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## Chapter

# A Report of the Survey on Shelter Management under COVID-19 in Japanese Local Governments

*Arisa Yasui and Muneyoshi Numada*

## Abstract

Japan is a disaster-prone country and natural disasters could happen under COVID-19. Shelter management is especially important because many people evacuate there and there's high risk of spreading infection. In order to establish feasible countermeasures in shelters, we conducted a survey about the current situation of preparation and experience of shelter management in Japanese local governments under COVID-19. From the answer of 346 municipalities, we found that some municipalities took measures against COVID-19 such as adding new shelters and conducting the training, and these proactive measures were very useful. However, due to the addition of infectious disease control work, it became clear that it would take time and difficulty at reception, and that it would be even more difficult to identify evacuees with the recommended distributed evacuation. These results can be useful in proceeding consideration of better shelter management under COVID-19.

**Keywords:** COVID-19, shelter management, infectious disease measures, Japan, local governments

## 1. Introduction

Currently, the infection of COVID-19 is spreading all over the world. As of April 21, 2021, the number of infected people worldwide has exceeded 140 million and the death toll has exceeded 3 million [1]. The infection has spread by an order of magnitude compared to the SARS infections of 8,096 and deaths of 794 [2] that prevailed in 2003, and the MARS infections of 971 and deaths of 356 [3] that prevailed in 2012. The development of therapeutic drugs and vaccines is progressing all over the world, and inoculation is progressing [4], but it has not yet ended in some countries such as Japan and India.

In Japan, which is a disaster-prone country, there are concerns about the occurrence of natural disasters such as earthquakes, tsunamis, and typhoons during the period when COVID-19 is spreading. Especially in recent years, disasters such as the 2011 off the Pacific coast of Tohoku Earthquake, the 2016 Kumamoto Earthquake, and the heavy rains in western Japan in 2018, have become more severe and frequent. When such disasters occur, schools and public halls become shelters and many residents evacuate [5, 6]. In these past disasters, the spread of infection in shelters has become a problem. Although the Basic Act on Disaster Countermeasures requires improvement of the living environment in shelters, such as distribution of food, clothing, medicines, and provision of health care

services (Article 86–6), specific measures against infectious diseases have not been mentioned. In addition, outbreaks in shelters can be larger under COVID-19 than infectious diseases after previous natural disaster because some people have not taken COVID-19 vaccine yet. It is also possible that people are more likely to suffer damage at home if they do not evacuate to a shelter for fear of getting infected. 90% of those who died in the heavy rains in western Japan were found at home [7], and it is said that they could not evacuate to a safe place.

Based on this situation, the problem is that human damage caused by both COVID-19 and natural disasters will increase, and it is necessary to consider measures against the occurrence of natural disasters and the shelter management system under COVID-19.

Therefore, our research question is, “What is the current situation regarding the shelter management in Japanese local governments under COVID-19?” This research will contribute to realize effective disaster countermeasures under COVID-19.

## 2. Literature review

Infectious diseases are often prevalent after a natural disaster [8]. In particular, there are many cases of infectious diseases occurring in shelters [9–11].

The spread of infectious diseases involves multiple factors. First, stress due to major changes in the living environment [12], food shortages, and unsanitary environments increase the risk of infection [8]. Next, although an unspecified number of people live together in shelters, it has been clarified that infection is spreading in shelters where the usable area per person is small and dense [13]. In addition, disasters can paralyze medical institutions and damage healthcare workers, so inadequate provision of medical care compared to normal times contributes to the spread of infection [12].

In the Great East Japan Earthquake, there were many acute respiratory and gastrointestinal symptoms [9]. During the Kumamoto earthquake, norovirus-induced infectious gastroenteritis was prevalent [10].

The epidemic of infectious diseases after the occurrence of a natural disaster is not limited to Japan.

For example, the 2004 Sumatra earthquake and tsunami caused aspiration pneumonia, skin and wound infections [14], the 2005 hurricane Katrina spread norovirus infections in shelters [11], and the 2010 Haiti earthquake caused a cholera outbreak [15].

It is necessary to take appropriate measures against the epidemic of such infectious diseases. During the Great East Japan Earthquake, an infectious disease control team [12] and Japan Medical Association Team (JMAT) from a nearby university hospital were dispatched to shelters [16]. At the time of the Kumamoto earthquake, Kagoshima Prefecture JMAT was also dispatched, and public health activities including infectious disease control were carried out along with medical care for the victims [17]. Activities from the early stage of 5 days after the disaster are attributed to the good relationship between the medical association and the local government before the disaster and the communication function using the Web [17]. Thanks to these activities, the effects of the infection are said to have been relatively small [18].

The main activities of these organizations are the provision of medical care and surveillance of infectious diseases. As medical needs change over time, the content and scale of medical care provided by various organizations changes [19]. Early after the disaster, disaster medicine is provided, but gradually shifts to support for daily medical care in the disaster area, and the proportion of nurses decreases and the proportion of

doctors increases [20]. Since conventional surveillance systems may not function or limited resources may be available in the early stages after the disaster, it is necessary to consider a system that efficiently collects infectious disease information from the early stages of the disaster [9]. In addition to relying on people with specialized knowledge, shelter operators, mainly local governments, also need basic knowledge [21] and understanding of pathogens [22] to improve the environment of shelters.

However, according to a survey conducted by Kudo et al., about 60% of local governments have prepared infection control manuals, and it cannot be said that a sufficient system is in place to prevent the spread of infectious diseases. In addition, 75% said they had insufficient knowledge about infectious diseases, and only 3% said they had sufficient knowledge [23].

As described above, infectious diseases have become prevalent in shelters after the occurrence of natural disasters, and many studies have analyzed individual cases and are considering countermeasures. However, they do not consider COVID-19 that is currently prevalent. In addition, this is a study on cases of infectious diseases that occur after natural disasters and their countermeasures, which is different from the case where natural disasters occur while infectious diseases are spreading as they are now. In order to implement effective countermeasures against COVID-19, it is necessary to understand disaster countermeasures that incorporate infectious disease countermeasures by local governments.

Therefore, the purposes of this study are i) to clarify the current status of proactive measures for shelter operation under COVID-19, and ii) to clarify the actual state and issues of shelter operation in COVID-19. These results are useful in considering countermeasures against the occurrence of natural disasters and shelter management under COVID-19.

### 3. Methods

#### 3.1 Outline of the survey

As the method of this research, we used the implementation of questionnaire surveys for Japanese local governments nationwide and their statistical analysis.

In this study, the authors created a questionnaire in Excel and sent it by e-mail to the departments in charge of disaster prevention in local governments. **Table 1** shows the outline of the survey, and the number of valid answers is 346.

**Table 2** shows the composition of the questionnaire. Most of them are multiple-choice, but some questions are descriptive. The contents of the survey can be roughly divided into four. The first is the proactive measures for the shelter management under COVID-19. In order to clarify what kind of measures are being taken by each local government in Japan, we have set up questions asking about the creation of shelter management manuals that incorporate infectious disease countermeasures, the implementation of training, and the addition of shelters. The second is the actual shelter management under COVID-19 in entire municipality. For local governments that have experience in opening shelters under COVID-19, we set up questions asking about the provision of evacuation information and the acceptance of support staff. The third is the actual shelter management under COVID-19 at each shelter. In order to clarify the infection countermeasures taken at the shelters and their issues, we set up questions asking about the specific contents of infectious disease countermeasures, how to grasp evacuees at home, and difficult tasks. The fourth is the attributes of the respondents. Questions were set up asking the name of the municipality, population size, name of the department in charge, title of the person in charge, and experience of opening shelters.

