

Air Pollution, Public Health Service and Regional Economic Development: Evidence from New York

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Abstract. The rapid development of world industrialization has brought more and more serious environmental problems, especially air pollution. Its impact on human health has become a shared preoccupation of governments and the public worldwide. Numerous studies have shown that air pollution is associated with the appearance of respiratory diseases. Taking New York as an example, this paper selected PM2.5, a common air pollutant, and asthma, a respiratory disease, as the research objects. By using GeoDa software, Moran scatter map, Significance map, and Cluster map were drawn. Air pollution and economic development in areas with high incidences of respiratory diseases were analyzed. The study revealed that regions where respiratory disease rates were higher had higher levels of air pollution, and developed areas had lower rates of respiratory diseases. Based on these findings, countermeasures and suggestions are put forward. To prevent the government from squeezing private capital, all localities should appropriately increase the procurement of basic public services, and appropriately increase the procurement of basic public services. The government should promote the innovation of the basic public services, improve infrastructure construction, and stimulate fair competition among basic public utilities.

1 Introduction

Public health is a kind of science and art that can prevent disease, prolong human life, and foster physical and mental health, whereas the public health service is a sort of low-cost, high-impact service, but it is also a type of service with a relatively long period of social profitability. The public health movement runs through the whole process of modern Western urbanization. The emphasis on public health and the appearance of corresponding services directly gave birth to modern urban planning, represented by urban infrastructure construction and building control. With the rapid development of globalization, public health emergencies are becoming more frequent year by year. The global outbreak of COVID-19 is an important turning point in the history of human public health. The world faces unprecedented public health challenges and many practical dilemmas. From the time of regional outbreaks of the epidemic, it is important to explore the relationship between regional economy and public health service, to coordinate the development of public health service and regional economy.

As the largest city in the United States, New York is the financial center and commercial center in the world. The overall economy of New York is developed and the public health service is perfect, but the internal development difference is obvious, which is a suitable sample to analyze the relationship between public health services and regional economic development. In this paper, the concentration of air pollutants PM2.5, asthma

discharge rate, asthma emergency department visit rate, and poverty rate will be analyzed. This paper will study the economic development implications of public health services, which are conducive to the formation of a good public health service system, to deal with public health emergencies, and ensure the healthy development of the economy.

2 Literature review

Numerous studies have discussed the correlation between health care and regional economic development. Hao Wei pointed out that the economic development of a region reflects people's living standards, public health investment, and the degree of modernization of urban construction. The high level of public health and health service in a region reflects the rapid development of the regional economy from the side. If the regional health facilities are poor, the professional level of health personnel is low, and the level of health services is also low. These will seriously restrict the growth of the regional economy, and reflect the slow growth of the regional economy [1]. Yue Han believes that all regions should pay attention to the development of medical and health services while paying attention to economic development, to avoid the occurrence of a high level of regional economic development while the development of medical and health services is relatively backward, which will inhibit the economic development of the region. Only by

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narrowing the economic development gap between regions and improving the imbalance of medical and health development can economic development adapt to the development of medical and health undertakings. Similarly, only by coordinating the pace of development can the economy and medical and health services promote common development [2]. On this basis, a regional economic development model with health investment as a variable is established by Wang and Song. The regression analysis is carried out by using Pool data, and the results show that the effect of public health services on regional economic growth has significant stage characteristics. In regions with low per capita GDP, public health services make a great contribution to economic growth. In areas with medium GDP per capita, the role of public health services is relatively small. In the regions with higher per capita GDP, the contribution rate of public health services to economic growth tends to increase [3].

These studies adopt mathematical models to outline the relationship between public health services and regional economic growth. However, regional economic development is uneven. It is not enough to study the regions instead of a whole country. It is necessary to further study the region through a more intuitive map model based on the overall analysis. This paper uses GeoDa software to make Moran scatter map, Significance map, and Cluster map to analyze spatial correlation, and conduct a more detailed analysis of the relationship between public health services and regional economic growth.

3 Analytical framework and discussion

Social and economic injustice has become a widely believed health problem. Many surveys have reached similar conclusions and show that most socio-economic indicators are in line with physical health. This is reflected in the fact that the health of low-income people is worse [4].

