



# OPEN An investigation into the health status of the elderly population in China and the obstacles to achieving healthy aging

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The phenomenon of population aging in China has evolved into an irreversible trend. The state places significant emphasis on the health-related initiatives for the elderly and has implemented pertinent policies. This study aims to identify the primary health issues affecting the elderly population in China, ascertain the key risk factors influencing their health, and offer a scientific foundation for the government to develop ongoing policies and strategies, as well as to allocate health resources efficiently. This study was conducted utilizing the nationwide surveillance and survey data collected by the National Center for Chronic and Noncommunicable Disease Control and Prevention, China. Descriptive statistics were employed to delineate the mortality rates, disease burden, prevalence of significant risk factors for chronic illnesses, as well as the incidence of disabilities and impairments among the elderly population in China. In 2019, the mortality rate of chronic non-communicable diseases among the elderly population in China aged 60 years and above was 31,238 per 100,000 individuals, representing 93.9% of all deaths. The disability-adjusted life years for males in the elderly population aged 60 years and above in 2019 totaled 103,850,000 person-years, while females accounted for 86,404,000 person-years. Among the elderly population in China, the top three diseases contributing to the highest Disability-Adjusted Life Years (DALYs) were stroke (19.202 million DALYs, representing 18.5% of the total DALYs), ischemic heart disease (13.895 million DALYs, 13.4%), and chronic obstructive pulmonary disease (COPD; 9.453 million DALYs, 9.1%). The primary risk factors associated with chronic diseases among the elderly population in China include inadequate consumption of fruits and vegetables, excessive intake of red meat, lack of physical activity, smoking, alcohol consumption, and being overweight or obese. There exist variations among genders, urban and rural areas, and regions. In 2015, the disability rate for activities of daily living (ADL) was notably high among the elderly population in China, reaching 19.4%. The prevalence of dysfunctions such as depressive symptoms, sleep disorders, and hearing loss is substantial. The prevalence of osteoporosis among the elderly in China is concerning. While China has achieved some progress in enhancing the health of the elderly, the current scenario of population aging in China is grave, and the health of the elderly continues to encounter numerous challenges. The prevalence of chronic diseases continues to be significant, with chronic conditions being the primary cause of mortality in the elderly population. Secondly, risk factors for chronic diseases persist among the elderly population, with a significant prevalence of smoking, alcohol consumption, and obesity. This issue is particularly serious in rural areas, showing an escalating trend that demands heightened attention. The prevalence of functional disorders among the elderly is notably high, and the issue of disability in this population segment is of significant concern. This study suggests five recommendations aimed at enhancing health-related policies and the health service system for the elderly, in response to the existing health challenges and demographic trends. The recommendations include creating an elderly-friendly environment, increasing government investment in elderly health, and addressing the aging population in China and so on to enhance the health outcomes of the elderly population in the country.

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Population aging is a significant trend in China's demographic changes and a fundamental national condition for an extended period<sup>1</sup>. Based on the findings of China's seventh population census, the population of individuals aged 60 and above in China has reached 260 million, representing 18.7 percent of the total population. Among this demographic, 190 million individuals, equivalent to 13.5 percent, are aged 65 and older. The percentage of individuals aged 65 and above in each of the 30 provinces in mainland China surpasses 7.0%, indicating that China has transitioned into an aging society<sup>2,3</sup>. In 2021, the proportion of individuals aged 65 and over in China's population has reached 14.2%, signifying a twofold increase from 7 to 14% over the last 21 years. The World Population Prospects 2022 report forecasts a significant increase in China's elderly population, aged 60 and above, during the first half of the twenty-first century. This demographic is expected to peak around 2050, reaching an estimated value of approximately 580 million individuals<sup>4,5</sup>. This trend not only means that the proportion of older persons in the total population has risen sharply, but will also pose even more serious challenges to social security, the distribution of health-care resources, and the old-age service system. In the future, how to address these challenges through effective policy and institutional reforms will be a major issue for the Chinese government and society<sup>6,7</sup>.

Meanwhile, many countries are confronting aging challenges, particularly Japan, South Korea, and several European nations<sup>8–10</sup>. These countries experienced aging earlier and have implemented a range of policies to address the associated issues. For instance, Japan, recognized as one of the first countries to enter a super-aged society, began addressing aging-related concerns as early as the 1990s through initiatives such as the long-term care insurance system. This provides valuable insights for other nations currently navigating similar aging challenges.

