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CITATION:

Nakai, Fuko ...[et al]. Community-mediated individual disaster preparedness practices: A case study in Kochi, Japan. *International Journal of Disaster Risk Reduction* 2023, 86: 103532.

ISSUE DATE:

2023-02-15

URL:

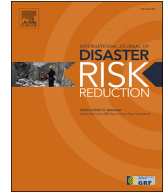
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## International Journal of Disaster Risk Reduction

journal homepage: [www.elsevier.com/locate/ijdr](http://www.elsevier.com/locate/ijdr)

## Community-mediated individual disaster preparedness practices: A case study in Kochi, Japan

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## ARTICLE INFO

## Keywords:

Community-based DRR  
Mediation  
Self help  
Emergency relief kits  
Deficit model  
Activity theory

## ABSTRACT

Self help has become an increasingly influential factor in disaster risk reduction due to the inherent uncertainty that comes with natural hazards. Despite a lack of public support in emergency situations, citizens' low commitment to self help has remained unaffected, and, consequently, both experts and the government have made efforts to encourage citizens to take action. Although the government- and expert-oriented efforts, and unidirectional communication in general, have been criticized as the deficit model approach, because they do not necessarily make behavioral changes, these methods still remain as the ones that are primarily used. This study introduces a community's tsunami disaster preparedness as an alternative to the deficit model. We focus on the community's practice of preparing boxes for individual emergency relief (the "individual box"), which were stored in a common storage facility on higher ground and managed by the community. We discuss this in the context of activity theory: self help is understood not only by the relationship between the government/expert (subject) and citizens (object), but also that between the individual box and the community. We showed through interviews and field work that this practice facilitates a high participation rate in preparing emergency relief and rapid evacuation. Moreover, cooperative communal practices had the added benefit of engaging individuals in the broader social system. Although this study focuses on small communities, this method can be applied to larger communities by regarding it as a practical application of activity theory and as a new alternative that encourages individual practice.

## 1. Introduction

## 1.1. Limitations of the deficit model approach

Tsunamis are rare natural hazards that can have devastating consequences for coastal areas. The vast majority of them are caused by earthquakes in active seismic zones and occur along limited coastal areas around the world. According to the Emergency Events Database (EM-DAT) records, a total of 30 tsunamis killed 252,730 people and affected 8,600,925 people in 20 countries between 2000 and 2018, causing mass injury and homelessness [1]. To reduce the damage from these events, the government and experts alike emphasize the importance of self-help actions for protecting one's life, such as evacuation drills, seismic retrofitting, furniture fixation, and keeping emergency relief kits [2–4]. For example, in Japan's 1995 Great Hanshin-Awaji Earthquake, public rescue teams were only able to rescue about 20% of the people trapped under collapsed buildings [5]. This has been cited in the latest Japanese White Paper on Disaster Management as demonstrating the importance of self help in disaster risk reduction [6]. The importance of

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self help is also supported by the fact that households that are prepared for disasters tend to have a more positive health status and a greater well-being [7]. These facts show that emphasizing the importance of self help has become an increasingly influential factor in situations where a society faces crisis and uncertainty.

Many studies have explored how to encourage citizens to take action toward reducing disaster damages from other natural disasters in addition to tsunamis through educational tools, programs, and evaluation methods. For example, The Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) in Japan promotes “My timeline,” an action planning tool for individuals that helps them and their households understand how to act appropriately during floods based on evacuation information that is pertinent to their circumstance [8]. Additionally, there are some other supplementary actions and tools, such as “Nige-Kid” (“Nige” means to escape in Japanese), a tool that allows children to quickly study “My Timeline” together with their parents [9], timelines for elementary schools [10] and districts [11,12], an educational card game [13], zone-specific hazard maps [14], and town walk programs in which both residents and experts participate [15]. All of these initiatives were implemented either by experts or the government.

These government- and expert-designed frameworks often involve a unidirectional form of communication, which has led them to be criticized as functioning under the linear model [16], or the deficit model. There are a few problems associated with communication based on the deficit model. (1) It is understood that communication involves only the relationship between the subject (experts) and the object (citizens). Therefore, (2) behavioral improvement strategies are proposed based on the belief that low-grade self-help behavior from citizens is principally due to a lack of knowledge about disaster risk, and (3) that providing sufficient information to fill the knowledge gap between experts and citizens will promote behavioral change. However, many studies have pointed out that a lack of self-help disaster preparedness, or ignorance of it, is not necessarily due to a simple lack of knowledge [16,17]. Moreover, a literature review on risk perception revealed the counterintuitive result that high risk perception is not directly correlated with high preparedness behavior [18]. In fact, there have been cases where people have understood the importance of disaster risk reduction but still failed to take action. For example, according to a web-based survey conducted by the Cabinet Office of Japan [19], less than 40% of respondents engaged in disaster preparedness (for various degrees, including “fully engaged” and “engaged as much as possible in daily life”). Additionally, the survey asked “Why don't you work on disaster preparedness even though you think it is important,” specifically targeting those who were not prepared for a disaster but were aware of the possibility that a major one could occur where they lived within the next 30 years. The results were: 25.6% replied “Lack of time,” 22.1% replied “No particular reason,” and 18.3% responded “Lack of opportunity,” while only 14.4% answered “Lack of information.” These studies highlight the deficiencies of the deficit model in that the conveyance of knowledge from experts to citizens has limited effectiveness when it pertains to disaster preparedness.

