

VIEWPOINT

Life Expectancy, Causes of Death, Risk Factors in China and the U.S.



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INTRODUCTION

The series of studies on the global burden of disease (GBD) is conducted by multinational researchers and is organized by the Institute for Health Metrics and Evaluation for multinational population-related data. These researchers can dynamically monitor and comprehensively evaluate disease incidence, mortality, disability-adjusted life years (DALYs), and healthy life expectancy (HALE). These researchers also analyze the burden of disease in different countries or regions, populations, and diseases; ascertain the main major disease, high-risk groups, and high-prevalence areas; and identify the main risk factors.¹ The GBD series of studies plays a crucial role in enacting public health policies, assessing the progress of millennium development goals, and promoting the implementation of sustainable development goals.

The current GBD series of studies was developed from GBD 1990 to GBD 2015, which covered all previous GBD results, comprehensively assessing 315 diseases and injuries, 249 causes of death, and 79 risk factors.²⁻⁴ Meanwhile, a summary metric referred to as the sociodemographic index (SDI) was constructed through the GBD 2015 to estimate the HALE and DALYs. The evaluation of the health status of countries or regions is crucial.

On the basis of the latest GBD 2015 data, the present study analyzes the life expectancy, causes of death, and risk factors; investigates the health status and quality of life; and evaluates the current situation and development trend of the disease burden in China and the United States to provide a scientific basis for health decision making in China.

LIFE EXPECTANCY AND HALE AT BIRTH

The disease and the cause of death spectra have changed significantly with the development of medical socialization; infectious and cardiovascular disease mortalities have decreased considerably, and the life expectancy of the world's population is much longer than that 23 years ago.⁵ The GBD 2015 data indicate that global life expectancy at birth increased by 7.1 years from 64.8 years in 1990 to 71.9 years in 2015. The life expectancy of men is less than that of women, which increased by 6 and 7.1 years, respectively. The life expectancy at birth of Chinese people is growing at a steady level and is higher than the global average. Although the growth trend of the Chinese life expectancy is significantly higher than that of the United States, a certain gap remains in life expectancy (Fig. 1). Since the 1960s, the growth trend of life expectancy at birth in China has been prominent. The life expectancy at birth in China was 76.3 years in 2015, which increased by 9.6 years from that in 1990 (66.7 years). The life expectancy at birth of men and women were 73.2 and 79.9 years, which increased by 7.2 and 9.7 years from 1990, respectively. In the past 25 years, the life expectancy at birth in the United States has increased by 3.7 years. Although the trend is continuous and gradual, the life expectancy at birth in the United States has increased modestly. The life expectancy at birth in the United States is 79.1 years, which is 2.9 years higher than that in China in 2015. The current mortality level of Chinese population is low, the health level of the population has significantly improved, and the life expectancy has been significantly extended.

The authors declare no actual or potential conflicts of interest.

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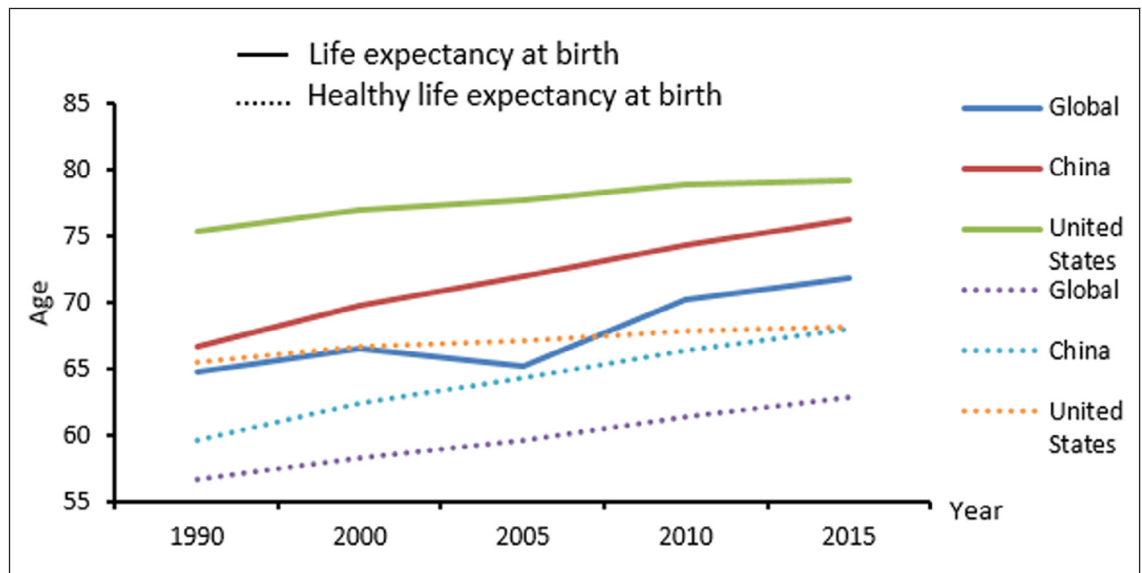