Population aging is expected to persist as a fundamental demographic trend in China for an extended period in the future. In reaction to this circumstance, the Chinese government has implemented a range of policies and initiatives, including the Healthy China Initiative (2019–2030), to proactively address the challenges posed by the aging population. These efforts aim to enhance the health and overall quality of life of the elderly, as well as to improve their well-being and access to services. Over the last three decades, there has been a notable enhancement in the health condition of the elderly population in China, attributed to the ongoing advancements in medical and healthcare services as well as the level of medical insurance coverage. As of 2019, the life expectancy of 60-year-olds in China stood at 21.3 years, aligning with the global average life expectancy. This marks a significant increase of 4.0 years compared to the figures recorded in 1990<sup>11,12</sup>.

While China has achieved some progress in addressing the issue of population aging, it still encounters significant challenges in proactively managing this irreversible demographic trend. Enhancing the well-being and inclusivity of the elderly remains a major challenge for China. One consequence of significant alterations in the population structure is an exponential rise in the incidence and prevalence of age-related diseases, including conditions such as cancer, chronic non-communicable diseases, and mental health disorders<sup>13–15</sup>. The existing literature in China has not provided a comprehensive report on the health status of older adults. Most studies tend to concentrate on a singular facet of the health status of elderly individuals. The findings from the China Longitudinal Health and Longevity Survey (CLHLS) indicate a correlation between age and the prevalence of disabilities in Chinese elderly individuals, particularly in activities of daily living (ADLs). The data reveals a progressive increase in disability rates with advancing age, starting at less than 5% in the 65–69 age bracket, escalating to 20% among those aged 80–84, and peaking at approximately 40% in the 90–94 age group<sup>16</sup>. This discovery underscores the necessity for older individuals to receive assistance with their daily activities and access to geriatric care services. A well-designed study that comprehensively reflects the overall health status of Chinese older adults in the context of population aging is urgently required.

Existing studies on the health status of elderly individuals in China often focus on limited aspects, such as mortality rates, disease burden, chronic disease risk factors, or functional impairments, typically confined to specific regions<sup>17–19</sup>. These fragmented approaches fail to provide a comprehensive and nationally representative understanding of the health challenges faced by the elderly population. Few studies have attempted to systematically analyze the multifaceted aspects of aging at the national level. Our research used data from a nationwide survey to comprehensively examine mortality rates, disease burden, chronic disease risk factors, and functional impairments among elderly individuals in China. This provides a more complete and nationally representative perspective on the health status of China's aging population, contributing valuable insights for public health strategies and resource allocation.

## Methods

### Study design and data sources

This study utilized the latest data obtained from surveillance or surveys conducted by the National Center for Chronic and Non-communicable Diseases Control and Prevention, China in recent years. Specifically, five data sources were included: the National Mortality Surveillance (2019), the provincial results of China from the 2019 Global Burden of Disease (GBD) study, the China Chronic Disease and Risk Factor Surveillance (CCDRFS; 2018), the Prevention and Intervention on Neurodegenerative Disease for the Elderly in China (PINDEC) program, and the China Osteoporosis Epidemiology Survey (2018), respectively.

The data concerning the causes of death among the elderly are sourced from the National Mortality Surveillance System (NMSS), which offers strong provincial representation through 605 death surveillance points across all 31 provinces, autonomous regions, and municipalities in mainland China. This study utilized data from the 2019 NMSS, which encompasses a population of over 300 million, representing 24% of the country's total population. Mortality rates and age-standardized mortality rates are utilized for assessing the incidence of deaths within the elderly population, with age subsections typically defined at five-year intervals<sup>20–22</sup>.

The data concerning the burden of disease among the elderly were acquired from the national and provincial levels in China from GBD 2019. The burden of disease data comprised a blend of cause-of-death information

sourced from the China National Disease Surveillance Points (DSP), the Chinese National Maternal and Child Health Surveillance System (MCHSS), the Chinese National Central Cancer Registry of China (NCCR), and the Chinese Center for Disease Control and Prevention (CDC) Network Direct Reporting Data, and systematically reviewed published and unpublished all-cause-of-death data sources from each province in China<sup>21</sup>. The burden of disease among the elderly was assessed by considering premature death in terms of years of life lost (YLL), disability in terms of years lived with disability (YLD), and the combined measure of disability-adjusted life years (DALY), where DALY is calculated as the sum of YLL and YLD<sup>23,24</sup>.

