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Epidemiological and space-time analysis of Beijing Intestinal Infectious Diseases

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Objective

To investigate epidemiological features and identify high relative risk space-time Intestinal infectious diseases clusters at the township level in Beijing city in order to provide the scientific evidence for making prevention and control measures.

Introduction

Intestinal infectious diseases (IID) is a common cause of illness in the community and results in a high burden of consultations to general practice, mostly affecting the health of infants, preschool children, young adults and elderly people, especially those living in low income countries. According to the published study on the global burden of disease, intestinal infectious diseases were responsible for 221,300 deaths worldwide in 2013. The Chinese Ministry of Health has listed bacillary dysentery, amebic dysentery, typhoid fever and paratyphoid fever as notifiable Class-B communicable diseases and other infectious diarrhea as notifiable Class-C communicable diseases to be included in the surveillance system and reporting network since 2004. Many studies of IID in different regions have been published. However, the epidemiological characteristics and space-time patterns of individual-level IID cases in a major city such as Beijing are still unknown. We aim to analyze the epidemiology features and identify space-time clusters of Beijing IID at a fine spatial scale in this study.

Methods

Data collection. Data on IID cases in the 2008-2010 period were provided by Beijing Center for Disease Prevention and Control, China, including basic social-demographic information and clinical diagnosis (mainly including upper respiratory tract infection, indigestion, gastrointestinal disorders, bacillary dysentery, amebic dysentery, typhoid fever, paratyphoid fever and other infectious diarrhea). The demographic data for each township was calculated based on 2010 census data and the data published in the Beijing Statistical Yearbook.

Epidemiological analysis. The home addresses from IID case records were matched to the geographic coordinates of the township level divisions. Age-gender incidence of IID (1/100,000) was defined as the number of IID cases in each age-gender group divided by the population size of that age-gender group. Total incidence was defined as the total number of IID cases divided by the average population size during the study period.

Space-time analysis. Local spatial autocorrelation analysis based on Indicators of Spatial Association (LISA) was used to measure the spatial autocorrelation of IID incidence. The High-High and Low-Low townships suggested the clustering of similar values for IID incidence, whereas the Low-High and High-Low townships indicated spatial outliers. The spatial and space-time scan statistics combined the covariates (gender and age) method were used to reveal the space-time clusters of Beijing IID.

Results

Epidemiological features. A total of 561,199 individual-level IID cases were reported in Beijing in the period, in which 95 cases without the township information. 22.1% (124,025) of the cases were in the 0 to 4-year age group. Secondly 21.8% (122,345) were in the 50+-year age group. Next 13.17% were in the 25 to 29-year age group (73,931) and 11.9% were in the 20 to 24-year age group (66,787). Among the total IID cases, 307,920 were male, and 253,278 were female. The average male-to-female sex ratio was 1.22. Total IID incidence was 1003.54 /100,000 (1035.16 in 2008, 992.67 in 2009 and 985.30 in 2010). Total IID age-specific incidence in the 0 to 4-year age group (19,004.95) was the highest, followed by 3267.40 in the 25 to 29-year age group. The sex ratio of IID cases varied among the different age-gender groups. For the 50+-year age group, the incidence in female was higher than that in male. However, for the other age groups, the incidence in female was usually lower. The monthly distribution of IID cases exhibited significant seasonality and periodicity. The annual peaks in incidence mostly occurred between May and July. The annual number of IID cases was the lowest (183,326) in 2008 and the greatest (193,237) in 2010.

Space-time Patterns. LISA analysis found that the borders between old city (Xicheng and Dongcheng) and urban districts (Haidian, Chaoyang, Shijingshan and Fengtai) showed the clear High-High positive spatial association for IID incidence. Rural areas (Yanqing, Huairou, Miyun and Pinggu) and outlying districts (the west of Mentougou and Fangshan, the southeast of Daxing and Tongzhou) showed the stable Low-Low positive spatial association for IID incidence. The townships showing Low-Low negative spatial association were mainly distributed in the urban-rural transition zones around the old city, while the High-Low spatial outliers mainly scattered in Xinggu county of Pinggu and Shahe town of Changping. Detected spatial scan clusters varied from year to year. The most likely clusters occurred in 15 townships around Chongwenmenwai of Dongcheng district (2008, Relative risk (RR) = 9.39, Log likelihood ratio (LLR) = 53927.93, P-value (P) < 0.001), Donghuamen and Qianmen of Dongcheng district (2009, RR = 35.01, LLR = 53286.52, P < 0.001), Donghuamen of Dongcheng district (2010, RR= 43.83, LLR = 62674.76, P < 0.001). The most likely space-time cluster (RR = 41.3, P < 0.001) was located in Donghuamen and Qianmen of Dongcheng district during the period from 2009/5/1 to 2010/10/31. The secondary space-time clusters (RR = 2.02, P < 0.001) were mainly scattered in the west part of Beijing including 133 townships during the period from 2010/6/1 to 2010/9/30.

Conclusions

The detected locations and space-time patterns of Beijing IID clusters are important for the local health officials to determine the source of the cluster to design effective prevention strategies and interventions against Beijing IID. The variations in Beijing IID epidemics over population, space, and time that were revealed by this study emphasize the need for more thorough research about the driving forces and risk factors (climate, geography, environment, and social-economic) that contribute to prevent and control Beijing IID outbreaks.

References

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