Preplanned Studies

Trends and Challenges for Population Health and Migration — China, 2015−2050

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Summary

What is already known about this topic?

Along with the quick change of society and health transformation, as well as the continued expansion of urbanization, the health risk and its variation of migrants in China would became more complicated.

What is added by this report?

Although a decreasing net migration flow trend was presented from 2015 to 2050, an increasing pace of aging and younger-age trend of migrants would pose serious challenges for population health in China. Deepening aging trend of migrants contributes to the increment of the disease burden of non-communicable diseases (NCDs) and disabilities, and the upward trend of young-age migrant patients with infectious diseases remain a threat to the future intervention and prevention of infectious diseases.

What are the implications for public health practice?

Health policies to eliminate the adverse effects of migration on population health should pay more attention to meet the health care demands of highly vulnerable migrant populations, such as very older and very young migrants.

Migration has been one of the most important drivers of socioeconomic progress. However, owing to their unfavorable socioeconomic conditions and barriers to resources, migrants often become the vulnerable and marginalized group at high risk of health problems in China (1). Along with the quick change of society and health transition, as well as the continued expansion of urbanization, the health risk and its variation of migrants in China would became more complicated. To better understand the future trend and population health challenges of migrants are essential for strengthening the health system. Based on Sample Census in 2015 and second hand data, this study used Population-Development-Environment (PDE) model and epidemiological calculations to present a glimpse into the future trend and population

health of migrants. An increasing pace of aging and younger-age trend in migrants poses serious challenges for population health. To meet the health care demands of highly vulnerable migrants are needed for eliminating the adverse effects of migration on population health.

2015 Sample Census used in this study was implemented by National Bureau of Statistics, which provided the most detailed data on population and covered 31 provinces in China. Second hand health data was mainly from Global Health Data Exchange, the prediction results based on Second National Sample Survey on Disability and previous publications (2–3). PDE model and epidemiological calculations were used to predict the trends of migrants and the population health status in 2015–2050, respectively. The mathematical expressions of PDE are as following:

$$P_{(t+1,n+1)} = P_{(t,n)} \times \left(1 - D_{(t+1,n+1)}\right) + N_{(t+1,n+1)} \qquad (1)$$

$$P_{(0,n+1)} = \sum_{i=15}^{49} \left[F_{(t,n+1)} \times FR_{(t,n+1)} \right] \times \left(1 - D_{(0,n+1)}\right) \qquad (2)$$

$$F_{(0,n+1)} = P_{(0,n+1)} \times fr_{n+1} \qquad (3)$$

$$PT_{n+1} = \sum_{i=1}^{m} P_{(t,n)} + P_{(0,n+1)} \qquad (4)$$

where, t, n, P, D, and N represent the age, year, population, mortality rate and net migration flow, respectively. F, FR, and fr represent the number of women, the fertility rate for specific age groups and the proportion of women with the newborn population, respectively. PT and m represent the total population and the highest age of the population, respectively. More details could be found in Supplementary Figure S1 (available in http://weekly.chinacdc.cn/) and previous study (4).

PDE model was based on different scenarios assumptions, and the predictive parameters of scenario assumptions include total fertility rate (TFR), life expectancy (LE) and urbanization rate (UR). TFR in 2015–2017 was set up based on National Fertility Intention Survey, and was assumed to decline since 2017 and reached 1.60 in 2018–2050. According to

the Outline of Healthy China 2030 Plan, LE in 2020 was assumed to be 77 years old and 80 years old in 2030. By 2050, LE would reach to 85 years old according to China's General Program for Sustainable Development. UR in 2020 was set up to be 60% according to the National New Urbanization Plan (2014–2020), and would be around 70% in 2030 and around 80% in 2050 based on the experts' judgements (5–7). More details could be found in Supplementary Tables S1-S3, available in http://weekly.chinacdc.cn/.

PDE results showed that China was facing rapid aging in future. Although two-child policy may make contribution to raising fertility levels which alleviated aging progress to some extent, the aging trend would be irreversible. Moreover, higher aging progress of rural population was found due to rural-urban population mobility (Figure 1).

