

Impact of Urbanization on Mortality in China

-- Empirical Analysis Based on Panel Data of 245 Prefecture-level Cities

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Abstract: Since the reform and opening up, the level of urbanization in China has been increasing. Urbanization has not only promoted economic growth and medical care, but also caused traffic congestion, environmental degradation, and resource depletion, and the impact of urbanization on residents' health has received increasing attention. The article analyzes the impact of urbanization on residential mortality at a national scale using panel data at the prefecture-level city level from 2010-2018, and the results show that urbanization causes a significant increase in residential mortality in China, and there are large regional differences in the impact of urbanization on mortality. Therefore, local governments should improve the level of urbanization while avoiding environmental pollution and excessive resource consumption and improving environmental quality as much as possible. At the same time, the government should improve the social security system in urban and rural areas, increase investment in infrastructure and public health services, and narrow the gap between urban and rural areas in order to improve the health of the population and reduce mortality.

Keywords: Urbanization, Mortality, Regional differences.

1. Introduction

Since the reform and opening up, with the rapid economic growth and free movement of labor, especially the gradual liberalization of the household registration policy in recent years, China has experienced and is experiencing a large-scale urbanization process that has never been seen before in history. This process has seen an increasing number of rural people moving to settle in cities, while urban areas continue to expand. According to the Seventh National Population Census Bulletin[1], the proportion of the population living in urban areas to the total population was 63.89% as of 2020, increased by 14.21 percentage points from 2010; the urbanization rate of China's household registration population in 2020 was 45.4%, a significant increase compared to 2010. While China's rapid urbanization has contributed to rapid economic growth, it has also been accompanied by serious environmental pollution and great consumption of resources. The impact of urbanization on residents' health and mortality is multifaceted, so it is necessary to conduct an in-depth study on the impact of urbanization on residents' health and mortality in order to formulate scientific and reasonable policies and promote the realization of a new type of urbanization with people at its core.

Many studies have been conducted by domestic and foreign scholars on the effects of urbanization on the health and mortality of the population, but the direction and extent of the effects are highly controversial. The relationship between urbanization and population health has been discussed by foreign scholars earlier, while the relationship between urbanization and economic growth has been studied more in China, and only in recent years has research on urbanization and population health been conducted. Most of the available studies have shown that urbanization has a catalytic effect on public health[2], and the mechanism may lie in the fact that the change of household status may promote residents' health through access to better benefits such as social security[3, 4]. With the level of economic development increases, people

become more concerned about their physical health, which leads to the expansion of social health consumption demand and significantly improves public health[5]. Compared with rural residents, urban residents obviously have access to more medical resources and better medical services, and the improved public health conditions can effectively counteract the hazards to public health[6]. In addition, urbanization has a catalytic effect on the abundance of educational resources and the improvement of education level, and people can learn more health-related knowledge as they have access to more information as well as knowledge channels in cities. On the other hand, urbanization also has a negative impact on people's health. Air pollution and environmental degradation brought about by urbanization increase the number of visits to hospitals and health checkups, and increase people's chances of getting sick and decrease their health level[7-9], leading to faster depreciation of health capital stock[10]. What's more, the work and life stresses of urbanization have changed people's living habits, increased the sedentary time, and also changed people's dietary habits. The intake of high-calorie and high-fat foods has increased the prevalence rate of cardiovascular and cerebrovascular diseases.

There are some shortcomings in the existing studies: first, most of the studies were conducted using cross-sectional data or provincial panel data, and the estimated results could not reflect a clearer and more detailed causal relationship between urbanization and mortality. Second, the existing studies failed to address well the possible reverse causality between urbanization and population health.

Based on the above, the article selects the panel data of 245 prefecture-level cities in China from 2010-2018 to investigate the relationship between urbanization and mortality.

2. Theoretical Framework and Figures

2.1. Theoretical Framework

The article is based on the health production function theory proposed by Grossman[11]. The theory suggests that health is a good produced by a series of input factors such as

lifestyle, living environment, education, personal income level and medical and health services. In order to investigate the impact of urbanization on residents' health, the article takes the level of urbanization as an input factor of health production and constructs the following model:

$$H_{it} = \beta_1 U_{it} + \beta_i x_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

Where H_{it} denotes the health level of the population in city i in year t , and U_{it} is the urbanization rate of city i in year t , and x_{it} denotes other control variables, and μ_i denotes the city-related area effect, and ε_{it} denotes the time varying random disturbance term. β_1 is the parameter to be estimated, which reflects the effect of urbanization level on the health of residents. The article assumes that ε_{it} is independently and identically distributed and μ_i is uncorrelated.

Regarding the estimation method for panel data, the slope of individual regression equations is often assumed to be the same in empirical analysis, but the intercepts can be different to capture individual heterogeneity. Whether a Fixed Effect Model (FEM) or Random Effect Model (REM) is used depends on whether it is correlated with the explanatory variables: if is correlated with one explanatory variable, then the fixed effect model is used; if not correlated with all explanatory variables, the Random Effect Model is used. The two estimation methods will be selected by the Hausman Test.

