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Cover Photo: In response to COVID-19, the China CDC Mobile P3 Laboratory Truck was deployed to Xingtai, Hebei Province, to assist with nucleic acid testing on January 7th, 2021.

Preplanned Studies

Development of the National Air Quality Health Index — China, 2013–2018

Qinghua Sun[1,2]; Huanhuan Zhu[2,3]; Wanying Shi[2]; Yu Zhong[2]; Yingjian Zhang[4]; Tiantian Li[1,2,#]

Summary

What is already known about this topic?

While the establishment of an air quality health index (AQHI) in some countries yielded positive outcomes in communicating health risks of air pollution, China lagged behind in developing its own AQHI. Several research studies of AQHI were conducted in China, but this scientific research has not yet been applied to standards.

What is added by this report?

This report introduced the method of calculation of Chinese AQHI to be launched in pilot cities. The index in this report was established on the basis of fully drawing on international experience and considering Chinese characteristics.

What are the implications for public health practice?

The purpose of this report is to guide unified application of the AQHI throughout China and translate scientific evidence into public services to promote public health. Based on the AQHI construction method in this report, an AQHI real-time computing platform and data transfer interface will be developed. The release of AQHI aims to communicate health risk of air pollution and provide scientific health protective guidance to the general public, accordingly to protect people's health.

Air pollution was among the leading ten health risk factors in 1990 and remained an important factor as of 2016 (*1*). Since air pollution control is a long-term challenge, China is likely to encounter more air pollution related health issues going forward. In environmental health risk communication aimed at protecting public health, an air quality index will play a significant role.

The United States Environmental Protection Agency (EPA) started using the Pollutant Standards Index (PSI) to report the daily air quality index in 1976. Since 1999, the EPA replaced the PSI with the air quality index (AQI) (*2*). This standard is now commonly adopted worldwide. In communicating air pollution health risks, the AQI avoids confusion caused by listing various pollutant concentrations. However, AQI is not intended to indicate health risks of air quality, so the usefulness of the AQI is inherently limited. Briefly, the AQI calculates air quality based on limits for different pollutants. Air quality standards are based on a variety of factors, including technical and economic accessibility as air quality management objectives. Nevertheless, AQI could not reflect the non-threshold concentration-response relationship between air pollutant(s) and health consequence(s). Moreover, AQI does not reflect the combined health effects of many air pollutants.

To better communicate health risks of air pollution to the general public, Canada considered some health risk parameters and introduced a new index system called the air quality health index (AQHI) (*3*). Based on the Canadian approach, Hong Kong, China developed an AQHI reporting system in 2013 (*4*). More recently, some studies in China discussed the construction of an AQHI from scientific perspectives for a single city, multiple cities, and nationwide. These studies suggested that the AQHI could better reflect the health risks of air pollution in China. Nevertheless, these studies covered few areas or were insufficiently validated because of data scarcity and most have not released to the public.

In order to develop a Chinese AQHI reporting system, the National Health Commission (NHC) and China CDC commissioned the National Institute of Environmental Health to study the development of a Chinese AQHI. This report introduced the construction method of Chinese AQHI to guide unified application of AQHI throughout China.

Chinese AQHI was constructed by referencing and improving on the approach of Stieb et al. (*3*). During the construction of AQHI, three key points were the included pollutants, preferred health outcomes, and chosen scaling parameter.

The air pollutants of AQHI in this report include $PM_{2.5}$, O_3, NO_2, and SO_2 (the rationale is discussed in the Supplementary Material). The descriptive analysis of national county-level pollutants was shown in Table 1.

Mortality was chosen as the health outcome due to its severity and because mortality data are more objective and have better quality in China. The burden of disease attributable to air pollution in the Global Burden of Disease study and the WHO air quality guidelines for particulate matter were also calculated based on mortality data (*5*). The chosen outcome was non-accidental mortality to reflect the overall health impact.

The AQHIs were scaled by dividing by the 99th percentile for the time period, instead of dividing by the maximum value like other studies. Pollution levels vary widely from region to region in China, and some regions had incidents of heavy pollution events. If divided by the maximum value, the indices in many areas would present low risk, which would mislead the users of this index.

Based on the above consideration, the Chinese AQHI was constructed. Hourly concentrations of $PM_{2.5}$, O_3, SO_2, and NO_2 were collected from 2013 to 2018 in 769 counties of China (Figure 1). The regression coefficient β was derived from the regression models relating air pollutants ($PM_{2.5}$, O_3, SO_2, and NO_2) (*6–9*) to mortality in China (Table 2).

Daily excess percentage risks of mortality relative to zero concentration, for non-threshold exposure-response relationship between air pollutant(s) and health consequence(s), of exposure to each pollutant in each day from 2013 to 2018 were calculated (Formula 1). Then the sum of daily excess percentage risks of mortality of the 4 pollutants at t day was calculated, then the 99th percentile at each study site was calculated (Formula 2). AQHI was separated into 11 levels of 1–10 and 10+ at each county at any day t in the past and the future (Formula 3).

$$ER_{ijt} = 100 \times \left[exp\left(\beta_i \times x_{ijt}\right) - 1\right] \quad (1)$$

where ER_{ijt} represents the daily excess percentage risk of mortality associated with the pollutant i in j county at t day, β_i was the regression coefficient of pollutant i from previous studies, x_{ijt} was the mean concentration of pollutant i in j county at t day.

$$ER_{P_{99}} = P_{99}\begin{smallmatrix} j=1\cdots n \\ t=1\cdots m\end{smallmatrix}\left[\Sigma_{i=1\cdots q}\left(ER_{ijt}\right)\right] \quad (2)$$

where $ER_{P_{99}}$ represents the 99th percentile of daily sum of excess percentage risk of mortality associated with $PM_{2.5}$, O_3, NO_2, and SO_2 in each county of all 769 counties at each day from 2013 to 2018. The result of $ER_{P_{99}}$ was 20.04.

$$AQHI_{jt} = \left(ER_{jt} \times 10\right)/ER_{P_{99}} \quad (3)$$

where ER_{jt} represents the daily sum of excess percentage risks of mortality associated with the $PM_{2.5}$, O_3, NO_2, and SO_2 in j county at t day.

Table 1 summarized the descriptive analysis of county-level pollutants and AQHI during 2013–2018 in China. The averaged levels of AQHI were 4. The frequency distribution of AQHI in 36 cities (all municipalities directly under the central government, cities specifically designated in the state plan, and provincial-level capitals of China) from 2013–2018 was shown in Supplementary Table S1 available in http://weekly.chinacdc.cn/.

For the convenience of public communication, AQHI values (1–10+) were grouped into 4 levels: low health risk (1–3), moderate health risk (4–6), high health risk (7–10), and very high health risk (10+). According to different health risk levels (including low, moderate, high, and very high health risk levels), health protective messages will be provided to the general population, patients with cardiopulmonary disease, and sensitive populations (including the elderly, pregnant woman, and children), respectively.

DISCUSSION

This report introduced the method of calculating the

TABLE 1. Descriptive analysis of county-level pollutants and air quality health index (AQHI) of China, 2013–2018.

Variable	Effective days	Mean ± SD	Min	P_{25}	Median	P_{75}	Max
Pollution (μg/m^3)							
$PM_{2.5}$	1,332,272	51.1 ± 43.3	3.0	23.9	39.0	63.7	806.6
NO_2	1,333,267	34.3 ± 20.7	1.0	19.1	29.9	44.9	471.1
SO_2	1,335,313	22.9 ± 26.7	2.9	8.7	14.7	26.4	715.7
O_3	1,326,722	59.6 ± 31.8	2.1	35.7	55.4	79.0	625.3
AQHI	1,307,118	4.0 ± 1.7	1	3	4	5	10+

Abbreviation: SD, Standard deviation; Min, minimum during the study period; P25, first quartile; P75, third quartile; Max, maximum during the study period.

