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Impact of Utility Damage on Meals for Older Adults after the Kumamoto Earthquake, Japan

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ABSTRACT In the post-disaster period, providing food especially for older adults is important since they require dietary care despite being in a lifeline disruption. In this study, we examined food service relating to utility disruption and explored the hardship of meals provision in older adult-care facilities after a disaster. Out of 96 facilities which answered our first questionnaire survey, we targeted 43 older adult-care facilities that were affected by the 2016 Kumamoto Earthquake. We analyzed the records of six facilities from our second survey which reported the changes in meals provision due to the earthquake. One facility without water, gas, and electricity supply served only two meals per day mostly consisting of ready-to-eat foods. On the contrary, facilities with lifeline supply could serve regular meals with just a few changes in dishes. Food delivery was disrupted during emergency. A hospital lost contact with dealers and could not get foods due to loss of communication tools. The number of staff was fewer than usual, which resulted in increased pressure sore patients. Utility outage and difficulties of delivery or manpower led to skipping meals and were an obstacle to serve meals. This study would contribute to preparation of meal provision in older adult-care facilities.
Keywords: disaster management; older adults; lifeline; meal provision, Kumamoto Earthquake

INTRODUCTION

Japan is a disaster-prone country and has experienced countless earthquakes, typhoons, and other disasters (1). The 2016 Kumamoto Earthquake, a recent large-scale disaster, damaged 198,000 homes and disrupted electricity, gas, and water supply infrastructure (2).

Lifeline outages after disasters are serious issues. For instance, Ulak et al. demonstrated that areas with many older adult residents were more susceptible to blackout in Hurricane Hermine occurred in 2016 (3). Puerto Rico faced long-term power outage due to Hurricane Maria in 2017 (4). In 2018 Hokkaido Eastern Iburi Earthquake, elevator outages had a negative impact on residents in high-rise building (5).

Under these circumstances, providing adequate food and nutrition is necessary in every phase of the disaster, particularly for older adult (6). The shortage of foods in proper form and manpower to take care of them during disasters links to aspiration or undernutrition of individuals requiring special meal attention (7). In fact, older adults complained that the food at evacuation centers after 2016 Kumamoto Earthquake was uncooked and hard to swallow (8). After the 1999 Athens earthquake, nutritional intake among older adults was insufficient (9). The residents of older adult-care facilities depend on their facilities for most of their life support, so facilities need to continue operations even during emergencies

.Despite these facts, the meals provided in older adult-care facilities following disasters remain understudied. It is unclear as to what is served and how staff change meal contents during emergencies. Moreover, the relationship between available utilities and meals which can be prepared under those conditions has not been verified. Therefore, this study examines the relationship between utility disruption and food service in the immediate aftermath of earthquake and explores the actual situation of meal provision in older adult-care facilities.

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MATERIALS AND METHODS

Study setting and design

Kumamoto Prefecture is located in Southern part of Japan. In November 2020, the authors conducted the first questionnaire survey on disaster preparedness for food service to all older adult-care facilities in Kumamoto, comprising 125 welfare facilities for the elderly requiring long-term care, 92 health care facilities for the elderly requiring long-term care, 50 sanatorium type medical care facilities for the elderly requiring care, and 6 integrated facilities for medical and long-term care (10). Out of 96 facilities which responded to the survey (response rate = 35.2%) (10), we targeted 43 facilities affected by the 2016 Kumamoto Earthquake. The second questionnaire was mailed in August 2021 to the food service managers of those facilities. Although some facilities presented meal contents of several weeks, we focused on only 1–3 days after the main shock that occurred at 1:25 a.m. JST on April 16, 2016, during the acute phase of the disaster (11).

Data sources and data collection methods

In the second survey, we inquired about (1) the number of meals per day in normal times, and the following for each meal occasion immediately after the Kumamoto Earthquake: (2) type of tableware

(daily use or disposable), (3) manpower, (4) whether or not providing meals to non-residents, and (5) to staff.

We also asked (6) whether meal contents were changed due to the disaster, and if so, what changes were made, (7) the state of utilities; water, gas, electricity, and food delivery, (8) the frequency of regular and disaster meals, and (9) the overall impression about the disaster by free-text description. Disaster meals are alternative menus for emergency, which mainly consist of ready-to-eat foods.

