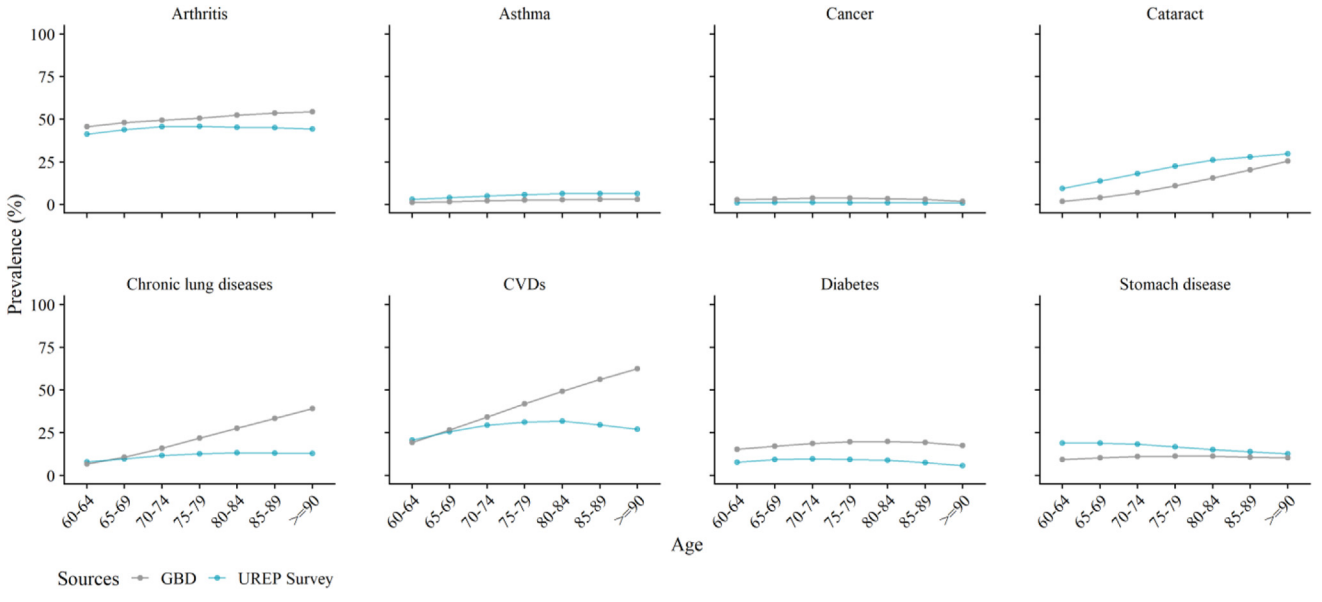
Supplementary Fig. 1. Geographic distribution of the national UREP survey primary sampling units (cities and counties) in China.



Supplementary Fig. 2. China's elderly population pyramid aged 60 years or older in 2015, comparing results from the 2015 Population Census (blue) with the sample population surveyed in the fourth national UREP survey (red).



Supplementary Fig. 3. Prevalence of the 10 studied chronic conditions in people 60 years and older in mainland China.



Supplementary Fig. 4. Comparison of chronic disease prevalence estimated in the GBD study and here using the fourth national UREP data. Data on reproductive diseases were not available in the GBD database.[42] Hypertension was classified as a risk factor in the GBD database. The specific codes used to extract each chronic disease in the GBD database were B.11.1 and B.11.2 for arthritis, B.3.3 for asthma, B.1 and D for cancer, B.10.1.1 and B.10.1.2 for cataracts, B.3.1 for chronic lung disease, B.2 for cardiovascular disease, B.8.1 for diabetes, and B.4.2 for stomach disease.