A gradual downward trend of net migration flow was found in China from 2015 to 2050, which was similar to our previous prediction work by using 2000 and 2010 census. Net migrant flow would be reached 22.57 million by 2030, and 17.57 million by 2050. Although migrants showed a decreasing trend in the

future, the huge population size of migrants may slow down the improvement of health level. From 2015 to 2050, both proportion and scale of older net migrants aged 60 years old and above showed upward trends. Moreover, younger-age trend was found in net migrants of China. The proportion of children aged 0–15 years old would increase and reach the peak number in 2025–2029 and then began to fall (Figure 2).

The upward tendency of older net migrants and the younger-age trend may play the negative role in population health of China. The deepening aging trend of net migrants would contribute to the increment of the disease burden of non-communicable diseases (NCDs) and disabilities. NCDs causing Disability Adjusted of Life Years (DALY) presented an increasing tendency from 2015–2050. Meanwhile, the scale of older migrants with NCDs also showed a trend of increase. Further, from 2015–2050, the prevalence of disabilities (unadjusted prevalence) would keep increasing which may be as the result of population aging, and the ascending of aging in migrants may aggravate the conditions of disabilities in China.
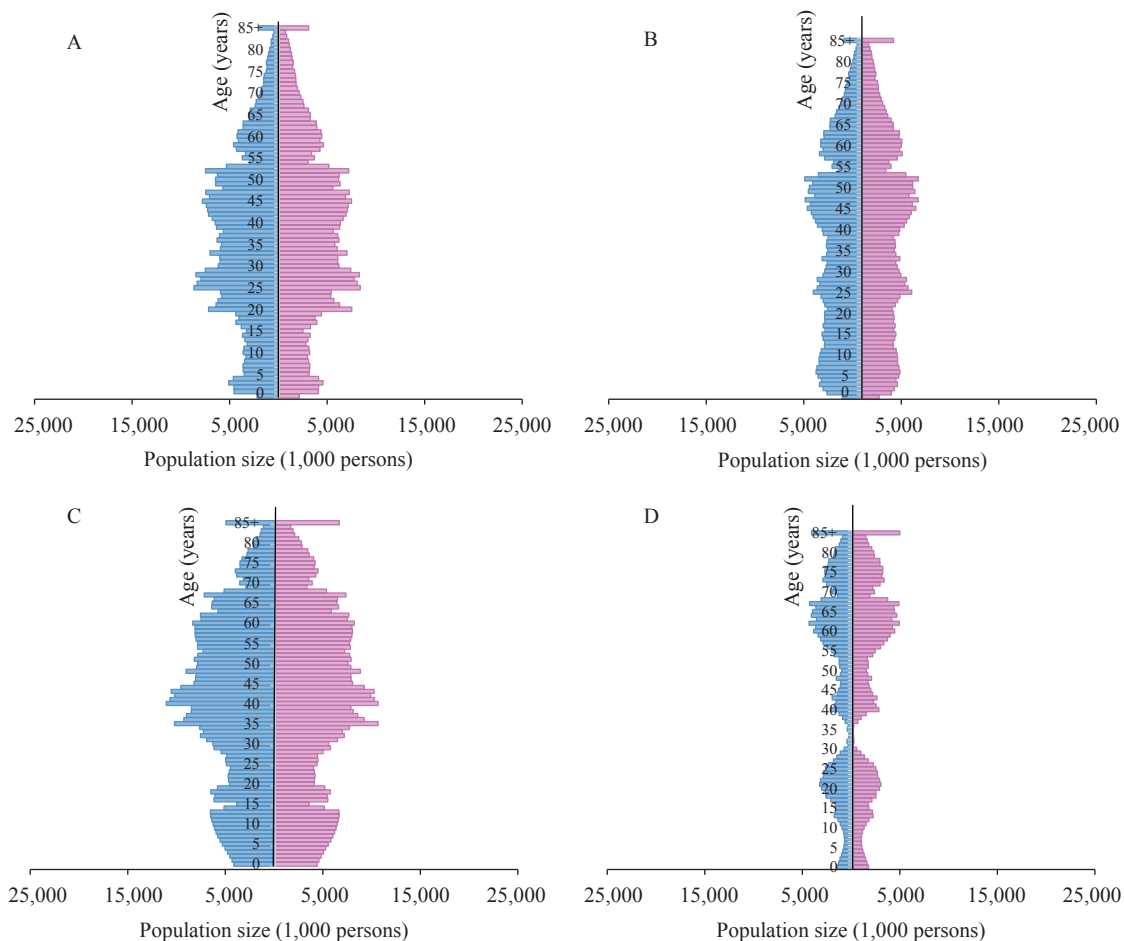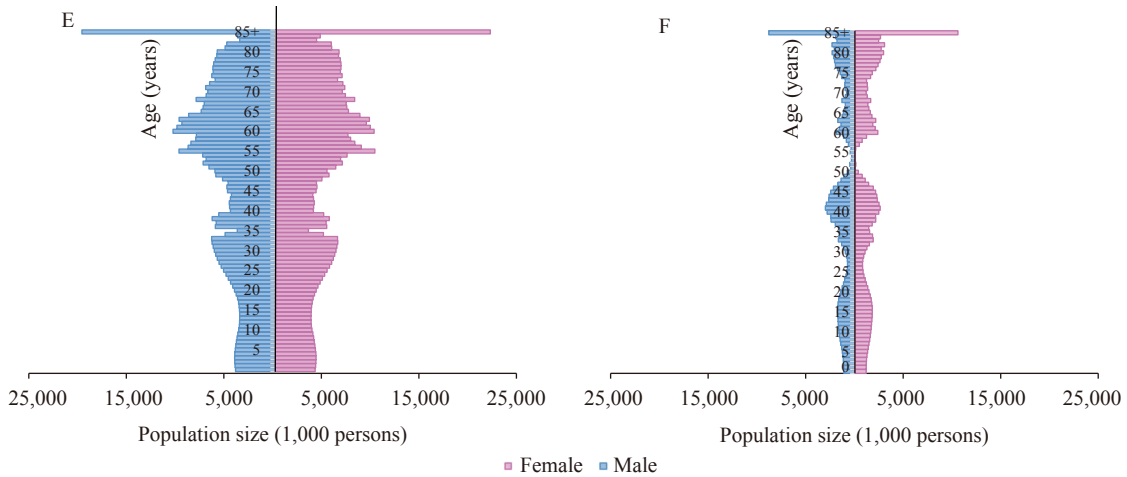
FIGURE 1. Population-Development-Environment prediction results of population pyramids by urban and rural, China 2015–2050. (A) Population Pyramid in urban, 2015; (B) Population Pyramid in rural, 2015; (C) Population Pyramid in urban, 2030; (D) Population Pyramid in rural, 2030; (E) Population Pyramid in urban, 2050; (F) Population Pyramid in rural, 2050.
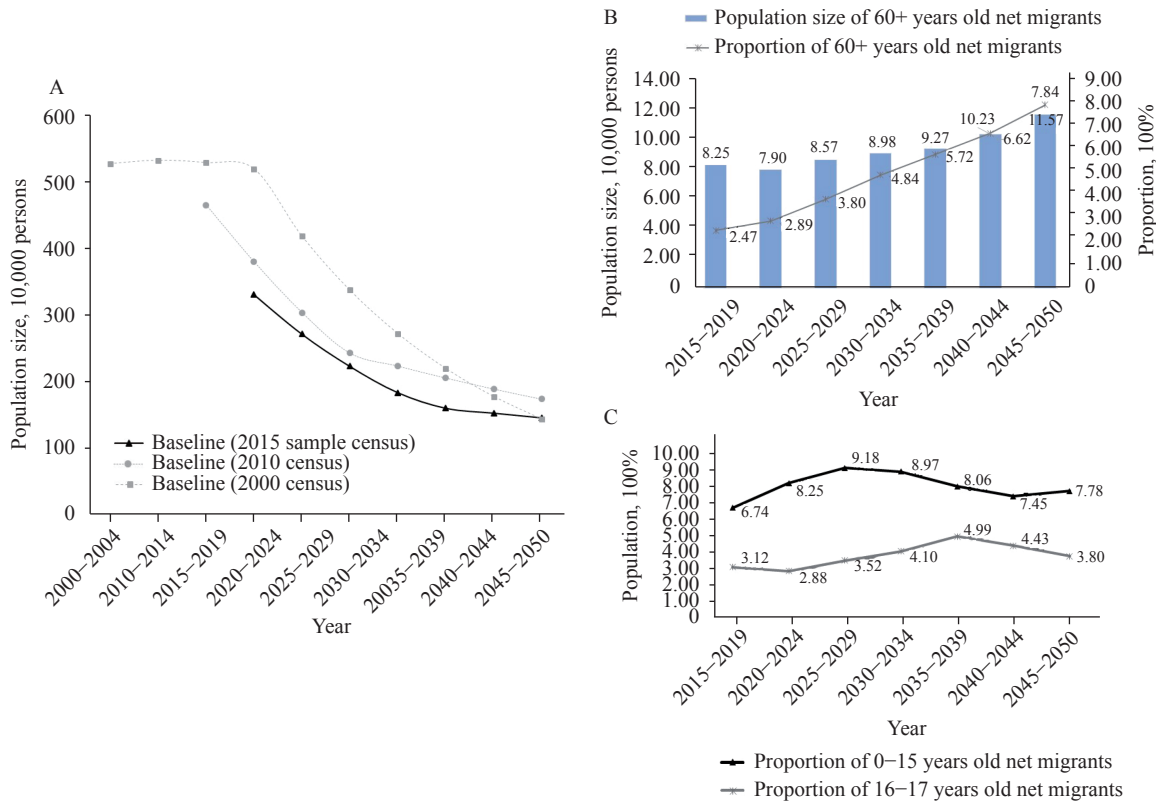

