Community and municipal organizational characteristics impacting the completion of disaster plans by local public entities in Japan

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\textbf{A R T I C L E   I N F O}

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Completion of disaster-management systems
Community characteristics
Municipal organizational characteristics
Secondary data analysis

\textbf{A B S T R A C T}

Survey results and publicly available data from government entities were used as secondary data to examine the completion of the three types of disaster plans (master plans, lists of people who would need assistance in a disaster, individual plans) by local public entities in Japan. The results of multivariate logistic analyses using the stepwise method (forward selection, likelihood method) show that the common factors that affected the completion of the three types of disaster plans were the number of entities given lists in normal times and the number of entities given lists in a disaster at local public entities in Japan. In other words, it shows important to establish a good relationship with regional affiliated organizations through collaborative activities for completing these lists. The results of this study were obtained by analyzing secondary data, therefore, there are several limitations on how they can be interpreted. There are many other variables that may affect the outcome variables of disaster-management system completion, which we hope future research will clarify.

\section{1. Introduction}

\subsection{1.1. Study background}

Due to its location, geography, geology, climate, and other natural features, Japan is particularly susceptible to disasters, including typhoons, torrential rains, heavy snowfall, flooding, landslides, earthquakes, tsunamis, and volcanic eruptions. Globally, Japan is subject to 18.5\% of the earthquakes of magnitude 6.0 or higher and 7.1\% of active volcanoes, as well as 1.5\% of the fatalities and 17.5\% of the damage from natural disasters. Considering Japan comprises only 0.25\% of the global land area, these are extremely high figures [1]. The Disaster Countermeasures Basic Law was enacted for this reason, requiring community residents to prepare for disasters and voluntarily take part in disaster management and other such activities [2].

However, if preparing for a disaster is the responsibility of individuals and households, many people have difficulty doing so. These people—such as elderly and disabled people, who are particularly vulnerable to disasters and considered high-risk—need assistance in the event of a disaster, and it is important for local public entities and communities to work together to create evacuation support systems for them [3].

It is particularly important for related entities and organizations to work together in the event of a major disaster [4], and it is necessary to discuss the government’s role (at the national, prefectural, and local levels) in disaster management in Japan, where disasters occur frequently. The particular role of local public entities is to provide administrative services during normal times, thus putting them in close contact with the lives of local residents [5]. These public bodies have primary care roles: if a disaster occurs, these government staff members would be most familiar with the residents who would be the victims of the disaster and would need to carry out duties such as issuing evacuation recommendations, providing lifesaving services, and running evacuation centers. Moreover, the 2012 revision of the Disaster Countermeasures Law strengthened systems of mutual cooperation and support between local public entities during normal times, expanded the coordination functions of government bodies, and promoted reforms to increase regional autonomy [5]. Therefore, the government, referencing the “Guidelines for evacuation support for people who would need assistance in a disaster” [6], developed guidelines and other programs so that local public entities can provide evacuation support to people who would be vulnerable in a natural disaster (master plans, lists of people who would need assistance in a disaster (vulnerable person lists), individual plans) and encouraged public bodies to...
start preparing for disasters during normal times.

In line with these moves, the Fire and Disaster Management Agency, in cooperation with prefectural governments, surveys the state of initiatives by local public entities as of April 1 every year. The agency then summarizes the progress made in formulating and completing programs and publishes the results. However, no analyses of the progress that local public entities have made on different disaster plans have been performed or published.

1.2. Objective and significance

Our research questions were as follows: (1) which municipal organizational characteristics affect the completion of the three types of disaster plans (master plans, vulnerable person lists, and individual plans) by local public entities in Japan?, and (2) which community characteristics affect the completion of each type of disaster plan by local public entities in Japan?

The significance of this research is not only to clarify the community and organizational characteristics that affect disaster plan completion, but also to provide material to examine the necessity of wide-area support (namely, that of national and prefectural governments).

2. Materials and methods

2.1. Operational definitions

The following terms were defined by referencing the “Guidelines for evacuation support for people who would need assistance in a disaster (revised March 2006)” [5].

A “vulnerable person” refers to a person who would need assistance in taking action during a disaster, which could include obtaining necessary information quickly and accurately, and evacuating to a place where he/she would be protected from harm. Those who are vulnerable during disasters are poorly prepared for adapting to new environments, so have difficulty dealing with changes to their living situations due to disasters, evacuating, and living in evacuation centers. However, if they receive the support they need at the appropriate time, they may be able to live independently. Generally, this group includes elderly people, disabled people, foreigners, infants, and pregnant women; however, different local public entities may define vulnerable people differently.