Supplementary Table 1
Characteristics of Participants in the Fourth National UREP Survey

	Overall	Gender		Region		Ethnicity	
		Men	Women	Rural	Urban	Han	Minority
Individuals interviewed	224,640						
Response rate (%)	98.9						
Respondents	222,179	106,141	116,038	106,519	115,660	208,253	13,677
Age, y (median [IQR])	68.00 [63.00, 75.00]	68.00 [63.00, 74.00]	68.00 [63.00, 76.00]	68.00 [63.00, 75.00]	68.00 [63.00, 76.00]	68.00 [63.00, 75.00]	68.00 [63.00, 75.00]
Gender (%)							
Men	106,141 (47.8)	…	…	52,102 (48.9)	54,039 (46.7)	99,549 (47.8)	6482 (47.4)
Women	116,038 (52.2)	…	…	54,417 (51.1)	61,621 (53.3)	10,8704 (52.2)	7195 (52.6)
Urbanization (%)							
Rural	106,519 (47.9)	52,102 (49.1)	54,417 (46.9)	…	…	97,779 (47.0)	8598 (62.9)
Urban	115,660 (52.1)	54,039 (50.9)	61,621 (53.1)	…	…	110,474 (53.0)	5079 (37.1)
Ethnicity (%)							
Han	208,253 (93.7)	99,549 (93.8)	108,704 (93.7)	97,779 (91.8)	110,474 (95.5)	…	…
Minority	13,677 (6.2)	6482 (6.1)	7195 (6.2)	8598 (8.1)	5079 (4.4)	…	…
Missingness	249 (0.1)	110 (0.1)	139 (0.1)	142 (0.1)	107 (0.1)	…	…
Education (%)							
Illiterate	65,274 (29.4)	15,322 (14.4)	49,952 (43.0)	39,861 (37.4)	25,413 (22.0)	60,524 (29.1)	4680 (34.2)
Primary school	91,795 (41.3)	48,624 (45.8)	43,171 (37.2)	49,559 (46.5)	42,236 (36.5)	85,869 (41.2)	5823 (42.6)
Secondary school	41,769 (18.8)	26,966 (25.4)	14,803 (12.8)	14,127 (13.3)	27,642 (23.9)	39,662 (19.0)	2077 (15.2)
High school or above	22,607 (10.2)	14,877 (14.0)	7730 (6.7)	2559 (2.4)	20,048 (17.3)	21,560 (10.4)	1036 (7.6)
Missingness	734 (0.3)	352 (0.3)	382 (0.3)	413 (0.4)	321 (0.3)	638 (0.3)	61 (0.4)
Household Income, yuan, median [IQR]	2.50 [1.00, 5.00]	2.50 [1.00, 5.00]	2.50 [1.00, 5.00]	1.50 [0.72, 3.00]	4.00 [2.00, 6.50]	2.50 [1.00, 5.00]	2.00 [1.00, 4.00]
Marriage (%)							
Married	157,710 (71.0)	84,963 (80.0)	72,747 (62.7)	73,856 (69.3)	83,854 (72.5)	148,566 (71.3)	8994 (65.8)
Single	61,062 (27.5)	19,552 (18.4)	41,510 (35.8)	30,659 (28.8)	30,403 (26.3)	56,593 (27.2)	4402 (32.2)
Missing	3407 (1.5)	1626 (1.5)	1781 (1.5)	2004 (1.9)	1403 (1.2)	3094 (1.5)	281 (2.1)
Number of children, median [IQR]	2.00 [2.00, 3.00]	2.00 [2.00, 3.00]	2.00 [2.00, 3.00]	2.00 [2.00, 3.00]	2.00 [1.00, 3.00]	2.00 [2.00, 3.00]	2.00 [2.00, 3.00]

"…" means not available.