The data regarding the prevalence of chronic disease risk factors is sourced from the China Chronic Disease and Risk Factor Surveillance (CCDRFS). The surveillance encompasses 298 monitoring counties (districts) across 31 provinces (autonomous regions and municipalities directly under the central government). The survey focused on individuals who are permanent residents and are 18 years of age or older. The survey utilized a multi-stage random cluster sampling method, resulting in an effective sample size of 184,509<sup>25</sup>. In this study, a total of 74,426 individuals aged 60 years and above from the CCDRFS were selected for analysis. The sample sizes for males and females were 35,291 and 39,135, respectively. The sample sizes for urban and rural areas were 31,400 and 43,026, respectively. The sample sizes in the eastern, central, and western regions were 29,498, 22,223, and 22,706, respectively. The survey consisted of three parts: questionnaire, physical measurement and laboratory testing. The detailed study design and content have been reported previously<sup>26</sup>.

The data on functional impairment in elderly individuals were derived from the Prevention and Intervention on Neurodegenerative Disease for the Elderly in China (PINDEC) program. The study centers on Alzheimer's disease (AD) and Parkinson's disease (PD) and involves recruiting a cohort of elderly individuals from the community to administer initial surveys and subsequent follow-up assessments. The aim is to examine the present conditions and progression patterns of mortality rates, the prevalence of typical ailments, disability and cognitive decline, as well as the caregiving responsibilities and requirements among older community members<sup>27</sup>. The study included and analyzed a sample size of 38,533 Chinese elderly individuals for the indicator of incapacity in activities of daily living, 24,117 for self-reported constipation prevalence, 19,854 for depressive symptom prevalence, and 10,347 for current prevalence of hearing loss.

The findings concerning osteoporosis in the elderly were obtained from the China Osteoporosis Epidemiology Survey (2018). The survey encompassed 44 counties and districts in 11 provinces (municipalities directly under the central government) in China. The survey targeted permanent residents aged 20 years and older. Individuals aged 20–39 years were selected for investigating peak bone mass in the Chinese population, while those aged 40 years and above were chosen to examine the prevalence of osteoporosis. The survey was carried out using a method of stratified cluster random sampling, resulting in an effective sample size of 20,281 individuals. The study population consisted of elderly individuals aged 60 years and older, resulting in a final sample size of 7,555 participants. Among these, 3,302 were men and 4,253 were women. Additionally, the sample sizes for urban and rural areas were 4,263 and 3,292, respectively<sup>28</sup>.

All surveys were conducted in accordance with relevant guidelines and regulations. All investigations and their protocols were approved by NATIONAL CENTER FOR CHRONIC AND NONCOMMUNICABLE DISEASE CONTROL AND PREVENTION, CHINESE CENTER FOR DISEASE CONTROL AND PREVENTION, ETHICAL REVIEW COMMITTEE approval. Informed consent was obtained from the respondents for all surveys. All respondents signed an informed consent form at the time of the survey. All other information on data sources is described in the data sources section of the supplementary document.

## Definition of indicators

Death and burden of disease, major risk factors for chronic diseases, and dysfunctional conditions have been delineated based on definitions provided by the World Health Organization (WHO) and various standards and expert consensus. Details are outlined in the supplementary document.

## Statistical analysis

Mortality rates were estimated using a combination of direct data and model-based approaches. For regions or age groups with sparse data, Gaussian Process Regression (GPR) was employed to estimate mortality trends. For areas with sufficient data, we relied on national mortality statistics.

This study focuses on using GPR to summarize and analyze the burden of disease. GPR is a non-parametric Bayesian approach used to estimate continuous variables across age groups, regions, and time periods. In our study, GPR was used to estimate mortality rates and other health outcomes where direct data were sparse or incomplete. The key advantage of GPR is its ability to generate smooth trends by accounting for both observed data and uncertainty, thus avoiding overfitting.

The rates were computed utilizing sophisticated weighted data analysis techniques. A standardized population from the 2010 Sixth National Population Census was uniformly employed to adjust for biases in age, sex, and urban/rural distribution within both the sample and the overall population. All data analyses were conducted using SAS software (version 9.4, SAS Institute Inc., Cary, NC, USA). The methodology for estimating the relevant mortality rates, DALYs and risk factors is described in more detail in the statistical analysis section of the supplementary document.