FIGURE 2. The predicted trends of net migration flow, China 2015–2050. (A) Total net migration flow, China 2015–2050; (B) Net migration flow aged 60+ years old, China 2015–2050; (C) Net migration flow aged 0–17 years old, China 2015–2050.

Additionally, although DALY related to communicable, maternal, neonatal, and nutritional diseases would decrease from 2015–2050, the upward trend of migrants aged 0–15 years old with infectious diseases would increase the pressure of infectious diseases intervention and prevention (Figure 3).

DISCUSSION

This study presented the future trend of migrants in China and also showed the possible effect of the change of migrant population structure on population health from 2015–2050 in China. Although a
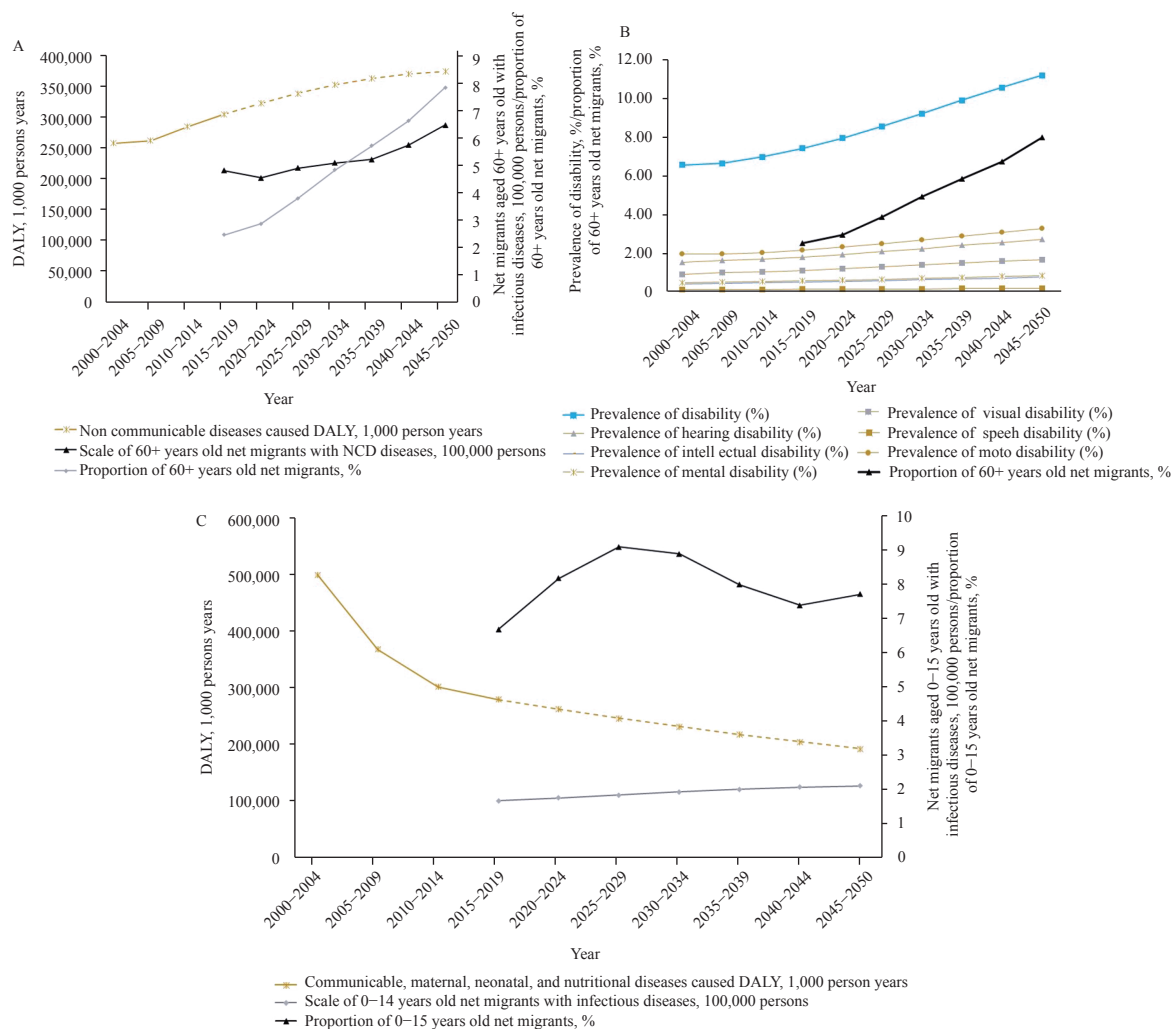
FIGURE 3. The predicted trend of net migration flow and population health conditions, China 2015–2050. (A) The trend of non-communicable diseases (NCDs) among 60+ years old net migrants and NCDs caused Disability Adjusted of Life Years (DALY), China 2015–2050; (B) The trend of 60+ years old net migrants and disabilities, China 2015–2050; (C) The trend of communicable diseases among 0–15 years old net migrants and communicable, maternal, neonatal, and nutritional diseases caused DALY, China 2015–2050.