Different disaster management systems were classified based on whether the following disaster management plans had been created: a master plan, a vulnerable person list, and an individual plan.

A “master plan” is drawn up by a local public entity based on local circumstances to create programs and guidelines for assisting vulnerable people. The plan includes basic guidelines for dealing with people who would be vulnerable during a disaster, and methods for gathering and sharing information on such individuals.

A “vulnerable person list” is a resource that contains the names, along with additional information, of people who would be vulnerable during a disaster. Local public entities, community associations, neighborhood associations, welfare officers, and others can use this information to help these individuals evacuate, check on their safety, and provide them with other support.

“Individual plans” are specific plans that specify how evacuation and other support would be provided to each person who may be vulnerable during a disaster. They are used by local public entities, community associations, neighborhood associations, welfare officers, and others in the event of a disaster.

Gathering and sharing information on individuals during normal times is essential for creating individual plans and creating evacuation support systems.

2.2. Data for analysis

2.2.1. Variables related to disaster planning

The outcome variables include whether the master plans, lists of potentially vulnerable people, or individual plans that the local public entities are encouraged by the national government to develop had been completed. Data on this was obtained from the “Survey of evacuation support for people who would need assistance in a disaster (as of April 1, 2012)” [5], conducted by the Fire and Disaster Management Agency under the Ministry of Internal Affairs and Communications. Each variable was classified as “complete” or “incomplete.”

Further, entities that were given lists of people who may be vulnerable were classified into five types: social welfare councils, welfare officers, fire brigade members, autonomous disaster management organizations, and others (such as police, etc.). These five entities are organizations that are different from entities that formulate and implement disaster prevention plans. Welfare officers, fire brigade members, and autonomous disaster management organizations were volunteer entities that were organized for self-governing by local community area. These entities were asked whether they received lists in normal times or only in the event of a disaster. From this data, the numbers of entities that received lists during normal times and only in the event of a disaster were totaled for use in the analyses. The possible range for these data was 0–5.

2.2.2. Variables related to community characteristics

The following variables on community characteristics were obtained from “Demographics and the number of households based on the basic registry of residents” [7]: total population of the local public entity, elderly population ratio (proportion of the total population aged 65 or older; %), natural growth rate (the annual number of births minus the annual number of deaths, divided by the total population and multiplied by 1000), social growth rate (the annual number of immigrants minus the annual number of emigrants, divided by the total population and multiplied by 1000), ratio of those employed in primary industries (number of people aged 15 or older employed in agriculture, forestry, or fishery, divided by total number of people aged 15 or older; %), ratio of those employed in secondary industries (number of people aged 15 or older employed in mining, quarrying, gravel digging, construction, or manufacturing, divided by total number of people aged 15 or older; %), ratio of those employed in tertiary industries (number of people aged 15 or older employed in wholesaling, retailing, healthcare, welfare, lodging, food services, etc., divided by total number of people aged 15 or older; %), and area (km²).

2.2.3. Variables related to municipal organizational characteristics

The following variables on municipal organizational characteristics were obtained from materials on surveys of local fiscal situations using the “Survey of fiscal conditions by municipality” [8]: fiscal index (an index used as a marker of the fiscal strength of local public entities; standard fiscal revenue divided by standard fiscal demand), ratio of annual spending on firefighting (annual firefighting spending divided by total annual spending; %), allocation of disaster management staff (number of disaster management departmental staff divided by total number of staff; %), and number of staff per capita (total population divided by total number of staff). The research originally sought to calculate the ratio of annual spending on disaster management, but because there was not a specific category for disaster management spending, annual spending on firefighting was used as a substitute. When we conducted an interview of several disaster prevention chief officers and staff in the local government, they told us the following: the budget would be allocated from the expenditure related to disaster prevention as “part of the general affairs budget,” and that the “firefighting budget” would include the management and maintenance of autonomous disaster management organizations, local fire brigades, and fire tap, in most local governments. This is because there is no
specific allocation in the expenditure category for disaster prevention. However, the breakup of general affairs budget is not shown as public data.

2.2.4. Analysis set

The data sets for the variables of disaster planning, community characteristics, and municipal organizational characteristics were given IDs for their respective local public entity; then, these IDs were matched to create the data sets used in this study.

2.3. Ethical considerations

This study used existing public data that did not contain personal information to perform secondary data analyses.