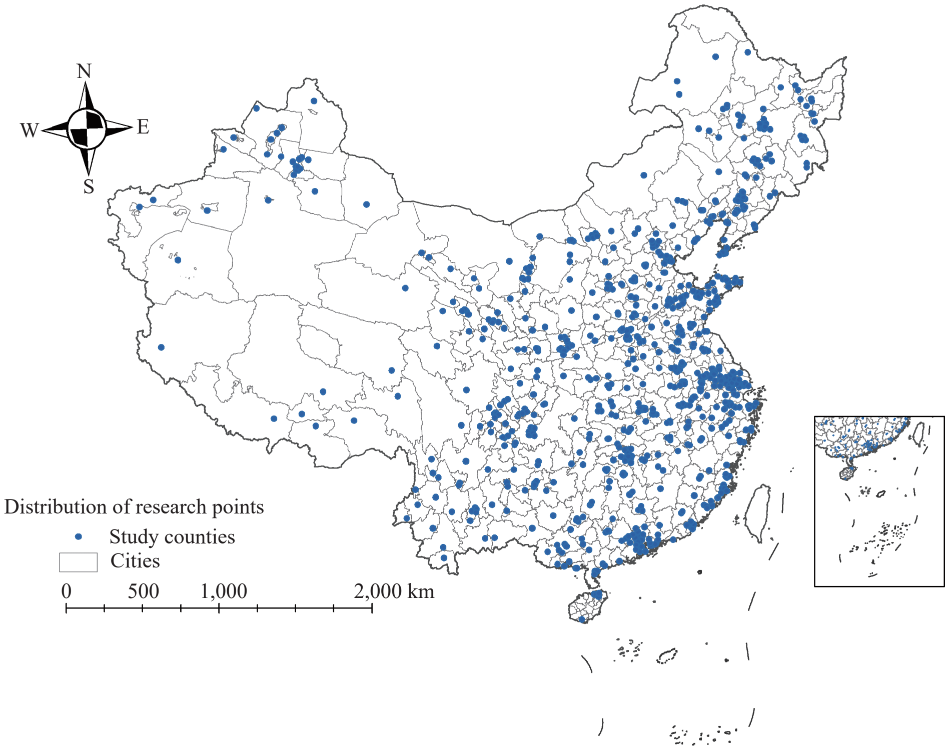

FIGURE 1. Distribution of 769 counties of the national air quality health index study in China from 2013 to 2018.

TABLE 2. Exposure-response relationships of air pollution and non-accidental mortality.

Pollutants	*β* value
$PM_{2.5}$	0.00022
O_3	0.00024
NO_2	0.00090
SO_2	0.00059

Chinese AQHI. This AQHI was established based on daily $PM_{2.5}$, O_3, NO_2, and SO_2 concentration of 769 counties and the exposure-response relationship between air pollution and mortality. The AQHI should be an effective tool to reflect and communicate the health risk of air pollution with the public in China.

Compared with research from Du et al. (*10*), this report had several differences: different research regions, different included pollutants, and different index of standardization. This report included almost all counties with national air pollution monitoring stations in China, which provided higher regional resolution and better data. Considering the concentration of SO_2 is still relatively high in some regions of China, our report also included this pollutant to be a better indicator of health risks.

While several factors were considered based on the current data, this method has several limitations. First, a uniform set of parameters and formulas across the nation could cause bias in some regions. Using regional exposure-response relationships and combining certain pollutants could provide a more accurate indication of the health risks of short-term exposure to air pollution. Nonetheless, in public communication, getting the index understood and avoiding conflicting results in different regions is more important than finding the best index. Hence, an AQHI was constructed with the idea of simplifying the information. Second, the β value used in this study was extracted from ecological studies which might contain inherent biases. In future studies, the index should be updated with better exposure-response relationships.

Additional validation of the AQHI is required. More relevant health data will be collected to further verify, evaluate, and optimize the index. Furthermore, more attention should be focused on the evaluation of the effectiveness of the AQHI application. To evaluate the effectiveness of the AQHI implementation, relevant data of differences-in-differences estimates before and after the AQHI application in county with and without published AQHI data will be collected in the next few years. The index will be adjusted and optimized based on the validation results

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Corresponding author: Tiantian Li, litiantian@nieh.chinacdc.cn.

[1] China CDC Key Laboratory of Environment and Population Health, National Institute of Environmental Health, Chinese Center for Disease Control and Prevention, Beijing, China; [2] National Institute of Environmental Health, Chinese Center for Disease Control and Prevention, Beijing, China; [3] Hebei University of Science and Technology, Shijiazhuang, Hebei, China; [4] Jinan Municipal Center for Disease Control and Prevention, Jinan, Shandong, China.

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Supplementary Material

The rationale of using $PM_{2.5}$, O_3, NO_2, and SO_2 to construct the air quality health index (AQHI):

Similar to previous studies in Guangzhou Province (*1*) and New York City (*2*), the air pollutants in the AQHI included $PM_{2.5}$, O_3, NO_2, and SO_2. In Hong Kong, China, the developed AQHI were based on the health effects of PM_{10}, O_3, SO_2 (*3*), and NO_2. While in Canada, the established AQHI were based on the health effects of $PM_{2.5}$, O_3, and NO_2 (*4*). The inclusion of O_3 and NO_2 is not controversial. Considering the collinearity of $PM_{2.5}$ and PM_{10}, and the health hazard differences between them, $PM_{2.5}$ was chosen in our calculations. SO_2 was included by considering the pollution types in different regions of China. Several studies revealed that SO_2 was strongly associated with total mortality risk (*5*–*6*). SO_2 pollution mainly comes from the combustion of sulfur-containing fossil fuels (*7*). Notably, China is a country with massive coal production and consumption (*8*). According to the Bulletin of China's Ecological Environment 2018, the yearly average concentration of SO_2 in the Fen-Wei Plains was 24 $\mu g/m^3$ in 2018 (*9*). According to our data in 2013–2018 (Supplementary Table S1), more than 25% of daily average concentration of county was higher than 26 $\mu g/m^3$. Therefore, the health risk of SO_2 pollution in China still needs to be considered.

SUPPLEMENTARY TABLE S1. Frequency distribution of air quality health index (AQHI) in 36 cities* of China, 2013–2018.

City	Level	Frequency	Distribution (%)
Xiamen	[1,3]	1,381	68.64
	(3,6]	609	30.27
	(6,10]	22	1.09
	(10,10+]	0	0
Shenzhen	(1,3]	1,345	66.68
	(3,6]	657	32.57
	(6,10]	15	0.74
	(10,10+]	0	0
Dalian	(1,3]	959	47.62
	(3,6]	968	48.06
	(6,10]	84	4.17
	(10,10+]	3	0.15
Qingdao	(1,3]	705	34.88
	(3,6]	1,183	58.54
	(6,10]	121	5.59
	(10,10+]	12	0.59
Ningbo	(1,3]	748	37.12
	(3,6]	1,172	58.16
	(6,10]	92	4.57
	(10,10+]	3	0.15
Beijing	(1,3]	628	31.99
	(3,6]	1,076	54.81
	(6,10]	227	11.56
	(10,10+]	32	1.63
Shanghai	(1,3]	539	26.74
	(3,6]	1,321	65.53
	(6,10]	148	7.34
	(10,10+]	8	0.40

Continued

City	Level	Frequency	Distribution (%)
Tianjin	(1,3]	398	19.77
	(3,6]	1,234	61.30
	(6,10]	317	15.75
	(10,10+]	64	3.18
Chongqing	(1,3]	704	34.90
	(3,6]	1,273	63.11
	(6,10]	40	1.98
	(10,10+]	0	0
Hefei	(1,3]	720	35.80
	(3,6]	1,206	59.97
	(6,10]	85	4.23
	(10,10+]	0	0
Fuzhou	(1,3]	1,502	74.58
	(3,6]	508	25.22
	(6,10]	4	0.20
	(10,10+]	0	0
Lanzhou	(1,3]	484	24.02
	(3,6]	1,377	68.34
	(6,10]	153	7.59
	(10,10+]	1	0.05
Guangzhou	(1,3]	798	39.62
	(3,6]	1,086	53.92
	(6,10]	125	6.21
	(10,10+]	5	0.25
Guilin	(1,3]	1,121	66.33
	(3,6]	542	32.07
	(6,10]	25	1.48
	(10,10+]	2	0.12
Guiyang	(1,3]	1375	68.24
	(3,6]	603	29.93
	(6,10]	37	1.84
	(10,10+]	0	0
Haikou	(1,3]	1,948	96.72
	(3,6]	66	3.28
	(6,10]	0	0
	(10,10+]	0	0
Shijiazhuang	(1,3]	250	12.39
	(3,6]	1,113	55.18
	(6,10]	463	22.95
	(10,10+]	191	9.47
Zhengzhou	(1,3]	1,345	66.68
	(3,6]	657	32.57
	(6,10]	15	0.74
	(10,10+]	0	0

Continued

City	Level	Frequency	Distribution (%)
Harbin	(1,3]	789	39.12
	(3,6]	882	43.73
	(6,10]	264	13.09
	(10,10+]	82	4.07
Wuhan	(1,3]	493	24.52
	(3,6]	1,198	59.57
	(6,10]	293	14.57
	(10,10+]	27	1.34
Changsha	(1,3]	818	40.62
	(3,6]	1,050	52.14
	(6,10]	146	7.25
	(10,10+]	0	0
Changchun	(1,3]	660	32.77
	(3,6]	1,126	55.91
	(6,10]	212	10.53
	(10,10+]	16	0.79
Nanjing	(1,3]	438	21.73
	(3,6]	1,339	66.42
	(6,10]	228	11.31
	(10,10+]	11	0.55
Nanchang	(1,3]	973	48.31
	(3,6]	963	47.82
	(6,10]	75	3.72
	(10,10+]	3	0.15
Shenyang	(1,3]	402	20.00
	(3,6]	1,181	58.76
	(6,10]	324	16.12
	(10,10+]	103	5.12
Hohhot	(1,3]	538	26.74
	(3,6]	1,229	61.08
	(6,10]	237	11.78
	(10,10+]	8	0.40
Yinchuan	(1,3]	530	26.38
	(3,6]	1,108	55.15
	(6,10]	315	15.68
	(10,10+]	56	2.79
Xining	(1,3]	553	27.43
	(3,6]	1,404	69.64
	(6,10]	59	2.93
	(10,10+]	0	0
Jinan	(1,3]	133	6.58
	(3,6]	1,385	68.50
	(6,10]	421	20.82
	(10,10+]	83	4.10