decreasing net migration flow trend was presented from 2015 to 2050, an increasing pace of aging and younger-age trend of migrants would pose serious challenges for population health in China.

In this study, the proportion and the number of older migrants presented the upward trends from 2015 to 2050, although a decreasing trend among net migrants was found. These results were similar to previous study (*8*). Compared with working ages migrants and local residents, older migrants with weak health awareness, low health literacy, insufficient awareness of chronic disease prevention, and lack of *Hukou* registration protections and the absence of continuous health care, are particularly vulnerable to inadequate health care and in poor health conditions (*9*). Increasing trend of the number of older migrants

with NCDs contributed to the increment of NCDs related disease burden and disabilities in China. The barriers to receive local healthcare and the problems of functional decline in older migrants put them into a dual NCDs burden.

An upward trend of infectious diseases among migrant children was found in this study, although our governments get progress from infectious diseases control. Migrant children are lack of adequate critical and routine health services, and have less extensive immunization coverage than their non-migrant counterparts, which lead them into the higher risk of contracting infectious diseases. Little awareness of immunization among parents, unaffordable of the inoculation expenses and frequent job-related changes of residence were the important drivers of low

immunization coverage among migrant children (*10*). Moreover, migrant children are more vulnerable to be exposed to pathogens and diseases related to unfavorable living environments as helminths and tuberculosis, which subsequently increase their risk of infectious diseases (*10*).

Health policies to eliminate the adverse effects of migration on population health should pay more attention to meet the health care demands of highly vulnerable migrant populations, such as very older and very young migrants. Healthcare policy makers should accelerate the progress to achieve the role of universal health coverage, and improve the coverage of affordable health services to migrants irrespective of *Hukou* status. To promote population health among those vulnerable migrants, improving the continuity of health care and health literacy training are also very useful. Strengthening health information systems, such as electronic medical record keeping, can improve health care continuity. Enhancing the coverage of health literacy education can help individuals to improve understanding and responses to NCDs and infectious diseases and make appropriate health decisions. To deal with the challenge of migrants aging and the growing burden of NCDs, the continuity and integration in the chronic care management of older migrants will be essential to improve the outcomes of population health. Additionally, infectious diseases still remain a threat and require continuous efforts to be kept under control especially in migrant children. Enlarging the vaccination coverage and improving health monitoring system are needed to reduce the infectious-disease transmission. Further, improving the living environment and sanitary conditions of the migrants are essential for infectious diseases prevention.

This study existed some limitations. For example, the results should be interpreted with caution, because the net migration flow in this study could not fully represent the status of migration. Due to the restriction of materials and models were used, this study could not predict the rural-urban and urban-urban migration flow. In the future, more studies should be taken to fix these issues.