Figure 1. Life expectancy and HALE at birth in 1990-2015 in the populations of China and the United States. Abbreviations: HALE, healthy life expectancy.

The HALE at birth in 2015 was 62.8 years—that is, 64.9 and 60.9 years in females and male populations, respectively. Since 1990, the HALE at birth increased by 6.4 and 5.5 years for female and male populations, respectively. The HALE at birth of people older than age 65 increased by 1.9 years from 11.2 to 13.1 years from 1990 to 2015. The HALE at birth in China and the United States has been a growing trend, but that in China increased significantly higher than that in the United States. In 2015, the HALE at birth in China was close to that in the United States, with a difference of only 0.1 years, 0.9 years between those of the population of older than 65 years, and 0.3 years between female populations. The health and functional status of the Chinese population, especially women, is approaching the health level of the American population, and the health gap is narrowing.

CAUSE OF DEATH AND DISABILITY

Based on the SDI, the top 10 diseases and injuries of global DALYs in 2015 included ischemic heart disease, cerebrovascular disease, lower respiratory infection, low back and neck pain, neonatal preterm birth, diarrheal disease, sense organ disease, neonatal encephalopathy, road injuries, and HIV/AIDS. Among these diseases, 59.7% of the DALY loss was caused by noncommunicable diseases. A total of 54% of the world's countries or regions suffered either from ischemic heart or cerebrovascular disease or from both.

From the DALYs in 1990, low back and neck pain, sense organ disease, and HIV/AIDS climbed to the top 10 in the past 25 years, whereas malaria and congenital malformations were removed from the list. In 2015, the total mortality in China was 6.8 per thousand. Cerebrovascular disease, ischemic heart disease (IHD), chronic obstructive pulmonary disease, and cancer (lung and liver) were the leading causes of death in China, accounting for 20.1%, 15.5%, 9.7%, 6.2%, and 4.2% of the total deaths, respectively. In addition, IHD, Alzheimer's disease, and lung cancer were the 3 leading causes of death in the United States, and the total mortality was 8.3 per thousand. The 10 leading causes of death and disability in 2015 in China and the United States are listed in Tables 1–3.

From 2005 to 2015, the cerebrovascular disease remained the leading cause of death in China even with the improvement of medical care, but the life loss caused by cerebrovascular disease decreased by 16.2% and 11.0% in China and the United States, respectively. The epidemic of chronic disease in China reported by the World Bank in 2011 indicated that the number of cases of cerebrovascular disease by the age of 40 would increase 2 to 3 times and mainly concentrated in the next 10 years.⁶ The incidence of cerebrovascular disease is much higher than the level in developing countries, and the incidence in the urban areas is higher than that in the rural areas. The loss of DALYs caused by cerebrovascular diseases increased by 11% in 2015. The morbidity and mortality

Table 1. Causes of DALYs in China and the United States

Ten Leading Causes of DALYs

China	Stroke	IHD	Back and neck	COPD	Road injuries	Sense organ disease	Lung cancer	Liver cancer	Depression	Diabetes
United States	IHD	Back and neck	Diabetes	Lung cancer	Depression	COPD	Drug	Alzheimer's	Sense organ disease	Other MSK

From left to right, ranked 1-10.
 COPD, chronic obstructive pulmonary disease; DALYs, disability-adjusted life years; IHD, ischemic heart disease; MSK, musculoskeletal disorder.

