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Abstract

In the 2016 Kumamoto earthquake that heavily impacted Mashiki Town of Kumamoto City, Japan, the cooperation between the Kumamoto City government, welfare shelters, and individuals with special needs was insufficient. As a result, many people requiring support could not use welfare shelters and spent their evacuation lives in places where they were not sufficiently equipped with adequate resources. Therefore, the purpose of this study is to propose support methods so that many people with special needs can use welfare shelters. In addition, we will deepen the cooperation between the three administrative parties by developing a support tool, "a support system for disaster prevention and evacuation". The system embraces (1) disaster prevention activities, (2) aid during disasters, (3) restoration and reconstruction, and (4) support each phase for taking records and addressing issues. This system will allow many people with special needs to use welfare shelters in times of grave need. Demonstration experiments will be conducted utilising the system to help verify usefulness and identify points for improvement.

Keywords: disaster prevention, Kumamoto earthquake, persons requiring assistance, support system

1. Research Background and Purpose

In Japan, in the event of a disaster such as an earthquake, residents temporarily evacuate to designated evacuation shelters. Furthermore, people who need support in the event of a disaster, such as the elderly, the disabled, pregnant women, and other people with special needs, can move from general shelters to special welfare shelters under the direction of the government. These welfare shelters are municipally designated social welfare facilities designed with consideration for those in need of special support so that they can receive the relevant support that matches

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their physical condition, as well as offer assistance from nurses and other caregivers. Designated welfare shelters that are used as social welfare facilities for ordinary life can be opened as welfare shelters when requested by the government in the event of a disaster. In other words, for people with special needs or circumstances to evacuate to the welfare shelter, cooperation between the administration, the welfare facilities, and the person in need is necessary.

However, in the 2016 Kumamoto earthquake that heavily impacted Mashiki Town of Kumamoto City, Japan, the cooperation between the Kumamoto City government, welfare shelters, and individuals with special needs was insufficient. As a result, many people requiring support could not use welfare shelters and spent their evacuation lives in places where they were not sufficiently equipped with adequate resources. In preparation for future disasters, proposing a viable solution to this problem is urgent.

Therefore, this study aims to map out problem cases where many individuals with special needs could not use welfare shelters to deepen the cooperation between the three administrative parties of government, people with special needs or circumstances, and welfare shelters. This study proposes support methods so that many people with special needs can use welfare shelters. In addition, we will deepen the cooperation between the three administrative parties by developing a support tool, "a support system for disaster prevention and evacuation". This system will allow many people with special needs to use welfare shelters in times of grave need. Demonstration experiments will be conducted utilising the system to help verify usefulness and identify points for improvement.

2. Related Studies

During his research on welfare shelters, Sakata made Nada-ku, Higashinada-ku, and Kobe-ku objects of research after the Great Hanshin-Awaji Earthquake. Sakata mapped the diversion situations, tracked problems from regional facilities to evacuation shelters, and evaluated the advantages and disadvantages of each shelter. As for his research on people with special needs, Sakata targeted Kobe City, Ashiya City, Nishinomiya City, Niigata City, and Los Angeles City and isolated characteristics of the evacuees against the number of evacuees.

Okada's research included investigating the situation of people with special needs in the acceptance process into welfare shelters during the Kumamoto earthquake and trends after they left the welfare shelters. So far, both Sakata and Okada's research are only investigations in situations after a disaster has occurred, but in this study, a new support technique is proposed to problem solve in anticipation of a future possible disaster. It is also novel that the system will have a process of development through data collected through demonstration experiments.

3. Research Methods

The research was advanced by the following method. (1) From the analysis of the questionnaire, surveys pertaining to the event of a disaster were given to welfare shelters and people with special needs or circumstances. This paper proposes a support method that deepens the cooperation between the three parties of government, welfare shelters, and individuals with special needs or circumstances to streamline the process and increase the number of people taking advantage of the help available for people with special needs. (2) By deepening the cooperation between the three parties, a support system and "a support system for disaster prevention and evacuation" were developed so that many needy persons could evacuate smoothly to welfare shelters. (3) Based on the "Manual for Operation and Installation of Welfare Shelters" in Kumamoto City using "a support system for disaster prevention and evacuation", a demonstration experiment was conducted simulating that an earthquake occurred in Kumamoto City that involved welfare shelters, and students with special needs. (4) Advantages and problems of the demonstration experiment were arranged, and future development opportunities were examined.