2.2. Figures

The explanatory variable is the health level of residents, and the mortality rate (/‰) is used to measure the health status of residents in a prefecture-level city. The main explanatory variable is the level of urbanization, and this paper uses the built-up area (/100 km²) to measure the level of urbanization of a prefecture-level city. Other explanatory variables include: gender ratio, population density, number of hospital beds per 10,000 people, industrial soot emissions, environmental pollution level, environmental regulation level and road mileage. The environmental pollution level is the pollution index calculated by considering industrial wastewater, industrial sulfur dioxide and industrial soot emissions. The environmental regulation level is the index calculated by considering the treatment rate of sulfur dioxide and soot.

The article takes 2010-2018 as the research time period and selects 245 prefecture-level cities across China as the research objects. The basic data were obtained from the China City Statistical Yearbook, the provincial and municipal city statistical yearbooks and the statistical bulletins on national economic and social development of some cities.

3. Results and Discussion

3.1. Empirical Results

3.1.1. Baseline Regression Results

Table 1 reports the results of estimating the effect of urbanization on residential mortality. From the results of the Hausman test, it is more appropriate to analyze with a fixed effects model (p-value of 0.0047). From the estimation results, urbanization has a significant positive effect on mortality, i.e., an increase in the level of urbanization increases the mortality rate of the population, with an increase of 0.383 unit for per unit increase in the urbanization rate.

Table 1. Definition of variables and descriptive statistics values

Variables	FE	RE
urbarea	0.383***	0.065
	(0.001)	(0.001)
Demographic characteristics	YES	YES
Medical Resource Characteristics	YES	YES
Environmental health characteristics	YES	YES
HausmanTest[p-value]	20.46[0.0047]	
N	2205	2205
R²	0.022	

Note: FE and RE denote fixed-effects and random-effects models, respectively; * p<0.1, ** p<0.05, and *** p<0.01 denote significant at the 10%, 5%, and 1% statistical levels, respectively; standard errors are reported in parentheses.

Among the other variables affecting mortality, population density had a non-significant effect on mortality. Resident sex ratio, number of hospital beds per 10,000 people, and level of environmental regulation had significant negative effects on mortality, suggesting that increased medical care and improved environmental quality can significantly reduce mortality. Industrial smoke emissions have a significant negative effect on mortality, but the coefficient is close to zero and can be disregarded. The coefficients of environmental pollution level and road mileage are significantly positive, which means that increased environmental pollution level and increased road mileage increase the mortality rate.

3.1.2. Regional Heterogeneity Analysis

The provinces of China were divided into four regions: east, middle, west and northeast, according to the standards of the Statistical Bulletin of the National Economic and Social Development of the People's Republic of China 2020. The 245 prefecture-level cities in the sample were divided by region and regressed on mortality rate and urbanization level separately to examine the regional heterogeneity of the effect of urbanization rate on mortality rate. The results are shown in Table 2.

Table 2. Regression results by region

Variables	FE	RE		
urbarea	0.328**	1.250***	0.008***	0.011
	(0.001)	(0.005)	(0.002)	(0.015)
Demographic characteristics	YES	YES	YES	YES
Medical Resource Characteristics	YES	YES	YES	YES
Environmental health characteristics	YES	YES	YES	YES
N	684	639	621	252
R²	0.069	0.028	0.064	0.161

Note: * p<0.1, ** p<0.05, and *** p<0.01 denote significant at the 10%, 5%, and 1% statistical levels, respectively; standard errors are reported in parentheses.

From the estimation results, there are significant regional differences in the effect of urbanization on mortality: the positive effect of urbanization on mortality in the central and western regions is significantly higher than the national total, and the difference is large; the coefficient in the eastern region is significantly lower than the national level, but the difference is not large; while the effect of urbanization on mortality in the northeast region is not significant.

3.2. Discussion

The empirical analysis reveals that the development of urbanization increases the residential mortality rate significantly, and for per unit increase in the urbanization rate, the mortality rate increases by 0.383 unit. The heterogeneity analysis of different regions shows that there are significant regional differences in the impact of urbanization on mortality, with the central and western regions significantly higher than the national total with a large difference; the eastern regions significantly lower than the national level but the difference is not large; and the impact of urbanization on mortality in the northeast is not significant. What is the theoretical basis for this conclusion, which contradicts most perceptions? What are the ways in which urbanization affects residential mortality? The article provides explanations in the following ways.

3.2.1. The Process of Urbanization Is Accompanied By Serious Environmental Pollution

Since the reform and opening up, with the rapid economic growth, China's urbanization process has been accelerating and urbanization level has been increasing. Although economic growth can enable people to have better food, clothing, shelter, and access to better medical services, the positive effects of economic growth on the health of the population can be offset by the negative effects of environmental degradation. Since China's economic growth has previously been crude, relying mainly on energy consumption and the seizure of nature, it is difficult to avoid causing great damage to the environment in the process, which has led to frequent natural disasters and extreme weather, such as haze and acid rain. Therefore, the urbanization process that accompanies economic growth also inevitably corresponds to serious environmental pollution. Many studies have shown that a decrease in environmental quality and an increase in pollution levels lead to an increase in mortality rates and a deterioration in the health of the population[12]. Studies have shown that air pollution accelerates the depreciation of health capital, which leads to an increase in health care costs[13]. This makes the advancement of urbanization, on the contrary, increase the mortality rate of the population.