Data analysis methods

Fifteen facilities responded to the second survey (response rate = 34.9%); among them, six facilities reported the changes in meals due to the earthquake. We thoroughly analyzed daily meal descriptions. The location of each facility was available on the website of the Ministry of Health, Labour and Welfare (12), and the damage sustained was drawn from the website of the Cabinet Office (13). According to that information, the seismic intensity of those six facilities was above the upper range of 6. Data from the first survey was used in determining the presence or absence of a private generator, as well as the number of electrical outlets from the generator in the kitchen (10). Supplements 1–3 show the contents of menus categorized into food groups based on the Japanese Food Guide Spinning Top (grain-based dish; vegetable-based dish; fish, eggs, and meat dish; milk; fruits; and others) (14). In this manuscript, we only summarized the changes in meal contents for three days after the main shock and examined the relationship with lifeline usage. In addition, we extracted some free responses to describe the challenges in emergency meal provisions in detail.

Ethical considerations

The following was explained in writing: that participation in the questionnaire survey is voluntary and even if they do not answer, they would not be disadvantaged at all, that the respondent's name and contact information are used only for inquiries regarding their answers, that responses would be anonymized and used only for research. By receiving the completed questionnaire, we obtained the consent. The Ochanomizu University Humanities and Social Science Research Ethics Review Board (approval number 2021-56) granted ethical approval for this study.

RESULTS

Faculty attributes

Table 1 lists the attributes of the six facilities. Welfare facilities for the elderly requiring long-term care and health care facilities for the elderly requiring long-term care were represented as "Home". Sanatorium type medical care facilities for the elderly requiring care were described as "Hospital". Almost all facilities, with the exception of Hospital F, had private generators. However, only the kitchens of Home C and Hospital D had outlets connected to private generators. The tableware used in Homes A–C and Hospitals D and E were disposable. Most facilities had reduced the number of staff compared to usual. Homes A–C distributed meals to non-residents as well. Most facilities, except for Hospital D, prepared meals for staff.

Table 1 Characteristics of six elder-care facilities (Days 1–3)

	Home A	Home B	Home C	Hospital D	Hospital E	Hospital F
Facility type*	a	b	b	c	c	c
Number of meals per day in normal times						
• **Breakfast**	52	120	121	118	38	25
• **Lunch**	76	170	187	120	55	25
• **Dinner**	52	120	149	118	38	25
Possession of private generator	Yes	Yes	Yes	Yes	Yes	No
Outlets in the kitchen connected to the private generator	0	0	5	1	0	Not applicable
Tableware	Disposable	Disposable	Disposable	Disposable	Disposable	Unknown
Number of staff (compared to usual)	Fewer	Fewer	Fewer	Day 1: Fewer Days 2, 3: Same	Same	Same
Providing meals to non-residents**	Yes	Yes	Yes	No	No	No
Providing meals to staff	Yes	Yes	Yes	No	Yes	Yes

* a: welfare facility for the elderly requiring long-term care
b: health care facility for the elderly requiring long-term care
c: sanatorium type medical care facility for the elderly requiring care

** Neighbourhood residents who have evacuated to the facility, older adults at-home care, and older adults living in other facilities, etc.

Relationship between lifeline utilities and meal contents

Tables 2–4 summarize the status of lifeline utilities and use of disaster meals for three days after the earthquake (Days 1–3). Although Home B described the meal contents on Day 1 only, other facilities provided descriptions of three days. On Day 1, gas was fully available as usual only in Home A (Table 2). That facility could serve three regular meals, omitting one vegetable-based dish for supper. Home B could not utilize most of the lifelines, leading it to serve only instant rice with canned or packaged foods as disaster meals. Hospital D changed the meal contents for lunch in response to the disaster and used in-stock items for supper. Hospital F had a disruption of water, gas, and electricity compelling staff to use perishable foods from refrigerator and freezer as priority. They served only two disaster meals in a day, such as instant rice. On Day 2, Home A, where only water was not available in perfect condition, could prepare three regular meals omitting some dishes in each meal (Table 3). Home C still had water outage. Staff utilized food aid and foods that were close to their expiry dates. That facility served only disaster meals as alternative. Hospital D did not serve miso soup due to elevator outage as it was too difficult to carry using the stairs. Hospital E, which had water and gas disruption, provided disaster foods such as canned miso mackerel stew. Water, gas, and electricity in Hospital F had still not recovered. The staff only provided two disaster meals. On Day 3, neither water nor gas was recovered in Hospitals E and F (Table 4). Hospitals C, E, and F, where some lifeline outages occurred, served disaster meals at least once in a day. These three facilities utilized relief supply. Hospital F still provided only two disaster meals in a day.