The level of regional economic development will affect the medical and health construction and infrastructure construction of a region. The quality of public health services affects how much pollution is emitted. The emission of pollutants will have direct and indirect effects on human health. If a region's economy is more developed, it will pay more attention to public health, and formulate and improve laws and regulations. The region will invest more funds in the field of public health services, improve health facilities, reduce the emission of pollutants, and improve public health awareness, to reduce the harm to the human body. If the economy of a region is relatively backward, then the public health services may not be paid attention to and medical and health facilities are lacking in this region. People may lack health awareness, related laws, and regulations. Uncontrolled discharge of pollutants will bring great threat to residents' health, especially the respiratory system, which is in close contact with harmful substances.

In this paper, PM_{2.5}, a common air pollutant, and asthma, a respiratory disease, are selected as research objects to analyze the nexus between air pollution and economic development in areas with a high incidence of respiratory diseases.

3.1 Current situation of air pollution and respiratory diseases

Air pollution is the change in atmospheric purity and quality caused by the natural chemicals or organisms produced by the human body or the discharge of these chemicals or organisms in daily life [5]. In recent years, with the development of the world's industrialization process, its impact on human health has become a shared preoccupation of governments and the public worldwide [6, 7]. Waste gas from factories, burning garbage, and car exhaust are all the causes of air pollution. Numerous studies have shown that air pollution is associated with the appearance of respiratory diseases. [8, 9]. In the meanwhile, indoor air pollution kills more people every year than traffic accidents, and it has become the world's number one hazard. According to the World Health Organization, According to WHO, 1.2 million people die from traffic accidents and 2 million people die from indoor air pollution in a year.

This study takes the New York area as an example to make percentile maps. As can be seen from Figure 1 and Figure 2, the emission of pollutant PM_{2.5} is less in the northeast and more in the southeast. Correspondingly, asthma discharge rates in 2007 were lower in the northeast and higher in the southeast. Using the data for further research, Moran scatter map, Significance map, and Cluster map can be made to digitize and visualize the relationship between the two.

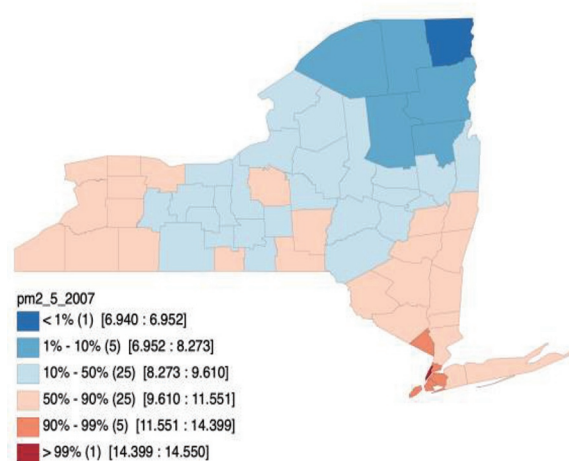


Fig. 1. Annual mean concentration of fine particulate matter (air pollutant) in $\mu\text{g}/\text{m}^3$ (micrograms per cubic meter) for 2007 (Photo credit: Original).

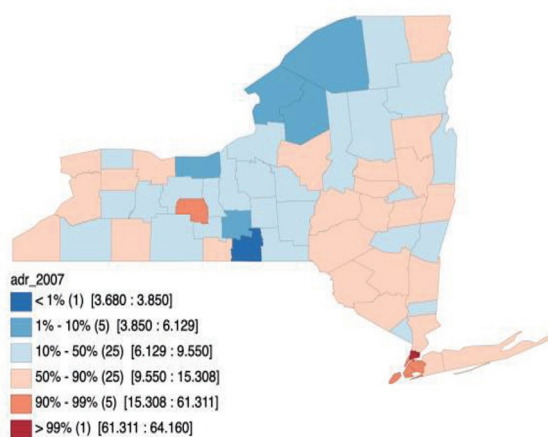


Fig. 2. Asthma discharge rate of residents in 2007 (Photo credit: Original).

