

Spatial diffusion of emerging and re-emerging infectious disease: A case study of Influenza type A/H1N1pdm09 in Japan, 2009-2010

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Influenza is the most widely distributed viral zoonotic disease on the Earth. In Japan, a seasonal Influenza epidemic occurs around November to March every year. Among the three types of viruses A, B, and C, Influenza type A may cause a pandemic because of a new type of virus.

This study, examines the spatial diffusion process of Pandemic Influenza A/H1N1pdm09 in Japan.

Whereas in various studies examined the pandemic from various fields, few ones considered the detailed diffusion process in Japan from spatial aspects. In particular, mapping its spatial distribution at different spatial scales is required to analyze the diffusion process and its regional differences in detail. In this study, we made multiscale analysis of the diffusion process by mapping at global scale, national scale, and local scale with GIS.

We used infectious disease surveillance data of pandemic season in 2009 to 2010. At the global and national scales, we used patient data from the National Institute of Infectious Diseases (NIID) of Japan, and at the local scale, we used the data from outbreaks at school facilities. The study area at the local scale is Wakayama prefecture, located in the southern part of the Kinki district. This area has regional characteristics of the northern region included in the Keihanshin metropolitan area, and southern region of depopulation area in mountainous lands of Kii Peninsula.

The global and national scale maps revealed that patient arrived taking two routes, mainly in the United States and Southeast Asian countries in May 2009. One is the route from Kansai International Airport, and the other is the Kanto region and Tohoku region from Narita Airport. The spatial diffusion within Japan is supposed to take path according to inter-regional ties.

The peak of the epidemic in Wakayama Prefecture is November 2009; there are it took six months to reach this peak in Wakayama Prefecture from the first confirmation in the Kinki district. An increase in outbreaks began in September 2009. From the distribution of closed facilities, it became clear that it gradually diffused from the northern part included in the metropolitan area to the south part of the prefecture.

These results provide not only emerging and re-emerging influenza but also basic information on daily epidemic prevention.

Keywords: Spatial diffusion, Influenza type A/H1N1pdm09, Japan, Geographical Information System (GIS)