Water

Table 5 shows the detailed usage status of lifeline during emergency. Home B failed to make use of food aid due to water outage. That facility covered the normal plate with plastic wrap to deal with the water shortage. Hospital D could purify cloudy water. The staff in that facility also indicated the necessity of having disposable dishes to prevent infectious diseases. Those dishes were also reported as a more convenient resource than a large water tank in Hospital F.

Gas

Home A was offered an electric rice cooker by a local resident (Table 5). Portable stoves (Hospitals E and F) and propane gas (Hospital F) were utilized to provide meals and sterilize water by boiling. Hospital E, where there was no outlet in the kitchen (Table 1), cooked and served meals in the staff cafeteria (Table 5).

Electricity

As shown in Table 5, outage of steam convection oven required alteration of meals. Electricity outage forced staff to use foods stocked in refrigerator and freezer. An elevator outage in Hospital E forced staff to carry meals by bucket brigade method.

Food delivery

Food delivery did not recover in Hospital D even on Day 3 (Table 4). As the staff could not connect with dealers, they experienced hardship in procuring foods (Table 5). Hospital E did not indicate supply disruption (Tables 2–4); however, staff could not procure fresh vegetables in the usual way. In Home A and Hospital E, special foods for older adults were delivered.

Table 2 Status of utilities and meal frequency on the first day after the earthquake (Day 1)

Facilities	Water	Gas	Electricity	Food delivery	Frequency of		Changes made (free description)
					Regular meals	Disaster meals	
A	△	○	○	○	3	0	● **Supper**: One vegetable-based dish was omitted.
B	×	×	○ except for morning	×	0	3	● **All meals**: Instant rice was served with canned or packaged food.
C	×	×	△	○ except for morning	0	3	Not specified
D	○	○ except for morning	○ except for morning	×	2	1	● **Breakfast**: Staff just provided what they had available at that time. ● **Lunch**: Meal content was changed according to the situation. ● **Supper**: Food in stock were used.
E	○cloudy	×	○	○	1	2	Not specified

F	×	×	×	○	0	2	● **All meals**: Food from refrigerator and freezer were used as priority. Instant rice was served.

○: available, △: partly available, ×: not available

Table 3 Status of utilities and meal frequency on the second day after the earthquake (Day 2)

Facilities	Water	Gas	Electricity	Food delivery	Frequency of		Changes made (free description)
					Regular meals	Disaster meals	
A	△	○	○	○	3	0	● **Breakfast**: The content of vegetable-based dish was changed according to the situation. ● **Lunch**: Bread could not be provided. ● **Supper**: One vegetable-based dish was omitted.
C	×	○	△	○	0	3	● **Breakfast**: Rice was cooked on gas (not using instant rice as previous day) ● **Lunch**: Food aids were served. ● **Supper**: Sauté was prepared using near-expired food.
D	○ cloudy	○	○	×	3	0	● **Breakfast**: Miso soup was not served when the elevators were not working due to difficulty in carrying it on the stairs. ● **Lunch/Supper**: Stocked food was used to prepare regular meals.
E	×	×	○	○	2	1	● **Breakfast**: Disaster food, canned miso mackerel stew was used. ● **Snack**: Instead of lunch, a snack was served.
F	×	×	×	○	0	2	● **All meals**: Food from refrigerator and freezer were used as priority. Instant rice was served.