Continued

City	Level	Frequency	Distribution (%)
Taiyuan	(1,3]	320	15.90
	(3,6]	1,198	59.54
	(6,10]	399	19.83
	(10,10+]	95	4.72
Xi’an	(1,3]	365	18.13
	(3,6]	1,344	66.77
	(6,10]	264	13.11
	(10,10+]	40	1.99
Chengdu	(1,3]	387	19.22
	(3,6]	1,422	70.61
	(6,10]	198	9.83
	(10,10+]	7	0.35
Lhasa	(1,3]	1,792	88.98
	(3,6]	222	11.02
	(6,10]	0	0
	(10,10+]	0	0
Urumchi	(1,3]	530	26.36
	(3,6]	1,161	57.73
	(6,10]	292	14.52
	(10,10+]	28	1.39
Kunming	(1,3]	1,255	62.31
	(3,6]	755	37.49
	(6,10]	4	0.20
	(10,10+]	0	0
Hangzhou	(1,3]	709	35.19
	(3,6]	1,228	60.94
	(6,10]	76	3.77
	(10,10+]	2	0.10

Note: 36 cities reffer to all municipalities directly under the central government, cities specifically designated in the state plan, and provincial-level capitals.

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Preplanned Studies

Characteristics of Falls Among Older People — China, 2018

Zhiming Lu[1]; Pengpeng Ye[1]; Yuan Wang[1]; Leilei Duan[1]; Yuliang Er[1,#]

Summary

What is already known about this topic?

The incidence of falls among older people is 20.7% in China. Falls are the top cause for death from injuries in people aged 65 years and above, and mortality rates increase with age in China. There are few reports on the epidemiological characteristics of falls in older people nationwide in recent years.

What is added by this report?

This study found that among older people with falls reported in the National Injury Surveillance System (NISS) in 2018, there were more females than males. The peak time for falls was in the morning. Home was the most common site where falls occurred, and leisure activities and housework were the main activities when falls occurred. After falling, the lower limbs and head were most often injured with bruises and fractures. The degree of injury was mainly mild and moderate.

What are the implications for public health practice?

Data based on the NISS can be used as an additional data source for research on falls in China. This study identified priorities for the control and prevention of falls.

As defined by the World Health Organization (WHO), a fall is an event that results in a person inadvertently coming to rest on the ground, floor, or other lower level. Falls have become a serious public health problem worldwide (*1*). The study data were from the National Injury Surveillance System (NISS) in China, and descriptive analysis was applied on characteristics of falls among persons aged 60 years and above. In total, 100,551 cases of falls were collected from the NISS in China, including 41,821 males and 58,730 females. Falls most commonly occurred at home (55.97%), and leisure activities (30.27%) were the main activity category when falls occurred. The elderly should be treated as the targeted population for effective prevention of falls.

Globally, the number of deaths from falls was double in 2017 compared with 1990 (*2*). In 2017, there was an estimated 75,000 deaths attributed to falls among people over 70 years of age in China. Falls can result in limited mobility and disability — even death on older adults — which compromises health conditions and quality of life and causes large strains on medical resources (*3*–*4*). The data of this study were medical and health institution based and suggested the importance of prioritizing the prevention of falls in older adults for injury prevention and control through describing the characteristics of falls in the elderly in China.

The NISS was established in 2006 and covers 84 surveillance points (33 rural and 51 urban), including 252 medical and health institutions. Cases of falls were obtained from the outpatient or emergency departments of 252 medical and health institutions. The doctors and nurses in the outpatient or emergency departments filled in "national injury surveillance report cards" and sent those reports to the local CDCs regularly. The local CDCs were responsible for collecting, summarizing, and inputting information and regularly reporting the data to the National Center for Chronic and Noncommunicable Disease Control and Prevention of China CDC through administrative channels. Sampling methods, quality of data, and other detailed information of the NISS have been reported in published articles (*5*–*6*). Software SPSS (version 25.0, SPSS Inc, Chicago, IL, USA) was used for statistical analysis. The data utilization of the NISS had been reviewed and approved by the Ethical Review Committee of the National Center for Chronic and Noncommunicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention (ethical application grant number: 201502).

In total, 100,551 cases of falls among older persons aged 60 years and above were collected by the NISS in 2018, including 58,730 females and 41,821 males with a gender ratio of 1.40. The number of falls was evenly distributed in 12 months. Falls mainly occurred in the daytime (06∶01–18∶00), and the peak time was the morning (06∶01–12∶00). Home (55.97%), road/street (18.69%), and public residential institution (12.80%) were the sites where falls most often occurred. In different age groups, the top 3 sites of falls were essentially the same, and the proportion of falls at home increased with age. Females (60.08%) had a higher proportion of falls at home than males (50.21%). The most common 3 activities when falls occurred were leisure activities (30.27%), housework (22.36%), and walking (20.20%). The activities when falls occurred differed based on age group. Higher proportions of falls occurred during housework for females (25.30%) than for males (18.23%). (Table 1)

In 2018, bruises (37.73%), fractures (34.34%), and sprains (14.94%) were the main natures of injury of falls in older persons aged 60–79 years, and the top 3 natures of injury of falls in older persons aged 80 years and above were fractures (41.62%), bruises (35.21%), and sharps injury, bites, and open wounds (8.74%). Higher proportions of fractures caused by falls were found in females (39.33%) than in males (27.34%). The most common body parts that falls affected were lower limbs (32.43%), head (21.48%), and torso (20.57%). The top 3 body parts that falls affected were lower limbs (31.95%), torso (21.08%), and head (19.44%) in older persons aged 60–69 years. Males (27.38%) had a higher proportion of head injuries caused by falls than females (17.27%).

About 60% of cases were mild in each age group, and moderate injury accounted for 34.66%. With an increase of age, the proportion of mild injury decreased, while severe injury increased. Overall, 70.49% of cases were discharged from the hospital after treatment, 24.64% required hospitalization, and 157 cases were fatal. The proportion of deaths increased with age.

DISCUSSION

This study showed the epidemiological characteristics of falls in older persons aged 60 years and above extracted from the NISS in China in 2018. As for cases of falls, there were more females than males. Home was the most common site where falls occurred. Older persons were more likely to suffer falls when they were engaged in leisure activities. These findings were consistent with previous research results in China (*7*). Previous studies showed that falls were the leading cause for the elderly to seek medical treatment for injuries in China. In total, 100,551 cases of falls among older persons were collected by the NISS in China in 2018, of which 34.34% resulted in fractures and 24.64% received hospitalization. The proportion of moderate and severe injuries was higher. These results indicated that falls were one of the major public problems for older people. Compared with 2014, there was an increasing tendency regarding the number of falls among the elderly aged 60 years and above (*8*). This may result from the increasing population of older persons caused by population aging in China and may be associated with a decreasing rate of underreporting for falls caused by improvements to the NISS (*6*).

In this study, falls mainly occurred in the daytime, and the peak time was between 06∶01–12∶00, which suggested that further attention should be paid to the epidemiological characteristics of falls and fall-related factors in the daytime, especially in the morning. Falls mainly occurred at home, and the proportion of falls at home increased with age, which may result from the poor action capacity and longer sedentary time at home caused by a decline of physiological function with increasing age. Behavioral factors were important risk factors for falls in older persons (*1*). The top three activities when falls occurred were leisure activities, housework, and walking. A study in Serbia showed that walking was most likely to cause falls (*9*), which is inconsistent with the results of this study. This may result from the different characteristics of physiology and behavior of people in different countries. Therefore, these activities should be taken into great consideration when implementing fall injury prevention and control programs. The potential risk of fall-related risk factors at home should be regularly identified and reduced to improve the safety of elderly people's daily lives.

These results suggested a higher proportion of fractures caused by falls, and this proportion increased with age. Females had a higher proportion of fractures than males probably due to postmenopausal women being more likely to develop osteoporosis caused by low estrogen levels (*10*), which increased the risk of fractures. It is important to strengthen the prevention and treatment of osteoporosis while preventing falls, especially paying attention to the prevention of osteoporosis in older women with histories of falls. It is essential to establish comprehensive prevention strategies when conducting intervention projects to prevent falls in older people.

The findings in this study were subject to some limitations. First, the data were collected in the form of report cards, and there may be recall bias for self-reported information. Second, the data of this study was extracted from the NISS, which only included outpatient and emergency department cases. Therefore, the number of falls was likely underestimated. Third, indicators, such as fall incidence at the community level, cannot be calculated from the NISS.