3. Calculation

First, the relationship of the completion of each disaster plan type (namely, master plans, vulnerable person lists, and individual plans) with community and municipal organizational characteristics were examined with a chi-squared test or the Mann-Whitney U test. Next, items that exhibited significant differences in these tests were examined as independent variables, taking collinearity into consideration. However, because several variables had high correlation coefficients across multiple variables, master plan completion, vulnerable person list completion, and individual plan completion were treated as separate dependent variables in multivariate logistic analyses using the stepwise method (forward selection, likelihood method) to select influential variables. Odds ratios (OR) and 95% confidence intervals (CI) were calculated.

SPSS version 24 was used for the statistical analysis. The level of significance was 5%.

4. Results

Of the 1472 entities surveyed for the “Survey of evacuation support for people who would need assistance in a disaster (status as of April 1, 2012)” [9], data was analyzed only from the 1470 entities that responded.

A master plan was completed by 1452 entities (83.4%), a vulnerable person list was completed by 1115 entities (64.0%), and individual plans were completed by 501 entities (28.8%). The entities that had completed each type of disaster plan (master plan, vulnerable person list, individual plans) provided lists more often to other entities (both during normal times and only during a disaster) than those that had not completed these plans (all p < 0.001). See Table 1 for details.

Next, correlations between continuous variables were examined as independent variables. A very high correlation coefficient was shown among a plurality of variables. It revealed a complicated relationship that made it difficult to judge which variable should be adopted as the confounding factor. Therefore, the final analysis used the stepwise method. See Table 2 for details.

Finally, multivariate logistic analyses were performed with master plan completion, vulnerable person list completion, and individual list completion as the dependent variables. The variables that exhibited significant differences in chi-squared tests or Mann-Whitney U tests were used as covariates. These were examined as independent variables, taking collinearity into consideration. However, several variables had high correlation coefficients across multiple variables; therefore, the stepwise method (forward selection, likelihood method) was used to select influential variables and calculate OR (95% CI). The analysis with master plan completion as the dependent variable resulted in total population OR = 1.000 (1.000–1.000), ratio of secondary industry employment OR = 1.041 (1.022–1.060), annual firefighting spending OR = 1.158 (1.058–1.270), number of entities given lists in normal times OR = 1.289 (1.163–1.428), and number of entities given lists only during a disaster OR = 1.320 (1.188–1.467). The analysis with vulnerable person list completion as the dependent variable resulted in natural growth rate OR = 0.740 (0.559–0.980), fiscal index OR = 4.715 (2.584–8.604), number of entities given lists in normal times OR = 1.928 (1.764–2.107), and number of entities given lists only during a disaster OR = 1.298 (1.208–1.395). The analysis with individual plan completion as the dependent variable resulted in ratio of tertiary industry employment OR = 0.988 (0.977–0.999), annual firefighting spending OR = 1.081 (1.018–1.148), number of entities given lists in normal times OR = 1.516 (1.401–1.639), and number of entities given lists only during a disaster OR = 1.147 (1.065–1.236). See Table 3 for details.

To summarize, the common factors affecting the completion of the three type of disaster plans (master plans, vulnerable person lists, and individual plans) were the number of entities given lists in normal times and the number of entities given lists of vulnerable people during a disaster by local public entities in Japan.

5. Discussion

5.1. The common factors: the number of entities provided with vulnerable person lists in normal times and in the event of a disaster

Our first research question was: which organizational characteristics affect the completion of the three types of disaster plans (master plans, vulnerable person lists, and individual plans) by local public entities in Japan? The results of our analysis show that the more the vulnerable person lists were used—namely, the more entities that were given lists either during normal times or only in the event of a disaster—the more likely master plans, vulnerable person lists, and individual plans were to be completed. This suggests the importance of improving and strengthening cooperation with relevant bodies, and that increasing the number of entities provided with lists can lead to more completed disaster plans.

Moreover, when deciding which relevant bodies to share lists with in normal times or during a disaster, it is important that local public entities fulfill their responsibility to be accountable to the people they serve and gain their understanding, because the information contained on these lists is sensitive and personal. In a previous study that offered similar views, Fernandez [10] found that in Chile, the accountability and social capital of local public entities played major roles in reducing disaster risk. Studies have shown that in addition to individual capacity to overcome secondary damage after a disaster, strong social capital can help reduce mental health problems, particularly mental health outcomes such as PTSD, anxiety, and depression [11–13]. In other words, while the primary objective of creating a vulnerable person list is to provide at-risk people with rapid lifesaving services in the event of a disaster, the act of creating these lists, providing them to a wide range of entities during normal times and during disasters, strengthening ties with these entities, and gaining the understanding and cooperation of both the vulnerable people and members of their communities can help minimize secondary damage after a disaster.