### 1.2. The activity theory: an alternative to the deficit model

Comprehensive knowledge does not necessarily change a citizen's behavior. Many of the alternatives to the deficit model can be explained within the framework of activity theory, a diagrammatic model of activity systems developed by Engeström [20]. Here the problem of low-grade self-help behavior is not understood by singling out individual residents but rather by the existence of “mediation,” which connects individuals and objects. Some studies have focused on what mediates behavioral change and the proliferation of disaster risk information. For example, Cook and Overpeck [17] conducted a literature review and showed that building relationships between experts and the public is conducive to behavioral change. To address the issues posed by climate change, Beck [21] proposed re-embedding the significance of climate change in local cultures to see if doing so would encourage adaptation to it, ultimately coming to the conclusion that it is important to shift toward a place-based, bottom-up approach involving local stakeholders and decision-makers. Nakano and Yamori [22] proposed a few different approaches: one centered around an instructor/learner fusion, one encouraging participation in community-based practice, and one centered around evaluating long-term commitments designed to enhance citizens' proactive attitudes toward disaster preparedness. Abunywah et al. [23] extended the deficit model and showed that community participation aids in disseminating disaster risk information and fostering an intent toward preparedness. These studies tried to develop a theoretical framework for understanding the expected actions of both individuals and mediations, such as the relationships between stakeholders [17], local cultures [21], long-term relationships between instructors and students [22], and community participation [23]. Meanwhile, several studies have performed practical research in this regard, especially in terms of activity theory. For example, Nakano et al. [24] developed movie clips that displayed a school evacuation drill and a tsunami inundation simulation and used them as a mediation tool. The clips created the perception that citizens themselves could deal with disasters and promoted the proactive implementation of alternatives. These studies showed the significance of the approach based on activity theory; however, practical cases have yet to be developed enough.

Based on this background information, we aim to show in this study that the practice of preparing boxes for individual emergency relief (hereafter, “the individual box”) (Fig. 1) developed by local communities in Japan can be understood in the context of activity theory. The idea of the individual box itself is common; each resident puts emergency items such as food, water bottles, clothing, and medicines into a box in their homes in advance. However, the method used by these communities is unique in terms of community-based management: individual boxes prepared by each resident were assembled and stored in a common storage facility on higher ground outside of the potential tsunami inundation zone by the community, not by individuals themselves. Local residents and their community association or community-based DRR group initiated and promoted the practice on their terms, whereas local officials supported it mainly in terms of financial procedures. The idea can be interpreted as taking a practice that has traditionally been considered an individual's responsibility and instead having it be mediated by broader social systems. Moreover, the practice has the potential to reinvigorate interest in disaster preparedness in local cultures, as mentioned in Beck [21]. Our study demonstrates how the community-based practice of preparing emergency kits enables greater levels of individual disaster preparedness and its significance as an example of activity theory.



Fig. 1. Boxes for individual emergency relief (the individual box). The community covered boxes with a net to prevent their collapse during earthquakes.

## 2. Study area and methodology

### 2.1. Study area

All of the communities targeted in this study are located in Kochi City and Kuroshio Town, Kochi Prefecture, both located in the southern part of Japan's Shikoku island (Fig. 2). Both areas face the Pacific Ocean and have a history of being affected by earthquakes and tsunamis originating from the Nankai Trough every 100–150 years. According to the estimations of earthquakes and tsunamis along the Nankai Trough that were announced by the government after the 2011 Great East Japan Earthquake [25], Kochi City and Kuroshio Town are thought to be susceptible to the following hazards: an inundation area with a depth of 30 cm or greater over 3690 ha and 1180 ha, a maximum inundation depth of 16 m and 34 m, and a minimum tsunami arrival time of 16 min and 8 min, respectively. The maximum expected seismic intensity for both areas is seven on the JMA Seismic Intensity Scale [26].

Kochi City is the capital of Kochi Prefecture and hosts a population of 320,722, including the highest concentration of people and industry in the prefecture. Kochi City's gross city product consists of 0.8%, 11.0%, and 88.3% of primary, secondary, and tertiary industries, respectively, while Kuroshio Town's share is 20.0%, 17.6%, and 62.4%, respectively [27]. The composition of the prefecture's total production value is 3.8% primary industry, 16.5% secondary industry, and 79.0% tertiary industry. This data indicates that Kochi City has a relatively large tertiary industry, while Kuroshio Town has a larger primary industry than the prefecture.

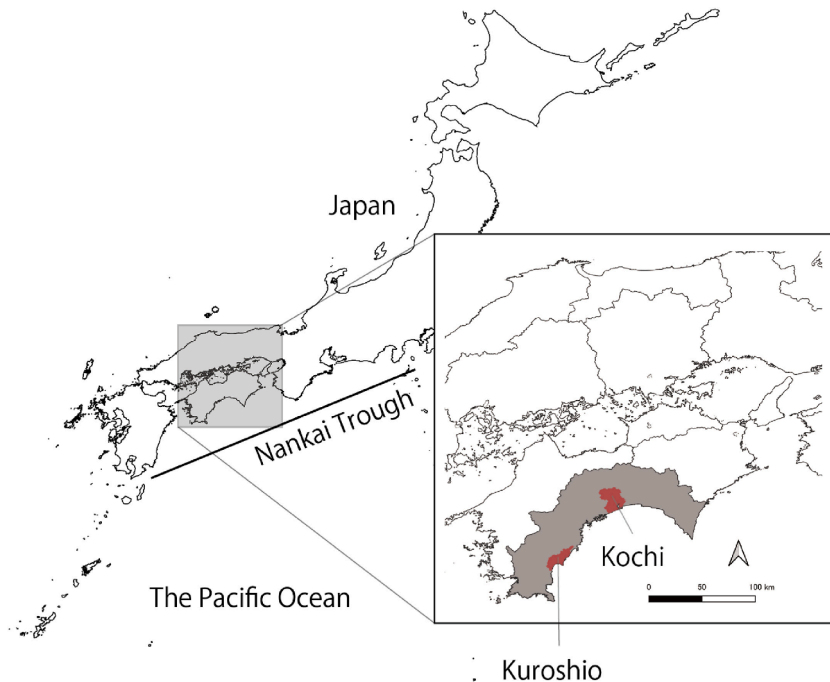


Fig. 2. Locations of Kochi city and Kuroshio town.