○: available, △: partly available, ×: not available

Table 4 Status of utilities and meal frequency on the third day after the earthquake (Day 3)

Facilities	Water	Gas	Electricity	Food delivery	Frequency of		Changes made (free description)
					Regular meals	Disaster meals	
A	△	○ except for morning	○	○	3	0	● **Breakfast**: One vegetable-based dish was omitted. ● **Lunch**: One vegetable-based dish was omitted. ● **Supper**: One vegetable-based dish and clear soup were omitted.
C	×	○	△	○	2	1	● **Supper**: Milk and strawberries were added. Strawberries were provided by a local farmer.
D	○ cloudy	○	○	×	3	0	● **Breakfast**: The president provided large amount of food from areas with minimal damage. Staff went shopping in a nearby prefecture to overcome food shortage. ● **Lunch**: Meals were provided using what they had in the facility (including relief supply).
E	×	×	○	○	2	1	● **Lunch/snack**: Instead of lunch, snack was served. ● **Supper**: “Protein jelly,” a relief food, was provided.

F	×	×	○	○	0	2	● **All meals**: Meals were prepared using food aids.

○: available, △: partly available, ×: not available

Table 5 The lifeline situations of each nursing care facility

Water	● **B**: Although we received food aid, the vegetables could not be washed due to the lack of water. The length of the water outage was unknown, so we decided to cover normal plates with plastic wrap for several days after the disaster. ● **D**: As the water was cloudy, we used a water purifier and used purified water in cooking. On Day 5, norovirus-infected individuals entered our facility, infecting other residents. There was insufficient disposable tableware from that day. ● **F**: The family of a staff member brought a large water tank to wash dishes. However, disposable ones were more convenient.
Gas	● **A**: An electric rice-cooker was provided by a local resident. ● **E**: Staff used some portable stoves in the cafeteria and provided hot meals. ● **F**: We could serve meals and boil water to disinfect using portable stoves and propane gas thanks to lifeline providers.
Electricity	● **E**: The cooking methods were changed for the regular meals due to the outage of the steam convection oven. All staff served meals by bucket brigade method because the elevator had stopped due to an aftershock. ● **F**: On Days 1 and 2, food in refrigerator and freezer were used as priority. Because of the elevator outage, we carried cooked meals manually to a hospital ward and served them.
Food delivery	● **A**: Dealers provided us with food thickeners and some food. ● **D**: Despite calling contractors, they had no explanation for delivery failures. We worked hard to procure food. ● **E**: Fresh vegetables were difficult to get for a few days. We could get eternal feeding products and special food for vulnerable as usual.

A, B, and D–F refer to different facilities (Table 1).
We only chose comments describing difficulties and coping methods which would contribute to disaster preparedness for the future.

Manpower

Some staff from Home A and Hospital D were forced to stay in the gymnasium or their cars overnight (Table 6). Under these situations, volunteers or staff from other facilities helped their works. Due to the lack of available care in Home B, the number of residents with bedsores increased.

Food

Local residents and farmers donated foods to Homes A and C. Hospital D reported that it was hard to serve milk or fruit. Hospital F had difficulty in utilizing food aid because of the close to expiry date and high-sodium content food (Table 6).

Nutrition

Home A, which was damaged the least of all six facilities (Tables 2–4) provided meals considering nutrition as usual (Table 6). In Home B, staff worried about nutrient deficiencies among residents due to food shortage. Although Hospital D tried to provide balanced and delicious diets, the nutrients appeared to be deficient.

Table 6 Situations other than lifelines of each elder-care facility

Manpower	● **A**: Some of the staff slept in the gymnasium or in their cars. Volunteers came to help out with our work. ● **B**: Because staff could not provide enough care for older adults, there were more patients with bedsores. ● **D**: Some staff had difficulty in commuting and camped in their cars. Staff in charge of morning shift were unable to commute, so those working in other facilities helped us serve meals.
Food	● **A**: Food was provided by local residents. ● **C**: Farmers near the facility provided asparagus and strawberries. ● **D**: Milk and fruit were difficult to serve after the disaster. ● **F**: Food aid, such as instant rice, noodles, and canned food were

	delivered. However, some of them were near their expiry dates and/or were high in sodium, which made it difficult to use them.
Nutrition	● **A**: Nutritional considerations were given to older adults as usual. ● **B**: Staff were concerned that residents took lower amounts of nutrition than usual due to food shortage. ● **D**: We made all the efforts to serve balanced and delicious diet as much as possible, but the nutrition seemed to be insufficient.