## Results

### Mortality levels and disease burden of major chronic diseases among the elderly in China

Chronic diseases constitute the primary cause of mortality among the elderly population in China. In 2019, the mortality rate attributed to chronic non-communicable diseases in individuals aged 60 years and older in China was 3,123.8 per 100,000, representing 93.9% of all recorded deaths. Cardiovascular and cerebrovascular diseases (such as stroke and ischemic heart disease), malignant tumors (including lung, stomach, esophageal, colorectal,

and liver cancers), and chronic respiratory diseases rank as the three leading causes of mortality. Moreover, standardized mortality rates indicate a higher prevalence among men compared to women. The standardized mortality rate of chronic diseases among Chinese individuals aged 60 years and above exhibited a noticeable decline from 1990 to 2019, decreasing from 4876.3 per 100,000 to 3169.4 per 100,000. Among the mentioned conditions, mortality rates decreased for cardiovascular and cerebrovascular diseases, stroke, liver cancer, gastric cancer, respiratory diseases, and Parkinson's disease. Conversely, mortality rates exhibited an upward trend for ischemic heart disease, lung cancer, colorectal cancer, diabetes mellitus, and Alzheimer's disease (Table 1).

Disability-adjusted life years (DALYs) for the male population aged 60 years and older in 2019 totaled 103,850,000 DALYs. The top five diseases with the highest DALYs in this age group were stroke (19,202,000 DALYs, 18.5%), ischemic heart disease (13,895,000 DALYs, 13.4%), COPD (9,453,000 DALYs, 9.1%), lung cancer (7.963 million person-years, 7.7%), and stomach cancer (4.380 million person-years, 4.2%). In the elderly female population aged 60 years and above, DALYs totaled 86.404 million. Among these, the top five diseases with the highest DALYs were stroke (14.854 million, 17.2%), ischemic heart disease (11.124 million, 12.9%), COPD (7.572 million, 8.8%), Alzheimer's disease (3.538 million, 4.1%), and lung cancer (3.378 million, 4.2%). Lung cancer (3.371 million person-years, 3.9%). Compared to 2009, there was an increase in DALYs for most diseases among the elderly population of different genders. Specifically, there was a notable increase in DALYs for falls, hypertensive heart disease, and Alzheimer's disease in elderly males, with respective increases of 85.4%, 62.2%, and 51.1%. Additionally, there was a significant rise in DALYs for falls and depression among females, with increases of 89.6% and 61.8% respectively (Table 2).

### Prevalence of major risk factors for chronic diseases among the elderly in China

This study delineates the prevailing prevalence of significant risk factors for chronic diseases among the elderly population in China, focusing on aspects such as diet, physical activity, smoking, alcohol consumption, and body weight (Table 3). In the realm of dietary habits, the prevalence of inadequate consumption of vegetables and fruits, as well as excessive intake of red meat, was found to be higher among men compared to women. Conversely, the utilization of nutritional supplements was notably lower among men in comparison to women. Rural areas exhibited a higher prevalence of insufficient consumption of vegetables and fruits, as well as a lower prevalence of excessive red meat intake and utilization of nutritional supplements compared to urban areas. Moreover, the western regions demonstrated a higher prevalence of inadequate vegetable and fruit intake in comparison to the eastern and central regions. In terms of physical activity, higher rates of physical inactivity are observed among women, individuals residing in rural areas, and those in the central region. In terms of smoking habits, there is a notable gender disparity, with a significantly higher prevalence among men compared to women, with a ratio of 12.3 to 1. Additionally, smoking rates are slightly elevated in rural areas compared to urban areas and are more pronounced in the western regions in contrast to the eastern and central regions. Secondhand smoke exposure rates exhibit significant disparities, with higher prevalence among women compared to men, particularly elevated in rural areas in contrast to urban areas. The rates are comparable in the central and western regions but surpass those in the eastern region. Alcohol consumption exhibited a notable gender discrepancy, with men consuming significantly more than women, at a rate 4.7 times higher. Conversely, the prevalence of drinking in the past 30 days was similar in urban and rural areas, as well as among older adults residing in the Eastern, Central, and Western regions. In relation to body weight, females exhibit higher rates of overweight and obesity compared to males. Urban areas also demonstrate higher rates of overweight and obesity than rural areas. Specifically, the prevalence of overweight in the eastern region does not significantly differ from that in the central region but is notably higher than in the western region. Conversely, obesity rates in the eastern region are significantly elevated compared to the other two regions.