It is not difficult to find that in the Moran scatter diagram (see Figure 3), scatter points are mainly distributed along a straight line and mainly in the first and third quadrants, indicating that the two variables are highly correlated and positively correlated. In the Significance map (see Figure 4), there were 13 areas with $p=0.01$ and $p=0.001$, and 5 areas with $p=0.05$, indicating that the emission of PM2.5 was significantly correlated with the discharge rate of residents with asthma. In the Cluster map (as shown in Figure 5), five High-High regions and nine Low-Low regions are displayed. The above research results not only reveal the relationship between air pollution and mortality and disability rate, but also reveal the relationship between air pollution and disability rate and disability rate but also bring new ideas for the prevention and control of air pollution [10].

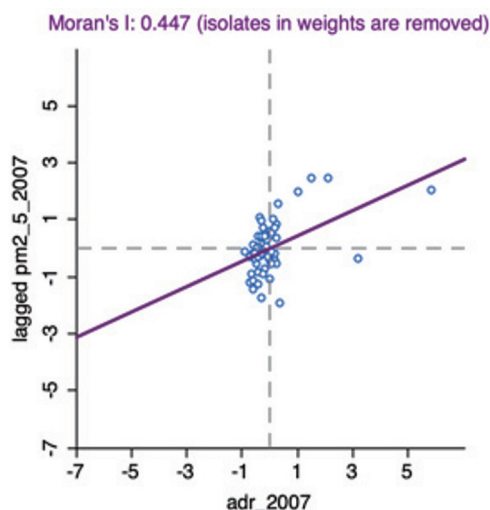


Fig. 3. Moran scatter diagram of adr and PM2.5 (Photo credit: Original).

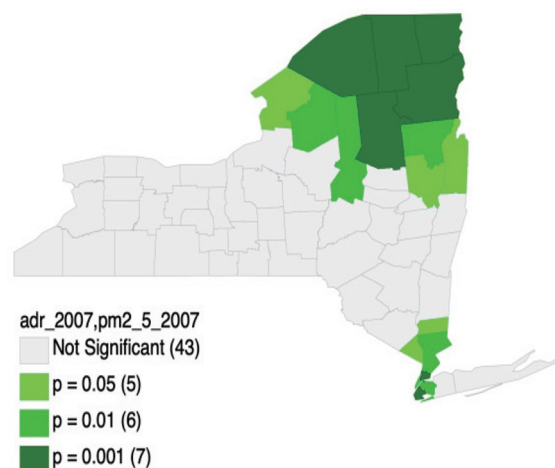


Fig. 4. Significance map of adr and PM2.5 (Photo credit: Original).

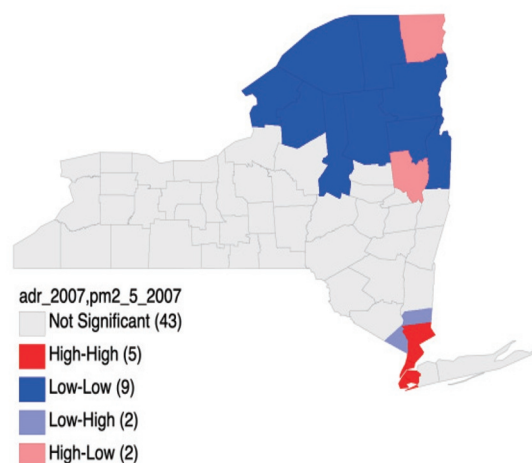


Fig. 5. Cluster map of adr and PM2.5 (Photo credit: Original).

3.2 Incidence of respiratory diseases in developed areas

The development of medical and health care levels is not only related to the planning of a social welfare policy, but also plays an important role in promoting economic growth [11]. Public health research input reflects the movement of health resources from the perspective of the whole society. It reflects the mobilization, allocation, and utilization of health resources in the form of monetary value [12].

Economic growth usually promotes the investment in public health. In the case of regional economic underdevelopment, most of the energy is put into economic development, and there is not much money to invest in public health. When the regional economy tends to grow steadily, it can spare more energy to promote economic growth, and it can also better find out the shortcomings of regional public health and correct them in time [4].

Taking the average household income and asthma discharge rate of residents in New York as two variables,

the Moran scatter map, Significance map, and Cluster map are drawn, which can digitize and visualize the relationship between them. It is not difficult to find that in the Moran scatter diagram (see Figure 6), the scatter points are mainly distributed along a straight line and mainly in the first and third quadrants, indicating that the two variables are highly correlated and positively correlated. In the Significance map of Figure 7, there were 6 regions with $p=0.01$ and 6 regions with $p=0.05$, indicating that there was a significant correlation between the two variables. In the Cluster map of Figure 8, there are three High-High regions and six Low-Low regions.