Item	Contents
Survey name	Survey on shelter management under COVID-19
Survey target	Municipalities nationwide
Investigation	<ul style="list-style-type: none"> <li>• Preparation for shelter management under COVID-19</li> <li>• Actual shelter management under COVID-19 etc.</li> </ul>
Survey period	From December 14th, 2020 to December 31st, 2020
Collection method	Send mail
Number of valid answers	346

**Table 1.**  
*Outline of the survey.*

Proactive measures for shelter management under COVID-19	<ul style="list-style-type: none"> <li>• <b>Addition of shelter:</b> Asked the question, “Did you add a new shelter as a measure against COVID-19? Please tell me all that apply.” Respondents who selected “Other” are requested to provide a descriptive response.</li> <li>• <b>Creation of a shelter management manual fur COVID-19:</b> In response to the question “Are you creating an evacuation shelter management manual based on COVID-19 measures?” Request a single selective answer from the three.</li> <li>• <b>Implementation of shelter management training under COVID-19:</b> In response to the question “Did you conduct shelter management training based on COVID-19 measures?”, You can choose from three options: “We did it for the entire municipality,” “We did it independently at each shelter,” and “We did not.” Request a single selective answer.</li> </ul>
Actual shelter management under COVID-19 (for the entire municipality)	<ul style="list-style-type: none"> <li>• <b>Experience of opening a shelter under COVID-19:</b> “Did you open a shelter under COVID-19? Please tell us about the target disaster. If not, please enter None”. We requested a descriptive answer to the question and asked the respondents who filled in the target disaster to answer the following questions.</li> </ul>
1. <b>Provision or evacuation information:</b>	In response to the question, “What kind of information did you provide in addition to the evacuation information when the above disaster occurred? Please tell me all that apply.” Request multiple selective answers from “Prompted for evacuation at home”, “Prompted for evacuation to house of acquaintances or relatives”, “Prompted for distributed evacuation”, “Request for wearing mask”, and “Other”, and requested respondents who selected “Other” to answer with a description of the contents.
2. <b>Acceptance of support staff:</b>	In response to the question “Did you accept the support staff?”, Request a single selective answer from “Yes” and “No”. For respondents who selected “Yes”, in response to the question “Which area did you accept support staff from? Please tell me all that apply.” Request an answer and request the respondents who selected “Other” to further describe the content.
3. <b>Acceptance of volunteers:</b>	In response to the question “Did you accept volunteers?”, Request a single selective answer from “Ye” and “No”. For respondents who selected “Yes”, in response to the question “Which area did you accept volunteers from? Please tell me all that apply.”, request multiple selective answers from “City / town” “Prefecture” “Kyushu region” “Others”, and request the respondents who selected “Other” to further describe the contents.
Actual shelter management under COVID-19 (for each shelter)	<p>Following the above, we asked the following questions for each shelter opened.</p>
4. <b>Shelter name:</b>	Request a descriptive answer to the question “Please tell me the name of the shelter.”
5. <b>Opening period:</b>	In response to the question “Please tell me the opening period of the shelter”, request a single selective answer from “within 24 hours”, “1–3 days”, “3 days–1 week”, “1 week–3 weeks”, and “3 weeks or more”.
6. <b>Maximum capacity:</b>	In response to the question “What is the maximum number of evacuees accommodated?”, request a single selective answer from “10 or less,” “10–50,” “50–100,” “100–300,” and “more”, and request the respondents who selected “more” to answer with a description of the content.
7. <b>Utilization of shelter management manuals incorporating infectious disease countermeasures:</b>	In response to the question “Have you been able to utilize shelter management manuals based on COVID-19 measures?”, we requested a single selective answer from “Yes”, “No” and a descriptive answer for each.

- 
8. **Utilization of shelter management training incorporating infectious disease countermeasures:** In response to the question “Did the evacuation shelter management training based on COVID-19 measures help in actual management?”, we requested a single selective answer from “Yes” and “No” and requested a descriptive answer for each.
- 
9. **Grasping home evacuation and staying in the car (distributed evacuation):** Requested a descriptive answer to the question “How did you grasp evacuation at home and staying in the car?”
- 
10. **Acceptance of pets:** Requested a descriptive answer to the question “How did you accept evacuees’ pets?”
- 
11. **Infectious disease control items:** In response to the question “Did you have enough items for infectious disease control?”, We requested a single selective answer from “Yes” and “No”, and the respondents who selected “No” were asked “In response to the question “Please tell me all that apply to the missing items”, request multiple selective answers from “Mask”, “Disinfectant”, “Gloves”, “Protective clothing”, “Face shield”, and “Other” and select “Other”. The selected respondents are requested to further describe the contents.
- 
12. **Measures taken against infections diseases:** In response to the question “Did you take the following measures against infectious diseases? Please tell me all that apply”, we requested multiple selective answers from “Limited number of people” “Temperature measurement at reception” “Zoning of evacuation space” “Not crossing the flow lines of each space” “Separate toilets and water supply between healthy people and people with poor physical condition” “Social distancing in each space” “Installing disinfectant solution in various places such as reception desks” “Regular ventilation” “Disinfection of handrails and doorknobs” “Operator’s sanitary equipment” and “Others”, and request respondents who selected “Others” to provide a descriptive response.
- 
13. **Shelter operator:** In response to the question “Please tell me everything that applies to the shelter operator”, request multiple selective answers from “local government officials”, “facility manager”, “residents”, and “others”, and request respondents who selected “others” to provide a descriptive response to the content. In addition, we requested a descriptive answer to the question “Please tell us about the reaction of the residents who participated in the shelter management.”
- 
14. **Transportation to medical institutions:** In response to the question “Did you transport the person with poor physical condition or fever to a medical institution?”, We requested a single selective answer from “Yes” and “No” and request respondents who selected “Yes” to provide descriptive answers to the question “Please tell us about the specific situation when transporting to a medical institution. (Procedures, persons in charge, issues, etc.)”.
- 
15. **Difficult work, problems:** “Which work was difficult or time consuming in the entire shelter management?” “Please tell us if there is a problem in the whole shelter management.” In response, each requested a descriptive answer.
- 
16. **Changes in evacuees’ characteristics before and after COVID-19:** In response to the question “Did the evacuees change before and after COVID-19? (The number of elderly people has decreased, the number of children has decreased, the number of nights in the car has increased, etc.), request a single selective answer from “changed” and “not changed”, and ask the respondents who selected “changed” to give a descriptive answer.
- 
17. **Changes in evacuation shelter operators before and after COVID-19:** In response to the question “Did the shelter management entity change before and alter COVID-19? (For example, the residents refrained from operating it, the elderly people refrained from operating it, etc.)”, we requested a single selective answer from “changed” and “not changed” and asked the respondents who selected “changed” to give descriptive answer to the content.
- 

#### Attributes

- 
- **City name:** Request a written response with the name of the prefecture and the name of the city.