Supplementary Table 2
Age-Gender Standardized Prevalence of All Chronic Conditions in People Aged 60 Years and Older in the 31 Provinces of Mainland China

Provinces	Regions	All Chronic Diseases	Arthritis	Hypertension	Cardiovascular Diseases	Gastric Diseases	Cataract	Chronic Lung Diseases	Diabetes	Asthma	Reproductive Diseases	Cancer
Anhui	East	83.2	44.2	41.0	26.4	20.1	17.0	9.6	8.3	4.2	2.7	1.3
Beijing	North	84.0	38.7	50.5	34.4	12.1	25.1	7.3	20.6	3.5	4.9	2.7
Chongqing	Southwest	82.9	48.7	33.3	23.2	22.5	15.9	16.0	8.7	8.0	2.8	1.1
Fujian	East	72.7	35.5	36.6	15.5	11.3	13.9	5.7	11.2	2.6	1.7	1.3
Gansu	Northwest	88.6	63.3	37.7	27.7	28.1	15.2	15.8	6.1	5.0	5.4	0.6
Guangdong	South	74.8	48.4	29.1	13.1	11.5	16.3	6.6	6.3	2.1	1.5	0.8
Guangxi	South	77.5	52.4	26.1	12.2	18.6	12.8	9.6	3.4	4.5	1.4	0.6
Guizhou	Southwest	80.9	57.2	28.0	13.3	19.2	14.2	10.3	5.2	5.9	2.2	0.8
Hainan	South	88.2	65.3	28.5	19.1	22.3	25.9	11.6	4.1	4.4	3.0	0.4
Hebei	North	82.2	39.2	43.6	36.3	18.1	14.0	8.2	9.4	5.3	2.8	0.9
Heilongjiang	Northeast	82.8	31.2	40.1	43.6	17.4	12.6	8.2	8.2	3.3	1.1	1.0
Henan	Central	82.4	38.3	35.6	34.5	19.4	14.1	8.8	7.6	4.2	2.5	1.1
Hubei	Central	85.0	48.1	39.7	25.5	21.2	19.8	11.9	7.9	5.7	6.6	1.4
Hunan	Central	82.4	50.0	32.9	28.4	17.0	13.8	12.7	7.7	4.2	2.6	1.2
Jiangsu	East	75.3	30.2	41.3	17.9	13.8	13.7	7.2	9.5	3.5	1.7	1.8
Jiangxi	East	80.2	44.7	34.3	21.2	19.1	14.4	10.9	6.1	5.6	2.6	1.1
Jilin	Northeast	83.7	39.0	36.8	48.6	17.5	16.7	11.6	9.5	4.6	2.6	1.2
Liaoning	Northeast	76.8	34.0	36.0	33.4	12.8	15.0	7.4	10.1	3.4	1.8	1.1
Neimenggu	North	87.9	49.9	46.7	45.3	24.3	17.3	16.5	12.3	6.8	3.9	1.1
Ningxia	Northwest	88.7	58.0	41.9	34.1	25.1	18.9	17.3	7.9	5.3	6.5	1.2
Qinghai	Northwest	87.6	41.5	39.2	28.3	18.2	23.0	16.1	12.0	6.6	5.3	0.7
Shaanxi	Northwest	84.2	42.4	39.1	35.6	17.4	20.9	10.2	9.6	4.8	4.5	0.8
Shandong	East	77.9	40.5	35.3	26.1	14.7	12.5	7.6	8.9	3.7	1.9	0.9
Shanghai	East	81.9	30.3	48.1	27.5	11.1	26.2	7.2	16.2	2.4	2.5	2.9
Shanxi	North	81.4	43.8	39.5	27.2	16.9	12.8	9.5	8.7	5.1	2.7	0.7
Sichuan	Southwest	84.3	51.4	33.1	22.1	24.3	17.8	16.5	8.9	7.5	3.6	1.3
Tianjin	North	83.6	41.2	46.6	42.4	12.5	17.0	6.5	17.2	3.5	1.9	1.3
Xinjiang	Northwest	83.9	42.3	35.9	36.6	18.4	17.9	17.8	12.8	5.9	9.8	1.8
Xizang	Southwest	91.8	59.0	54.3	25.2	31.0	32.2	11.2	1.0	3.3	0.4	0.2
Yunnan	Southwest	85.5	63.2	27.3	15.7	23.6	18.4	14.0	5.2	6.2	2.1	1.0
Zhejiang	East	81.7	37.7	46.5	22.0	20.3	20.5	10.6	10.7	2.3	4.9	1.3
AD		19.16	35.01	28.21	36.39	19.88	19.70	12.06	19.64	5.99	9.39	2.78
RD		1.26	2.15	2.08	3.97	2.79	2.58	3.10	21.39	3.91	23.48	18.88

All values except RD are percentages.
AD, absolute difference; RD, relative difference.