A-C, and F refer to different facilities (see Table 1). We only chose comments describing difficulties and coping methods which would contribute to disaster preparedness for the future.

DISCUSSION

Lifeline disruption made food provision difficult. Hospital F, where water, gas, and electricity had been cut off on Days 1 and 2, served only two meals per day. Meals in this facility were all disaster foods as alternative of regular menus. On the contrary, three meals were served as usual in Home A, where only the water supply was partially disrupted. That home simply omitted a few dishes without any other difficulty. This result shows that meal provisions had a definite link to utilities. Older adults in disaster-stricken areas require special dietary care (70), so the disruption of lifelines precludes appropriate food supply and the use of cooking appliances which require gas and electricity.

Disposable dishes were used in most facilities (Table 1), which are convenient resources under suspension of water supply. However, garbage-disposal facilities might stop working due to the malfunctioning of incinerator after the disasters (15). The excess garbage accumulation in health care facilities and hospitals for long period could lead to sanitary and health problems (16). This might particularly affect older adults, who are susceptible to infection7. Although disposable dishes might be user friendly for staff (Table 5), they are usually thin and fragile making it difficult for older adults to eat (17). Therefore, normal dishes covered with plastic wrap (Table 5), might be preferable in terms of reducing the volume of waste and improve usability for older adults unless there is no virus-infected individual.

Ensuring heat source is also essential because it affects cooking well-balanced diet (18). In fact, Hospital F, the only facility without a private generator, could not serve regular meals at all for three days (Tables 1–4). This presents the necessity to have generators and find other places for cooking, such as a cafeteria as seen in Table 5.

Electricity lead vulnerability in facilities during emergency (19). This study also revealed that power outages limited the range of available foods. As in the case of Hospital D, which refrained from serving easy-to-spill soup for safety (Table 3), meals may need to be transported by hand on a stairway if elevators are unavailable. For that case, facilities should consider using transportable containers to deal with the unavailability of meal carts (20).

Like Hospital F, where foodstuffs in the refrigerator were used first (Table 5), it is recommended to utilize perishable foods as priority, followed by foods preserved in a freezer (21). Food service facilities always have large refrigerators and freezers. If food there can be stored in good condition, it would ease food shortage in emergencies. Therefore, above everything else, limited electricity from in-house generation should be connected to cold storage equipment. Electricity is also necessary for the purpose of using cooking appliances; if electric appliances such as blenders cannot be used, it is difficult to make appropriate meals for older adults (22). This could cause aspiration pneumonia, a life-threatening illness (7). Although five out of six facilities had private generators, only two of them had outlets in the kitchen which connected to an in-house generator (Table 1). Because the provision of meals will be hindered without refrigerators and cooking equipment, portable generators should also be arranged in advance.

Hospital D struggled with procuring foods due to unavailability of communication tools to connect with dealers (Table 5). Even in a facility that provided meals without missing any, staff was concerned about malnutrition among older adults (Table 6) as they are susceptible to infection7. Some food aid they received were close to expiry date or had high sodium content (Table 6), as seen in a previous study (23,24). That meal contents were inadequate for older adults, as hypertension is a concern (7). To deal with this, contact with the outside world is essential because meal scores during the Great East Japan Earthquake were related to that (25). Because email or landline telephone cannot be used during power outage, facilities should create emergency contact lists (17) or utilize social networking services such as LINE to communicate with dealers (26).

Although our respondents did not clearly refer to transportation, its impairment could also cause limited access to foods (19). Special foods are especially vulnerable to stagnation or deterioration (27) due to their production on a small scale. Thus, having food stockpile, not relying on food aid, is essential to ensure consistent provision of special care meals for older adults.