### Prevalence of disability and dysfunction among the elderly in China

The prevalence of disability and dysfunction among the elderly in China is illustrated in Table 4. In 2015, the prevalence of incapacity in performing activities of daily living (ADL) among the elderly population in China was approximately one-fifth. Women exhibited a significantly higher rate of incapacity compared to men, and the western region showed a higher prevalence than the central and eastern regions, respectively. The incidence of self-reported constipation was notably greater in women compared to men, and marginally higher in the central region in contrast to the western and eastern regions. In 2016, the prevalence of depressive symptoms was notably higher in women than in men, and it was higher in the western region compared to the eastern and central regions. Similarly, in 2018, the prevalence of sleep disorders was higher, with a significant difference between women and men, and it was more prevalent in the central region than in the eastern and western regions. Moreover, the prevalence of age-related hearing loss in the elderly population of China in 2020 was approximately 70%, with a significant predominance in men over women.

The prevalence of osteoporosis among the elderly population in China is notably high, with a significantly higher occurrence in women compared to men. Conversely, low bone mass is more prevalent in men than that in women. Additionally, both osteoporosis and low bone mass are more common in rural areas than that in urban areas in China.

### Conclusion

This study provides a thorough analysis of the health status of the elderly population in China, focusing on mortality rates, disease burden, prevalent factors contributing to chronic diseases, as well as disability and dysfunction among the elderly demographic. China has demonstrated notable advancements in elderly healthcare, leading to a continuous enhancement in the overall health status of the elderly population. Behavioral risk factors, such as diet and physical activity, have shown improvement. The current scenario of population aging in China is concerning, with the elderly facing numerous health challenges. Chronic diseases continue to

Diseases	Male				Age group mortality rate										Female	
	Total				Standardized mortality rate				Age group mortality rate						Total	
	Mortality rate	Standardized mortality rate	60–64	65–69	70–74	75–79	≥ 80	Mortality rate	Standardized mortality rate	60–64	65–69	70–74	75–79	≥ 80	Mortality rate	Standardized mortality rate
Cardiovascular disease	1750.0	1941.1	471.2	809.0	1591.9	2875.2	7759.4	1408.3	1318.3	252.2	485.1	1014.1	1909.7	5739.7		
Stroke	876.6	964.9	243.5	432.4	862.2	1522.0	3554.8	634.6	599.7	129.2	249.8	516.1	938.3	2348.2		
Ischemic heart disease	692.8	773.0	188.5	305.5	580.8	1065.7	3293.7	591.0	548.9	95.0	181.2	380.9	741.3	2585.2		
Malignant tumor	1046.8	1096.6	536.2	795.3	1215.2	1626.2	2466.4	532.0	520.2	268.2	391.0	584.0	779.9	1083.1		
Liver cancer	61.1	62.4	44.1	55.3	66.4	79.3	102.1	26.8	26.3	14.6	21.6	30.6	38.2	48.1		
Lung cancer	338.3	353.3	168.8	262.2	408.1	538.6	751.1	140.3	137.1	65.8	101.3	155.2	213.8	291.1		
Gastric cancer	184.7	192.8	94.4	141.8	223.6	288.3	411.3	74.0	72.0	30.5	49.1	80.9	113.7	171.6		
Esophageal cancer	124.3	129.2	67.7	98.7	148.7	187.9	264.1	40.2	39.0	13.5	25.4	45.9	65.2	96.4		
Colorectal cancer	97.3	103.3	45.2	67.2	106.0	157.6	270.4	57.1	55.5	24.1	36.1	59.9	86.9	138.4		
Chronic respiratory diseases	480.5	544.8	73.4	158.4	410.2	853.1	2482.1	329.5	306.4	35.7	81.7	215.7	462.8	1468.6		
Diabetes mellitus	56.1	60.6	19.7	33.4	61.1	95.0	188.6	57.7	56.0	19.3	36.0	64.3	94.4	141.2		
Nervous system diseases	122.8	140.9	18.6	37.1	83.6	186.9	724.9	181.7	165.3	18.8	38.0	81.7	182.2	937.1		
Alzheimer disease	82.6	95.4	12.0	24.4	49.4	110.3	522.8	157.2	142.1	14.5	29.9	61.8	142.0	845.2		
Parkinson disease	36.4	41.7	3.7	9.5	30.4	71.7	194.5	21.9	20.7	2.4	6.0	17.4	37.2	87.4		
Total (total chronic diseases)	3641.2	3983.8	1198.1	1945.3	3540.0	5924.7	14,263.4	2646.7	2497.5	637.7	1102.9	2080.0	3626.4	9806.7		

Table 1. Levels of deaths from major chronic diseases in China’s elderly population by gender, 2019.