TABLE 1. The characteristics of falls among older people in China, 2018.

Item	Age (Years)			Sex		Total, N (%)
	60–69, N (%)	70–79, N (%)	80–, N (%)	Male, N (%)	Female, N (%)	
Sites						
Home	22,757 (45.28)	17,441 (61.20)	16,085 (73.79)	20,999 (50.21)	35,284 (60.08)	56,283 (55.97)
Road/street	11,743 (23.37)	4,764 (16.72)	2,281 (10.46)	8,481 (20.28)	10,307 (17.55)	18,788 (18.69)
Public residential institution	6,932 (13.79)	3,637 (12.76)	2,298 (10.54)	5,616 (13.43)	7,251 (12.35)	12,867 (12.80)
Farm/farmland	2,800 (5.57)	834 (2.93)	145 (0.67)	2,056 (4.92)	1,723 (2.93)	3,779 (3.76)
School and school-related areas	1,752 (3.49)	753 (2.64)	423 (1.94)	1,370 (3.28)	1,558 (2.65)	2,928 (2.91)
Industrial and construction area	1,656 (3.30)	138 (0.48)	64 (0.29)	1,522 (3.64)	336 (0.57)	1,858 (1.85)
Commercial and serve area	1,232 (2.45)	381 (1.34)	194 (0.89)	801 (1.92)	1,006 (1.71)	1,807 (1.80)
Sports and athletics area	671 (1.34)	269 (0.94)	112 (0.51)	512 (1.22)	540 (0.92)	1,052 (1.05)
Others	99 (0.20)	34 (0.12)	25 (0.11)	63 (0.15)	95 (0.16)	158 (0.16)
Unknown	612 (1.22)	249 (0.87)	170 (0.78)	401 (0.96)	630 (1.07)	1,031 (1.03)
Activities						
Leisure activities	14,111 (28.08)	8,669 (30.42)	7,653 (35.11)	12,868 (30.77)	17,565 (29.91)	30,433 (30.27)
Housework	12,444 (24.76)	6,661 (23.37)	3,377 (15.49)	7,622 (18.23)	14,860 (25.30)	22,482 (22.36)
Walking	9,055 (18.02)	6,225 (21.84)	5,027 (23.06)	8,207 (19.62)	12,100 (20.60)	20,307 (20.20)
Life activity	5,621 (11.19)	4,609 (16.17)	4,652 (21.34)	6,087 (14.55)	8,795 (14.98)	14,882 (14.80)
Work	4,569 (9.09)	796 (2.79)	185 (0.85)	3,648 (8.72)	1,902 (3.24)	5,550 (5.52)
Driving/riding vehicles	2,530 (5.03)	678 (2.38)	222 (1.02)	1,846 (4.41)	1,584 (2.70)	3,430 (3.41)
Sports activities	585 (1.16)	192 (0.67)	103 (0.47)	448 (1.07)	432 (0.74)	880 (0.88)
Education	94 (0.19)	38 (0.13)	21 (0.10)	74 (0.18)	79 (0.13)	153 (0.15)
Others	297 (0.59)	171 (0.60)	122 (0.56)	269 (0.64)	321 (0.55)	590 (0.59)
Unknown	948 (1.89)	461 (1.62)	435 (2.00)	752 (1.80)	1,092 (1.86)	1,844 (1.83)
Time						
00:01–06:00	2,356 (4.69)	1,476 (5.18)	1,467 (6.73)	2,234 (5.34)	3,065 (5.22)	5,299 (5.27)
06:01–12:00	22,047 (43.87)	12,602 (44.22)	8,839 (40.55)	17,985 (43.00)	25,503 (43.42)	43,488 (43.25)
12:01–18:00	16,975 (33.78)	9,605 (33.70)	7,757 (35.59)	14,323 (34.25)	20,014 (31.38)	34,337 (34.15)
18:01–24:00	8,876 (17.66)	4,817 (16.90)	3,734 (17.13)	7,279 (14.50)	10,148 (17.28)	17,427 (17.33)
Natures of injury						
Bruise	19.779 (39.36)	10,482 (36.78)	7,675 (35.21)	17,345 (41.47)	20,591 (35.06)	37,936 (37.73)
Fracture	15,076 (30.00)	10,382 (36.43)	9,072 (41.62)	11,434 (27.34)	23,096 (39.33)	34,530 (34.34)
Sprain	9,267 (18.44)	3,896 (13.67)	1,863 (8.55)	5,826 (13.93)	9,200 (15.66)	15,026 (14.94)
Sharps injury, bites and open wounds	3,500 (6.96)	2,022 (7.09)	1,904 (8.74)	4,211 (10.07)	3,215 (5.47)	7,426 (7.39)
Concussion/Cerebral contusion	1,821 (3.62)	1,262 (4.43)	980 (4.50)	2,252 (5.38)	1,811 (3.08)	4,063 (4.04)
Organ system injury	200 (0.40)	103 (0.36)	50 (0.23)	223 (0.53)	130 (0.22)	353 (0.35)
Burn	137 (0.27)	80 (0.28)	57 (0.26)	127 (0.30)	147 (0.25)	274 (0.27)
Others	384 (0.76)	220 (0.77)	144 (0.66)	328 (0.78)	420 (0.72)	748 (0.74)
Unknown	90 (0.18)	53 (0.19)	52 (0.24)	75 (0.18)	120 (0.20)	195 (0.19)
Body part injured						
Lower limbs	16,055 (31.95)	8,956 (31.42)	7,595 (34.84)	12,920 (30.89)	19,686 (33.52)	32,606 (32.43)
Head	9,769 (19.44)	6,201 (21.76)	5,625 (25.81)	11,451 (27.38)	10,144 (17.27)	21,595 (21.48)
Torso	10,594 (21.08)	6,006 (21.07)	4,088 (18.75)	8,181 (19.56)	12,507 (21.30)	20,688 (20.57)

TABLE 1. (Continued)

Item	Age (Years)			Sex		Total, N (%)
	60–69, N (%)	70–79, N (%)	80–, N (%)	Male, N (%)	Female, N (%)	
Upper limbs	1,0582 (21.06)	5,334 (18.72)	3,066 (14.07)	6,104 (14.60)	12,878 (21.93)	18,982 (18.88)
Multiple parts	2,555 (5.08)	1,604 (5.63)	1,154 (5.29)	2,461 (5.88)	2,852 (4.86)	5,313 (5.28)
Whole body	318 (0.63)	168 (0.59)	97 (0.45)	315 (0.75)	268 (0.46)	583 (0.58)
Others	296 (0.59)	186 (0.65)	140 (0.64)	308 (0.74)	314 (0.53)	622 (0.62)
Unknown	85 (0.17)	45 (0.16)	32 (0.15)	81 (0.19)	81 (0.14)	162 (0.16)
Severity						
Mild	33,637 (66.93)	17,091 (59.97)	11,739 (53.86)	26,984 (64.52)	35,483 (60.42)	62,467 (62.12)
Moderate	15,350 (30.54)	10,419 (36.56)	9,083 (41.67)	13,358 (31.94)	21,494 (36.60)	34,852 (34.66)
Severe	1,267 (2.52)	990 (3.47)	975 (4.47)	1,479 (3.54)	1,753 (2.98)	3,232 (3.21)
Disposition						
Discharged after treatment	38,139 (75.89)	19,297 (67.71)	13,443 (61.67)	29,665 (70.93)	41,214 (70.18)	70,879 (70.49)
Observed	956 (1.90)	783 (2.75)	705 (3.23)	1,110 (2.63)	1,344 (2.29)	2,444 (2.43)
Admitted	10,179 (20.26)	7,656 (26.86)	6,945 (31.86)	10,022 (23.96)	14,758 (25.13)	24,780 (24.64)
Transferred	642 (1,28)	533 (1.87)	479 (2.20)	731 (1.75)	923 (1.57)	1,654 (1.64)
Dead	68 (0.14)	45 (0.16)	44 (0.20)	87 (0.21)	70 (0.12)	157 (0.16)
Others	270 (0.54)	186 (0.65)	181 (0.83)	216 (0.52)	421 (0.72)	637 (0.63)
Total	50,254 (100.00)	18,500 (100.00)	21,797 (100.00)	41,821 (100.00)	58,730 (100.00)	100,551 (100.00)

In summary, the data from the NISS can be used as an additional data source for research on falls in China. Older people could be prioritized as a target population for fall prevention and control programs. Professional institutions should further improve the collection of fall information, establish a multidisciplinary and multidepartment team for fall prevention, and carry out more high-quality community intervention trials. The intervention measures and strategies with strong evidence should be prioritized in terms of the domestic and foreign guidelines on fall prevention from the aspects of exercise, environmental improvement, disease prevention and control, rational drug use, use of auxiliary tools, and behavioral adjustment.