Manpower

As observed in previous studies (28) some facilities accommodated outside evacuees, although they had fewer staff than usual (Table 1). The manpower shortage might cause increased number of pressure sore patients (Table 6). Moreover, meal provision for the staff (Table 1) is also inevitable because staff tend to suffer from health issues due to overwork under a chaotic situation (290. Because meal preparation under those emergency situation is difficult, human resource planning that utilizes external support is a crucial part of business continuity plan. For example, inter-networks among meal provision facilities are structured within the jurisdiction of the Okayama Bihoku Health Department. This network allows disaster-stricken facilities to request meal delivery from places in regular operation (30).

Limitations of this study

The first limitation is the small number of facilities analyzed. Our final number of respondents was only six facilities, which is very small since the target of the analysis was narrowed down to facilities in which the disaster affected the content of meals and that described the content of meals for one day or more. The second limitation is that some of their description about changes in meals content were

ambiguous. They provided free responses describing meals changes. At times, it was unclear how ingredients and cooking methods were changed. Therefore, we could not strictly divide between changed and unchanged meals. However, this is the first study to describe the precise meal contents served at senior care facilities in an acute phase of a disaster. We were able to clarify the actual situation of meals provided during disasters and evaluate the direct impact of utilities by taking a descriptive approach rather than statistical analysis.

CONCLUSION

Utility outage leads to skipping meals and represents an obstacle to serving meals. On the contrary, facilities with lifeline supply can serve regular meals with a few changes in dishes. Moreover, food deliveries were disrupted by the earthquake. The number of staff was fewer than usual in some facilities resulting in increased pressure on staff and patients. Human resource planning utilizing external support thus appears to be crucial for business continuity.

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Supplement 1: Meal served on the first day after the earthquake (April 16, 2016: Day 1) Homes A-C

	Home A	Home B	Home C
Breakfast	***Regular meal***	***Disaster meal***	***Disaster meal***
Grain-based dish	● Rice	● Instant rice	● Bread
Vegetable-based dishes	● Vegetable dishes ● Japanese pickles	-*	● Vegetable juice
Fish, eggs, and meat dishes	-	● canned or pouched dishes	-
Milk	-	-	-
Fruits	-	-	-
Others	● Miso soup ● Furikake†	-	● Strawberry pudding
Lunch	***Regular meal***	***Disaster meal***	***Disaster meal***
Grain-based dish	● Rice	● Instant rice	● Rice
Vegetable-based dishes	● Root vegetable salad	-	● Potato salad
Fish, eggs, and meat dishes	● Yuan-style grilled fish ● Agedashi tofu	● Canned or pouched dishes	● Mapo tofu‡
Milk	-	-	-
Fruits	-	-	-
Others	● Clear soup	-	-
Supper	***Regular meal***	***Disaster meal***	***Disaster meal***
Grain-based dish	● Rice	● Instant rice	● Rice
Vegetable-based dishes	● Spaghetti salad	-	● Kidney beans
Fish, eggs, and meat dishes	● Beef miso stew	● Canned or pouched dishes	● Canned mackerel
Milk	-	-	-
Fruits	-	-	-
Other	-	-	-

* not served

† Furikake: Japanese seasoning sprinkled on the rice, which is made of some mixed ingredients such as sesame seeds, dried fish flakes, seaweed, and so on

‡ Mapo tofu: Stewed tofu and minced meats seasoned with red pepper, Sichuan peppercorns, doubanjiang (chili bean paste), fermented black beans, and so on (Chinese dish)

Supplement 2: Meal served on the first day after the earthquake (April 16, 2016: Day 1) Hospitals D-F