Elderly people, who make up the majority of potentially vulnerable people in rural areas in particular, are sometimes treated as a homogenous group in need of protection, which may result in some of a community’s human resources being overlooked. This is because elderly people who are in robust shape generally have a strong desire to contribute to society. If they can be motivated, they can improve the younger generations and their communities’ ability to protect their welfare [14]. Although the variables examined in this study did not include the human resources of the communities, it is essential for local public entities looking to improve the disaster management capacities of the community as a whole to gain the understanding and cooperation of relevant bodies and local residents throughout the process of completing their disaster plans.
Table 1
Local characteristics, local public entity organizational characteristics, methods used to create vulnerable person list, and use of vulnerable person lists as these factors relate to disaster plan completion status

<table>
<thead>
<tr>
<th>Local characteristics</th>
<th>Total</th>
<th>Master plan</th>
<th>Vulnerable person list</th>
<th>Individual plans</th>
<th>p value</th>
<th>Vulnerable person list</th>
<th>Individual plans</th>
<th>p value</th>
<th>Vulnerable person list</th>
<th>Individual plans</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Complete</td>
<td>Incomplete</td>
<td>Complete</td>
<td>Incomplete</td>
<td>Complete</td>
<td>Incomplete</td>
<td>Complete</td>
<td>Incomplete</td>
<td>Complete</td>
<td>Incomplete</td>
<td>Complete</td>
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<tr>
<td></td>
<td>1740(100.0)</td>
<td>1452 (83.4)</td>
<td>288(16.6)</td>
<td>1115 (64.0)</td>
<td>625 (36.0)</td>
<td>501 (28.8)</td>
<td>1239 (71.2)</td>
<td></td>
<td>710 (41.1)</td>
<td>970 (55.0)</td>
<td></td>
</tr>
<tr>
<td>Total population (10,000 people)</td>
<td>7.37 ± 18.57</td>
<td>7.93 ± 19.88</td>
<td>4.55 ± 9.21</td>
<td>8.43 ± 19.73</td>
<td>5.47 ± 16.13</td>
<td>7.06 ± 20.77</td>
<td>7.50 ± 17.62</td>
<td>0.361</td>
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<tr>
<td>Elderly population ratio (%)</td>
<td>28.9 ± 6.7</td>
<td>28.8 ± 6.7</td>
<td>29.2 ± 6.9</td>
<td>28.5 ± 6.5</td>
<td>29.6 ± 7.1</td>
<td>28.8 ± 6.3</td>
<td>28.9 ± 6.9</td>
<td>0.761</td>
<td></td>
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<tr>
<td>Natural growth rate (%)</td>
<td>-0.57 ± 0.58</td>
<td>-0.57 ± 0.57</td>
<td>-0.60 ± 0.59</td>
<td>-0.54 ± 0.56</td>
<td>-0.63 ± 0.61</td>
<td>-0.57 ± 0.56</td>
<td>-0.56 ± 0.59</td>
<td>0.761</td>
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<tr>
<td>Social growth rate (‰)</td>
<td>5.63 ± 13.42</td>
<td>6.09 ± 13.34</td>
<td>3.34 ± 13.62</td>
<td>6.86 ± 13.59</td>
<td>3.88 ± 12.82</td>
<td>5.41 ± 11.69</td>
<td>5.72 ± 14.06</td>
<td>0.954</td>
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<tr>
<td>Ratio employed in primary industries (%)</td>
<td>11.6 ± 10.6</td>
<td>10.9 ± 10.3</td>
<td>14.7 ± 11.8</td>
<td>10.6 ± 10.2</td>
<td>13.2 ± 11.2</td>
<td>11.8 ± 10.1</td>
<td>11.5 ± 10.8</td>
<td>0.049</td>
<td></td>
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<tr>
<td>Ratio employed in secondary industries (%)</td>