In conclusion, our prediction found the increasing pace of aging and younger-age trend of migrants in China, which exacerbate the complexity of population health in the future. The deepening aging trend of net migrants contributes to the increment of the disease burden of NCDs and disabilities. The upward trend of young-age migrant patients with infectious diseases remain a threat to the future intervention and prevention of infectious diseases. Future health action plan on migrants should be more concerned about the health impact from the upward trend of young-age and the deepening aging trend of migrants.

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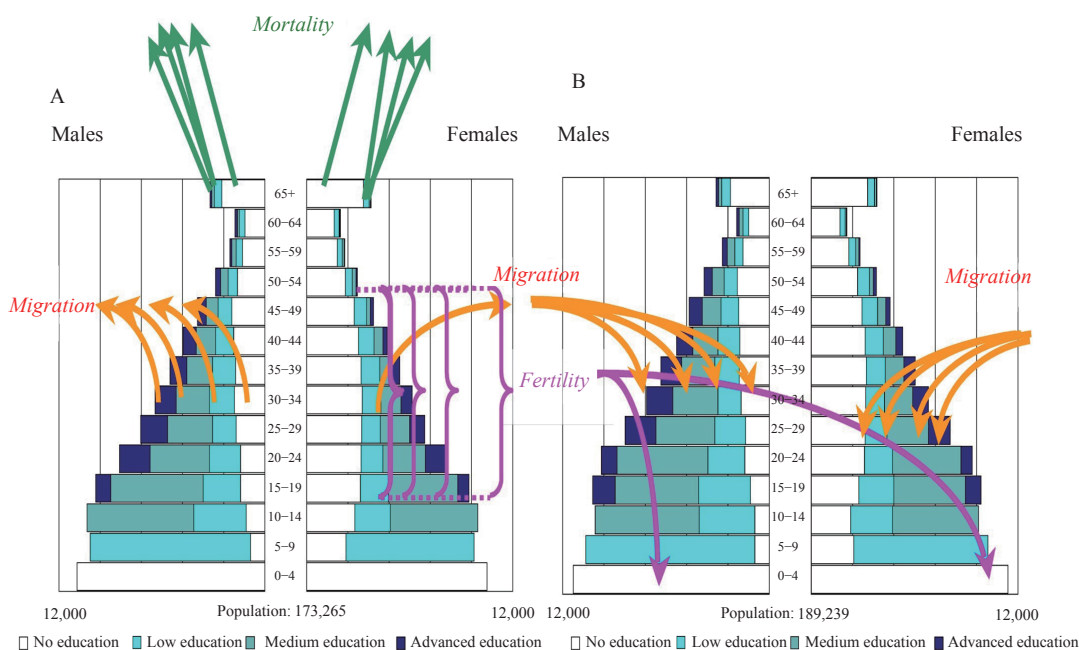
SUPPLEMENTARY FIGURE S1. The principle of Population-Development-Environment model. (A) Population by age, sex, and education, 2000; (B) Population by age, sex, and education, 2005.

SUPPLEMENTARY TABLE S1. Population-Development-Environment model predicative parameters assumption: total fertility rate (TFR) in China, 2015–2050.

Year	TFR in total	TFR in rural	TFR in urban
2015	1.41	1.69	1.16
2016	1.77	2.05	1.54
2017	1.72	2.00	1.53
2018–2050	1.60	2.00	1.42

SUPPLEMENTARY TABLE S2. Population-Development-Environment model predicative parameters assumption: life expectancy (LE) in China, 2015–2050.

Year	Rural, years		Urban, years	
	Male	Female	Male	Female
2015	75.83	80.49	80.31	83.85
2020	76.41	80.92	80.79	84.20
2025	76.98	81.34	81.27	84.55
2030	77.54	81.76	81.74	84.89
2035	78.10	82.16	82.20	85.23
2040	78.66	82.56	82.67	85.57
2045	79.20	82.96	83.13	85.90
2050	79.75	83.35	83.58	86.22

SUPPLEMENTARY TABLE S3. Population-Development-Environment model predicative parameters assumption: urbanization rate in China, 2015–2050.

Year	Urbanization Rate, %
2015	56.10
2016	57.35
2017	58.52
2018	59.58
2020	60.00
2030	68.38
2040	75.37
2050	81.63