	Hospital D	Hospital E	Hospital F
Breakfast	***Disaster meal***	***Disaster meal***	-*
Grain-based dish	-	● Rice balls	-
Vegetable-based dishes	-	-	-
Fish, eggs, and meat dishes	-	● Crab-flavored omelet	-
Milk	-	-	-
Fruits	-	-	-
Others	● 2 packs of Pempals†	● Miso soup ● Furikake‡	-
Lunch	***Regular meal (changed)***	***Disaster meal***	***Disaster meal***
Grain-based dish	● Rice	● Rice balls	● Instant rice
Vegetable-based dishes	● Salad with vinegar and miso	● Broccoli salad	● Vegetable sauté
Fish, eggs, and meat dishes	● Fish-ball stew ● Soy milk tofu	● Stewed fish	-
Milk	● Milk	● Milk	-
Fruits	-	● Canned tangerine	-
Others	-	-	● Miso soup
Supper	***Regular meal (changed)***	***Regular meal***	***Disaster meal***
Grain-based dish	● Rice	● Rice balls	● Instant rice
Vegetable-based dishes	● Sweet potato salad ● Japanese pickles	● Egg-bound soup with wheat gluten	● Dressed salad (carrots and green beans)
Fish, eggs, and meat dishes	● Grilled fish with plum sauce	● Beef and tofu stew	● Stewed Ganmodoki§ and vegetable soup
Milk	-	-	-
Fruits	-	-	-
Other	● Matcha agar	-	-

* not served

† Pempal: Oral nutritional supplement produced by Nestle.

‡ Furikake: Japanese seasoning sprinkled on the rice, which is made of some mixed ingredients such as sesame seeds, dried fish flakes, seaweed, and so on

§ Ganmodoki: A fried tofu mixed with some sliced ingredients such as vegetables (Japanese dish).

Supplement 3: Meal served on the second day after the earthquake (April 17, 2016: Day 2) Homes A, C

	Home A	Home C
Breakfast	***Regular meal***	***Disaster meal***
Grain-based dish	● Rice	● Rice
Vegetable-based dishes	● Japanese pickles	● Dried daikon strips
Fish, eggs, and meat dishes	● Fried tofu stew	-*
Milk	-	-
Fruits	-	-
Others	● Miso soup	● Miso soup ● Furikake†
Lunch	***Regular meal***	***Disaster meal***
Grain-based dish	● Rice balls	● Bread
Vegetable-based dishes	● Stewed vegetables	-
Fish, eggs, and meat dishes	● Cream stew	-
Milk	-	-
Fruits	-	● Strawberries
Others	-	● Potage
Supper	***Regular meal***	***Disaster meal***
Grain-based dish	● Rice	● Rice
Vegetable-based dishes	● Sesame-dressed salad	● Sauté
Fish, eggs, and meat dishes	● Fish with tomato sauce	● Curry
Fruits	-	-
Others	● Miso soup ● Jelly	-

* not served

† Furikake: Japanese seasoning sprinkled on the rice, which is made of some mixed ingredients such as sesame seeds, dried fish flakes, seaweed, and so on

Supplement 4: Meal served on the second day after the earthquake (April 17, 2016: Day 2) Hospitals D-F

	Hospital D	Hospital E	Hospital F
Breakfast	***Regular meal (changed)***	***Combination of regular & disaster foods***	***-****
Grain-based dish	● Rice	● Rice	-
Vegetable-based dishes	-	● Grated daikon	-
Fish, eggs, and meat dishes	● Tofu stew	● Miso mackerel stew	-
Milk	-	-	-
Fruits	-	-	-
Others	● Furikake	● Miso soup ● Furikake†	-
Lunch	***Regular meal (changed)***	***-***	***Disaster meal***
Grain-based dish	● Rice	-	● Rice
Vegetable-based dishes	● Stewed hijiki‡	-	-
Fish, eggs, and meat dishes	● Cream stew	-	● Stewed Ganmodoki§ and vegetable
Milk	-	-	-
Fruits	-	-	-
Others	● Apple jelly	-	● Miso soup
Supper	***Regular meal (changed)***	***Combination of regular & disaster foods***	***Disaster meal***
Grain-based dish	● Rice	● Rice balls	● Rice
Vegetable-based dishes	● Vegetable omelet ● Cauliflower salad	● Steamed eggplant ● Pickled cucumber	● Stir-fried salmon flakes and cabbage
Fish, eggs, and meat dishes	-	● Stew with meat-stuffed inari ● Pork miso soup	● Chinese-style shrimp stew
Fruits	-	-	-
Others	Clear soup	-	-
Snack	***-***	***Disaster meal***	***-***
Grain-based dish	-	-	-
Vegetable-based dishes	-	-	-
Fish, eggs, and meat dishes	-	-	-
Milk	-	● Milk	-
Fruits	-	-	-
Others	-	● Castella manju or Isocal jellyHC‖	-