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  - **Population size:** In response to the question “Please tell me the population size of the municipality”, “10,000 or less”, “10,000-30,000”, “30,000-50,000”, “50,000-100,000”, “10”, request a single selective answer from “10,000–300,000” and “300,000 or more”.

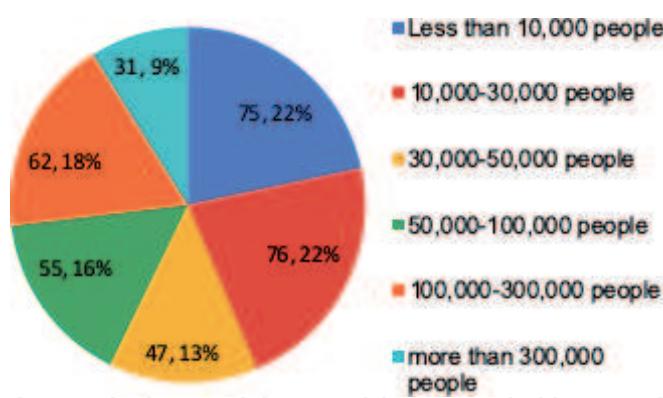
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  - **Name of department in charge:** In response to the question “Please tell me the name of the respondent’s department in charge.”, requested a descriptive response.

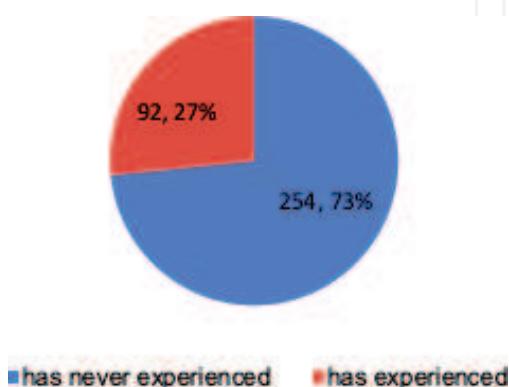
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  - **Experience of opening a shelter:** Asked “Have you ever opened a shelter in a municipality before COVID-19 disaster?” and requested a single selective answer from “Yes” and “No”.
- 

**Table 2.**  
*Composition of the questionnaire.*



**Figure 1.**  
Distribution of the population size.



**Figure 2.**  
Experience of opening a shelter under COVID-19.

The structure of this paper is as follows. Chapter 4 shows the proactive measures for the shelter management under COVID-19, and the following Chapter 5 shows the actual shelter management under COVID-19. Based on the above, Chapter 6 considers how shelters should be operated under COVID-19. Finally, Chapter 7 describes the limitations and prospects of this research.

### 3.2 Survey target

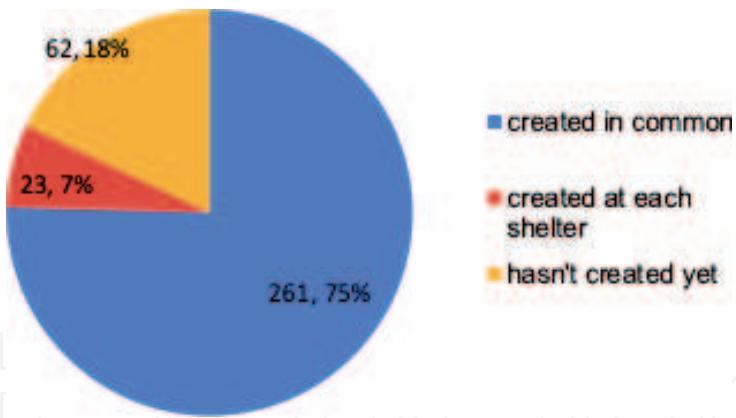
The characteristics of the local governments that responded to this survey are shown in **Figures 1** and **2**. **Figure 1** shows the distribution of the population size of the responding municipalities. About half of the municipalities have less than 30,000 people.

**Figure 2** shows the experience of opening a shelter under COVID-19. About 1/4 of the local governments have opened shelters due to some natural disaster under COVID-19. In this survey, the target disaster was not specified, and each local government was requested to answer the description of the target disaster. According to their answer, heavy rains in July 2020, typhoon No. 8, typhoon No. 9, typhoon No. 10, typhoon No. 12, and typhoon No. 14 were mentioned. There are no cases of opening shelters after the earthquake, and all shelters were opened after the storm and flood damage.

## 4. Proactive measures for shelter management under COVID-19

### 4.1 Creating a manual

**Figure 3** shows the status of preparation of a manual on the shelter management under COVID-19. Approximately 3/4 of the municipalities created the manuals in



**Figure 3.**  
Status of preparation of a manual on the shelter management under COVID-19.

common, and when combined with the municipalities created individually at the shelters, about 80% of the municipalities answered that they created the manual. The Cabinet Office [24] and NPOs [25, 26] have issued guidelines for shelter management under COVID-19, and it is probable that they were created with reference to them. It can be utilized for countermeasures by showing the overall guideline at an early stage.

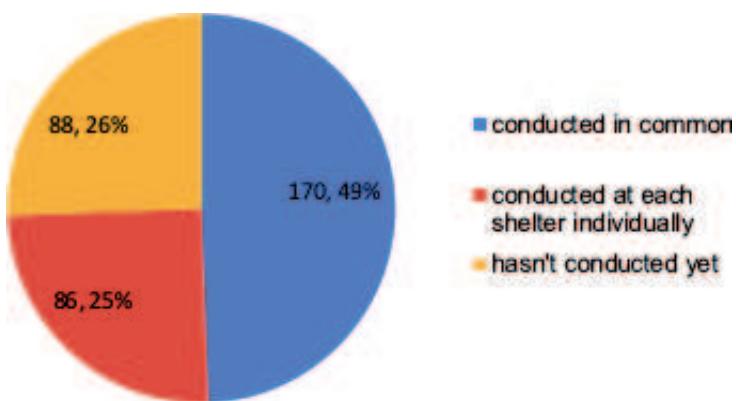
#### 4.2 Implementation of training

**Figure 4** shows the implementation status of shelter management training under COVID-19. Approximately half of the local governments conducted training for the entire municipality, and when combined with the local governments that conducted individual training at shelters, about 3/4 of the local governments conducted shelter management training under COVID-19. Compared to the preparation of manuals, many local governments conducted their own training at shelters. It is thought to be because training at the shelter can be conducted in a state closer to the actual situation.