3.2.2. Changes in the Lifestyle and Eating Habits of Residents in The Process of Urbanization

Urbanization has brought about a significant improvement in people's living standards, but the increase in work and life stress and the frequent occurrence of psychological problems have brought a great negative impact on the health of residents. Due to longer working hours and increased work pressure, people's lifestyles have changed greatly. People stare at their cell phones or computers for a long time, spend more and more time being sedentary, and usually neglect or do not have time for physical exercise, which makes the body resistance decrease. In addition, people's eating habits have changed greatly, such as the preference for fast food, snacks, fast food, etc., while the intake of high-calorie, high-carbon food has increased significantly. This has increased the burden on the body and increased the chances of chronic diseases. All of these reasons have led to a decline in health and an increase in the incidence of disease, with "sudden death" tragedies occurring more frequently and at younger and younger ages, making the mortality rate inevitably rise.

3.2.3. Low Level of Public Health Care Spending in China

The urbanization process has brought about the improvement of medical facilities and the increase in the level of medical resources, while along with the economic growth, the local government's financial expenditure on public health has been increasing. However, what cannot be ignored in this process is the unequal and unreasonable distribution and use of medical resources between regions and urban and rural areas, which will undoubtedly offset some of the positive effects of medical development on the improvement of residents' health. Sun Meng and Li Xiaowei's study shows that the inhibitory effect of public health care expenditure on the negative impact on residents' health caused by air pollution accompanying the urbanization process in China is inverted U-shaped and has a large inflection point value. [14] This means that under the current level of public health care expenditure in China, government expenditure on public health care has not fully balanced out the negative impact of environmental pollution on residents' health, especially the unreasonable distribution of public health care expenditure among regions and between urban and rural areas, which has imposed a greater burden on residents in backward and poor areas and rural residents and brought great harm to their health.

3.2.4. Large Regional Differences Exist in China's Urbanization Level

As of 2017, the urbanization rate of land in China was 54.1%, and the urbanization rate of population was 58.52%. Divided by regions, the urbanization rates of land in the east, middle, west, and northeast regions are 59.92%, 53.94%, 52.00% and 45.22%, respectively; and the urbanization rates of population in the east, middle, west, and northeast regions are 62.09%, 53.27%, 51.58%, and 55.02%, respectively[15]. It can be seen that although the urbanization rate in China has been on an upward trend in recent years, there are significant differences in the urbanization levels of different regions; the urbanization rate of land in the eastern region is significantly higher than that of other regions, among which the urbanization rate of land in the northeastern region is the lowest; the urbanization rate of population in the eastern region is significantly higher than that of other regions, among which the urbanization rate of population in the western region is the lowest. The significant differences in urbanization levels among regions indicate that each region is at a different stage of urbanization development, which also leads to large differences in the effects of urbanization on residents' health and mortality in each region.

4. Conclusion and Recommendations

The article analyzes the impact of urbanization on residential mortality at the national level using panel data at the prefecture-level city level from 2010-2018, and the results show that urbanization causes a significant increase in residential mortality in China, with mortality increasing by 0.383 unit for per unit increase in the urbanization rate. Meanwhile, there are large regional differences in the impact of urbanization on mortality, with the positive effect of urbanization on mortality in the central and western regions being significantly higher than the national aggregate level with a large difference; the coefficient in the eastern region is significantly lower than the national level, but the difference is not large; and the impact of urbanization on mortality in the

northeast region is not significant.

The policy implication of the article's findings is that the positive effects of urbanization on residential mortality are less than its negative effects, and therefore local governments should focus on improving the quality of urbanization development in the process of developing new urbanization. While improving the level of urbanization, they should also avoid pollution and excessive resource consumption to the environment and improve environmental quality as much as possible. At the same time, the government should improve the social security system in urban and rural areas, increase investment in infrastructure and public medical and health services, and strive to narrow the gap between urban and rural areas in order to improve the health of residents and reduce mortality rates.

The article has the following shortcomings: the level of urbanization should be a comprehensive indicator involving population, land, economy, etc., and the article's use of built-up area to measure the level of urbanization may be biased; limited by the availability of data, the mortality rate used in the article is the total mortality rate of prefecture-level cities, and it is impossible to identify the causes of death and whether they are affected by sudden events; the article does not make a distinction between urban and rural areas, and only considers the impact of urbanization on the overall population mortality, so it cannot identify the impact of urbanization on different populations by urban and rural areas. A feasible direction for later research should start from the acquisition of mortality data and strive to obtain more specific, cause-specific mortality data to better analyze the effects of urbanization.

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