After the Great East Japan Earthquake, both municipalities strengthened their disaster risk reduction measures by building evacuation towers and other facilities and by running evacuation campaigns [28,29]. Kuroshio town in particular employs unique variants of the “staff-in-charge” system (chiku tanto sei), where around 200 employees are assigned to all 61 communities to promote disaster preparedness [30]. This allows local officials to become mediators for promoting disaster risk reduction practices and to connect residents with various subsidy programs. Additionally, we worked collaboratory with local residents, municipal officers, and university researchers to establish the community-based evacuation plan from 2012 to 2016 [31]. Furthermore, since 2015, several university staff have worked with residents and local officials to build a “community disaster prevention plan (chiku-bosai-keikaku),” with practical disaster preparedness having been implemented by 61 individual communities (There are some papers and reports about this program written in Japanese: for example, Refs. [32–34]). Through these efforts, most residents in the study area were aware of the possibility of natural disasters.

## 2.2. Methodology

In this study, we focus on disaster preparedness actions among nine communities where the individual box initiative is being implemented: Higashikuratani in Kochi City and Shiba, Machi, Hamanomiya, Shimotanokuchi, Shirahama, Machibun, Owada, and Umaji in Kuroshio town, all in Kochi prefecture. This practice was initially developed by the local coastal communities in Kochi City and Kuroshio Town to mitigate the loss of evacuation time from people returning home to retrieve goods after an earthquake. Each household stores necessary items in customized individual boxes, primarily those that cannot be satisfied by communal stockpiling, such as medicines, hygiene products, and favorite foods. By placing the individual box at a safe evacuation site in advance, household members do not need to stop by their house or search for necessary items after an earthquake. Instead, they can go directly to the evacuation site away from the areas inundated by the resulting tsunami.

We visited the nine communities mentioned above where the individual box initiative is being implemented and conducted semi-interviews with one to three men and women in their 40s–80s who were involved in disaster preparedness activities in those communities, including members on the board of the community association or community-based DRR group. The survey targeted all the communities that practiced the individual box at the time the survey was conducted. All of these communities were small having 36 to 171 households. We told residents in advance that we would discuss the individual box and recent disaster-related activities. The interview was conducted as a focus group discussion (FGD) between members on the board of the community association or community-based DRR group (Row 11 of Table 2) and us. Moreover, in eight communities in Kuroshio, the staff of the local officials who are in charge of the community in the staff-in-charge system were also involved in the interview. They functioned sometimes as questioners and sometimes as the interviewees.

The interviews included information regarding the extent to which people were involved in the practice, the cost-sharing scheme, including financial resources for initial and running costs, the workflow for installing the boxes, resident-initiated maintenance and management methods, reactions and impressions by residents, and the process of inter-community propagation of the practice within the prefecture. Table 1 shows the questions that were asked. The questions went back and forth and were not always ordered as numbered because we tried to gather information from a more natural free flow conversation with the residents. Site visits were also conducted to gain a better understanding of the area around them and the storage conditions.

**Table 1**

The questions posed during the semi-structured interviews. Questions were scattered throughout a free flow conversation with the residents, their order was not always as numbered.

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Questions posed in the semi-interviews.

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**About the installation of the individual box**

1. Why did your community install the individual box?
2. What brought the idea to you? If you have pilot cases that you referred to, tell me which points applied to your community (what did you imitate) and what was required as an extra step to reinstall the individual box in your community.
3. What kind of outcomes did you expect when you started the individual box?
4. Timeline for installing/managing the individual box.
5. How many residents/what percentage of residents in your community joined this practice? Have there been any changes since the first time?

**About management and maintenance**

6. Do you have opportunities for maintenance: checking, replacing, and refilling the contents of the individual box.
7. Are there opportunities for residents to review/examine the contents with each other?
8. What efforts have been made to ensure continued maintenance and management?
9. Who manages the key to the storage?
10. How did residents, other than the association members, react to the individual box? Were there any additional requests?
11. Were there any changes in your community regarding relationships or evacuation drill participation after installing the individual box?
12. Did you have any problems/findings with the facilities?
13. Did you have any problems/findings with community management?

**Breakdown of cost burden by:**

14. Household
15. Community (Collected and stocked membership fees belonging to the community)
16. Subsidies from foundations or the government
17. Local officials

**Other**

18. Freely talking about recent weather, community history, old stories by the elderly, how and when the community-based DRR group was formed, community gatherings for reasons other than disaster mitigation, and what the community has been working on recently.

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As mentioned in subsection 2.1, the authors have been included in a collaborative project between local governments and researchers addressing disaster mitigation in Kuroshio since 2012, so we observed the situation in Kuroshio's communities for a long time. However, focusing on the individual box, we conducted one intensive survey for each community for the half year between January and June in 2019. Since some participants hesitate to speak freely in the presence of video or audio recordings, we had the interviewer take notes on survey paper, as well as photographs as data recordings. Therefore, it was not possible to record verbatim what was said. Figs. 1 and 3–5 and 7 are photos taken during the site visits.

In chapter 3, we qualitatively analyze the data summarized in Table 2 and the interview data based on the interviewer's notes, then qualify the practices in terms of the sites where individual boxes were stored (3.1), the people involved in the practice (3.2), the forms of cost burden (3.3), the installation workflow (3.4), the maintenance and management method (3.5), and the horizontal development of similar initiatives in communities (3.6). We did not use any text mining tools to interpret the data but instead classified the



Fig. 3. Evacuation site on high ground (Kuroshio).