<td>26.3 ± 8.3</td>
<td>26.9 ± 8.2</td>
<td>23.5 ± 8.3</td>
<td>27.1 ± 8.4</td>
<td>24.9 ± 8.0</td>
<td>27.1 ± 8.3</td>
<td>26.0 ± 8.3</td>
<td>0.010</td>
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<tr>
<td>Ratio employed in tertiary industries (%)</td>
<td>62.1 ± 10.4</td>
<td>62.2 ± 10.3</td>
<td>67.1 ± 11.1</td>
<td>62.3 ± 10.4</td>
<td>61.8 ± 10.4</td>
<td>61.1 ± 9.8</td>
<td>62.5 ± 10.6</td>
<td>0.019</td>
<td></td>
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<tr>
<td>Area (km²)</td>
<td>214.1 ± 247.5</td>
<td>213.2 ± 244.0</td>
<td>218.3 ± 264.7</td>
<td>208.3 ± 246.1</td>
<td>224.5 ± 249.8</td>
<td>215.5 ± 247.1</td>
<td>213.5 ± 217.7</td>
<td>0.288</td>
<td></td>
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</tr>
<tr>
<td>Fiscal index</td>
<td>0.49 ± 0.28</td>
<td>0.51 ± 0.28</td>
<td>0.42 ± 0.29</td>
<td>0.52 ± 0.29</td>
<td>0.44 ± 0.27</td>
<td>0.48 ± 0.26</td>
<td>0.50 ± 0.26</td>
<td>0.556</td>
<td></td>
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<tr>
<td>Annual spending on firefighting (%)</td>
<td>4.2 ± 1.8</td>
<td>4.3 ± 1.8</td>
<td>4.0 ± 2.0</td>
<td>4.3 ± 1.8</td>
<td>4.2 ± 1.8</td>
<td>4.4 ± 1.8</td>
<td>4.2 ± 1.8</td>
<td>0.004</td>
<td></td>
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</tr>
<tr>
<td>Allocation of disaster-management staff (%)</td>
<td>0.9 ± 1.0</td>
<td>1.0 ± 1.0</td>
<td>0.9 ± 1.0</td>
<td>1.0 ± 1.0</td>
<td>0.8 ± 1.0</td>
<td>1.0 ± 1.2</td>
<td>0.9 ± 1.0</td>
<td>0.029</td>
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<tr>
<td>Staff per capita (people)</td>
<td>94.2 ± 42.6</td>
<td>96.6 ± 41.3</td>
<td>82.3 ± 47.2</td>
<td>97.1 ± 41.0</td>
<td>88.9 ± 44.9</td>
<td>95.1 ± 39.1</td>
<td>93.8 ± 44.0</td>
<td>0.339</td>
<td></td>
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<tr>
<td>Status of disaster-planning*</td>
<td>Master plan completed</td>
<td>1452(83.4)</td>
<td>1010 (91.6)</td>
<td>474 (94.6)</td>
<td>709(78.9)</td>
<td>0.001</td>
<td></td>
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<td></td>
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<tr>
<td>Vulnerable person list completed</td>
<td>1010(69.9)</td>
<td>105(36.5)</td>
<td>1042(70.7)</td>
<td>474 (94.6)</td>
<td>641(51.7)</td>
<td>0.001</td>
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<tr>
<td>Individual plans completed</td>
<td>474(32.6)</td>
<td>279(4.3)</td>
<td>474(32.6)</td>
<td>279(4.3)</td>
<td>&lt;0.001</td>
<td></td>
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<tr>
<td>Use of vulnerable person lists</td>
<td>Number of entities provided with lists in normal times</td>
<td>1.7 ± 1.5</td>
<td>1.9 ± 1.5</td>
<td>1.1 ± 1.4</td>
<td>2.2 ± 1.4</td>
<td>0.9 ± 1.3</td>
<td>2.4 ± 1.4</td>
<td>1.5 ± 1.5</td>
<td>&lt;0.001</td>
<td></td>
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<tr>
<td>Number of entities provided with lists only in event of a disaster</td>
<td>1.0 ± 1.6</td>
<td>1.1 ± 1.6</td>
<td>0.6 ± 1.3</td>
<td>1.2 ± 1.6</td>
<td>0.7 ± 1.5</td>
<td>&lt;0.001</td>
<td>1.1 ± 1.5</td>
<td>1.0 ± 1.6</td>
<td>&lt;0.001</td>
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</tbody>
</table>

Mann-Whitney U test.

* Chi-square test.
Table 2
Correlations between local characteristics and local public entity characteristics.