* not served

† Furikake: Japanese seasoning sprinkled on the rice, which is made of some mixed ingredients such as sesame seeds, dried fish flakes, seaweed, and so on

‡ Hijiki: One of the seaweeds which is usually used in stewed dishes

§ Ganmodoki: A fried tofu mixed with some sliced ingredients such as vegetables (Japanese dish)

‖ Isocal jelly HC: Oral nutritional supplement produced by Nestle

Supplement 5: Meal served on the third day after the earthquake (April 18, 2016: Day 3) Homes A, C

	Home A	Home C
Breakfast	***Regular meal***	***Regular meal***
Grain-based dish	● Rice	● Rice
Vegetable-based dishes	● Tsukudani*	● Hijiki†
	● Japanese pickles	● Japanese pickles
Fish, eggs, and meat dishes	-‡	-
Milk	-	-
Fruits	-	-
Others	● Miso soup	● Miso soup
Lunch	***Regular meal***	***Disaster meal***
Grain-based dish	● Rice	● Mixed rice
Vegetable-based dishes	● Sesame-dressed salad	-
Fish, eggs, and meat dishes	● Chicken stew	● Canned saury
Milk	-	-
Fruits	-	-
Others	● Clear soup	● Stew
Supper	***Regular meal***	***Regular meal***
Grain-based dish	● Rice	● Rice
Vegetable-based dishes	● Plum vinegar-dressed salad	● Dressed salad
Fish, eggs, and meat dishes	● Boiled fish with grated radish	● Stir-fried soboro§
Milk	-	● Milk
Fruits	-	● Strawberries
Others	-	-

***** Tsukudani: Shellfishes boiled in soy sauce and sugar

† Hijiki: One of the seaweeds which is usually used in stewed dishes

‡ not served

§ Soboro: Minced and cooked fishes or meats

Supplement 6: Meal served on the third day after the earthquake (April 18, 2016: Day 3)
Hospitals D-F

	Hospital D	Hospital E	Hospital F
Breakfast	***Regular meal (changed)***	***Combination of regular & disaster foods***	***-****
Grain-based dish	● Rice	● Rice balls	-
Vegetable-based dishes	● Tsukudani†	● Salad with grated daikon	-
Fish, eggs, and meat dishes	● Simmered pumpkin and deep-fried tofu	● Teriyaki‡ fish stew	-
Milk	-	-	-
Fruits	-	-	-
Others	-	● Miso soup	-
Lunch	***Regular meal (changed)***	***-***	***Disaster meal***
Grain-based dish	Rice	-	● Rice
Vegetable-based dishes	● Vegetable salad ● Stew with dried daikon strips	-	● Vegetable sauté
Fish, eggs, and meat dishes	Grilled fish	-	-
Milk	-	-	-
Fruits	-	-	-
Others	Tangerine jelly	-	● Miso soup
Supper	***Regular meal (changed)***	***Combination of regular & disaster foods***	***Disaster meal***
Grain-based dish	● Rice	● Wakame rice	● Rice
Vegetable-based dishes	● Dressed daikon Yogurt-dressed salad	-	● Salad
Fish, eggs, and meat dishes	● Chicken and egg stew	● Babaocai§ ● Egg soup	● Simmered mackerel in miso
Milk	-	-	-
Fruits	-	-	-
Others	-	● Protein jelly	-
Snack	-	***Disaster meal***	-
Grain-based dish	-	-	-
Vegetable-based dishes	-	-	-
Fish, eggs, and meat dishes	-	-	-
Milk	-	● Milk	-
Fruits	-	-	-
Others	-	● Citrus madeleine ● Protein jelly	-

* not served

† Tsukudani: Shellfishes boiled in soy sauce and sugar

‡ Teriyaki: Fishes or meats grilled or boiled with soy sauce, mirin, and sugar

§ Babaocai: Thickened stew made of various foods including meat, shellfishes, vegetables, eggs and so on (Chinese dish)