Table 2. Causes of YLL in China and the United States

Ten Leading Causes of YLL

China	Stroke	IHD	Road injuries	Lung cancer	COPD	Liver cancer	Stomach cancer	LRI	Congenital	Self-harm
United States	IHD	Lung cancer	COPD	Alzheimer's	Stroke	Self-harm	Road injuries	Drugs	Colorectal cancer	LRI

From left to right, ranked 1-10.
 COPD, chronic obstructive pulmonary disease; IHD, ischemic heart disease; LRI, lower respiratory infection; MSK, musculoskeletal disorder; YLL, years of life lost.

Table 3. Causes of YLD in China and the United States

Ten Leading Causes of YLD

China	Back and neck	Sense organ disease	Depression	Skin	Diabetes	Other MSK	Iron	Schizophrenia	Migraine	Anxiety
United States	Back and neck	Depression	Diabetes	Sense organ disease	Other MSK	Skin	Anxiety	Migraine	Drugs	Iron

From left to right, ranked 1-10.
 COPD, chronic obstructive pulmonary disease; IHD, ischemic heart disease; MSK, musculoskeletal disorder; YLD, years lived with disability.

rates in China simultaneously indicated an increasing trend that was far greater than those in developed countries, such as the United States, and those for men were higher than those for women. Furthermore, the mortality burden in rural areas was higher than that in urban areas and the disability burden in urban areas was higher than in rural areas.

IHD is the leading cause of death among cardiovascular diseases. The global loss of DALYs caused by IHD was 164,020 per thousand in 2015, which indicated an increase of 11% from 2005, and the number of deaths rose from 7,640,000 in 2005 to 8,910,000 in 2015. The GBD 2015 studies indicated that IHD was the leading cause of death in the United States and was the second leading cause of life loss in China. The declining trend of female deaths in the United States, especially of young women aged 35-54, was significantly greater than that of male deaths.⁷ The death percentage from IHD increased by 19% from 2005 to 2015. Chang et al⁸ analyzed the difference among ages and the urban/rural IHD groups of the Chinese population aged 20-84 and found that the mortality of the urban population was greater than the rural population, whereas the preva-

lence of IHD in low-income areas was significantly greater than in the middle- and high-income areas.⁹ Compared with developed countries, such as the United States, the standardized mortality rate of IHD in China is increasing, and its mortality is closely related to the risk factors, such as diet, smoking, high body mass index, and mental stress.

With the continuous growth and aging of the global population, cancer has become the world's second largest cause of death next to cardiovascular diseases. The global cancer incidence increased by 33% in 10 years (2005-2015). In 2015, 17,500,000 people were diagnosed with cancer, which led to the DALY loss of 208 million person-years. Prostate and breast cancer were the most common cancer types in men and women, and the incidences of these cancer types were 1.6 and 2.4 million, respectively. Lung cancer was the leading cause of death in China and the United States. The standardized mortality rate of lung cancer in China was 40.41 per 100,000 in 2013, which increased by 12.13% since 1990, resulting in the DALY loss of 11.76 million person-years.¹⁰ In the same year, 18 million Americans were diagnosed with lung cancer, and 16 million of them died of it.¹¹ The

loss of life caused by lung cancer increased by 8.5% in 2015 since 2005, and the growth trend in men was higher than that in women. With the rising incidence of and mortality from lung cancer, the health sector should reduce or control the risk factors, such as smoking,¹² air pollution,⁴ and household air pollution,^{13,14} and intensify the early census to reduce the incidence of lung cancer.