Fig. 4. Tsunami evacuation tower (Kuroshio).



Fig. 5. Evacuation site created by the Higashikuratani community.

similarities and differences between communities manually. This is because the amount of data was small (9 communities), and we did not take verbatim recordings. Therefore, quantifying the frequency of the occurrence of words could not lead to meaningful interpretation. On the basis of these results, we will discuss in section 4 how the practice fuses the responsibilities of the individual and the community in a way that is not achieved by either the experts' top-down approach or the individual's practice alone.

### 3. Results from the interviews

#### 3.1. Sites where individual boxes were stored

The initiative to implement individual boxes was contingent on the availability of community-managed evacuation sites. The storages where individual boxes were stored were located in evacuation sites on high ground (Fig. 3) or at tsunami evacuation towers (Fig. 4) (Row 4 of Table 2). These evacuation sites are designed to resist the level of tsunami inundation estimated to be produced by a Nankai Trough earthquake. In Higashikuratani, an evacuation site was spontaneously created by community residents after one of them voluntarily provided privately owned land on high ground free of charge. Residents then constructed the site by building fences, cutting down bamboo thickets, and clearing the land (Fig. 5). The storage there was installed with the support of subsidies from the Kochi City municipality (Row 9 of Table 2). By contrast, a government initiative in Kuroshio has been constructing evacuation towers, storage facilities, evacuation sites, and evacuation routes since 2013. A majority of the funds for building costs, 70%, were covered by emergency disaster prevention and mitigation bonds issued by the Ministry of Internal Affairs and Communications, and the remaining 30% were covered by a Kochi Prefecture provisional grant system for accelerating tsunami evacuation countermeasures. All communities recognize these evacuation sites as safe and agreed-upon places to get together in the event of a tsunami. In fact, they are used as places for people to go during regularly scheduled evacuation drills. The establishment of sites like this within communities where these kinds of activities can be conducted is one factor helping to promote community-driven efforts.

#### 3.2. People involved in individual box installations

In each of the communities, the primary actors involved in the installation of individual boxes were members of community associations and community-based DRR groups. The chief organizer who initiates the practice disseminates an invitation and information about the individual box to all households that are members of or pay dues to the community associations (hereafter, "community dues"), generally by letters or Fax. Since we were unable to obtain a membership list for every community, the participation rates of those associations were uncertain, but it is generally the case that most people who actually live in those areas are members. Participation in the individual box initiative was noncompulsory, with only volunteering residents taking part. The exception was the Hamanomiya community, where boxes were distributed to all households regardless of whether they requested them. Participation rates for the individual box initiative among the nine areas targeted in this study were between approximately 10% and 100%, with four attaining 100% participation. If we limit the discussion to those households that are associated with the local community associa-

Table 2

Overview of the communities implementing individual boxes by household where interviews were conducted (based on information available at the time of the survey, Jan–Jun 2019).

Area	Higashikuratani	Shiba	Machi	Hamanomiya	Shimotanokuchi	Shirahama	Machiwake	Owada	Maji
Households	125	131	47	127	171	36	73	62	43
Individual box participation rate	Approx. 67%	10%	100%	100%	65–90%	Approx. 100%	Approx. 52%	100%	Approx. 30%
Installation location	Evacuation site	Evacuation site	Evacuation tower	Evacuation tower	Evacuation site	Evacuation site	Evacuation site	Evacuation site	Evacuation site
Frequency and opportunities for maintenance and review	2 times/mo, grass cutting	1 time/yr, general disaster prevention training	1 time/yr, general disaster prevention training	1 time/yr, review session	Varies by small neighborhood group	2 times/yr, cleaning, shrine festival	Planned for around Sept each year	1 time/yr, general disaster prevention training	1 time/yr, when replacing water in storage facility
Cost coverage	Household	¥1000	¥750	Approx. ¥800	×	×	×	¥1100	×
	Community Subsidy	×	×	×	×	×	×	×	×
Storage facility construction fund	City	Town and community women's group	Town	Community grant	Town, community grant	Town	Town	Town	Town
Established	May 2015	Apr 2014 Nov 2018	Jun 2016	Jun 2017	May 2017	Apr 2017	Mar 2018	2018	2017
Interviewees	1 pres, 2 members of community-based DRR group	1 pres, 1 members of community-based DRR group	1 leader of community association, 1 member of community-based DRR group	1 leader of community association	1 leader of community association	1 leader of community association	1 leader of community association	2 members of community association	1 leader of community association

tion, then nearly all households in Higashikuratani were participating, meaning that there was 100% household participation in five communities.

The support of Kochi City and the Kuroshio officials also played a major role in the process of disseminating information about the initiatives of other communities and encouraging their adoption. In Higashikuratani, the chief organizer started by contacting city officials. In the Kuroshio communities, however, there were local officials from the staff-in-charge system, and the introduction of the individual box system came about through their regular communication with community leaders. For example, in addition to the community subsidy program used by the Hamanomiya community, local officials helped residents by providing detailed information about how to access various programs, such as subsidies for installing furniture fixation devices or for seismic retrofitting. They also advocated for the selection of communal goods to be kept in storage facilities and for planning evacuation drills. This communication basis established between residents and local officials can be considered as an essential factor in handling the complex tasks required for the installation of individual boxes.