4. Problems in the Process of Opening Welfare Shelters

Final Based on the "Manual for Operation and Installation of Welfare Shelters" in Kumamoto City, a process was established for receiving information on designated welfare shelters in Kumamoto City, and opinions on welfare shelters were summarised (Figure 1). The evacuation process for

persons requiring long-term supporters is moving to general shelters (2) and then to welfare shelters (8). Individuals in need cannot evacuate directly to the welfare shelter by self-judgment; instead, it is the judgment of the city whether it is possible to evacuate to the general shelter first and then enter the welfare shelter. In the questionnaire, there was an opinion that life in a public shelter might be difficult when a person in need has a disability and the idea that it is difficult for the welfare shelter side to respond adequately when moving from a general shelter to a welfare shelter. In this case, moving to a welfare shelter directly with the help of the person in question or their family was considered necessary.

Regarding the process for determining who is eligible for evacuation to welfare shelters, the city dispatches a health and welfare team from each ward's countermeasure department to the general evacuation centres (3), and the health and welfare team confirms the condition of the persons in need (4), reports to the city (5), and decides to evacuate to the welfare shelter, or not. An opinion from the welfare shelter side was that the number of personnel dispatched to the general shelter should be increased so that everyone's situation can be evaluated thoroughly and promptly.

Regarding the request from Kumamoto City to establish a welfare shelter for the designated facilities (6), an opinion was put forth that there was much confusion between the city office and the welfare facilities. Individuals with special needs or circumstances were asked to give information about their physical condition and disability to several contacts responsible for Kumamoto City, creating a communication gap. In addition, opinions came forth that staff needed to confirm the process with the operation manual after requests because they had not been prepared for the case of a disaster. Specifically, before the earthquake, opinions were given that the vast administrative procedures should be simplified all the way through until the evacuation life ends, and clear guidelines for calculating the costs charged to the city because it is difficult for staff alone to respond to the operation of welfare shelters, including general shelters. There was an opinion calling for constructing a wide-area support system to support this whole.

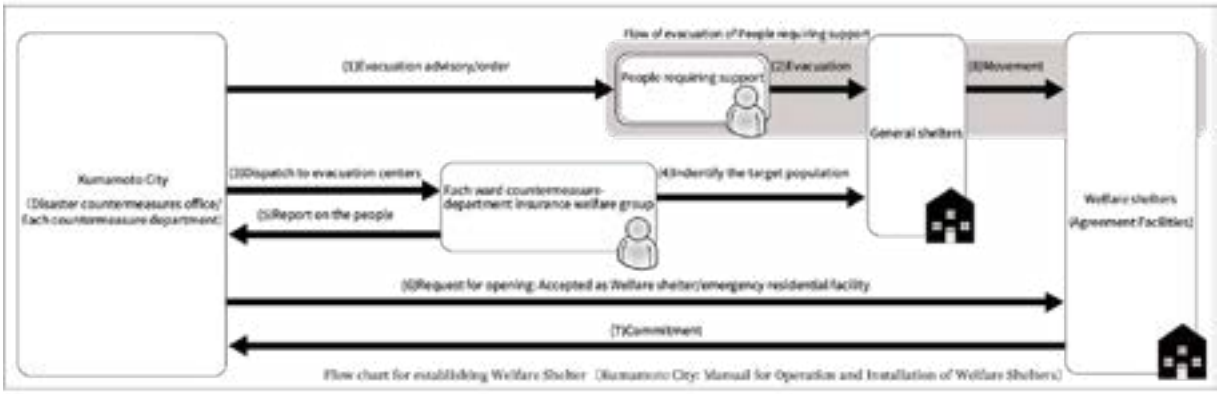

Figure 1. Flow chart for establishing welfare shelters

5. Disaster Prevention Activities and Support for Disaster Evacuation

From the analysis of the entire emergency evacuation process for people with special needs from start to finish, the ideal way for the proposed support system in this study is described below. The target subject is the three-party administrative unit, including Kumamoto City, individuals with special needs, and welfare shelters, with the purpose being to deepen their cooperation and to ensure that many persons in need can safely use welfare shelters in the event of a disaster. The system embraces (1) disaster prevention activities, (2) aid during disasters, (3) restoration and reconstruction, and (4) support each phase for taking records and addressing issues. The important thing in each phase is that the municipal administration, which has the primary role of connecting people with special needs to welfare shelters, can obtain and manage all information in an easy-to-understand manner and, under any circumstance, be able to contact the persons in need and the welfare shelters.