The most common nonfatal diseases that affected the health of Chinese people in 2005-2015 were sense organ diseases and lower back and neck pain, of which the disability loss increased by 21.3% and 10.5%, respectively. Meanwhile, the most common nonfatal diseases in the United States were drug use disorder (21.1%) and sense organ diseases (13.8%). Lower back pain caused 16.34 million person-years of years lived with disability (YLD) in 2013, of which 30- to 59-year-old people constituted 54.6% of the YLD. The top 3 provinces were Guangdong, Shanghai, and Beijing, and the age-standardized YLD rates were 1742.2, 1227.8, and 1136.6 per 100,000, respectively.¹⁵ The DALY loss caused by drug use disorders in the United States surpassed the expected loss; drug use disorder was common in the United States, especially among men, Native Americans, young and middle-aged populations, and those who were widowed, divorced, or single.¹⁶ Sense organ diseases, such as hearing loss, seriously affected the health of Chinese and American people. Nearly 24% American adults had varying degrees of hearing loss, and the incidence of men was higher than that of women.¹⁷ Although these diseases are nonfatal in the short term, they seriously affect the health of an individual and increase the burden of disease.

MAJOR RISK FACTORS

Based on the DALYs, the top 10 risk factors in 2015 were high blood pressure, smoking, high fasting plasma glucose, high body mass index, childhood undernutrition, ambient particulate matter, high total

cholesterol, household air pollution, alcohol use, and high sodium. Only childhood undernutrition moved down, from first place in 1990 to the fifth place, and the rest of the risk factors moved up or retained their ranks. Metabolic risk factors, such as high body mass index, fasting plasma glucose, and total cholesterol, rose from the 13th, 10th, and 12th to 4th, 3rd, and 7th, respectively. High blood pressure was among the top risk factors. The DALY loss caused by high blood pressure from 2005 to 2015 increased by 11.7%, and the trend in men was higher than that in women, with an increase of 9.2% and 7.8%, respectively. The DALY loss increased by more than 20.0% because of high fasting plasma glucose and high body mass index. These risk factors are closely linked with unhealthy diet.¹⁸ The top risk factors in China and the United States in 2015 are presented in Table 4. Hypertension is not only a disease but also an important risk factor for cardiovascular diseases and all-cause mortality.

Kearney et al¹⁹ reported that 26.4% of the people in the world suffered from hypertension in 2000, the number of patients would increase to 60% in 2025, and 1.56 billion people would suffer from hypertension. The Asia Pacific Cohort Studies Collaboration reported that the deaths of more than 66% of the people who suffered from cardiovascular diseases were attributed to hypertension.²⁰ In China, hypertension is the leading risk factor.³ A cohort study of 35- to 74-year-olds in China revealed that more than one-third of the people had hypertension, and hypertension awareness, treatment, and control rates were lower than those in Western countries; the burden caused by hypertension and related diseases was heavy.²¹ With the development of the economy and the acceleration of population aging in China, hypertension patients are characterized by high salt intake and high blood pressure variability, and the incidence rates of chronic kidney disease and stroke are increasing. Therefore, prevention and control tasks are difficult.

Smoking (including secondhand smoking) is closely related to cardiovascular and cerebrovascular

Table 4. Risk Factors in China and the United States

Ten Leading Risk Factors										
China	Blood Pressure	Sodium	Smoking	Fasting plasma glucose	Particulate matter	Alcohol use	Body mass index	Whole grains	Fruit	Total cholesterol
United States	Smoking	Body mass index	Fasting plasma glucose	Blood Pressure	Total cholesterol	Drug use	Alcohol use	Glomerular filtration	Physical activity	Whole grains

From left to right, ranked 1-10.