### 3.3. Forms of cost burden

The boxes were purchased from a local wholesaler at costs between ¥750 and ¥1500. That cost was paid by individuals, the community (through community dues), subsidies, or some combination of the three (Rows 6–8 of Table 2). The communities that required individuals to bear those costs were Higashikuratani, Shiba, Machi, and Machibun. Higashikuratani asked Kochi City to provide a subsidy program, lowering the ¥1650 retail cost of the boxes to ¥1000 per individual. In the Machi, Shirahama, Owada, and Umaji communities, costs were paid from community dues. Only Hamanomiya residents received subsidies, which community leaders won from a community subsidy program (from lottery income) that covered the whole cost for the individual box, so all households in Hamanomiya were provided with boxes without any individual or community dues.

From the perspective of funding, we expected that participation rates would be higher in programs that did not require personal expenses. However, the participation rate was 100% in the Machi community despite requiring personal expenditure. By contrast, participation rates in the Shimotanokuchi and Umaji communities, where boxes were purchased using community dues, were not necessarily higher than those in other communities. This implies that the individual financial burden involved does not have any direct correlation to participation rates.

### 3.4. Workflow leading to the installation

Since the storage facilities and evacuation sites are located in common areas, when proposing the individual box initiative, each community followed the processes for obtaining approval by members of the boards of their local community association. Representatives or organizers purchased one size of box in bulk for those who wanted them, which allowed them to keep storage facilities neat and orderly and to maintain fairness in space utilization.

After the boxes were distributed, each household considered what they would put in their individual box. We asked two residents to show us the contents of their individual boxes, and these are listed in Table 3. This table shows how the content of individual boxes can vary by age or by the physical characteristics of those in the household, examples being the inclusion of feminine hygiene products for families with women or of prescription medications selected under consultation with regular physicians.

Finally, each household stored the individual boxes in a shared storage facility. In every community, a label with a name or household identification number was affixed to the box to identify its owner. Some communities took further steps, such as securing boxes with bands that had to be cut to open them as a security measure, covering boxes with a net (Fig. 1), or attaching bars to shelves to prevent their collapse during earthquakes. To reduce the burden of the organizers in the community and the voluntary disaster prevention associations who manage access to these storage facilities, most communities designated a specific time during which households could store their boxes in the facility. Fig. 6 shows residents gathering to perform their storage tasks. However, in some communities, association members hauled boxes to the storage facility on behalf of elderly residents.

**Table 3**  
Examples of individual box contents.

	Resident A	Resident B
Household composition	Married couple (70s), their son and his wife, two children (6 total)	Married couples (60s)
Box contents	Canned bread Crackers Facemasks Water tank Flashlight Feminine hygiene products Disinfectant Gloves Toothbrushes Garbage bags Backpacks Plastic sheeting	Bottled water (2 L, 500 mL) Canned bread Chocolate bread Canned fruit salad Radio Lighting Towels Matchsticks Rain gear Underwear Reading glasses Medicines (2-week supply) Change for vending machines





Fig. 6. Storage for the individual boxes brought by each household. (Photo: Chief, Hamanomiya Community, Kuroshio Town).



Fig. 7. “Life Boxes” provided by the Godaisan–Higashikuraya Community-based DRR group.

### 3.5. Methods for maintenance and management

Individual boxes are not left in the storage facility once they are placed there but are instead maintained on a regular basis (Row 5 of Table 2). Every community that introduced individual boxes over a year ago has had the opportunity to replace them at least once. The residents of Higashikuratani have grass-cutting events once every two months, and they replenish and replace the contents of their individual boxes on this occasion. The communities of Kuroshio do the same at events that most residents take part in, such as the annual disaster evacuation drill, around 1st September, the Disaster Prevention Day (bousai no hi) in Japan, local festivals, and grass-cutting events.

During these maintenance opportunities, each household can adjust the contents of their box according to the life stages of its family members, such as including diapers when children are infants and replacing them with other necessary items as they grow. People taking prescription medications can also consult with doctors regarding their effective shelf life and periodically replace them as needed. In the Machibun community, there were about ten requests for replacement during the first year after installation. Elderly residents sometimes notified community leaders of medications that were approaching their expiration date, and association members would take replacements to the storage facility.

### 3.6. Horizontal development of similar initiatives in communities

The individual box initiative spread among communities in Kochi Prefecture. The use of individual boxes is increasing in Kuroshio, but their origins lie in the “Life Boxes” [35] initiative started in 2015 by the Higashikuratani community in Kochi City (Fig. 7). When Higashikuratani’s efforts were featured in the local newspaper, Mr. Kubota, a Machi community resident and member of the Kuroshio Fire Department, read the article and then visited Higashikuratani through an introduction by a researcher of Kochi University. He then started a similar effort in the Machi community in 2016 [36].

One reason why the individual box concept spread to other Kuroshio communities was the Community Disaster Prevention Planning Symposium, which Kuroshio has hosted every autumn since 2015. This is an assembly event in which local students, including community-based DRR group members, disaster prevention experts, and people who have experienced actual disasters outside the prefecture participate and give presentations. It is sponsored by the Kuroshio Community-based DRR Group Association and co-sponsored by the town’s Board of Education, the Fire Department, and Kochi Prefecture. About two hundred participants from both

inside and outside the town attend. At the 2nd Community Disaster Prevention Planning Symposium, held in 2016, Mr. Kubota, as the representative of the community-based DRR group in Machi, gave a presentation on the practice of using individual boxes entitled “Rapid evacuation through the utilization of disaster prevention storage facilities” (Fig. 8). He described the purpose for preparing individual boxes as follows: “By preparing everything that will be required after an evacuation and storing it at the evacuation site, we can evacuate empty-handed without having to worry about what to take with us, which will lead to quicker evacuations after an earthquake before the tsunami comes.” They also presented specifics regarding the boxes, such as the process, storage methods, and their contents, along with photographs. The communities in Kuroshio that later introduced individual boxes (Shiba, Hamanomiya, Shimotanokuchi, Shirahama, Machibun, Owada, and Umaji) learned about the efforts of the Machi community directly through this symposium or indirectly through local officials of the staff-in-charge system and used them as a reference for their own implementation.