(n=1740)

<table>
<thead>
<tr>
<th></th>
<th>Number of sites provided with lists in normal times</th>
<th>Number of sites provided with lists in event of a disaster</th>
<th>Total population</th>
<th>Elderly population ratio</th>
<th>Natural growth rate</th>
<th>Social growth rate</th>
<th>Ratio employed in primary industries</th>
<th>Ratio employed in secondary industries</th>
<th>Ratio employed in tertiary industries</th>
<th>Area</th>
<th>Fiscal index</th>
<th>Annual spending on firefighting</th>
<th>Allocation of disaster-management staff per capita</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of sites provided with lists in normal times</td>
<td>1.000</td>
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<tr>
<td>Number of sites provided with lists in event of a disaster</td>
<td>-0.024</td>
<td>1.000</td>
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<td></td>
<td></td>
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<tr>
<td>Total population</td>
<td>0.179**</td>
<td>-0.138</td>
<td>1.000</td>
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<tr>
<td>Elderly population ratio</td>
<td>-0.060</td>
<td>0.094**</td>
<td>-0.612**</td>
<td>1.000</td>
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<tr>
<td>Natural growth rate</td>
<td>0.071**</td>
<td>-0.109**</td>
<td>0.613**</td>
<td>-0.923**</td>
<td>1.000</td>
<td></td>
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<tr>
<td>Social growth rate</td>
<td>0.096**</td>
<td>-0.039</td>
<td>0.491**</td>
<td>-0.605**</td>
<td>0.590**</td>
<td>1.000</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ratio employed in primary industries</td>
<td>-0.098</td>
<td>0.096**</td>
<td>-0.663**</td>
<td>0.48**</td>
<td>-0.645**</td>
<td>-0.521**</td>
<td>1.000</td>
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<td></td>
<td></td>
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<tr>
<td>Ratio employed in secondary industries</td>
<td>0.089**</td>
<td>0.104</td>
<td>0.139**</td>
<td>-0.180**</td>
<td>0.114**</td>
<td>0.190**</td>
<td>-0.282**</td>
<td>1.000</td>
<td></td>
<td></td>
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<tr>
<td>Ratio employed in tertiary industries</td>
<td>0.032</td>
<td>-0.147</td>
<td>0.511**</td>
<td>-0.415**</td>
<td>0.446**</td>
<td>0.266**</td>
<td>-0.702**</td>
<td>-0.365**</td>
<td>1.000</td>
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<td></td>
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<tr>
<td>Area</td>
<td>0.031</td>
<td>-0.003</td>
<td>0.070**</td>
<td>0.380**</td>
<td>-0.344**</td>
<td>-0.304**</td>
<td>0.390**</td>
<td>-0.069**</td>
<td>-0.241**</td>
<td>1.000</td>
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<tr>
<td>Fiscal index</td>
<td>0.112**</td>
<td>-0.098**</td>
<td>0.707**</td>
<td>-0.761**</td>
<td>0.707**</td>
<td>0.627**</td>
<td>-0.772**</td>
<td>0.309**</td>
<td>0.471**</td>
<td>-0.305**</td>
<td>1.000</td>
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<tr>
<td>Annual spending on firefighting</td>
<td>0.007</td>
<td>0.012</td>
<td>-0.148**</td>
<td>0.102**</td>
<td>-0.137**</td>
<td>-0.064**</td>
<td>0.055**</td>
<td>0.120**</td>
<td>-0.083**</td>
<td>-0.086**</td>
<td>0.019</td>
<td>1.000</td>
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<tr>
<td>Allocation of disaster-management staff per capita</td>
<td>0.108**</td>
<td>-0.108**</td>
<td>0.287**</td>
<td>-0.154**</td>
<td>0.138**</td>
<td>0.103**</td>
<td>-0.190**</td>
<td>0.093**</td>
<td>0.139**</td>
<td>0.001</td>
<td>0.269**</td>
<td>0.107**</td>
<td>1.000</td>
</tr>
<tr>
<td>Staff per capita</td>
<td>0.104**</td>
<td>-0.063**</td>
<td>0.703**</td>
<td>-0.725**</td>
<td>0.699**</td>
<td>0.521**</td>
<td>-0.653**</td>
<td>0.211**</td>
<td>0.444**</td>
<td>-0.361**</td>
<td>0.738**</td>
<td>0.008</td>
<td>0.212**</td>
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Spearman's correlation coefficient: *p < 0.05, **p < 0.01.
Table 3
Logistics regression analysis for each disaster plan's completion status.