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Corresponding author: Yuliang Er, eryuliang@ncncd.chinacdc.cn.

[1] National Center for Chronic and Noncommunicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing, China.

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Preplanned Studies

Prevalence and Correlates of Healthy Aging Among Elderly Aged 65 Years and Over — 6 PLADs, China, 2019

Zhaoxue Yin[1]; Xin Gao[1]; Xiaochang Zhang[1]; Xiang Si[1]; Xiaolei Zhu[1]; Jixiang Ma[2,#]

Summary

What is already known on this topic?

Healthy aging among Chinese older people has low prevalence. Some sociodemographic and lifestyle factors were shown to be associated with healthy aging.

What is added by this report?

The age-adjusted prevalence of healthy aging in the 6 provincial-level administrative divisions (PLADs) of China is 15.8 % in 2019. County-level factors, such as the prevalence of healthy communities in a county, as well as some sociodemographic variables and physical exercise, are potential factors of healthy aging.

What are the implications for public health practice?

These findings showed that more targeted actions, including generalizing healthy communities and individual-level interventions, may be of great importance for healthy aging.

China's population is known to be aging, but research on the overall health of the aging population is limited. This study aimed to evaluate the prevalence of healthy aging as defined in Table 1 and its correlates among China's elderly aged 65 years and over through the community-based Healthy Aging Evaluation Longitudinal Study in China (HAELS), which was conducted in 6 provincial-level administrative divisions (PLADs) in 2019. Descriptive statistics and multilevel logistic regression were used. Results showed the age-adjusted prevalence of healthy aging in the 6 PLADs in 2019 was 15.8%. The prevalence of communities that satisfied criteria of being a "healthy community" at the county-level was significantly associated with healthy aging [odds ratio (OR): 1.20 per 10% increase in prevalence; 95% confidence interval (95% CI): 1.05–1.38]. Age, level of education, marital status, personal wealth, and physical exercise were also potential factors influencing healthy aging (P<0.05). More targeted interventions should be implemented to improve healthy aging.

The number of elderly people aged 65 years and over in China was 176 million in 2019, accounting for 12.6% of the population (*1*). Aging is a multifaceted process that affects physical, mental, and social functions. Rowe and Kahn have proposed a conceptual model of aging that describes aging as "usual" and "successful" (*2*); however, the "successful" category has been criticized due to potential stigmatization of the "usual" category as unsuccessful aging (*3*), so the term healthy aging is used in this paper. The Rowe and Kahn concept of successful aging has been widely used to measure healthy aging (*4*–*5*), and the specific measurements for the 5 criteria [no major disease, no disability, high cognitive function, high physical function, and active engagement with life (*6*)] used in this study are provided in Table 1.

HAELS was initiated in 2019 in 6 PLADs (Beijing, Shandong, Jilin, Jiangxi, Ningxia, and Guangxi) and collected high-quality information from representative samples of elderly individuals aged 65 years and over to evaluate and monitor the trends of healthy aging. These 6 PLADs were selected based on economic development level; 2 counties or city districts were randomly sampled from each province or municipality, respectively; 2 towns or street districts were sampled from each county or city district, respectively, using multistage stratified probability-proportional-to-size (PPS) sampling; and within each town or street district, 2 villages or communities, respectively, were selected using the PPS sampling method. In the final stage, within each village or community, 100 participants were randomly sampled from residents aged 65 years and over with consideration of the overall PLAD-based proportion of the 2 age groups (aged 65–79 years and ≥80 years). Overall, HAELS recruited 4,800 participants and had a final sample size of 4,690 for a response rate of 97.7%.

County-level information for the participants was also collected including the total population aged 65 years and over, the gross domestic product (GDP) per capita, the implementation of long-term care insurance, the total number of villages/communities, and the prevalence of communities that were deemed

TABLE 1. Criteria used to define 'healthy aging' in the HAELS conducted in 6 PLADs of China in 2019.

Concept model of Rowe and Kahn	Definition	Measurements in this study
No major disease	No major chronic disease and no depression symptom	None of the following chronic diseases: cancer, chronic lung disease, heart disease, and stroke; 15-item geriatric depression scale <5
No disability	No limitations in activities of daily living	Reporting no difficulty in performing activities of bathing, dressing, toileting, indoor transferring, continence, and feeding
High cognitive function	Getting median or higher score using MMSE	MMSE≥26 scores
High physical function	High performance in the physical tests or reporting no difficulty in moderate and high intense activities	Time to complete 4 meter gait speed test: <4.75 seconds (in the high tertile group); Time to complete the FTSST: <11.34 seconds (in the high tertile group); Performing moderate and high intense physical activities every week
Active social engagement	Reported involvement in those outdoor social activity	Reporting "joining in the social activities with friends or families at least once per week in the last year," "doing physical exercise outdoors," or "playing poker with friends" at least once per week

Abreviation: HAELS=Healthy aging evaluation longitudinal study; PLADs=Provincial-level administrative divisions; MMSE=Mini-mental state examination; FTSST=Five time sit-to-stand test.

"healthy". Healthy communities are part of the "China Healthy Lifestyle for All" national campaign (*7*), which promotes the construction of communities that have clean environments, places for physical activity and exercise, trails, "health huts", and activities promoting healthier lifestyles. The prevalence of healthy community was defined as the proportion of healthy communities/villages to the total number of communities/villages in one county. The HAELS study was approved by the ethics committee of Chinese Center for Disease Control and Prevention, and all participants (or proxies) provided written informed consent.

Descriptive statistics were performed to show the prevalence and 95% CI of healthy aging. The age-adjusted prevalence and the corresponding 95% CI were also calculated according to the proportion of the two age groups among the elderly in the 6 PLADs. Considering the hierarchical structure of the data and the dichotomous nature of healthy aging, two-level random intercept logistic regressions were applied using the programs of PROC GLIMMIX and PROC NLMIXED; the OR and 95% CI for healthy aging were estimated. First, the null model was fit with no independent variables included to determine whether the data in this study was sufficient to assess the random effect at the second level (county-level) or not; then three models were further fit: model 1, only level 2 explanatory variables including residence, GDP per capita, long-term care insurance, and prevalence of healthy community in a county were included; in model 2, level 2 explanatory variables and sociodemographic variables (level 1 explanatory variables) were included; and in model 3, lifestyles, as level 1 explanatory variables, were further included. All statistical analyses were performed with SAS (version 9.4, SAS Institute Inc., Cary, NC, US). $P<0.05$ was considered statistically significant; all P values were two-sided.

As shown in Table 2, the crude prevalence of healthy aging was 16.9% among older people in the 6 PLADs, and the age-adjusted prevalence was 15.8%. The age-adjusted rate of "no major diseases", "no disability", "high cognitive function", "high physical function", and "active engagement with life" was 43.0%, 88.7%, 49.1%, 79.3%, and 69.0%, respectively.

The empty model showed there was significant variation in the effect of healthy aging across counties (P=0.04), and the intra-class correlation coefficient in the null model was 7.5% (P=0.03), which meant the random effect model that considering the effect of clustering should be fit. As shown in Table 3, the prevalence of healthy communities as a level-2 predictor was positively associated with healthy aging with OR=1.20 (95% CI: 1.05–1.38), which meant that odds of healthy aging would increase 20% per 10% increases in the prevalence of healthy communities in a county-level region. Age was negatively associated with healthy aging, while high education level, being married, having high wealth, and doing physical exercise were potential protective factors of healthy aging (P<0.05).

DISCUSSION

This study demonstrated that the age-adjusted prevalence of healthy aging was 15.8% among the older people aged 65 years and over in 6 PLADs. The proportion of healthy communities in a county/district, as well as some demographic variables and physical exercise were factors affecting healthy aging.

TABLE 2. Prevalence of healthy aging and each component by characteristics among older people aged 65 years and over (N*=4,690) in 6 PLADs† of China in 2019.