diseases, malignancies, and respiratory diseases. The GBD 2015 study reported that smoking was the top risk factor in the United States and ranked third in China. According to the World Health Organization, more than 8 million people in the world will die from diseases linked to smoking by 2030. In 2014, the number of deaths from cancer caused by smoking in the United States was 160,000, accounting for 28.6% of the total deaths from cancer and more than 40% of male deaths from cancer.²² However, the smoking rates for women were higher than for men in South Dakota, Montana, and Arkansas, and the risk of dying from smoking had an increasing trend.²³ Meanwhile, the rate of smoking reached 28.1% in China, which is the world's largest tobacco producer and consumer, and more than 3 million people die from smoking and related diseases yearly.²⁴ The DALYs (13.83 per thousand) caused by smoking constituted 10.83% of the total DALYs in China, and the incidence in men was higher than that in women.²⁵ Smoking is a major public health problem not only in China but also in the United States. The burden of smoking cannot be ignored. The government should adopt a strong tobacco control policy, strengthen citizen health education, and reduce the risk factors of smoking.

Outdoor air pollution caused by ambient particulate matter pollution ranked sixth in the lethal risk factors in the world and fifth in China. The fatality rate caused by ambient particulate matter pollution reached 7.8% from 2005 to 2015, resulting in 4.24 million deaths. China has become one of the world's most polluted countries, and the pollution caused by ambient particulate matter is serious. A systematic review of the fine particle concentration in China indicates that the highest concentration of fine particulates is in northern and northwestern China, especially Beijing, where the current federal regulatory standards have been exceeded.²⁶ Lin et al²⁷ conducted a study on the burden of death caused by particulate matter (PM)_{2.5} exposure in the Pearl River Delta of China. A total of 3.79% of all-cause mortality was attributed to PM_{2.5} exposure. If an average increase of 10 µg/m³ PM_{2.5} concentration occurs every 4 days, then the all-cause mortality increases by 1.76%. Therefore, the mortality rates from cardiovascular and respiratory disease increase by 2.19% and 1.68%, respectively. Fang et al²⁸ conducted a study on the environmental particulate matter pollution in 74 cities in China. A total of 35% of the deaths caused by cardiovascular diseases were attributed to PM_{2.5} pollution, which accounted for 47% of the total number of deaths. Under the severe situation of environmen-