<table>
<thead>
<tr>
<th></th>
<th>Master plan completed</th>
<th>Vulnerable person list completed</th>
<th>Individual plans completed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR(95%IC)</td>
<td>OR(95%IC)</td>
<td>OR(95%IC)</td>
</tr>
<tr>
<td>Local characteristics</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Total population (10,000 people)</td>
<td>1.000(1.000–1.000)</td>
<td>0.740(0.559–0.980)</td>
<td></td>
</tr>
<tr>
<td>Natural growth rate (%)</td>
<td>1.041(1.022–1.060)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local public entity organizational characteristics</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fiscal index</td>
<td>4.715(2.584–8.604)</td>
<td></td>
<td></td>
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<tr>
<td>Use of vulnerable person lists</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of entities provided with lists in normal times (ref. 0)</td>
<td>1.158(1.056–1.270)</td>
<td>1.081(1.018–1.149)</td>
<td></td>
</tr>
<tr>
<td>Number of entities provided with lists only in event of a disaster (ref. 0)</td>
<td>1.289(1.163–1.428)</td>
<td>1.928(1.764–2.107)</td>
<td>1.516(1.401–1.639)</td>
</tr>
<tr>
<td></td>
<td>1.320(1.188–1.467)</td>
<td>1.298(1.208–1.395)</td>
<td>1.147(1.065–1.236)</td>
</tr>
</tbody>
</table>

Multivariate logistic regression analysis, stepwise forward selection, likelihood method.
* Master plan completion to select influential variables: total population, social growth rate, ratio employed in primary industries, ratio employed in secondary industries, index, annual spending on firefighting, staff per capita, number of entities provided with lists in normal times, number of entities provided with lists only in event of disaster, included sharing with relevant bodies, included consent-based sharing, included voluntary registration, multiple methods adopted.

Vulnerable person list completion to select influential variables: total population, elderly population ratio, natural growth rate, social growth rate, ratio employed in primary industries, ratio employed in secondary industries, ratio employed in tertiary industries, index, allocation of disaster-management staff, staff per capita, number of entities provided with lists in normal times, number of entities provided with lists only in event of disaster, included sharing with relevant bodies, included voluntary registration.

Individual plans' completion to select influential variables: ratio employed in primary industries, ratio employed in secondary industries, ratio employed in tertiary industries, annual spending on firefighting, number of entities provided with lists in normal times, number of entities provided with lists only in event of disaster, included sharing with relevant bodies, included consent-based sharing, included voluntary registration, multiple methods adopted.

5.2. Community and municipal organizational characteristics affecting master plan completion

Our second research question was: which community characteristics affect the completion of each type of disaster plan by local public entities in Japan? The results of our analysis show that the community characteristics that affected the completion of a master plan were total population and ratio of employment in secondary industries. The municipal organizational characteristics that affected the completion was annual firefighting spending.

Kusumasari [15] defined the capacities that enabled local public entities to manage disasters as organizational functions, human resources, policies that enable effective enforcement, fiscal strength, technical resources, and leadership functions. In the present study, the completion of master plans, vulnerable person lists, and individual plans are thought to fall under “policies that enable effective enforcement.”

Compared to local public entities with small total populations, those with larger populations need more systematic evacuation plans and plans for preventing secondary damage. In addition, these entities tend to have larger areas under their control and more related groups to interact with, which means they often must put their proposals and explanations into writing. These factors seem to indicate the reasons that a larger population was tied to the completion of a master plan. An analysis of spatial and temporal comparisons based on demographic indices from Serbia indicated that vulnerability to natural disasters in urban areas was dependent on population density [16]. Cities, which have larger populations and higher population densities, may have a stronger sense of crisis because they are more vulnerable to natural disasters, and the resulting behavior may lead to higher rates of master plan completion. However, the fact that only 16.6% of entities had not completed a master plan, and that these entities had significantly smaller populations, suggests that entities in smaller towns have made less progress than those in bigger cities.

It is difficult to interpret why the ratio of secondary industry employment would have an impact on master plan completion based on the variables used in this study. We could not find any previous studies that have suggested a relationship between industrial structure and disaster planning.

The only municipal organizational characteristics that affected the completion of master plans was annual spending on firefighting. This suggests that, for example, even a local public entity with a small fiscal index could complete a master plan if it allotted a large proportion of spending to firefighting; in other words, a master plan could be completed if its allocation of funds was based on an awareness of the necessity and importance of firefighting. The aim was to calculate the ratio of annual spending on disaster management, but because there was not a specific category for disaster management spending, annual spending on firefighting was used as a substitute. For this reason, the size of spending on disaster management within this category could not be determined.

5.3. Community and municipal organizational characteristics affecting vulnerable person list completion

Our second research question also asked which community characteristics affect the completion of vulnerable person lists, and the results of our analysis show that the only characteristic of this type was the natural growth rate being negative. Areas with low birth rates and high death rates—known as depopulation—had more difficulty making progress on their vulnerable person lists. The municipal organizational factor that had an impact was the fiscal index; the odds ratio of 4.7 compared to entities that had not completed a list was the highest observed in this study.