Characteristics	N*	Healthy aging §	No major disease§	No disability§	High cognitive function§	High physical function§	Active engagement with life§
Crude rate	4,690	16.9 (15.8, 18.0)	43.8 (42.4, 45.2)	89. 8 (88.9, 90.7)	51.7 (50.3, 53.1)	81.3 (80.2, 82.5)	70.0 (68.7, 71.3)
Age-adjusted rate		15.8 (14.7, 16.9)	43.0 (41.1, 44.9)	88.7 (85.9, 91.3)	49.1 (47.1, 51.2)	79.3 (76.8, 81.8)	69.0 (66.7, 71.4)
Age (years)							
65–79	4,181	18.4 (17.2, 19.6)	45.0 (43.5, 46.5)	91.6 (90.7, 92.4)	55.4 (54.0, 57.0)	84.3 (83.2, 85.4)	71.4 (70.0, 72.8)
≥80	509	4.3 (2.56, 6.09)	34.0 (29.8,38.1)	75.4 (71.7, 79.2)	21.0 (17.5, 24.6)	57.0 (52.7, 61.3)	58.4 (54.1, 62.6)
P		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sex							
Male	2,135	20.7 (19.0, 22.4)	47.0 (44.9, 49.1)	89.7 (88.4, 91.0)	60.3 (58.3, 62.4)	79.9 (78.2, 81.6)	71.4 (69.5, 73.3)
Female	2,555	13.7 (12.4, 15.0)	41.2 (39.3, 43.1)	89.9 (88.7, 91.1)	44.5 (42.6, 46.4)	82.6 (81.1, 84.1)	68.8 (67.0, 70.6)
P		<0.001	<0.001	0.82	<0.001	0.02	0.06
Years of education							
0	1,226	4.2 (3.0, 5.3)	38.4 (35.7, 41.1)	86.1 (84.1, 88.0)	17.2 (15.1, 19.3)	74.3 (71.9, 76.8)	60.5 (57.8, 63.3)
1–6	2,106	16.2 (14.7, 17.8)	45.5 (43.4, 47.7)	90.5 (89.2, 91.8)	54.3 (52.2, 56.4)	81.3 (79.7, 83.0)	66.1 (64.1, 68.2)
>6	1,358	29.4 (27.0, 31.8)	46.0 (43.4, 48.7)	92.1 (90.7, 93.5)	78.8 (76.6, 81.0)	87.7 (86.0, 89.4)	84.4 (82.5, 86.4)
P		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Marital status							
Married	3,384	19.5(18.1, 20.8)	46.8 (45.1, 48.5)	90.8 (89.8, 91.8)	56.7 (55.0, 58.4)	83.5 (82.2, 84.7)	71.3 (69.8, 72.8)
Other	1306	10.2 (8.5, 11.8)	36.1 (33.5, 38.7)	87.2 (85.4, 89.0)	38.7 (36.1, 41.4)	75.9 (73.6, 78.2)	66.6 (64.0, 69.1)
P		<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Living alone							
Yes	750	12.9 (10.5, 15.3)	37.3 (33.9, 40.8)	89.9 (87.7, 92.0)	41.7 (38.2, 45.3)	80.9 (78.1, 83.7)	67.6 (64.3, 71.0)
No	3,940	17.6 (16.5, 18.8)	45.1 (43.5, 46.6)	89.8 (88.8,90.7)	53.6 (52.1, 55.2)	81.4 (80.2, 82.6)	70.4 (69.0, 71.9)
P		0.002	<0.001		<0.001	0.75	0.12
Wealth status							
Good	754	26.4 (23.2, 29.5)	48.9 (45.4, 52.5)	91.5 (89.5, 93.5)	61.0 (57.5, 64.5)	83.4 (80.8, 86.1)	82.9 (80.2, 85.6)
Poor	3,936	15.1 (14.0, 16.2)	42.8 (41.3, 44.4)	89.5 (88.5, 90.4)	49.9 (48.4, 51.5)	81.0 (79.7, 82.1)	67.5 (66.0, 69.0)
P		<0.001	0.002	0.09	<0.001	0.11	<0.001
Residence area type							
Urban	2,357	21.7 (20.1, 23.4)	44.6 (42.6, 46.6)	91.3 (90.2, 92.5)	61.3 (59.3, 63.2)	82.8 (81.3, 84.3)	82.9 (81.4, 84.5)
Rural	2,333	12.0 (10.7, 13.3)	43.0 (41.0, 45.0)	88.3 (87.0, 89.6)	42.1 (40.1, 44.1)	79.9 (78.3, 81.5)	56.9 (54.9, 58.9)
P		<0.001	0.26	<0.001	<0.001	0.01	<0.001
Long-term healthcare insurance							
Yes	1,538	15.1 (13.3, 16.9)	50.3 (47.7, 52.8)	91.2 (89.7, 92.6)	45.8 (43.3, 48.3)	82.9 (81.0, 84.8)	60.9 (58.4, 63.3)
No	3,152	17.8 (16.4, 19.1)	40.7 (38.9, 42.4)	89.2 (88.1, 90.2)	54.6 (52.9, 56.3)	80.6 (79.2, 82.0)	74.4 (72.9, 76.0)
P		0.02	<0.001	0.03	<0.001	0.06	<0.001

*: N=Number of participants.

†: PLADs=Provincial-Level Administrative Divisions.

§: Data was shown as % (95% Confidence Internal).

TABLE 3. Multilevel logistic regression of healthy aging among elderly people aged 65 years and over (N*=4,690) in 6 PLADs† in China in 2019§.

Variables	Model 1	Model 2	Model 3
County-level variables			
Rural (ref.=urban)	0.55 (0.38, 0.78) ¶	0.80 (0.55, 1.16)	1.05 (0.68, 1.62)
GDP per capital (per 1,000 dollars)	1.00 (0.97, 1.03)	0.90 (0.64,1.26)	0.95 (0.64, 1.41)
Long-term care policy (ref.=no)	1.12 (0.79, 1.59)	1.17 (0.81, 1.71)	1.38 (0.89, 2.13)
Prevalence of health community (per 10% increase)	1.21 (1.09, 1.35)¶	1.23 (1.10, 1.39)¶	1.20 (1.05,1.38)**
Sociodemographic variables			
Age (ref.=65–79 years)			
Age≥80 years		0.27(0.16, 0.45)¶	0.29 (0.17, 0.48)¶
Sex (ref.=male)			
Female		0.83 (0.68, 0.99)**	0.85 (0.68, 1.06)
Education years (ref.=0)			
1–6		3.90 (2.73, 5.58) ¶	3.82 (2.66, 5.53)¶
>6		6.49 (4.43, 9.47)¶	6.11 (4.13, 8.98)¶
Marital status (ref.=other status)			
Married		1.43(1.08, 1.90)**	1.38 (1.04, 1.82)**
Living alone (ref.=no)			
Yes		1.16 (0.84, 1.59)	1.15 (0.83, 1.58)
Wealth status (ref.=poor)			
Good		1.92 (1.52, 2.41)¶	1.75 (1.40, 2.22)¶
Lifestyle variables			
Smoke			0.96 (0.76, 1.19)
Alcohol drinking			1.15 (0.91, 1.44)
Tea			1.01 (0.81, 1.25)
Physical exercise			2.62 (2.11, 3.23)¶

*: N=Number of participants.

†: PLADs=Provincial-Level Administrative Divisions.

§: Data was shown as odds ratio (95% confidence internal). The null model, with no independent variables included, was fit; results assessed the random effect at level 2 (county/city-district level) and the three models were then fit. Model 1: only level 2 explanatory variables, including residence, GDP per capita, and long-term healthcare insurance, were included. Model 2: level 2 explanatory variables and sociodemographic variables (level 1) were included. Model 3: smoking, alcohol drinking, tea, and physical activities were further included.

¶: P<0.01.

**: P<0.05.

The prevalence found in this study was slightly higher than the national prevalence reported by the China Health and Retirement Longitudinal Study (CHARLS) in China in 2011 (13.2%) (*6*), and further analysis showed that the increase came mainly from the dimensions of physical function and social engagement. The prevalence found in this study was lower, however, than that of a comparable study conducted in Singapore in 2013 (19.6%), and the difference was most likely related to the higher prevalence of 'active engagement with life' in Singapore (*8*). However, the results of this study showed a higher prevalence than the mean level of European countries (8.5%) from 2004 to 2007 (*9*). The discrepancy across studies is also likely related to the inconsistent measurements of components of healthy aging, especially the dimension of "high physical function" and "active engagement with life." However, there is currently no consensus on exactly what specific measurements should be included in the construct of healthy/successful aging.

In this study, the finding of negative association between age and healthy aging was not unexpected. Education was found to be positively associated with healthy aging, which was consistent with recent studies (*6*,*10*). Those with higher levels of education may possess greater knowledge and skills that enable them to have good lifestyles, participate in their communities, and avoid chronic diseases. Good wealth status was found to be one potential protective factor of healthy aging, which has been reflected in previous studies (*4*,*8*), and it is possible that older people with good wealth status can more easily access healthcare resources. Physical exercise was found to be positively associated with healthy aging, which was consistent with previous studies (*11*).

This study also found that the prevalence of healthy community was positively related with healthy aging, which was supported by a previous study that suggested that older adults living in communities with proper health-related infrastructure had higher odds of experiencing healthy aging (*4*). Constructing healthy communities that have health-promoting elements in the community could be beneficial to healthy aging, and environmental resources were also shown to be an important factor in explaining inequality in healthy aging (*12*).

The findings are subject to some limitations. First, causal association cannot be established because this data was cross-sectional. Second, elderly aged 80 and over were less sampled in this study, considering the proportion of this age group in the 6 PLADs. However, the prevalence was age-adjusted to address this challenge. Third, some variables, including genetic factors and interaction effect between variables, were not included in the model.

These findings have important public health implications. They showed that more targeted actions, including county-level as well as individual-level interventions, should be taken to improve healthy aging.