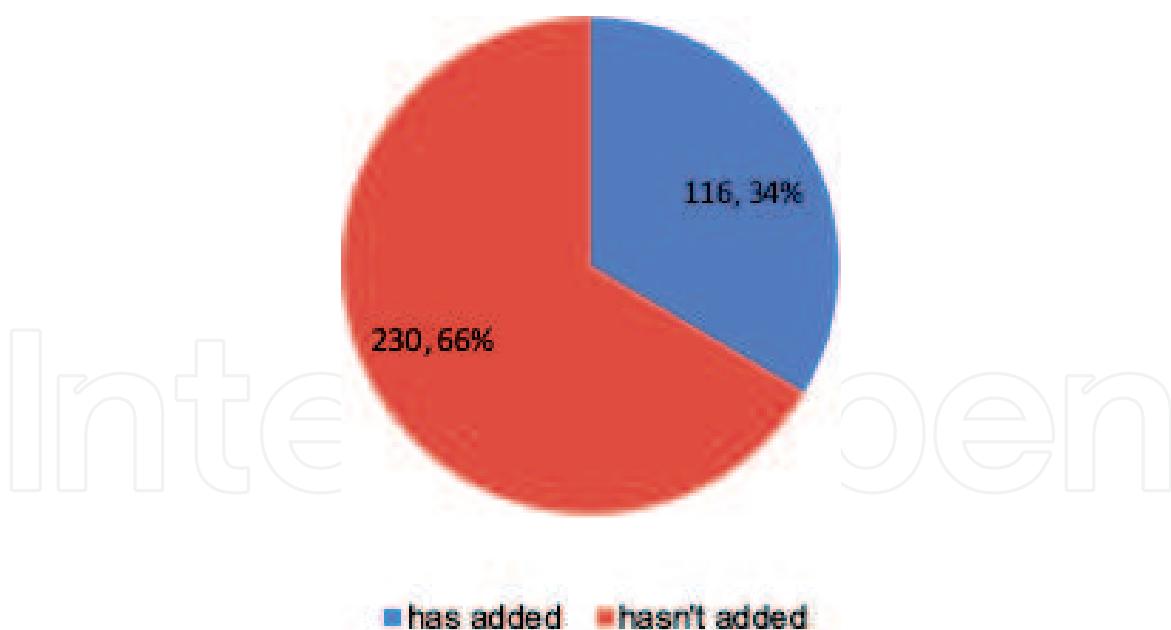
#### 4.3 Addition of shelter

**Figure 5** shows the presence or absence of shelters newly added as a countermeasure against COVID-19.

Under the Disaster Countermeasures Basic Law, as a rule, basic municipalities are obliged to designate shelters (Article 49–7), and local elementary schools and public halls are shelters.



**Figure 4.**  
Implementation status of shelter management training under COVID-19.



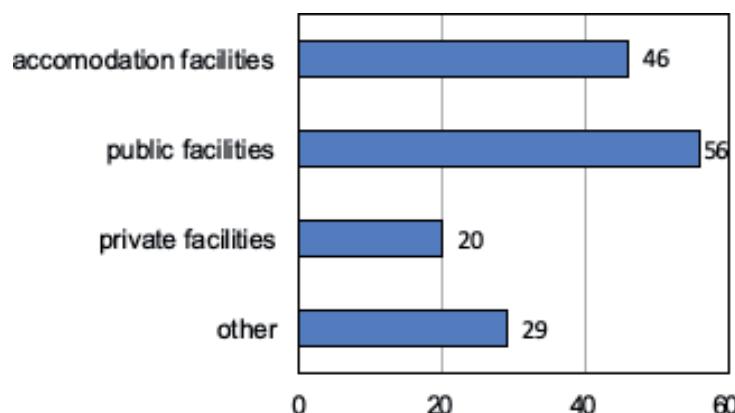
**Figure 5.**  
Presence or absence of shelters newly added.

In addition, as a measure against infectious diseases, securing social distance will result in a shortage of conventional shelters. Therefore, it is recommended by the government to add new shelters and carry out distributed evacuation.

About 30% of local governments have added new shelters. In addition, the municipalities that answered “not added” include those that are in the process of adjustment.

**Figure 6** shows the details of the newly added shelter. We asked the local governments that answered that they had “added” shelters to answer with multiple answers as to what kind of facilities they are using. Most of them are public facilities, followed by accommodation facilities such as hotels and inns. Others included shelters for overnight stays in cars and the use of empty classrooms in shelters.

Since public facilities are owned by the local government, it is assumed that it is relatively easy for the local government to add new shelters as internal adjustments will be made. It is considered to be the factor that the number of public facilities as newly added shelter is the largest. On the other hand, accommodation facilities and private facilities need to conclude agreements to be used as shelters, and it is considered difficult to secure them compared to public facilities. However, accommodation facilities are attracting attention due to the spread of COVID-19 [24]. In order to prevent the collapse of medical care, hotels are being rented and converted into accommodation facilities for the mildly ill.



**Figure 6.**  
Details of the newly added shelter.

In addition, it is presumed that a special place was set up for the shelter for overnight stays in the car, as many people stayed in the car during the 2016 Kumamoto earthquake [27].

## 5. Actual shelter management under COVID-19

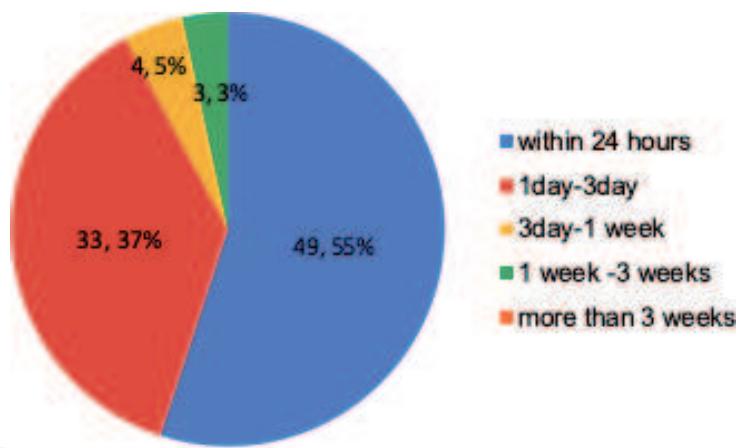
### 5.1 Outline of opening a shelter

**Figure 7** shows the shelter opening period under COVID-19. About half of them are opened within 24 hours, and about 90% are opened within 3 days. It can be seen that the opening was relatively short.

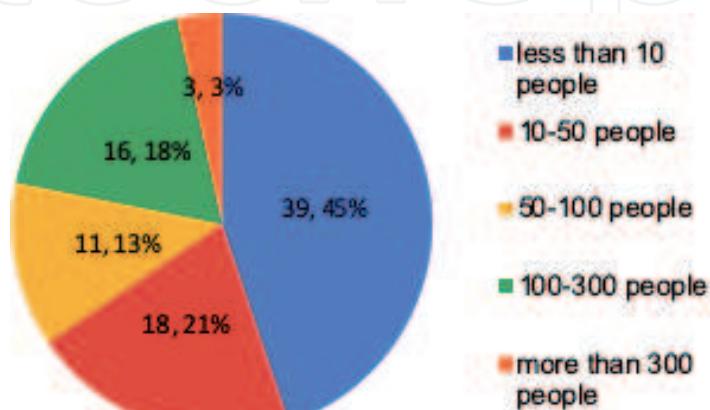
**Figure 8** shows the total number of evacuees in shelters under COVID-19 per shelter. About half are 10 or less, and the total number of evacuees is small. It also includes cases where evacuees did not come to the shelter even though they opened the shelter. Considering this together with **Figure 7**, it is assumed that the scale of the disaster was smaller than usual.