Supplementary Methods

I. Quality Control Methods:

1. Controlled the length of the questionnaire to 30 to 60 minutes, and conducted a presurvey to ensure that the reliability and validity of the questionnaire were within a reasonable range.
2. Recruited reliable interviewers, and ensured each interviewer underwent rigorous training.
3. Compiled an investigator manual to explain the indicators in detail, and provided strict training for interviewers.
4. After data collection, we reviewed the questionnaire, including effectiveness review, consistency review, and data distribution review.
5. If a sampled individual was unwilling to participate in the survey or was not at home, the interviewer tried to follow-up with the person up to 3 times. If the respondent still refused to be interviewed or could not be contacted, the investigators considered replacing them according to the selected candidates in advance. Much other additional work, such as advertising, informing, and explanation, was done to minimize the no response rate.

II. Standardized Survey Procedures:

1. To conduct an effective survey, the investigator should reach out to the older adults interviewed and make an appointment in advance following the sampling list of older adults' roster in the selected community (village/household). If the sampled older adults refuse to be interviewed, die, move, cannot be contacted (contacted more than 3 times), are long-term residents in the field, or live in a distant nursing home (outside the county/district), it is allowed to replace the interviewee and to re-select from the shortlist sequentially.
2. Before door-to-door visits, the investigator should prepare the materials needed for the survey including the survey certificate, ID card, questionnaire, investigator brochure, signature pen, cell phone, etc., and fill out the questionnaire cover and other information.
3. After stepping into the household, the investigator should read out the survey guideline and fill out the first 3 items of Part A, and then officially start the survey.
4. After the survey, the investigator should carefully review the questionnaire to ensure that there are no missing items and errors, then sign and fill in the contact number.
5. After all the questionnaires are completed, they will be handed over to the supervisors at the township level in a unified manner.

III. The Questionnaire Template:

Questions	Options
Gender of the older individual being interviewed (filled in by the investigator)	1: Male, 0: Female
Date of birth of the older individual being interviewed (filled in by the investigator according to interviewee's ID card)	Year-Month
What is your registered residence? (filled in by the investigator according to the interviewee's ID card)	1: Agricultural, 2: Non-agricultural, 3: Unified household registration
What is your ethnicity? (filled in by the investigator according to the interviewee's ID card)	1: Han, 2: Zhuang, 3: Hui, 4: Man, 5: Uygur, 6: Miao, 7: Yi, 8: Tujia, 9: Tibetan, 10: Mongolian, 11: Others
What is your highest education level?	1: No schooling (including literacy class), 2: Primary school (including private school), 3: Junior high school, 4: Senior high school/technical secondary school/vocational high school, 5: Junior college, 6: Bachelor's degree or above
What is your marital status	1: Married, 2: Widowed, 3: Divorced, 4:Single
What is your annual household income in 2014?	
What is the number of children in your family?	
Do you have the following chronic diseases?	1: cataract/glaucoma, 2: hypertension, 3: diabetes, 4: cardiovascular disease (coronary heart disease, angina, or stroke), 5: gastric diseases, 6: arthritis (osteoporosis, osteoarthritis, rheumatoid arthritis, or intervertebral disc disease), 7: chronic lung diseases (chronic obstructive pulmonary disease, tracheitis, or emphysema), 8: asthma, 9: cancer, 10: reproductive system diseases, 11: others, 12: none