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Corresponding author: Jixiang Ma, majix@163.com.

[1] Division of non-communicable diseases and elderly health management, Chinese Center for Disease Control and Prevention, Beijing, China; [2] Shandong Center for Disease Control and Prevention, Jinan, Shandong, China.

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Perspectives

Time to Take Actions to Reduce the Harmful Use of Alcohol in China

Ning Ji[1]; Yamin Bai[1,#]; Jianwei Xu[1]; Min Liu[1]; Ainan Jia[1]

Harmful use of alcohol negatively impacts and harms the drinkers, the people around them, and society at large. Harmful use of alcohol ranks among the top 5 risk factors for disease, disability, and death worldwide, and alcohol consumption is related to approximately 230 health conditions including infectious disease, noncommunicable diseases, and injuries (*1*–*2*).

DISEASE BURDEN OF ALCOHOL

Worldwide, alcohol use was responsible for some 3 million deaths (5.3% of all deaths) and 132.6 million disability-adjusted life years (DALYs) (5.1% of all DALYs) in 2016 (*2*). In China, alcohol caused 381,200 deaths and decreased people's life expectancy by an average of 0.43 years in 2013 (*3*). In that year, in terms of population attributable risk of deaths, 44.56% of cirrhosis, 28.80% of esophageal cancer, 27.65% of nasopharyngeal cancer, 27.45% of epilepsy, and 25.13% of liver cancer were attributable to alcohol consumption in China (*3*). Disturbingly, the burden of disease and injuries resulting from alcohol consumption increased rapidly in China. According to the global burden of disease (GBD) study, from 1990 to 2017, the total number of DALYs and the age-standardized DALY rate due to alcohol consumption increased by 58.51% and 16.02%, respectively (*4*).

ALCOHOL CONSUMPTION

Alcohol consumption is part of Chinese culture which has a long history dating back to 7,000 years ago when drinking was common in festivals and in business meetings, especially for men. The 2015 China Chronic Disease and Nutrition Surveillance (CCDNS) reported that the prevalence of current alcohol use (those who have drank in the last 12 months) among Chinese adults over 18 years was 41.3% overall, 61.7% in men, and 20.3% in women (*5*). In 2013, among the same population, the prevalence of current alcohol use was 37.1% overall, 58.3% in men, and 15.4% in women. The 2007 CCDNS reported the prevalence of current alcohol use in those aged 18–69 years was 35.7% overall, 55.6% in men, and 15.0% in women, which indicated a continuous increase (*6*).

ALCOHOL POLICY IN CHINA

In 2018, the World Health Organization (WHO) launched SAFER, a new initiative and technical package aimed to help governments to reduce the harmful use of alcohol. SAFER encompasses five high-impact strategies, namely: strengthening restrictions on alcohol availability; advancing and enforcing drunk-driving countermeasures; facilitating access to screening, brief interventions, and treatment; enforcing bans for comprehensive restrictions on alcohol advertising, sponsorship, and promotion; and raising prices on alcohol through excise taxes and other pricing policies. SAFER is a roadmap for governments to address the issue of harmful use of alcohol (*7*). In the following sections, alcohol policy in China were described according to the SAFER framework.

Alcohol Availability

Alcohol use is lawful in China, therefore the key to reducing alcohol consumption and alcohol-related harm is to control the accessibility of liquor. Since China adopted the Reform and Opening-Up Policy in the 1980s, the government discontinued the monopoly on alcohol (*8*). Different departments independently managed the materials, production, and sales of alcohol. Currently, China regulates alcohol under the Food Safety Law, in which the licensing system plays an important role. However, the decentralized management of alcohol production and circulation poses a major barrier for reducing the harmful use of alcohol because no sector can commit to taking full responsibility, and stakeholders have different interests and have difficulty reaching consensus. China has no enforceable legal provision to regulate when or where alcoholic beverages are sold. Setting the minimum age is an important measure to protect minors from alcohol consumption. The Law on the Protection of Minors bans selling alcohol to minors under the age of 18 years old (*9*) and the Health Promotion Law also explicitly prohibits the sale of alcohol to minors (*10*), but violations are commonplace. In China, several measures may be considered to control the availability of alcohol. A government monopoly can effectively limit the availability of alcohol. In China, where monopolies do not exist, harmonizing interests of all stakeholders and strengthening their cooperation can help effectively enforce licensing regulations. It is advisable to regulate the density of alcohol outlets and ban it where there is undue harm and to regulate the days and hours of sale. Moreover, strictly enforcing the ban on the sale of alcohol to minors plus limiting the secondary supply of alcohol from parents or friends can help this issue.

Drinking and Driving Countermeasures

Effective road safety transport policies are essential to reduce drinking and driving, which harms not only the drinker but also innocent people such as passengers and pedestrians. Drinking and driving has received special attention in China. The Road Traffic Safety Law of the People's Republic of China, revised in 2011, has been amended to impose harsher penalties. Based on blood alcohol concentration (BAC), the law imposed different punishments for drinking and driving (20 mg/100 mL≤BAC<80 mg/100 mL) and drunk driving (BAC≥80 mg/100 mL), including flat fines, penalty points, mandatory treatment, license suspension/revocation, imprisonment, short-term detention, and criminal penalty (*11*). Furthermore, drunk driving is listed in criminal law since 2011. An interrupted time-series analysis based on data from the Traffic Management Bureau of the Ministry of Public Security of the People's Republic of China showed that the average annual incidences of crashes, mortality, and injuries slightly dropped after the enactment of the amended laws, which is far from expectation (*12*). On October 30, 2020, the Traffic Management Bureau of the Ministry of Public Security organized the national public security traffic departments to carry out centralized and unified weekend night inspections, which investigated and punished more than 9,000 drinking and driving cases, including more than 1,500 drunk-driving cases (*13*). Drinking and driving remains an urgent problem in China, requiring effective enforcement of laws accompanied by strong public awareness campaigns.

Screening, Brief Interventions, and Treatment

Health services are central in helping individuals to tackle alcohol-related harms. Consistent evidence indicates that screening and brief interventions in healthcare settings could bring in a large health gain, although they are costly to implement. To date, China has not implemented systematic screening and brief interventions. Behavior and pharmacological therapies are effective in treating alcohol use disorders. In China, many patients suffering from alcohol-use disorders were untreated, although it ranked among the top 3 mental diseases. Several concrete steps were recommended to facilitate access to screening, brief interventions, and treatment by increasing the capacity of the health and social welfare systems by funding and supporting initiatives for screening and brief interventions and by enhancing availability, accessibility, and affordable health services especially to persons of low socioeconomic status.

Restrictions on Alcohol Advertising, Sponsorship, and Promotion

Alcohol advertising can recruit new drinkers and increase the amount of alcohol consumed by current drinkers, and it is therefore widely used by alcohol enterprises to promote sales. Bans or comprehensive restrictions on alcohol advertising, promotion, and sponsorship could help protect young people from alcohol marketing and reduce the reactivity of alcohol-dependent persons. Currently, alcohol advertising is regulated under the Advertisement Law of the People's Republic of China (*14*) and the Regulation on Broadcasting of Radio and Television Advertisements (*15*). Legal provisions stipulate the content, form, quantity, time, and publishing media of alcohol advertisements, but these legal provisions are poorly enforced. In addition, there are no regulations on outdoor alcohol advertising and online alcohol advertising (*16–17*). China has several measures at its disposal to limit the marketing of alcohol by improving relevant laws and regulations, by developing effective systems of surveillance of marketing of alcohol products, and by establishing effective administrative and deterrence systems for violations.

Raising Prices on Alcohol

Raising alcohol prices leads to decreased alcohol consumption. Pricing and taxation were assessed to have the strongest impacts on alcohol consumption among all alcohol policy measures. Both a value-added tax (VAT) and excise taxes are imposed on alcohol in China. The VAT has been maintained at 17% (*18*), while the excise tax has been adjusted several times. The history of levying taxes in China is complicated and has been more focused on expanding production, sales, and resulting tax revenue instead of reducing harmful drinking. For example, grain wine was taxed at 50% in 1984 and decreased to 25% in 1995 and 20% in 2006, and it has remained at 20% following new policies in 2009 (*11*). Therefore, China's tax policy has a relatively low tax rate on alcohol that is not used as a tool to reduce harmful consumption. Raising the lowest prices on alcohol by introducing a legal minimum price per gram of alcohol has a potentially great impact on total consumption. Currently, there is no legal minimum prices for alcohol in China. China can try several steps to influence the final price of alcohol by increasing excise taxes, by establishing minimum prices for alcohol, and by restricting the use of price promotion.