Rank	Male				Female			
	diseases	DALY absolute value	DALY rate	DALY standardized rate	diseases	DALY absolute value	DALY rate	DALY standardized rate
1	Stroke	1920.2	15,579.3	16,404.5	Stroke	1485.4	11,113.8	10,809.2
2	Ischemic heart disease	1389.5	11,273.7	12,016.6	Ischemic heart disease	1112.4	8322.9	7890.3
3	Chronic respiratory diseases	945.3	7669.7	8321.0	Chronic respiratory diseases	757.2	5665.1	5448.5
4	Lung cancer	796.3	6460.9	6521.7	Alzheimer disease	353.8	2646.9	2470.9
5	Gastric cancer	438.0	3553.9	3587.3	Lung cancer	337.1	2522.4	2506.4
6	Esophageal cancer	296.5	2406.0	2421.2	Hearing loss	287.8	2153.1	2115.5
7	Diabetes mellitus	271.4	2202.0	2241.8	Diabetes mellitus	284.9	2131.8	2116.0
8	Hearing loss	270.9	2197.9	2252.3	Lower backache	239.3	1790.7	1779.5
9	Hypertensive cardiopathy	240.4	1950.6	2108.6	Hypertensive cardiopathy	223.8	1674.3	1598.0
10	Colorectal cancer	229.4	1861.3	1901.6	Blindness and loss of vision	180.0	1346.9	1322.4
11	Alzheimer disease	202.7	1644.3	1824.7	Gastric cancer	172.9	1293.7	1281.5
12	Road injury	172.2	1397.4	1392.9	Chronic kidney disease	162.0	1212.3	1190.8
13	Chronic kidney disease	167.3	1357.4	1416.1	Tumble	156.8	1172.9	1124.6
14	Tumble	161.5	1310.6	1370.7	Osteoarthritis	153.2	1146.2	1142.6
15	Liver cancer	153.9	1248.7	1241.6	Depression	145.0	1084.6	1087.4
16	Lower backache	131.3	1065.1	1083.8	Colorectal cancer	136.9	1024.0	1015.4

**Table 2.** DALY Levels by disease category by sex in China’s elderly population, 2019. DALY absolute value: per 10,000 person-years; DALY rate: Person-years/100,000; DALY standardized rate: Person-years/100,000.

Risk factors	Total	Gender		Urban and rural areas		Region		
		Male	Female	Urban	Rural	East	Middle	West
Dietary								
Inadequate intake of fruits and vegetables	51.1	49.3	52.8	41.8	58.4	47.9	52.5	54.4
Excessive intake of red meat	28.7	33.7	24.0	33.5	24.9	28.4	20.4	38.9
Use of nutritional supplements	16.1	12.5	19.5	19.2	13.6	17.0	16.6	14.1
Physical activity								
Regular exercise	13.1	13.7	12.5	17.7	9.5	15.5	12.3	10.4
Insufficient physical activity	23.1	23.5	22.8	20.1	25.6	23.5	24.8	20.6
Smoking								
Smoking	24.2	45.5	3.7	21.4	26.4	22.3	24.3	26.9
Secondhand smoke exposure	46.6	41.8	48.2	42.9	49.7	41.3	46.6	47.2
Smoking cessation	31.2	31.5	27.4	35.7	28.0	34.8	32.0	25.2
Alcohol consumption	23.5	39.3	8.3	23.7	23.3	25.5	21.8	22.3
Body weight								
Low body weight	3.8	3.9	3.7	2.7	4.7	3.0	3.8	5.0
Overweight	36.6	35.9	37.4	40.6	33.5	38.4	38.2	32.1
Obesity	13.6	11.2	16.0	16.3	11.6	16.1	12.9	10.7

**Table 3.** Prevalence of major risk factors for chronic diseases in the elderly in China, 2018 (Unit: %).

impose a significant burden, being the leading cause of mortality among this demographic. The prevalence of chronic disease risk factors remains widespread among the elderly, particularly concerning are smoking, alcohol consumption, and obesity, which are escalating in rural areas. Functional disorders are prevalent among the elderly, and the issue of disability warrants attention.

Chronic diseases significantly impact the health of the elderly population in China. While the standardized mortality rates for specific diseases like ischemic heart disease, lung cancer, colorectal cancer, and Alzheimer’s disease have shown an increase, the standardized mortality rates for most of chronic diseases are generally declining. Specifically, the total mortality rate has exhibited a consistent decline of 12.14% since 2018, accompanied by a significant reduction in the mortality rate of digestive malignant tumors<sup>29</sup>. However, the incidence of lung and gastric cancers remains high in China, making early screening and diagnosis essential for reducing morbidity and mortality associated with these diseases, particularly among high-risk populations. Chronic illnesses significantly affect health outcomes, with conditions such as stroke, ischemic heart disease, COPD and cancer emerging as the primary contributors to DALYs lost among the elderly population in China.