1) Support for disaster prevention activities

In preparation for future disasters, information on persons requiring assistance (physical information, medicines, emergency contact information, etc.) and information on welfare shelters (facility outlines, contact information, staff, etc.) are put into a database, and records of disaster drills and stockpile inventory to be carried out at periodic intervals are recorded. The municipal administration always manages and is aware of this information.

2)Support in the event of a disaster

Information such as the identity and number of persons with special needs and welfare shelters designated to modify according to the disaster situation is transmitted to the city administration in real-time, and the administration provides accurate instructions to both. The information for each person with special needs includes their current location (movement information after the disaster), their physical and mental situation, and whether there is a need for support. The data for each welfare shelter includes whether they can be safely opened as welfare shelters or whether the facility has been damaged, the number of staff members able to respond, the number of people currently receiving care, and the number of how many more people who can be accepted. Information on the current stock of material resources and data on needed resources.

3)Recovery and reconstruction support

After a disaster and after each person returns to their home following the restoration of infrastructure and supplies, they will send reports from welfare shelters to the government, for example, their billing for expenses.

4)Records and tasks

In the whole process, from disaster to recovery and reconstruction, trends of the three parties of the city office, welfare shelters, and individuals with special needs are recorded and analysed. From this, problems are identified and clarified, and preparations for the future can be made. And, as a basic concept of the tool to be developed, (1) it can be used immediately, (2) anyone can use it, (3) all information can easily be grasped, and (4) it can be used anywhere. It is assumed that the tool can be utilised immediately even by staff not regularly in charge of this area. It can be used in response to a situation where the designated facility was damaged and could not be opened as a welfare shelter. Even if the personnel in charge at the Kumamoto City office were to change many times, and the contact with the agreement facility was not sufficiently received, people should be able to use this tool easily.

6. Outline of “A Support System for Disaster Prevention and Evacuation”

This system provides support for (1) disaster prevention activities, (2) disasters, (3) restoration and reconstruction, and (4) disaster prevention activities. In addition, this system has different modes corresponding to each party: an administrative mode for the city office, a welfare shelter mode, and a support person mode for individual users (Figure. 2).

In the support person mode, the supporter and their family in need, use a smartphone. In regular times, information about one’s physical condition, medicines that are always needed, contact information in emergencies, etc., are registered. In the event of a disaster, the current location and the trajectory of movement are displayed on the system’s map in real-time by the GPS function of the smartphone. Comments can be sent to the administration, and communication with the administration can be available through the system. Since the person requiring support cannot evacuate to a welfare shelter at their own judgment, it is impossible to see the situation of other persons requiring help and information pertaining only to welfare shelters and the municipal administration.

In the welfare shelter mode, basic information such as the location of the welfare shelter, contact information, number of staff, facility outline, etc., is registered, and records of disaster prevention drills and stockpile inventory information are recorded. Each welfare shelter can inform the administration whether they can be opened as a welfare shelter in the event of a disaster by entering the number of current supporters and the number of persons in need who can be

accepted in the future. Information on current supplies and necessary supplies information can also be made available to the administration. Shelters can enter comments and keep in touch with the administration as well as individuals using the supporter mode through the system.

In the administrative mode, the administration can obtain and manage all information in an easy-to-understand manner, and under any circumstances, it is available to communicate with people with special needs or circumstances and welfare shelters. Since the trajectory of the people with special needs is displayed on the map, and the situation of welfare shelters is also displayed, it becomes possible to accurately instruct the person in need as to which welfare shelter they should move to and analyse trends for the future.