### 5.2 Dissemination and collection of information on distributed evacuation

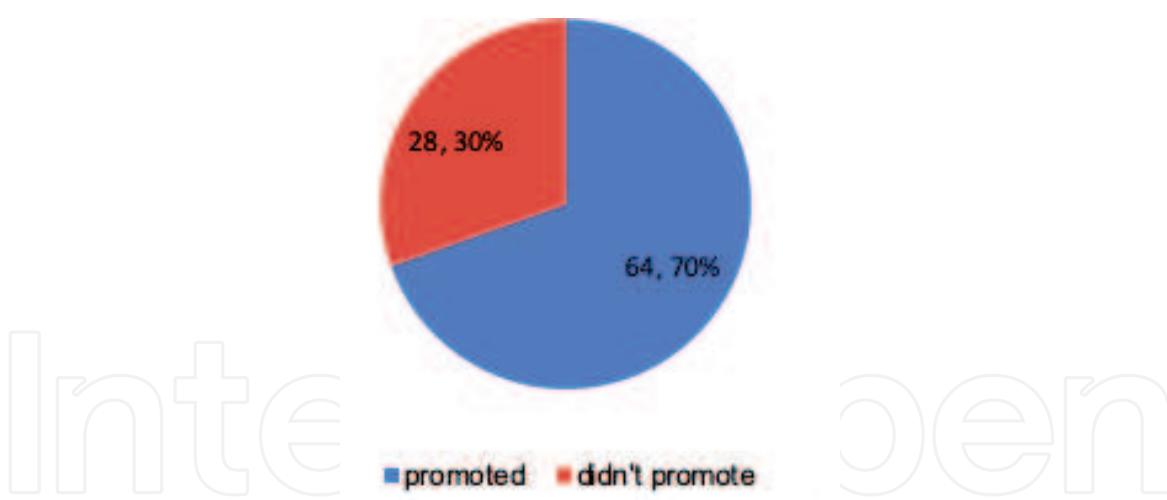
**Figure 9** shows whether residents were urged to do distributed evacuation under COVID-19. Here, distributed evacuation is defined as various evacuation that keeps



**Figure 7.**  
Shelter opening period under COVID-19.



**Figure 8.**  
Total number of evacuees in shelters under COVID-19 per shelter.



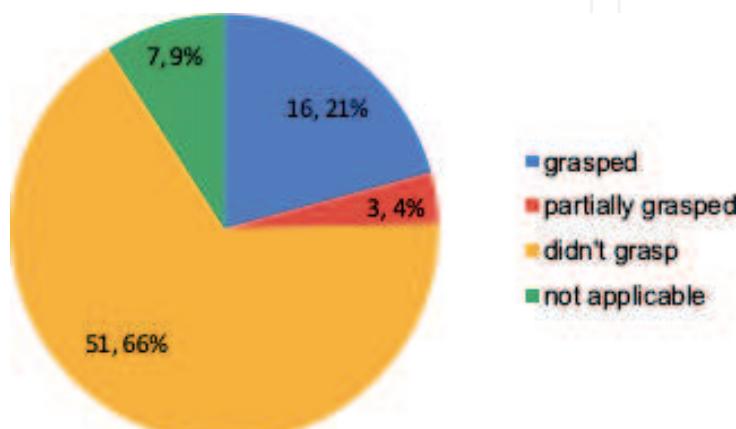
**Figure 9.**  
Whether residents were urged to do distributed evacuation under COVID-19.

a social distance to prevent infection, and in addition to shelters, stay in the car, evacuate at home, evacuate to acquaintances and relatives' homes, and evacuation to accommodation facilities.

As a result of the survey, about 70% of local governments promoted distributed evacuation. Distributed evacuation is effective for preventing infection, but it is different from conventional evacuation methods, so it is important to educate the residents daily so that the residents can correctly understand the meaning and method.

**Figure 10** shows the status of grasping evacuees' information in distributed evacuation under COVID-19. Only about 20% of the local governments have grasped it. From the written answers, we received the opinions that "reports from the mayor of each administrative district regarding evacuation at home", "we cannot be grasp unless contacted from residents", and "only grasp the stay in the car in the parking lot of the shelter". It can be seen that many local governments are based on requests from residents to grasp information. It has become clear that it is difficult for local governments to comprehensively grasp evacuee's information.

From **Figures 9** and **10**, it became clear that there are many local governments that have promoted distributed evacuation but have not been able to grasp the information of distributed evacuees. It is expected that the number of evacuees evacuating to places other than shelters will increase, making it more difficult to grasp the information. However, since it is important to know where and how



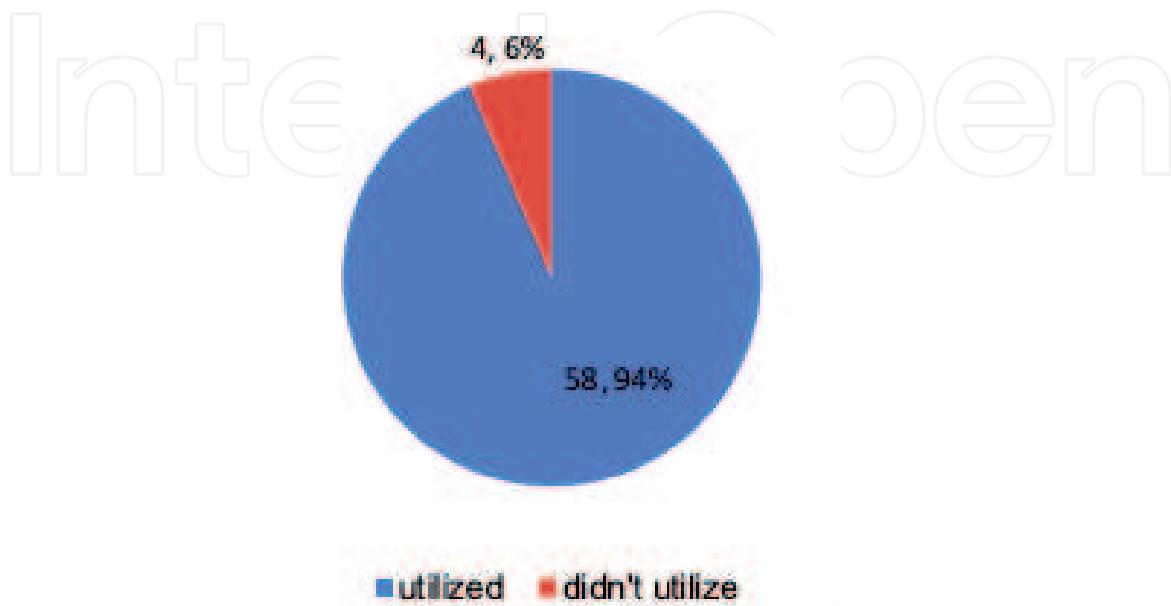
**Figure 10.**  
Status of grasping evacuees' information in distributed evacuation under COVID-19.

many evacuees are in the provision of supplies, it is necessary to consider effective methods. In addition, in order to save people's lives, it's important to grasp where are patients and what medical care is needed, which will lead to effective provision of medical care. Also, these kinds of information should be shared with hospitals or other medical organizations.