	Total	Gender		Urban and rural areas		Region		
		Male	Female	Urban	Rural	East	Middle	West
Incapacity	19.4	12.6	25.8	8.0	28.3	7.8	17.8	24.3
Sleeping disorder	68.2	63.3	73.0	64.9	70.9	66.1	72.3	66.8
Depression	12.0	9.5	14.3	12.0	12.0	9.5	6.5	14.5
Hearing loss	69.8	74.5	66.3	65.2	73.0	–	–	–
Self-reported constipation	12.4	9.9	14.8	12.5	12.3	11.2	14.6	12.0
Osteoporosis								
Prevalence of osteoporosis	27.4	8.0	45.9	22.3	30.0	–	–	–
Prevalence of low bone mass	47.5	51.2	44.1	46.8	47.9	–	–	–

**Table 4.** Functional dysfunction of the elderly in China (Unit: %).

These findings align with results reported in earlier research studies<sup>30</sup>. Therefore, preventing and managing these conditions are crucial steps in enhancing the health status of the elderly and alleviating the disease burden.

Within the older demographic in China, fewer than half of individuals fail to meet the recommended dietary intake of vegetables and fruits, while over a quarter consume excessive quantities of red meat. Approximately 40% of elderly men engage in daily smoking or have consumed alcohol within the last 30 days. Approximately 25% of the elderly population exhibited physical inactivity, with a notably smaller percentage of 13.1% consistently participating in physical activities. The prevalence of insufficient consumption of vegetables and fruits has shown improvement in comparison to the data from 2013. Nevertheless, the prevalence of excessive red meat intake, levels of alcohol consumption, smoking rates, and inadequate physical activity remain either on the rise or persist at elevated levels<sup>31</sup>. As living standards improve and behavioral habits evolve, risk factors for chronic diseases among older adults in rural areas exhibit a more pronounced escalation in comparison to urban areas. In 2018, the prevalence of current smoking, daily smoking, and exposure to secondhand smoke among rural older adults was approximately 5 percentage points higher than that in urban areas. Conversely, rates of smoking cessation and successful cessation were approximately 8 percentage points lower in rural areas than in urban areas. The average daily alcohol consumption among rural older adults (34.3 g) surpasses that of urban populations (25.3 g). In comparison to 2013, there was a 2.2 percentage point increase in alcohol consumption among rural older adults, with a more substantial increase of 4.1 percentage points observed in harmful drinking rates. Simultaneously, there was a 4.4 percentage point increase in the prevalence of excessive red meat consumption among elderly individuals residing in rural areas. Overweight and obesity are acknowledged as significant risk factors for chronic diseases, with prevalence rates of overweight and obesity surpassing half (36.6% and 13.6%) among the elderly population in China. Since 2013, there has been a 3.9 percentage point increase in the prevalence of overweight individuals, whereas the obesity rate has shown a tendency to remain constant. In addition to lifestyle-related risk factors, it is essential to manage other factors contributing to cognitive decline during middle age, such as hypertension, high cholesterol, and hearing impairment, to minimize the deterioration of cognitive function in later years.

Research has shown that the fundamental causes of chronic diseases such as obesity, diabetes, and cardiovascular diseases can be traced back to the 1,000 days during pregnancy and early life<sup>32</sup>. This “1,000-day window” represents a critical opportunity for the prevention of chronic non-communicable diseases in adulthood. Therefore, we propose that when formulating health management policies for the elderly, a life-course approach should be integrated to more effectively prevent and control chronic diseases.

The presence of disabilities among the elderly poses a significant health challenge for this demographic. The prevalence of Activity Daily Living (ADL) disability among China’s elderly population was reported to be 19.4% in 2015. Among individuals aged 80 and older, the rate increased to 45.7%. Furthermore, the incidence of disability is twice as prevalent in females compared to males, 3.5 times more common in rural regions than in urban areas, and 3.1 times higher in western areas than in eastern regions. These trends align with results reported in earlier research studies<sup>33</sup>.