Figure 2. Interface of “a support system for disaster prevention and evacuation”

7. Demonstration Experiment of the Support System

On November 24, 2020, a demonstration experiment was conducted to verify the usefulness of the support system. The subjects were six staff members of the administration (Kumamoto City), three facilities for welfare shelters, and three persons who needed support. The object place is Kumamoto City.

The experiment was based on the “Manual for Operation and Installation Shelters” of Kumamoto City and verified that the municipal administration, welfare shelters, and persons needing support utilised the support system to cooperate and that the persons requiring support could be smoothly moved to welfare shelters. And in this preliminary experiment, an earthquake with a seismic intensity of less than 6 occurred, and it was carried out on the assumption that this disaster relief method was adapted. Figure 3 shows the experiment.

The advantages and problems of the support system were discussed by interviews with the staff of Kumamoto City, welfare shelters, and the students in the role of people with special needs. Table 1 shows the results. These discussions with the staff of Kumamoto City verified that simple access to welfare shelters was possible through the system.

As verified by the results from the welfare evacuation centres, the comprehensibility of the necessary information, such as the number of people who can accepted into the facility, can be easily displayed by the support system. On the other hand, it was stated that selecting from the facilities on the map took too much time.

The advantage that the students in the support person mode gave was that information could be easily inputted with a smartphone. On the other hand, the ease of use was based on someone being familiar with smartphone apps and an interface that is easy for anyone to use, even without

this skill needed.

Figure 3. The practical experiment

Table 1. Advantages Problems and issues

	Advantages	**Problems and issues**
The administration (Kumamoto City)	It was simple access to welfare shelters was possible through the system.	It is necessary to conduct drills many times, considering disaster cases, before the system is established.
Welfare shelters	The comprehensibility of the necessary information, such as the number of people who can accepted into the facility, can be easily displayed by the support system. It is possible to use it when FAX is not available.	It took time to select own facilities from many facilities on the map took too much time. It would be helpful if people who need assistance could input their preferred facilities.
The students in the role of people with special needs	Information could be easily inputted with a smartphone. It is easy to input information using smartphones instead of paper.	The ease of use was based on someone being familiar with smartphone apps and an interface that is easy for anyone to use, even without this skill is needed. I had to zoom in on the map to find my location on the system screen.

8. Conclusion

In this study, we proposed a support method that allows people with special needs to access available welfare shelters because of the problems that many people were not able to use welfare facilities during the Kumamoto earthquake. Towards this end, we developed “a support system for disaster prevention and evacuation”. In addition, a demonstration experiment using the system was carried out, and the usefulness and improvement points were verified. The following findings are summarised.

1) The process from establishing welfare shelters in the event of a disaster in Kumamoto City to receiving supporters was arranged, and opinions on welfare shelters were summarised. It was clarified that the process of evacuating persons with special needs to the welfare shelter in the disaster was complicated, and the problem of information shortage, such as what kind of disability each individual had, was difficult to access by the welfare shelters receiving evacuees.

2) As a new way of support, we proposed a process to target three phases, and fourthly, support for each phase. The phases are (1) disaster prevention activities, (2) disasters, (3) restoration and reconstruction, and (4) support for each phase in taking records and inputting new issues that arise. The aim is to deepen the cooperation between the three parties of government, shelter, and individuals with special needs and ensure that many people in need can safely use welfare shelters during a disaster.

3) Of the above, (1) disaster prevention activities in preparation for a disaster, (2) disaster prevention activities for the time of a disaster and disaster evacuation action support systems were developed at a basic level, and demonstration experiments verified the usefulness of the system. In this system, the government can easily obtain information on the person in need (where they are and what their situation is), and information on welfare shelters (whether or not it has been opened, the number of people they can accept it, etc.) on the map of the screen, and it is possible to give instructions through the system and communicate if someone is eligible to evacuate to a special welfare facility.

4) As for future issues, we will work to raise awareness of disasters among local residents by advancing the development of disaster prevention activities, such as keeping records of disaster prevention activities and stockpiling information about supplies that each neighbourhood association tackles on a daily basis. We will also hold functions for supporting disaster prevention activities that the city administration can confirm in an easy-to-understand manner, utilising this system and conducting disaster prevention activity workshops.

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Conflict of Interests

The author declares no potential conflict of interest was reported by the author.

Endnotes

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