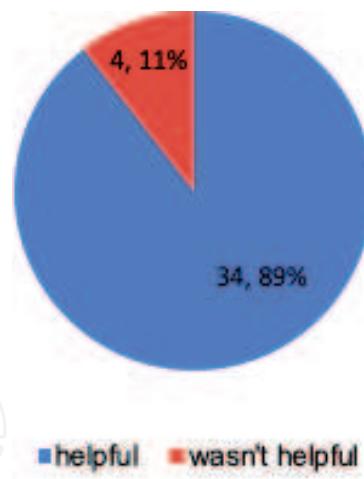
### 5.3 Utilization of proactive measures

**Figure 11** shows the utilization status of the shelter management manual under COVID-19. We asked the local government, which had created the manual at the time of the response, about the utilization status. About 95% of local governments answered that they were able to utilize the manual. Specifically, from the written answer, "We were able to install infectious disease control items (hand sanitizers, facility disinfectants, etc.) that had been deployed to shelters in advance at necessary locations such as entrances and exits according to the manual. "I was able to confirm in advance the flow at the time of reception and what to do when a person with poor physical condition appears (separate rooms and flow lines, etc.)" "If a person with poor physical condition occurs, isolate it. The staff members had a common understanding of that points. " Based on these opinions, by creating a manual in advance and using it in the event of a disaster, the flow from setting up a shelter to accepting evacuees can be carried out smoothly, and special measures in the event of an unwell person can be confirmed. It can be said that this led to fostering a common consciousness among the staff. On the other hand, regarding the local governments that answered that the manual could not be used, from the written answer, we obtained the opinions like, "I could not hand over the manual because it was opened at the branch office." "The shelter was opened but there were no evacuees." Although the manual was created, there was a problem that it could not be referred to at the time of opening because it was not on site. It is considered necessary to deliver it in advance so that it can be referred to at each shelter. In addition, it was found that there were cases where the manual was not used because the evacuees did not come to the shelter.

**Figure 12** shows the implementation status of shelter management training under COVID-19. As in **Figure 11**, we asked the local governments that were



**Figure 11.**  
Utilization status of the shelter management manual under COVID-19.



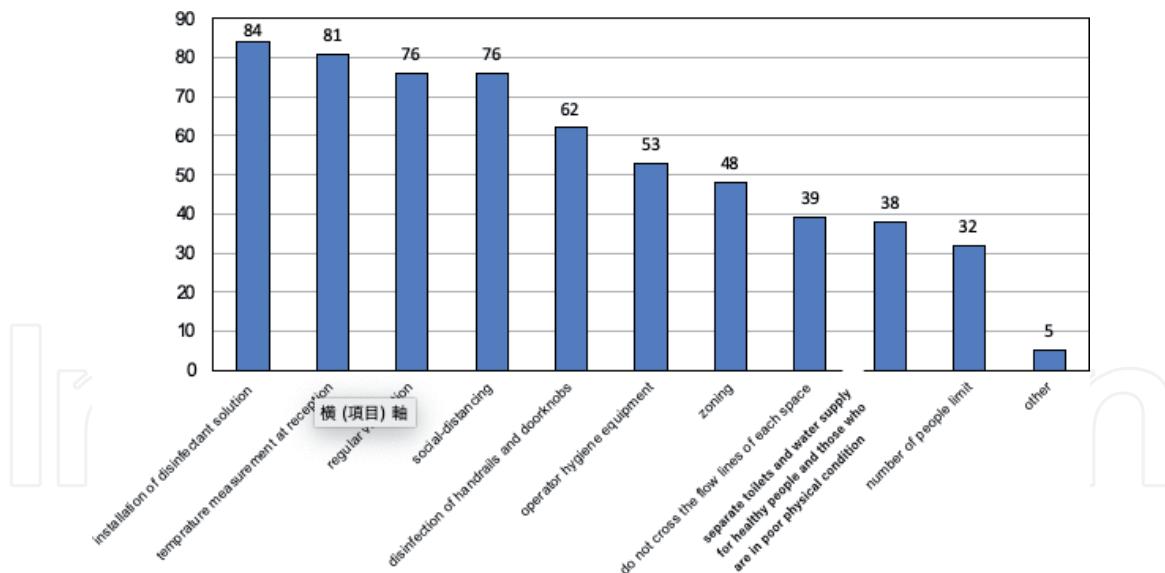
**Figure 12.**  
Implementation status of shelter management training under COVID-19.

conducting the training at the time of the response about the utilization status. About 90% of local governments answered that the training was “helpful”. Specifically, from the written answers, there are opinions like, “I think that we were able to operate the shelter with a margin by assuming various situations in advance.” “We were able to smoothly set up the venue such as reception and creation of partitions.” “The training at the shelter gave me an image of zoning.” By conducting the training, shelter operators were able to get an image of the work content and work calmly and smoothly. Unexpected things can happen in the shelter management, but there are many tasks that should always do the same, and the implementation of training could facilitate the movement of the operator for such basic tasks. On the other hand, regarding the local governments that answered that they could not utilize the training, from the written answers, there are opinions like, “because the training was conducted after the typhoon period” and “because the shelter was opened but there were no evacuees”. At the time of answering the questionnaire survey, training was conducted, but at the time of opening the shelter, training was not conducted, and as in the case of the manual, there were cases where there were no evacuees and there were no useful situations. It is inferred that it is important to take proactive measures as soon as possible.

#### 5.4 Measures against infectious diseases inside shelters

**Figure 13** shows the measures taken at the shelter for COVID-19. Most local governments install disinfectants in various places, and the temperature is measured at the reception desk, regular ventilation is maintained, and social-distances are secured in the evacuation space. There are several new stockpiles needed as a infectious disease countermeasure, but it can be said that many local governments are able to respond to them. In addition, it is said that it is effective to separate the space and flow lines of people who are in good physical condition from those who are in poor physical condition in order to prevent the spread of infection in shelters, but few local governments have taken such measures. It is probable that there was no need to deal with this in the short-term shelter opening like this time because it is not necessary to divide the space and flow line if the person who is in poor physical condition does not come to the shelter.

These measures considered to be helpful not only for COVID-19 but also for other infectious diseases, such as SARS, flu, and norovirus. In the past disasters, there was not much infectious disease control at shelter and nurses or other medical

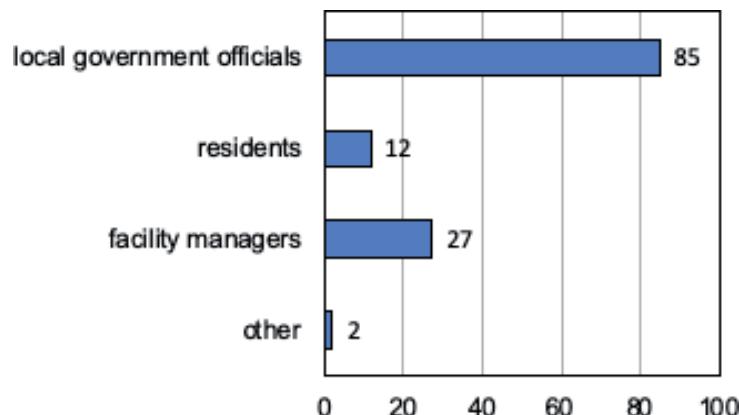


**Figure 13.**  
*Measures taken at the shelter for COVID-19.*

staff have been dispatched to a shelter to respond. However, like this COVID-19 response, it is considered that local governments should prepare for other infectious diseases or the next pandemic.

