Visualizing Spatio-temporal Small Area Data of Suicide in Japan

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Abstract — In this study we use spatio-temporal small area data of suicide in Japan. Especially, we focused on a municipality unit that is a political unit, such as a city, ward, town, or village, incorporated for local self-government. We used line chart of time series of suicide rates and choropleth map of suicide rates to detect temporal trend and spatial transition from these graphs. Furthermore, in order to reduce difficulties of parameter selection and detecting connections between two graphs, we developed a system to visualize the spatio-temporal small area data of suicide in Japan.

Keyword: Visualization; spatial-temporal data; suicide data.

1 Introduction

The number of persons who commit suicide in Japan remains at a high level in this decade. The figure is more than 30,000 per year and the rate of suicide per 100,000 population is around 25 (in 2010), and is the highest among seven major countries. This situation has to be improved and the rate of suicide has to be reduced. This study will contribute to the situation through the results of the data analysis and the visualization of the data.

In the previous studies, spatial scan statistics was applied for Japanese suicide data to investigate spatio-temporal clusters. These studies focused on the general trends found in the whole area of Japan (Tomita, et al., 2010) or in Kanto District of Japan (Ishioka, et al, 2010), respectively. These studies only covered a small area of secondary medical care zones. However, local trends of time series and local spreads of areas are necessary for further research, which can be used for local government policies. Therefore, we focused on a municipality unit that is considered a political unit, such as a city, ward, town, or village, incorporated for local self-government.

Furthermore, it is useful to visualize these local spatio-temporal data. We used line chart of time series of suicide rates and choropleth map of suicide rates. Our objective is to detect temporal trend and spatial transition from these graphs. In order to draw the graphs, we applied some packages of R such as ggplot2, maptools and RColorBrewer.

There are two kinds of difficulties. One is to select and change parameters appropriately. The other is to detect the connection between line chart and choropleth map in a municipality. Thus, in order to reduce these difficulties, we developed a system to visualize the spatio-temporal small area data. In order to implement browser independence and interactive handleability, we used HTML and JavaScript for client side, and Ruby and R for server side.

In section two, we introduce the data, and show the system we developed. Then we show the example in section three. Finally, we discuss the system and future studies in section four.

2 Visualizing suicide data

2.1 Data

In the objective of visualization, we used two kinds of data: suicide data and map data. Fujita(2009) had updated the Ministry of Health, Labour and Welfare demographic survey of death “local statistics

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about suicide" in 2009. We focused on a municipality unit that is considered a political unit, such as a city, ward, town, or village, incorporated for local self-government. In terms of characteristics we used four kinds of parameters as follows:

- number: the number of Japanese living in Japan who committed suicide
- rate: number per 100,000 populations
- rate(age-adjust): age-adjusted rate. The details were written by Fujita(2009)
- smr: the ratio of observed deaths to expected deaths of suicide. The details were written by Fujita(2009).

For map data, we used "Administrative Zones (surface)" of 2007 in the National Land Numerical Information download service (Ministry of Land, Infrastructure, Transport and Tourism, 2011). In the example of section four, we only used the data of Okayama Prefecture.

2.2 Development of system

The user interface of client side was scripted by HTML and JavaScript. The choices of characteristics and municipality are asynchronously sent to server. In server side, some packages of R are used to draw graphs. ggplot2 is used to draw line chart; maptools is used to draw choropleth map; and RColorBrewer is used to control colors. In server side, Ruby is also used to connect each script and library. The type of the output graphs is PNG, therefore users don't have to install newer add-on in their browser.

3 Examples

Figure 1 shows the top page of our system in Okayama prefecture. In the form found on left side, users can choose some parameters such as sex, type of characteristics, time periods and municipality. In output graphs found on the right side, there are line chart (top) and choropleth map (bottom). The line chart has 27 lines which has the same number as the municipality of Okayama in 2007. The selected municipality is colored red. Choropleth map shows classes of selected characteristics in selected time period. In order to compare with all the time period, same color classes are used in same characteristics all over time periods. The selected municipality of coordinate in population center is colored red.

- Comparison between 1990 and 2008 of age adjusted suicide rate of male at 33210 Niimi-shi

Figure 2 shows the comparison between 1990 and 2008 of age adjusted suicide rate of male at 33210 Niimi-shi. Because same color classes are used, it is very clear that the rate is increased so much. Because the color of Niimi-shi changes from blue to red, the increase is very large.

- Comparison between male and female of age adjusted suicide rate in 1990 at 33210 Niimi-shi

Figure 3 shows comparison between male and female of age adjusted suicide rate in 1990 at 33210 Niimi-shi. From line chart, the rapid increase of male (top left) occurred from 1990 to 1995, but that of female (top right) occurred from 1995 to 2000. There is one time period lag (five years).

4 Discussions and summary

In this study, we developed a system to visualize the spatio-temporal small area data. We anticipate that the users can find newer knowledge about suicide in the area they would like to see. In our example of Okayama prefecture, we find large increase from 1990 to 2008 in Niimi-shi and five year delay of rapid increase between male and female. In our future studies, we will develop all prefectures of Japan. We will also add the results of spatio-temporal analysis such as spatial clustering and spatial regression.
Figure 1: Top page of the system

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References


Figure 2: age adjusted suicide rate of male, left is in 1990 and right is in 2008

Figure 3: age adjusted suicide rate, left is male and right is female