The Higashikuratani and Machi communities appear to have pioneered the practice. However, a women's association in the Shiba community of Kuroshio was actually the first to implement the project. At the suggestion of the club president in 2014, they purchased a storage facility and introduced the individual box concept in April of the same year. A woman who was also a member of the Shiba women's association and of the community-based DRR group said, “We couldn't wait for everyone in the community to agree, so we decided to start with those who wanted to. We felt that the women's association could do something, even if others in the community were acting slowly.” It was not until four years later, however, after hearing a Machi community presentation at the Community Disaster Prevention Planning Symposium held in November 2018, that individual boxes were prepared for all residents in the Shiba community, including men. She added, “There wasn't much awareness of what the women's club was doing at the time,” and that this was one reason why the initiative didn't spread to men and others throughout the Shiba community.

Presentations on the individual box initiative and its expected benefits at the Community Disaster Prevention Planning Symposium and writeups on it in Higashikuratani newspapers acted as a catalyst for spreading the practice to other communities. Comparing and contrasting the Machi community, which triggered the spread of the initiative to other Kuroshio communities, and the Shiba community women's association, which promoted the initiative only to those supporting it, we can see that with regard to horizontal development, opportunities for communication to report on those efforts, such as at the Community Disaster Prevention Planning Symposia, can be considered to have been important.

#### 4. Individual box function as a mediation tool for promoting individual preparedness

In this section, we discuss the significance of this practice from a theoretical standpoint (4.1) and its practicality in terms of how individual boxes encourage citizens to prepare emergency relief kits (4.2), as well as how it improves evacuation actions (4.3).

##### 4.1. Interpreting the practice in the context of activity theory

In this section, we discuss how individual boxes function in community disaster preparedness from a theoretical perspective. The significance of this case study is in how it provides a new perspective for understanding the problem of low-grade self-help behavior, one in which emphasis is not placed on residents but rather on the mediating relationships among experts, citizens, and other factors, such as tools and rules. The problems with communication that arise from the deficit model do so because it involves only the relationship between the government/experts (subjects) and citizens (objects) (The upper framework of Fig. 9). There was a belief that providing enough information would encourage behavioral changes within this framework. Therefore, methods for remedying this problem were limited to those related to information. However, the practice proposed in this study could be interpreted within activity theory [20]. This is the case for the government/experts (subject) and citizens (object) preparing emergency relief kits, as well as for the community as a whole, which includes local officials and experts (community) (the lower framework of Fig. 9). When the community is included within the framework, the rules and division of labor also mediate subject, object, and community. The rule proposed in this study is taking responsibility for preparedness, in other words, the norm that individuals should prepare for disasters by themselves. This rule also mediates subject, object, and community. Moreover, the effort required to prepare emergency relief kits,



Fig. 8. Presentation by the Machi community-based DRR group (at the 2nd Regional Disaster Prevention Symposium, 5th November 2016).

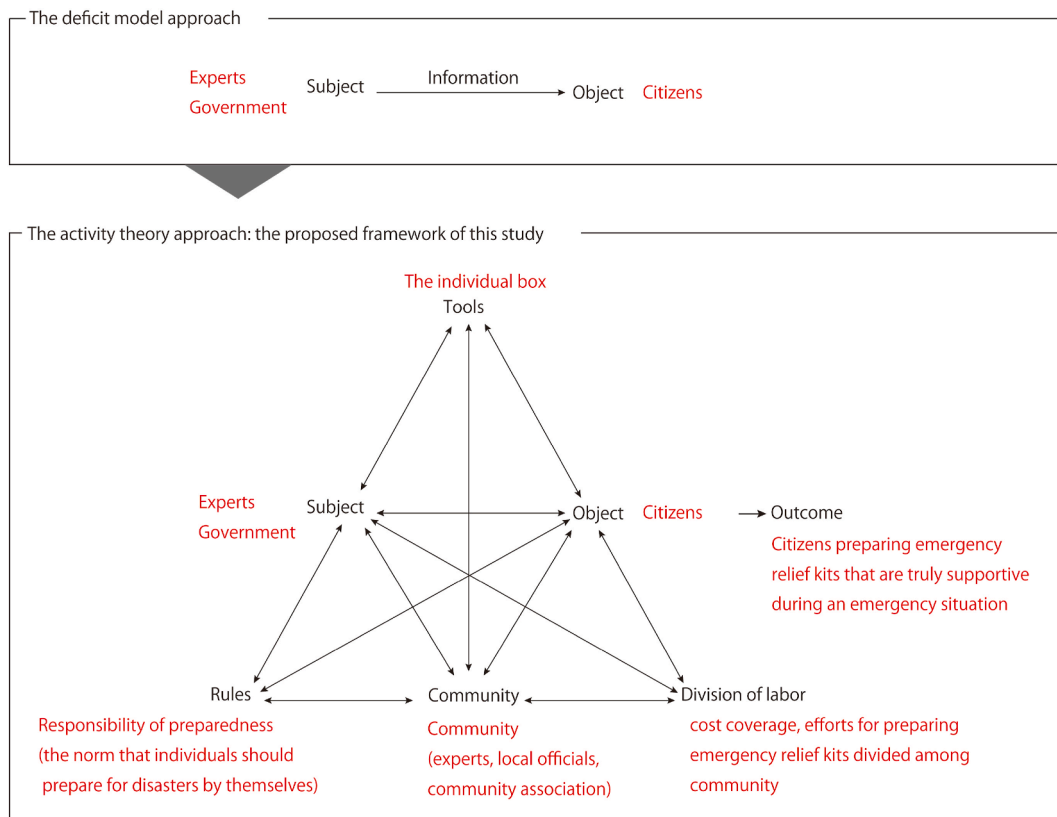


Fig. 9. Relationship between the experts/government and citizens preparing emergency kits: the deficit model and activity theory approach it differently.

such as providing sites and storage facilities where individual boxes can be kept, and the cost burdens are interpreted as part of the division of labor. Community events, such as festivals and evacuation drills, that encourage residents to keep up with their individual boxes also factor into the division of labor. Through these activities, citizens (object) are encouraged to prepare emergency relief kits, which was the original goal: self help in disaster risk reduction.