## 5.5 Shelter operator

**Figure 14** shows the shelter operator under COVID-19. The number of local governments officials is the largest, and the number of residents is small. It is possible that the residents did not operate the shelter in connection with many people because they were afraid of infection. However, we received the opinions like, “they were very supportive because we were taking measures against infection.”, “After taking measures such as wearing a mask, measuring the temperature at the reception desk, and disinfecting, we received an active cooperation from residents based on training.” On the other hand, from the local government where the residents did not participate in the operation of the shelter, we obtained the opinions like, “There was no participation of the residents because it was a temporary evacuation and did not proceed to the phase of shelter management by residents. “ Based on these opinions, the reason why residents do not participate in shelter management is that the shelter opening period was short as shown in **Figure 7** and there was little need to be cooperated by residents. Also, it is considered that COVID-19 is not much effect.



**Figure 14.**  
*Shelter operator under COVID-19.*

## 5.6 Difficult tasks and issues

**Table 3** shows the difficult tasks and problems of shelter management under COVID-19. The answers obtained were grouped into groups with similar contents, and classified into five: reception, keeping social-distances, zoning, personnel, and responding to residents.

First is the reception. It became clear that work such as temperature measurement, disinfection, and filling out a questionnaire was added as measures against infectious diseases, and the amount of work increased significantly, and it took time. It was also found that congestion was more likely to occur because the time required for reception per evacuee increased. Most of the local governments cited the work related to reception as a difficult work.

Second is work related to keeping social-distances. Measures were taken to install partition panels and corrugated cardboard partitions for each household, but

Reception
<ul style="list-style-type: none"> <li>• It took time to accept evacuees due to temperature measurement, etc.</li> </ul>
<ul style="list-style-type: none"> <li>• When accepting evacuees, multiple staff members were required, such as temperature measurement → disinfection → mask distribution → evacuees card → tent guidance.</li> </ul>
<ul style="list-style-type: none"> <li>• It took a long time to receive the test because of the temperature measurement and filling out the questionnaire.</li> </ul>
<ul style="list-style-type: none"> <li>• It took time to set up because it was necessary to separate the reception desks such as pre-reception and secondary reception from those who are not infected and those who are suspected</li> </ul>
<ul style="list-style-type: none"> <li>• It took time to collect information on evacuees (address, name, etc.)</li> </ul>
<ul style="list-style-type: none"> <li>• Since many evacuees came from the beginning of the shelter, the reception was not in time.</li> </ul>
<ul style="list-style-type: none"> <li>• Congestion at reception</li> </ul>
Social-distancing
<ul style="list-style-type: none"> <li>• Preparing to accept evacuees, especially the installation of partition panels. It was for several people in a few hours.</li> </ul>
<ul style="list-style-type: none"> <li>• Installation of cardboard partitions</li> </ul>
<ul style="list-style-type: none"> <li>• There was a shortage of partitions prepared in advance for the number of evacuees.</li> </ul>
<ul style="list-style-type: none"> <li>• Arrangement of evacuation spaces to avoid crowded evacuees</li> </ul>
Zoning
<ul style="list-style-type: none"> <li>• It took time to allocate healthy people, people requiring special care, people with poor physical condition, etc.</li> </ul>
<ul style="list-style-type: none"> <li>• Since information on close contacts cannot be obtained from the public health center, zoning cannot be performed without the declaration of the evacuees.</li> </ul>
Management personnel
<ul style="list-style-type: none"> <li>• Since the number of shelters will be increased, staff cannot be accommodated between each shelter, and the number of shelter response staff will decrease.</li> </ul>
<ul style="list-style-type: none"> <li>• Many shelter management staff are needed</li> </ul>
Resident support
<ul style="list-style-type: none"> <li>• Those who live in the sediment-related disaster warning area and were worried about COVID-19 and had difficulty in giving instructions to those who did not evacuate.</li> </ul>
<ul style="list-style-type: none"> <li>• Even if you ask the evacuees to keep social-distances and refrain from unnecessary contact as a measure against COVID-19, acquaintances approach each other and chat.</li> </ul>

**Table 3.**  
*Difficult tasks and problems.*

the installation was time-consuming. In addition, it was reported that the partition was insufficient because it was not included in the conventional stockpile and was newly prepared.

Third is zoning. In order to prevent the outbreak of clusters and the spread of infection at shelters, evacuation spaces should be provided according to the physical condition of the evacuees, such as those in good physical condition, those requiring special attention who are at high risk of serious illness, close contacts, and those who are in poor physical condition. It was found that there were issues such as the time required for this allocation and the fact that the evacuees must rely on the evacuees' self-reports because it is the health center that possesses the information on the close contacts necessary for zoning. Even if a manual or training is provided for a large policy, it is not known what kind of physical condition will actually come to the shelter, and it is necessary to respond flexibly on the spot.

Fourth is the management staff. In this survey, shelters were opened in a relatively short period of time, but securing management personnel, which has been an issue in the past, has become an issue. Under COVID-19, some local governments have increased the number of shelters opened to carry out distributed evacuation. In that case, the staffing at each shelter will be different from before, and there is a high possibility that there will be a shortage. In addition, since infectious disease control work has been added, it is considered difficult to handle with the same number of people as before. It can be said that securing management personnel has become a more prominent problem under COVID-19.

Last is the response to residents. It is thought that it is difficult to encourage residents to make correct decisions and take actions in situations where they are exposed to the combined dangers of a COVID-19 and a natural disaster. If you evacuate to a shelter when your home is safe against natural disasters, the risk of infection increases, while if your home is dangerous to natural disasters but you stay at home due to fear of the risk of infection at the shelter, a natural disaster may kill you. It can be said that it is necessary to take the best action to save lives according to the situation each person is placed. In addition, awareness of infectious diseases and their countermeasures is expected to vary greatly from person to person. Therefore, asking people with low consciousness to cooperate with the measures is mentioned as a difficult task.

## 6. Conclusions

The purposes of this study are i) to clarify the current status of proactive measures regarding the shelter management under COVID-19, and ii) the actual state and issues of shelter management under COVID-19. We conducted a questionnaire survey targeting local governments.

As a result, the findings obtained from this study are as follows.

- i. It was found that proactive measures for shelter management under COVID-19, such as the creation of manuals incorporating measures against COVID-19, the implementation of training, and the addition of shelters, are in progress.
- ii. It was found that the proactive measures were very useful, and that the shelter was operated with the measures against infectious diseases under COVID-19. However, due to the addition of infectious disease control work, it became clear that it would take time and difficulty at reception, and that it would be even more difficult to identify evacuees with the recommended distributed evacuation.

Proactive measures regarding the shelter management under COVID-19 have progressed considerably, and it became clear that these were also useful in the actual shelter management under COVID-19, reaffirming the importance of proactive measures. In addition, it is considered that this measure will be helpful for other infectious diseases, such as SARS, flu, and norovirus. This is because droplet infection and contact infection are the main transmission routes and basic knowledge of infectious diseases is common.

However, issues have also been raised, and it is thought that improving these will lead to more efficient shelter management.

## 7. Limitations of this research and prospects

The limits of this study are described.

First, the number of responses from local governments that actually opened shelters under COVID-19 is small. At the time of the survey, the period during which a natural disaster could occur under COVID-19 was about half a year, and few local governments opened shelters there. As the number of cases increases, it is possible that the overall trend will change, and new issues will become apparent.

Second, the scale of the disaster targeted was small. This is fortunate, but the scale of the disaster and the lengthening of the shelter opening period could lead to events different from those revealed in this survey.