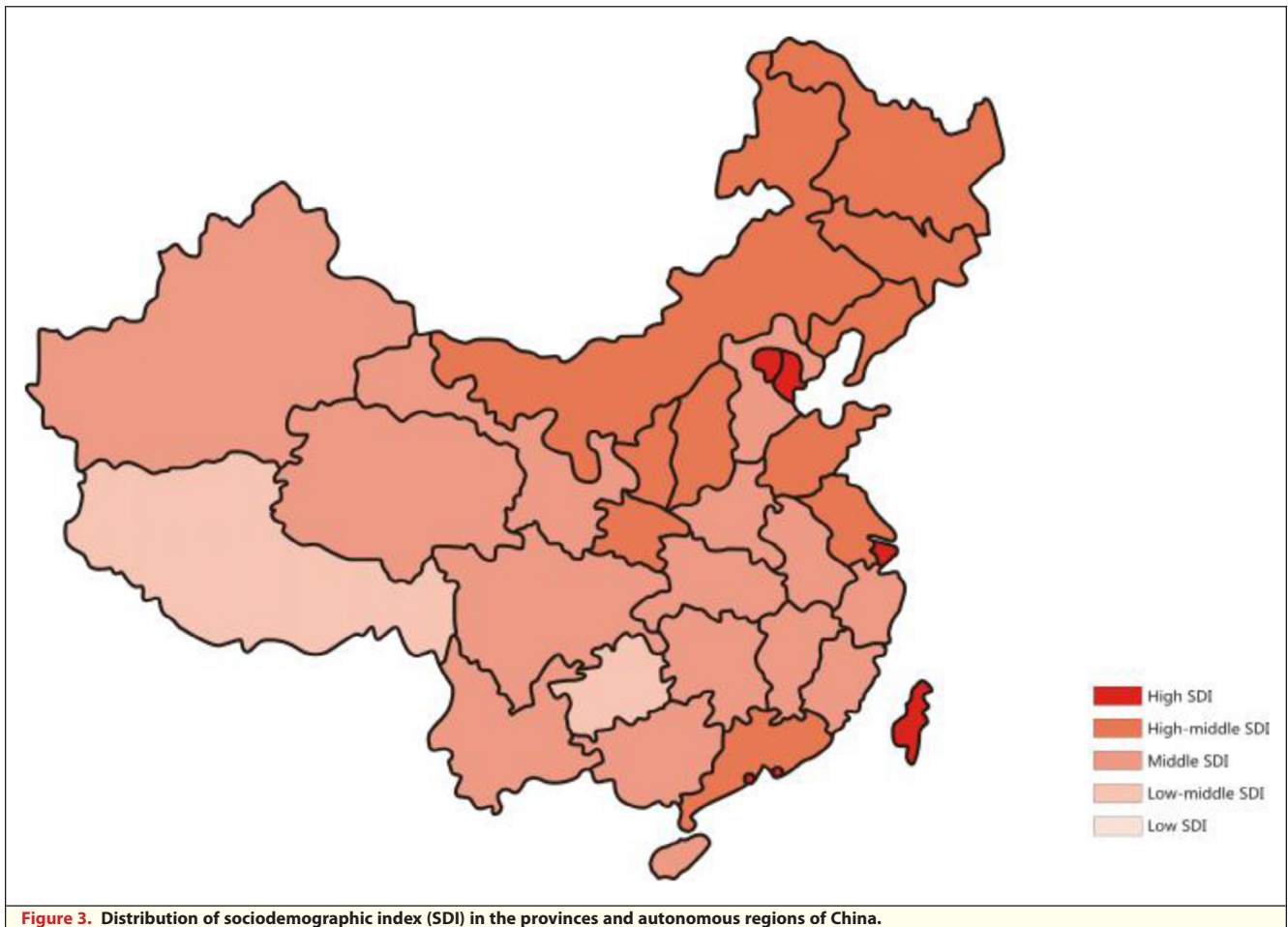
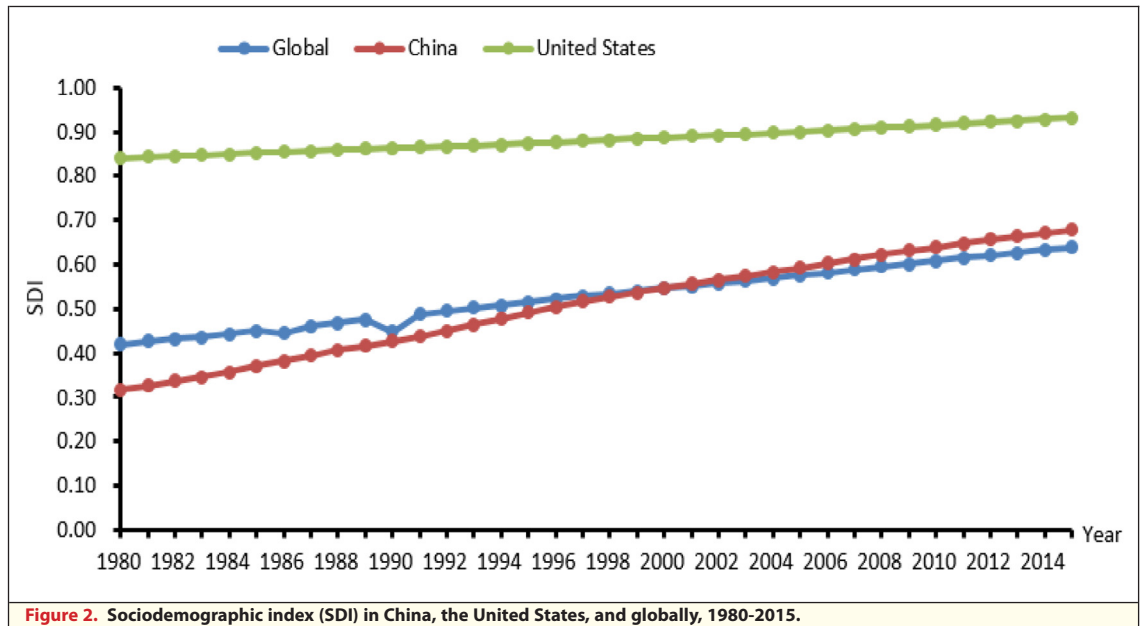
tal pollution, China has taken a series of measures to prevent and control air pollution and has achieved initial success. China continues the pursuit of sustainable development in preventing and controlling air pollution, although a great gap from the United States still exists.