Functional impairment, alongside disability, represents a significant health challenge encountered by the elderly population. The incidence of hearing impairment is notably elevated among the elderly population, reaching 69.8%, and typically escalates with advancing age. The prevalence of sleep disorders stands at 68.2%, a rate significantly higher than that observed in the general population. The prevalence of depression among older individuals is significant, with approximately 12.0% affected. This indicates that one in ten older individuals exhibits symptoms of depression, necessitating potential hospital diagnosis or intervention.

Although this study focuses on the health status of the elderly population, interventions during midlife are also essential, as functional decline typically begins between the ages of 45 and 55. In particular, muscle-wasting disorders, frailty, and mobility impairments are significant contributors to limitations in daily activities among older adults. Preventive measures aimed at reducing falls and osteoporosis-related hip fractures, in particular, need to be enhanced<sup>34–36</sup>.

This study offers a comprehensive analysis of the prevalence of osteoporosis among elderly individuals in China who are 60 years of age and older. The prevalence of osteoporosis in this age cohort was 27.4%, with a significantly higher prevalence in women (45.9%) compared to men (8.0%). In relation to gender, the incidence of osteoporosis among the elderly is greater than that in the general population, affecting both males and females<sup>28</sup>

The promotion of healthy aging is considered a crucial component in addressing the challenges posed by population aging and aligning with the objectives of the Healthy China initiative. The state has placed significant emphasis on this aspect and has introduced a series of policies aimed at facilitating proactive measures to address the implications of population aging. China's geriatric health sector is experiencing rapid development. In light of the current geriatric health challenges and situation, this study proposes the following recommendations: Firstly, there is a need to enhance geriatric health policies and the geriatric health service system, establishing a supportive environment for the elderly and boosting government investments in geriatric health. Secondly, it is essential to utilize basic public health services for chronic disease management and geriatric health management to enhance the comprehensive management of prevalent chronic diseases and key conditions in the elderly population. Health education and health promotion initiatives should be extensively implemented to enhance the health literacy of the elderly population, foster the development of a scientific perspective on aging among older individuals, and cultivate and sustain a healthy behavioral lifestyle. Furthermore, early health education is crucial for improving the lifestyle of older adults. By enhancing health education, parents can reinforce the dietary and physical activity recommendations provided by schools at the family level, thereby contributing to the alleviation of chronic disease burdens among the elderly. Furthermore, it is imperative to conduct screening and early intervention for prevalent physical dysfunctions and psychological issues in the elderly to mitigate the risk of incapacitation. Enhancing scientific research in the field of geriatric health is imperative, and there is a need for enhancements in geriatric health monitoring and assessment. Finally, enhancing geriatric education is crucial for improving the quality of elderly care. China's training programs for medical and nursing personnel in this field must be further strengthened to effectively address the challenges posed by an aging population.

This study provides a comprehensive assessment of the current mortality rates, disease burden, key risk factors for chronic diseases, and disability and dysfunction among the elderly population in China. Additionally, it presents, for the first time, data on the prevalence of osteoporosis in China. The study aims to assist researchers and policymakers in gaining insights and making informed decisions regarding the health status of the elderly population. For future endeavors, it is imperative that research maintains its focus on the evolutionary trajectory of the health status of the elderly demographic, aligns with the requirements of national policies, and proactively addresses the ongoing trend of population aging. Furthermore, there is a necessity for ongoing enhancements in health policies and service systems to elevate the health literacy and overall quality of life among the elderly population.

## Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available due to confidentiality and privacy concerns related to sensitive national monitoring data and the need to comply with governmental data protection regulations, but they are available from the corresponding author upon reasonable request.

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## Author contributions

Haotian Wu: The first author of this paper, responsible for research scheme design, experiment execution, data analysis, and manuscript writing. Yaqiang Wang: Participated in experiment design and data analysis, providing crucial support for interpreting the results of the paper. Han Zhang: Provided essential technical support during the experiments and participated in data collection and processing. Xiangjun Yin: Improved and optimized the methods described in the paper, enhancing the accuracy and reliability of the experimental results. Lijun Wang: Responsible for statistical analysis of experimental data and participated in the discussion and revision of the manuscript. Limin Wang: Provided technical equipment used in the research and participated in experiment design and data collection. Jing Wu: Corresponding author, responsible for the planning and organization of the entire research project, providing important theoretical guidance and academic support, and playing a key role in manuscript writing and revision. All authors contributed to the design, implementation, and manuscript writing process of this study. Each author made significant contributions to the successful publication of the research.

## Competing interests

The authors declare no competing interests.

## Additional information

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