#### 4.2. Encouraging the preparation of emergency relief kits in households

The ability to customize emergency supplies is especially important for evacuees who are concerned about their housing and health at the evacuation site. Some residents stated directly that this made them feel safer. Publicly prepared stockpiles of goods cannot reflect individual circumstances or accommodate specific requests; stockpiled goods must be designed for general use among all evacuees. Because individual boxes allow customized content according to what their users need, they can bridge the gap between the need to provide public support and the ability to accommodate individual needs.

As was discussed in section 3.2, five of the nine communities targeted in this study attained 100% participation rates for the individual box initiative. These are high values compared to previous findings. For example, surveys of the evacuation behaviors of residents in the cities of Seki, Gero, Hida, and Gujo [37], where evacuation advisories were issued after torrential rain in July 2008, showed that 35–45% of respondents in each municipality had stockpiled drinking water and food and 36–49% had prepared emergency items. Furthermore, a survey related to tsunami disaster risk reduction that was conducted among residents in the coastal area of Okayama City, which has never experienced a tsunami disaster [38], showed that only 17% of the respondents had prepared an emergency evacuation kit. According to an online survey conducted by the Cabinet Office [19], 45.15% of respondents (10,000 men and women, all of whom were aged 15 and older) said that they always have a portable radio, flashlight, and medical supplies on hand, and 38.2% said that they stockpile food and drinking water. Additionally, in a case study involving expert intervention, Hamanaka and Umemoto [13] conducted a workshop in which participants took part in a game about stockpiling. They reported that 51% of the participants checked their stockpiles of disaster supplies after participating in the workshop, that 39% prepared (stockpiled) disaster supplies they considered to be necessary during the workshop, and that 61% purchased and stockpiled more daily necessities.

As was mentioned in the introduction, a Cabinet Office survey [19] showed that “Lack of time,” “No particular reason,” and “Lack of opportunity” were the primary reasons for individuals not taking disaster preparedness actions. Since individual boxes are contingent on a great deal of collaborative work, this might be motivational for those who would take action if given a chance, prompting them to use the opportunity to do what others are doing. The practice also fostered an atmosphere of “preparing together” in the community. The topics described in Section 3 included the use of shared community evacuation facilities, the process of obtaining the ap-

proval of the board of directors and community residents, the bulk purchase of items by representatives, the storage of those items in the community's storage facility, and the maintenance of those items at events attended by the community residents. While there were some differences among areas, these cooperative efforts would increase momentum for the adoption of individual preparedness.

Compared to previous case studies that focused on individual preparedness, the individual box approach seems more likely to encourage stockpiling among households. This can be interpreted as an example of mobilization, which sometimes causes problems. As Bajek et al. [39] pointed out, one such problem is that when the activities of community-based DRR groups in Japan are based on “mobilized participation,” the participant's motivation is not driven by disaster risk recognition but rather by a sense of obligation to the organizer requesting their participation. By contrast, the practice of individual boxes has aspects of mobilization, but it also leaves room for individuals to engage in trial and error and to take the initiative in tasks, such as stockpiling supplies in the box. For example, in the Hamanomiya community, where boxes were distributed to all households at no cost to the individual, residents were urged not to leave them at home and to take them to the storage facility instead, even if they were empty. According to the community leader, one of the reasons for sending out this notification was that they believed that the goods bought with public funds should not be privatized. However, they also established this policy in the hopes that if there were some “occasion” during which people would go through the trouble of taking boxes to the storage facility anyway, then most would pack at least something into them, thereby resulting in more individuals stockpiling. Thus, the preparation of individual boxes can serve as a mechanism for encouraging proactive activities and individual preparedness, even if participation is initially through mobilization.

#### 4.3. Encouraging rapid evacuation for people requiring support

As noted in section 3.6, individual boxes can also enable rapid evacuation immediately after an earthquake. Moreover, they are especially useful as a tool for facilitating individual preparation among those who need support from others during an evacuation. The Ando community of Otsuchi in Iwate Prefecture, which was severely damaged by the tsunami of the Great East Japan Earthquake, has demonstrated this. In that community, 11 of the 28 firefighters who were involved in tsunami evacuation and rescue efforts after the earthquake died while doing so. According to Oyane [40], firefighters seeking to support elderly people who were living alone and confined to bed had to engage in multiple activities. These included “persuasion” (convincing elderly people to evacuate), “searching and packing” (gathering personal items the person deemed necessary for evacuation), and “transport” (carrying elderly people to higher ground). Based on the lessons that were learned from that disaster and from the time lost performing these tasks, the Ando community established specific rules for supporting those in need of assistance [41]. These rules include limiting the time during which assistance is provided (to within around 15 min after the earthquake), limiting the forms of assistance provided (to only relocating to a safe evacuation site, leading evacuations, calling out to people), and prioritizing those who have registered in advance as being in need of assistance (and those who have engaged in certain self-help activities). In particular, they noted that tasks like “persuasion” and “searching and packing” were beyond the scope of support provided by the firefighters. One role of the individual box, in which necessary items are stored in advance and in a safe place, is to reduce the time loss from assistance activities by ensuring that “searching and packing” activities are limited as a self-help measure.