OPPORTUNITIES, CHALLENGES, AND THE WAY FORWARD

Sustainable reaction to address the issue of harmful use of alcohol requires solid political will and commitment. In response to the huge burden caused by alcohol consumption, both the Healthy China 2030 plan (*19*) and Medium-to-Long Term Plan for the Prevention and Treatment of Chronic Disease (2017–2025) (*20*) (hereafter: "the two national plans") pointed out that the harmful use of alcohol should be reduced. This is the first time that China included the reduction of alcohol use in national level plans, which indicated that China has gradually attached importance to the harm of alcohol consumption. In addition, the government requires public officials to avoid extravagance and drinking high-end alcohol, which provides a strong role model effect in reducing alcohol consumption.

However, China's efforts to reduce harmful use of alcohol are still at the beginning. Although the two national-level plans pointed out the need to reduce harmful use of alcohol, neither gave specific targets for reducing alcohol consumption or drinking rates. China has not yet established a specialized agency responsible for reducing the harmful use of alcohol, let alone a mechanism for multisectoral coordination. In all five areas of SAFER which the WHO recommended, as mentioned above, China's current strategies have not yet been implemented or need to be promoted further.

Facing the huge public health challenge caused by harmful use of alcohol, the WHO proposed the Global Strategy to Reduce the Harmful Use of Alcohol in 2010 (*21*) and further launched the SAFER initiative, which are the most comprehensive documents with guidance on reducing the harmful use of alcohol. The harmful use of alcohol is closely relevant to the 2030 Agenda for Sustainable Development. As a member state, China should fully utilize the existing evidence-based cost-effectiveness strategies and measures recommended by the WHO and, based on the current situation of alcohol epidemiology, address the severe public health challenge caused by harmful use of alcohol.

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[#] Corresponding author: Yamin Bai, baiyamin@ncncd.chinacdc.cn.

[1] National Center for Chronic and Noncommunicable Disease Control and Prevention, China CDC, Beijing, China.

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Healthy China

Health Education in the Healthy China Initiative 2019−2030

Zhuojun Jiang[1]; Wen Jiang[1,#]

Summary

As the first of 15 Healthy China initiatives, the Health Education Initiative has the crucially important goal of improving citizens' health literacy. There are two key activities in the initiative for improving health literacy. The first is to establish a mechanism for dissemination of health sciences knowledge through development of national and provincial databases of health sciences expertise and a national resource of accessible health knowledge. The second is to establish a health education and health promotion performance evaluation mechanism for medical institutions and medical personnel. In this paper, we analyzed the content and strategies of these two health educational activities.

BACKGROUND

In 2016, China put forward "Healthy China 2030" as a national strategy, stressing the importance that China places people's health as a developmental priority (*1*) and the importance of China's active participation in global health governance and fulfillment of its commitment to the United Nation's 2030 Agenda for Sustainable Development (*2*). Three years later, China promulgated the Healthy China Initiative 2019–2030 as the implementation plan for Healthy China 2030 (*3*).

The Healthy China Initiative 2019–2030 will conduct 15 major initiatives, including health education promotion, mental health promotion, and tobacco control, each with its own progress indicators. These initiatives highlight the importance of preventing and controlling diseases at their source, targeting major problems and diseases affecting people's health, and highlighting health promotion and social mobilization. The Health Education Initiative will strengthen the health education system, popularize knowledge about health, teach scientifically valid perspectives of health, strengthen early intervention, promote healthy lifestyles in good ecological and social environments, and ultimately prolong healthy lives.

KEY CONTENT & TARGETS

The Health Education Initiative has a premise that improvement of health literacy will improve the health of all people. That is, a prerequisite for improving health is to improve knowledge about health, which can help make healthy behaviors and skills high quality and practiced universally. Health education is the first of the 15 Healthy China Initiatives, and it works at three levels — the individual/family level, the societal level, and the governmental level — indicated in shorthand by "1, 2, 7, 7".1, 2, 7, 7".

"1" refers to an outcome indicator of health literacy that is measured at the national level.

"2" refers to two binding targets. The first is to establish a national and provincial database of health science experts and a national resource of health knowledge, with the purpose of establishing a mechanism of health science knowledge dissemination. The second target is to establish a health education and health promotion performance evaluation mechanism for medical institutions and medical personnel.

"7" and "7" refer to the contents of each of the seven parts of the individual/family and society/government levels.

Targets of the Health Education Initiative are to achieve national health literacy levels of at least 22% by 2022 and 30% by 2030. Specific indicators are shown in Table 1.

Health literacy refers to the ability of individuals to access and understand basic health information and services, and use information and services to make informed decisions to maintain and promote their own health (*4*). The health literacy level refers to the proportion of people achieving health literacy among the total population.

Figure 1 shows health literacy over time. In 2008, health literacy was 6.48% (*5*); between 2012 and 2019, health literacy increased. Literacy rose by 2.6% and 2.88% in 2016–2017 and 2017–2018, 2.11% from 2018 to 2019.

We think that rising health literacy may be related to popularization and development of the Internet in

TABLE 1. Major outcome indices proposed for the Health Education Initiative.

Indices	Targeted data 2020 (%)	Targeted data 2030 (%)
National level of health literacy	22	30
Basic knowledge and conceptual literacy level	30	45
Healthy lifestyle and behavioral literacy level	18	25
Basic skills and literacy level	20	30
Basic medical literacy	20	28
Chronic disease prevention and control literacy	20	30
Infectious disease prevention and control literacy	20	25
Population blood donation rate	15	25
Proportion of departments set up in traditional Chinese medicine hospitals to treat sub-health diseases	90	100

China. In 2016, fixed broadband networks and mobile communication networks - the foundation of China's communication industry - made great progress. The fully packetized fixed broadband network has been completed nationwide, and the 4G mobile communication network has been completed. China's network environment has been further optimized, as it encompasses the entire country and all cities with fiber optic networks. Currently, 72% of broadband is optical fiber, and there are over 700 million 4G users in China (*6*).

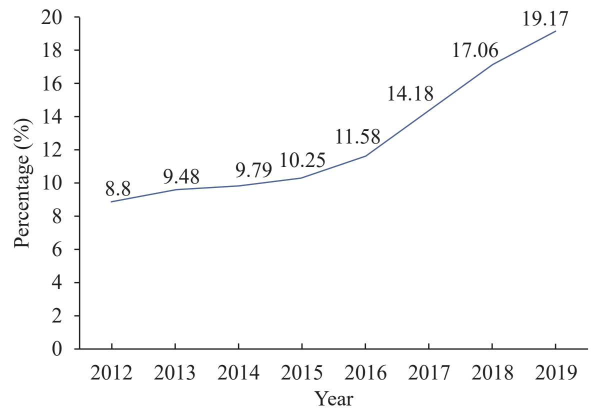

FIGURE 1. National health literacy level of residents in China, 2012–2019.

STRATEGIES

Achieving health literacy under the Healthy China Initiative will require implementation of several strategies, described below.

Strengthen Monitoring and Testing

Health literacy should be regularly monitored in a nationally-representative manner. In accordance with monitoring results, targeted science education can be conducted so that residents know, believe, and implement healthy behaviors, ultimately forming healthy values. The Healthy China Initiative advocates prevention first. Thus, it is important to disseminate science knowledge and inform residents about lifestyle changes that can prevent diseases at their sources. Once cultural values are established and firmly rooted, they will become behavioral habits and will improve the nation's overall health.

Enrich Popular Science Knowledge Resources

Strengthening science popularization and promoting health knowledge requires analysis and effective resource material. For example, identifying behavioral change points and using plain language to explain professional concepts can make important knowledge accessible to lay people. To be effective, it is important to consider the audience when developing material to help people make decisions promoting healthy behaviors in their complicated lives. Health literacy materials must be updated to remain relevant and provide accurate information about hot or popular topics.

Use Multiple Perspectives and Channels

People receive information from a variety of sources. A key strategy is to combine new media to promote new ideas and knowledge from multiple perspectives and channels. At the government level, it is necessary to enhance inter-governmental cooperation and increase channels for health knowledge dissemination. For medical professionals, health industry and other associations should be encouraged to organize experts to for medical institution-oriented training. Communities should regard promotion of health knowledge as important work and organize health communication activities that address people's health problems. It is especially important to strengthen the promotion of health literacy among in poor areas.

PERSPECTIVE

Health literacy is an important factor for effective disease prevention and control. With COVID-19 under good control in China, health literacy will help the public maintain protection from the virus while fighting the pandemic globally. In view of resurgences of COVID-19 in other countries during autumn and winter this year, precautions must be taken in China. The COVID-19 outbreaks in Qingdao, Tianjin, and Shanghai remind us that we need to adhere to important prevention and control measures: wearing masks, maintaining safe physical distancing, washing hands frequently, and ventilating homes adequately. These measures are effective not only for COVID-19, but also for other respiratory infections such as influenza. Basic prevention and control measures need to be universally adopted so that everyone can master and apply them to better prevent and control COVID-19.

In the long run, it is important to increase healthy life expectancy to 79 years — a target that is on the pathway to achieving a health China by 2030.

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Corresponding author: Wen Jiang, 2225840889@qq.com.

[1] Media Integration and Mass Communication Department, China Population Communication Center, Beijing, China.

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