In the future, based on the results of this research, we would like to deepen our studies on countermeasures for complex disasters of natural disasters and COVID-19, especially shelter management.

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## Author details

Arisa Yasui<sup>1\*</sup> and Muneyoshi Numada<sup>2</sup>

<sup>1</sup> Department of Civil Engineering, School of Engineering, The University of Tokyo, Tokyo, Japan

<sup>2</sup> Interfaculty Initiative in Information Studies, Institute of Industrial Science, The University of Tokyo, Japan

\*Address all correspondence to: antant36z@icloud.com

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## References

- [1] WHO, WHO COVID-19virus (COVID-19) Dashboard. Available from: <https://covid19.who.int/>, [accessed 2021-04-22]
- [2] WHO, Cumulative Number of Reported Probable Cases of Severe Acute Respiratory Syndrome (SARS). Available from: [https://www.who.int/csr/sars/country/table2004\\_04\\_21/en/](https://www.who.int/csr/sars/country/table2004_04_21/en/) [accessed 2021-04-22]
- [3] WHO, Middle East respiratory syndrome COVID-19virus (MERS-CoV): Summary of Current Situation, Literature Update and Risk Assessment as of 5 February 2015. Available from: [https://www.who.int/csr/disease/COVID-19virus\\_infections/mers-5-february-2015.pdf?ua=1](https://www.who.int/csr/disease/COVID-19virus_infections/mers-5-february-2015.pdf?ua=1) [accessed 2021-04-22]
- [4] WHO, COVID-19 vaccines. Available from: <https://www.who.int/emergencies/diseases/novel-COVID-19virus-2019/covid-19-vaccines> [accessed 2021-04-22]
- [5] Kazuko Ueyama et al., "Current situation and future suggestions of Niimi University as an ShelterDue to the heavy rain disaster in July 2018", Bulletin of Niimi University, Vol. 39, pp.185-187, 2018.
- [6] Takashi Ito and Hiroshi Kawana, "School as a" designated shelter"in the event of a disaster A case study at an elementary school located in an area affected by the Great East Japan Earthquake", Ibaraki University Faculty of Education Bulletin (Educational Science), Vol. 65, pp. 425-435, 2016.
- [7] Mainichi Shimbun, West Japan Heavy Rain 90% of Mabi's dead are too old to go upstairs at home, 2018.7.22, Available from: <https://mainichi.jp/articles/20180722/k00/00m/040/106000c> [accessed April 22, 2021]
- [8] I., K., Kouadio, S., Aljunid, T., Kamigaki, K., Hammad, and H., Oshitani, "Infectious diseases following natural disasters: Prevention and control measures", Expert Review of Anti-infective Therapy, Vol. 10, No. 1, pp.95-104, 2012.
- [9] Ken Kimi, Taro Kamigaki, Keiji Mimura, Hitoshi Oshitani, "Survey of infectious diseases in evacuation centers in Miyagi prefecture after the great East Japan earthquake", Japan Public Health Magazine, Vol. 60, No. 10, pp.659-664, 2013.
- [10] Kenichi Goto and Fumio Oka, "Infectious gastroenteritis epidemics and countermeasures for infectious diseases at Kumamoto earthquake evacuation centers", Journal of Infectious Diseases, VOL. 91, No. 5, pp.790-795, 2017.
- [11] E., L., Yee, H., Palacio, R., L., Atmar, et al, "Widespread outbreak of norovirus gastroenteritis among evacuees of Hurricane Katrina residing in a large" megashelter "in Houston, Texas: lessons learned for prevention", Clinical Infectious Diseases, Vol. 44, pp.1032-1039, 2007.
- [12] K., Izumikawa, "Infection control after and during natural disaster", Acute Medicine & Surgery, Vol. 6, pp.5-11, 2019.
- [13] T., Kawano, Y., Tsugawa, K., Nishiyama, H., Morita, O., Yamamura, and K., Hasegawa, "Shelter crowding and increased incidence of acute respiratory infection in evacuees following the great eastern Japan earthquake and tsunami ", Epidemiology and Infection, Vol. 144, No. 4, pp.787-795, 2016.
- [14] I., Uckay, H., Sax, S., Harbarth, L, Bernard, and D., Pittet, "Multi-resistant infections in repatriated patients after natural disasters: lessons learned from the 2004 tsunami for hospital infection control", Journal of Hospital Infection, Vol. 68, pp.1-8, 2008.

- [15] S. Shinoda, "Special issue on infectious disease control of natural disasters," *J. Disaster Res.*, Vol.7, No.6, pp. 739-740, 2012.
- [16] M., Ishii, T., Nagata, and K., Aoki, "Japan medical Association's actions in the great eastern Japan earthquake", *World Medical & Health Policy*, Vol. 3, No. 4, pp.1-18, 2011.
- [17] Hideki Kawamura, Koichi Tokuda, Masayuki Kawakami, Toshiaki Arimura, Tatsuya Kawaguchi, Tamano Matsui, Junichiro Nishi, "Kagoshima medical association disaster medical assistance team 2016 Kumamoto earthquake infection control support activities", *Environmental Infection Magazine*, Vol. 32, No. 5, pp.282-290, 2017
- [18] K. Iwata, G. Ohji, H. Oka, <. Takayama, T. Aoyagi, Y. Gu, <. Hatta, K. Tokuda, and M. Kaku, "Communicable Diseases After the Disasters: with the Special Reference to the Great East Japan Earthquake, " *J. Disaster Res.*, Vol.7, No.6, pp. 746-753, 2012.
- [19] K. Kaku, "Preparedness for natural disaster-associated infections," *J. Disaster Res.*, Vol.4, No.5, pp. 337-345, 2009.
- [20] M., Ishii, "Activities of the Japan medical association team in response to the great East Japan earthquake", *Japan Med Assoc J*, Vol. 55, No. 5, pp. 362-367, 2012.
- [21] H., Kanamori, H., Kunishima, K., Tokuda, and M., Kaku, "Infection Control and Hospital Epidemiology, 32 (8), pp.824-826, 2011.
- [22] F. Kasuga, "Special Issue on Understanding Emerging and Re-emerging Infectious Diseases," *J. Disaster Res.*, Vol.6, No.4, p. 371, 2011.
- [23] Ayako Kudo, Shihoko Sakuma, Keiko Inatomi, Megumi Ikeda, Seiko Nishina, "Local Governments' awareness and response to infection prevention in the event of a disaster", *Environmental Infection Magazine*, Vol. 27, No. 3, pp.171-177, 2012.
- [24] Cabinet Office, "Manual for securing accommodation facilities for accommodation treatment for mildly ill persons with new COVID-19virus infection (1st edition)", 2020.4.23.
- [25] Human and Disaster Prevention Future Center, "Preparation Checklist Ver.2-Guide to Prevent Infection at Evacuation Centers", DRI Special Issue, 2020.
- [26] JVOAD, "New COVID-19virus Evacuation Life Useful Support Book", 2020.5.29.
- [27] Kotaro Tsuboi, "Study on disaster response in Nishihara Village in Kumamoto earthquake and life reconstruction / health evaluation of victims", *Environmental Information Science Academic Research Papers*, Vol. 31, pp.77-82, 2017.