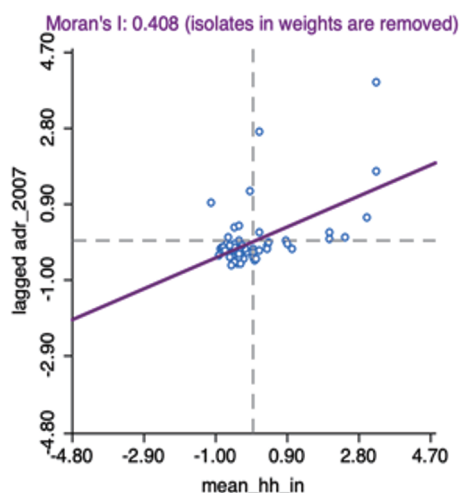


Fig. 6. Moran scatter diagram of mean household income and adr (Photo credit: Original).

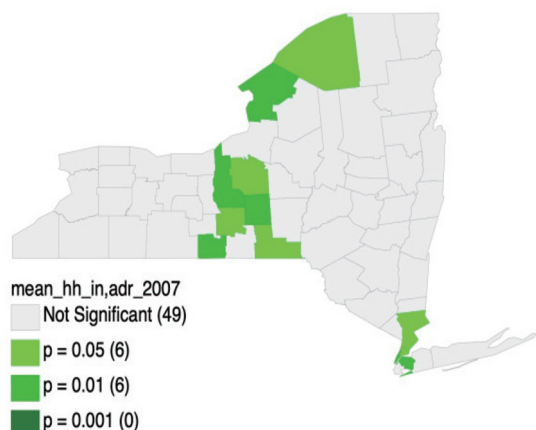


Fig. 7. Significance map of mean household income and adr (Photo credit: Original).

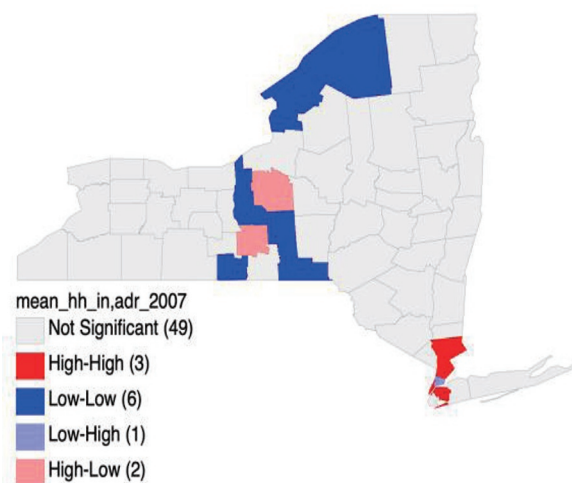


Fig. 8. Cluster map of mean household income and adr (Photo credit: Original).

4 Conclusion

This paper explores the public health service from a historical perspective and discusses the relationship between regional economic development and public health service. It is recognized that the development of medical and health care levels is not only related to the planning of a region's social welfare policy, but also plays an important role in promoting economic growth. Taking New York as an example, this paper selected PM2.5, a common air pollutant, and asthma, a respiratory disease, as research objects to analyze the nexus between air pollution and economic development in New York areas with a high incidence of respiratory diseases. Using data and visualization methods and using GeoDa software, Moran scatter map, Significance map, and Cluster map are drawn. The study revealed that areas, where respiratory disease rates were higher, had higher levels of air pollution, and economically developed areas had lower rates of respiratory diseases.

Based on these findings, countermeasures and suggestions can be put forward. To prevent the government from squeezing private capital, all localities should appropriately increase the procurement of basic public services, and appropriately increase the procurement of basic public services. The government should promote the innovation of basic public services, improve infrastructure construction, and stimulate fair competition among basic public utilities. In addition, it is urgent to improve the public health governance system, promote reform of health governance, and enhance the capacity for health service. In the meanwhile, the international community needs to strengthen the mutual coordination, promote international cooperation, and establish a sound and effective global public health emergency mechanism.

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