SDI

The GBD 2015 study used the SDI, which is based on income per capita, average years of schooling, and total fertility rate. The range is between 0 and 1. Zero represents the low income per capita, low average years of schooling, and high total fertility rate, whereas 1 represents the high income per capita, high average years of schooling, and low total fertility rate. In the GBD 2015 study, the SDIs of all countries and some regions were comprehensively evaluated, and the SDIs were divided into 5 grades, namely, high, high-middle, middle, low-middle, and low. The SDIs of China, the United States, and the world from 1980 to 2015 are illustrated in Figure 2. The distribution of the SDI in the provinces and autonomous regions of China is presented in Figure 3. The SDI of the United States was higher than the global and the Chinese levels. Since 2000, the SDI of China reached and began to exceed the global level. A significant gap from that of the United States was observed. The SDI grades of all the states of the United States were high. However, a significant difference was noted in the income per capita, educational level, and fertility rate in China caused by the imbalance between the eastern and western development. High SDI grades were obtained in Beijing, Shanghai, Tianjin, Macao, Hong Kong, and Taiwan. High-middle SDI was distributed in northeast and north China, except Hebei, Shandong, Jiangsu, Guangdong, Shaanxi, and Shanxi. Guizhou and Tibet had low-middle SDI. The other 17 areas had middle SDI. Since its reform and opening up, China has made remarkable achievements in terms of economic and social development, and its SDI has increased significantly. However, differences between regions have been identified because of the imbalance in regional economic development. China, which is a developing country with a large population, implemented the 1-child policy to control the growth of population, to reduce the fertility rate, and to improve the life expectancy of the Chinese population.

DISCUSSION

The GBD study indicated that the life expectancy of the population of China is longer than it was 25



years ago. Cardiovascular and cerebrovascular diseases, cancer, and chronic respiratory diseases remain fatal diseases in China. The increase in the prevalence of nonfatal diseases, such as low back and neck pain and hearing impairment, and the increasing prevalence of associated risk factors affect the quality of life, which causes a heavy burden on the health system of China. Although the living standard and the level of health care in China have been substantially improved and the national HALE in China is close to the US life expectancy, numerous deaths still occur because of the acceleration of population aging. In addition, 4 of 10 leading risk factors are diet related (Table 4). Since the 1980s, rapid economic development and the growth of global trade and cultural exchanges have accelerated changes in China. The food consumption patterns of the whole nation, and especially of rural residents, have dramatically changed. Plant product consumption, such as whole grains, have presented a steady decrease, whereas meat consumption and oil and fat intake have increased rapidly,^{29,30} which will lead to chronic conditions such as diabetes, dyslipidemia, and hypercholesterolemia.³⁰ Furthermore, the United States' diet culture has had a profound impact on Chinese diet culture over the past two decades. More and more Chinese people prefer Western fast food like Kentucky Fried Chicken, McDonald's, and Pizza Hut, which may increase the risk of cardiovascular diseases and diabetes.³¹

Nationwide more than one-third of Chinese adults are overweight or obese, whereas in major cities, like Beijing and Shanghai, more than half are overweight or obese.³² And high intake of sodium has resulted in an ionic imbalance that will increase the risk of hypertension, stroke, and gastrointestinal tumor.^{33,34} Therefore, the government is required to increase its investments in public health to determine the point of disease prevention and control, to conduct a prospective study, to continue the all-directional management of risk factors, and to allocate health resources rationally to regulate the burden of disease effectively.

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