As can be surmised from the high correlation coefficients between the fiscal index and the natural growth rate and elderly population ratio, depopulated areas with declining populations, low young population ratios, and low fiscal indices (≤ 0.5) likely have smaller ratios of working population and local tax revenue [17]; thus, these entities have more difficulty raising the funds needed to complete disaster plans. In other words, even if the 36% of local public entities that had not completed their vulnerable person lists wanted to make further progress, and even if they were aware of the need and importance of completing these lists, they would probably find it extremely difficult to
do so on their own, from a fiscal point of view. In addition, due to the revision of the Basic Act on Disaster Countermeasures in June 2013, the completion of the master plans and the compilation of the list of vulnerable persons became a municipal obligation, not a recommendation. Therefore, higher administrative organizations (prefectural, national level) would likely need to provide some kind of fiscal support. Of course, entities that have not completed their lists should not merely rely on others. They should try to improve and strengthen their cooperation with relevant bodies and increase the number of entities given vulnerable person lists, either during normal times or only during a disaster. During the interview with disaster prevention chief officers in some local governments, they told us that collaborative activities with regional affiliated organizations within their own community were more important than the economic support provided by the nation for creation of vulnerable person lists. The final goal is not to create a list of vulnerable persons, but to make effective use of it in the event of a disaster. In other words, it is important to establish a good relationship with regional affiliated organizations through collaborative activities for completing them.

Furthermore, we believe that it is important to create a collaborative system between the disaster prevention department and the welfare department for understanding the state of almost all vulnerable persons in normal times. Collaboration with welfare departments and regional cooperative organizations will make it easier for annual updating by the addition of new names.

5.4. Community and municipal organizational characteristics affecting individual plans completion

Finally, our second research question asked which community characteristics affect the completion of individual plans, and the results of our analysis show that the only characteristic of this type was the ratio of tertiary industry employment being negative. The municipal organizational characteristic that had an impact was annual operation with relevant bodies and increase the number of entities. Therefore, higher administrative organizations (prefectural, national level) would likely need to provide some kind of fiscal support. Of course, entities that have not completed their lists should not merely rely on others. They should try to improve and strengthen their cooperation with relevant bodies and increase the number of entities given vulnerable person lists, either during normal times or only during a disaster. During the interview with disaster prevention chief officers in some local governments, they told us that collaborative activities with regional affiliated organizations within their own community were more important than the economic support provided by the nation for creation of vulnerable person lists. The final goal is not to create a list of vulnerable persons, but to make effective use of it in the event of a disaster. In other words, it is important to establish a good relationship with regional affiliated organizations through collaborative activities for completing them.

As to why the ratio of tertiary industry employment would affect the completion of individual plans, no past studies have suggested a relationship between industrial structure and disaster planning, and it was difficult to make conjectures based on the variables examined in the present study.

Regarding the impact of annual firefighting spending, many of the local public entities that had not completed individual plans had small fiscal indices. Despite having few fiscal resources, these entities may be able to increase staff spending so that they might complete their individual plans, if there is a strong will and the support of the town mayor, or if there is a subsidy from the country. However, it is important to first consider sharing information and collaborative activities with welfare departments within local governments. As a final analysis of present study, the number of disaster-management staff was not determined to be an influential factor. However, from the interviews with the disaster prevention chief officers and staff in the local government, it was suggested that the longer the assignment years of the disaster-management staff, the better the prospects for disaster prevention based on regional characteristics.

Since the legal background of this research has changed and become mandated, it is even more necessary for completion of the lists by collaborative activities with regional affiliated organizations.

5.5. Limitation

The results of present study were obtained by analyzing secondary data; therefore, there are many limitations on how they can be interpreted. There are many other variables that may affect the outcome variables of disaster management system completion in Japan.

Furthermore, because this study is a cross-sectional survey, causality can not be discussed. We hope that future research will clarify these variables, both for Japan and the rest of the world.

6. Conclusion

Our results indicate that collaborative activities with regional affiliated organizations in the community is very important for the promotion of vulnerable person lists. The final goal is not to create the master plan, vulnerable person lists, and individual plans, but how they could be used effectively in the event of a disaster. In other words, it is important to establish a good relationship with regional affiliated organizations through collaborative activities for completing these lists.

Declarations of interest

None.

Funding

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References