## 5. Conclusions

Regarding the problem of low-grade self help behavior, we looked at an expanded framework for understanding the problems that arise between the community and tools (the individual box) apart from the simple relationship between subject and object. Specifically, we looked at individuals and their disaster preparedness when participating in the “individual box” initiative in Kochi. We used interviews to assess community participation in the initiative, analyzing it specifically from the perspective of activity theory. We then identified how local community practices facilitated self-help actions: preparing emergency relief kits in households and enabling rapid evacuations. Some significant advantages can be seen in current implementations of individual boxes and the practices associated with them. First, they provide solutions to some issues involved with disaster risk reduction practices, such as the low commitment to self help despite public support that has been noted in previous studies. For example, “blank area where no one takes responsibility” highlights the fact that those involved in disaster risk reduction activities are codependent with no one person in particular taking the lead in implementing measures [42]. In contrast, the individual box initiative has a structure that consists of the public sector, communities, and individuals, all of which complement each other. While the community encourages individuals to prepare emergency relief kits, local officials provide a place for activities (evacuation sites or storage facilities). This is one example of a successful effort to fill a potential vacuum in stockpiling measures by linking the government, the community, and individuals. Second, this practice not only directly impacts peoples' disaster preparedness, but it also functions to facilitate peoples' engagement in broader social systems. The practice, which includes box maintenance, has been integrated into culturally significant events, such as local festivals, mowing, and evacuation drills, encouraging people to regularly see to their individual box's maintenance over a long period of time. This can be seen as a means of reinforcing the importance of disaster preparedness in local cultures, as was mentioned in Beck [21]. Moreover, though it may be a derivative or a potential effect, with regards to maintenance and management, individual boxes can also function to facilitate evacuation training. This method of having residents bring their individual boxes from home to the storage facility during the facility's regular maintenance provides them with opportunities to regularly visit the evacuation site. In the minds of residents, this reinforces the location of the safe place, how far it is from their homes, and whether their own physical strength is sufficient for reaching it, all of which are things that are emphasized when performing evacuation drills.

However, these advantages are not always recognized by participating residents, thereby lessening their impact by way of poor practice. For example, it is up to each household to decide whether individual box contents are sufficient, so that they do not have to return home to retrieve items, and whether the combination of both publicly available and household stockpiles are adequate. Fur-

thermore, in communities where there is little cooperative work, it can be difficult to use the actions of others as a source of motivation. If a community eliminates occasions for community members to gather and check the contents of their individual boxes, then the mechanisms that motivate people to habitually maintain their boxes over long periods of time become degraded. To enhance and preserve the practice of individual boxes, it is necessary to emphasize their advantages to each resident and to innovate on the practices themselves to further improve them.

While the individual box practice described in this paper can be considered to be a special effort in one region, I would like to close with a consideration of the generality of these findings. The first question is whether this initiative is possible only in these communities. In particular, we conducted these case studies only in small communities in which residents tended to know each other with between 36 to 171 households, so similar success is not guaranteed in larger communities. The kind of collaborative tasks seen in the target area when introducing individual boxes may be difficult to achieve in urban areas or in locations where the organization is large, so there may be fewer opportunities to foster an atmosphere of “stockpiling together.” It will therefore be necessary to consider different incentives for participation when introducing this initiative to large areas.

That being said, the local governments and community-based DRR groups that led this effort are not unique to the areas targeted in this study. According to a white paper on disaster reduction by the Fire and Disaster Management Agency of the Ministry of Internal Affairs and Communications in Japan [43], as of 1st April 2020, there were 169,205 community-based DRR groups established in 1688 of the 1741 municipalities throughout Japan, and the coverage ratio (the ratio of the number of households in an area covered by a community-based DRR group to the total number of households) was 84.3%. We can thus assume that the condition of having an organization around which the practice is centered is generally fulfilled. Additionally, evacuation facilities and storage sites are already in place in many areas, so implementation is generally possible. Furthermore, 1018 municipalities provided subsidies for the purchase and operation of equipment and materials in fiscal 2020, and 207 municipalities provided actual equipment and materials, totaling nearly ¥4 billion provided for the activities of community-based DRR groups. Consequently, financial support for storage facility management is also generally available in Japan.

If we consider the individual box as a special case only suitable for implementation in small communities, then the scope of its application would not necessarily need to be wide. However, if the tools, community, rules, and division of labor can be adjusted to the targeted case's characteristics, apart from our specific case, then that case could be an example to be referenced by other communities. The expanded framework presented in this study provides a new alternative that enables a degree of individual practice that cannot be achieved solely through the “awareness-raising” approaches of experts and the government. The essential goal of the individual box initiative is to take a task that has traditionally been seen as the responsibility of an individual and incorporating it into broader social systems. By documenting cases like these in the future, it may become possible for residents to take the lead in self help and mutual aid, rather than doing so at the behest of experts or the government.

## Funding

This work was supported by the Japan Society for the Promotion of Science [grant number 18K13848] and the Advanced Disaster Prevention Engineering Research Center, Nagoya Institute of Technology. The sponsors had no role in study design, in the collection, analysis, or interpretation of data, in the writing of the report, or in the decision to submit the article for publication.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Data availability

The authors do not have permission to share data.

## Acknowledgments

We are indebted to the community-based DRR groups of the Higashikuratani, Shiba, Machi, Hamanomiya, Shirahama, Machibun, and Owada communities, and to the local officials of Kochi City and Kuroshio Town for accepting interviews and inspection. We would also like to thank Prof. Eizo Hideshima for providing advice during this study.

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