

Factors Contributing to Community-Based Disaster Risk Reduction for Foreign Residents in Japan

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Abstract:

This study investigated the disaster risk reduction factors for community-based disaster risk reduction for foreign residents in Japan. Japan is well-known as a disaster-prone country that is especially vulnerable to massive earthquakes. Past experiences have shown that mutual help has been vital in saving lives. Previous research has found that foreign residents' knowledge of disaster risk reduction (DRR) varies depending on their country of origin, disaster experience, and disaster education. However, there have been few studies at the community level on DRR for foreign residents in Japan, even though their numbers have been increasing. Therefore, this study examined the factors affecting DRR aspects and community-based DRR (community-related aspects) of a foreign resident by using a questionnaire. It was found that household members (with child/children, roommate/housemate) positively affected some aspects of DRR, the lack of Japanese language abilities and shorter periods of stay had negative effects, earthquake experience in Japan and before living in Japan did not significantly affect DRR, earthquake education in Japan (only lectures) and before living in Japan (earthquake workshops) positively affected some aspects, and compulsory earthquake education in Japan negatively affected DRR community cooperation. The only factors that positively affected DRR community linkage were foreign residents with child/children, who had elementary and advanced Japanese language abilities and had attended earthquake workshops before living in Japan. These findings imply that earthquake education in Japan has not been effective in improving community-based DRR; thus, earthquake education for foreign residents needs to be reviewed and improved in order to encourage mutual aid.

Keywords: *earthquake experience, earthquake education, community-based disaster risk reduction, foreign residents, Japan*

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Received on 2022/1/21, accepted after peer reviews on 2022/10/19.

1. Past Earthquakes and the Foreign Resident Situation in Japan

Japan is in a disaster-prone area and has been frequently subjected to multiple disaster events, such as typhoons, tsunamis, and earthquakes (Cabinet Office of Japan, 2021). In particular, over 20 percent of earthquakes occurring in Japan are of a magnitude 6 or higher (JICA, 2018). Over the 30 years from 1989 to 2018, there have been many severe earthquakes and tsunamis, such as the Hokkaido Nansei-Oki Earthquake in 1993, the Great Hanshin-Awaji Earthquake in 1995, the Great East Japan Earthquake in 2011, and the 2016 Kumamoto Earthquake (Japan Meteorological Agency, 2019). The impacts of earthquakes are also more deadly than in other disasters; for example, the Asian Disaster Reduction Center (ADRC) reported that in the 2018 heatwave, 77 people died and more than 33,000 people were taken to hospital (ADRC, 2018a), The Cyclone Nargis in Myanmar in 2008 killed around 138,366 (Asian Development Bank [ADB], 2019), and the Super Typhoon Haiyan that hit Philippines in 2013 killed approximately 6,300 (Singer, 2014) whereas, the 2004 Indian Ocean Earthquake and Tsunami caused over 200,000 deaths (ADB, 2019) and in the Great East Japan Earthquake in 2011, there were 19,630 deaths, 6,230 injuries, and 2,569 missing persons, with 73,349 people still living as evacuees in 2018 (ADRC, 2018b). In addition, earthquakes are frequent disasters in Japan and happen approximately 1,500 times annually (The University of Tokyo, n.d.). Considering earthquake impacts and their frequency, it is better to be well-prepared for an earthquake in Japan. Past major earthquakes, however, have provided valuable disaster risk reduction (DRR) information. For example, it was found that during the 1995 Great Hanshin-Awaji Earthquake, neighbors helped each other the most (Shaw, 2016). Because disaster damage can make it difficult for rescue teams to reach victims, advanced community preparedness and readiness are crucial (Matsuda and Okada, 2006). During the 2011 Great East Japan Earthquake, public help (public assistance from administrative bodies) was limited, emphasizing the importance of self-help (protecting oneself, being able to take appropriate action or decisions on one's own) and mutual help (helping and protecting one another in their regional communities) in DRR education (Cabinet Office of Japan, 2015a).

The number of foreign residents had been growing during the five years before the COVID-19 pandemic in 2020 and is expected to increase in the future (Okada, 2018; Jiji, 2019). As of 2019, there were 2.8 million foreign residents in Japan, which was approximately 2.25% of Japan's total population, of which 790,000 were permanent residents (Itabashi, 2020). The Japanese government estimated that there would be 300,000 foreign students by 2020, but by 2019 there were over 310,000 (Nippon news, 2020). Most foreign students have little background knowledge about DRR (Leleito et al., 2015), and foreign residents are less prepared and aware of disasters than local Japanese, the majority of whom have participated in disaster drills and training (Nippon News, 2019).

Green et al. (2021) found that disaster preparedness in different ethnic groups was possibly affected by their previous disaster experience and that the important household disaster preparedness factors impacting foreign residents in Japan were their nationality and disaster training experiences. Gómez (2013) found that disaster training, drills, and study had assisted international students during the Great East Japan Earthquake in 2011. Even though the Japanese government has organized many disaster-related activities for foreign residents, most of such activities focused on the language barrier. Green et al. (2021) found that compared to disaster-related training, Japanese language ability was an inferior disaster preparedness factor because understanding Japanese only gave foreign residents an understanding of the disaster risks but did not motivate them to be well-prepared. Moreover, the previous study assumed that DRR knowledge could be affected by disaster education such as training

or workshops (Tuladhar et al., 2015). Another study also claimed that disaster education and disaster experience could impact disaster preparedness behavior (Hoffmann and Muttarak, 2017). Therefore, because of the increase in foreign residents in Japan, it is necessary to develop disaster learning activities that are focused on the role of cooperative mutual help with the local residents rather than on the language or the foreign resident community. To ensure effective disaster education and to improve foreign residents' disaster preparedness, it is necessary to understand foreign residents' community-based DRR (CBDRR) awareness and the specific factors associated with their self-preparedness.

Therefore, the research objective of this study was to determine the specific factors that contributed to the DRR of foreign residents in Japan, for which two hypotheses were developed: (1) the earthquake experience factor positively contributes to foreign resident DRR; and (2) the earthquake education factor positively contributes to foreign resident DRR.

2. Community-based DRR for Foreign Residents

(1) Importance of DRR

As DRR can decrease future losses, the United Nations Office for Disaster Risk Reduction implemented the Sendai Framework for Disaster Risk Reduction 2015-2030, which outlined seven main DRR goals to reduce loss and damage. It also adopted an all-society approach in the guiding principles and the priorities for action and especially prioritized the need to understand disaster risk, build knowledge, and promote DRR at all levels. As a result, foreign residents must be included in host country policies (Guadango, L., Fuhrer, M., and Twigg, J., 2017). The framework also proposed solutions to DRR knowledge and problems, as well as DRR education, environmental, and disaster risk challenges. As foreign residents have different disaster knowledge depending on their country of origin, it is necessary to determine the extent of their DRR knowledge so that DRR for foreigners can be prioritized in future DRR policies.

(2) Community-Based DRR in Japan

The first disaster responders are generally people in the community (Shaw, 2016), and it has been found that mutual community help decreases the risk of fatalities and injuries (Toyoda, 2017), as was found after the Great Hanshin-Awaji Earthquake, with 80 percent of all survivors being saved by neighbors (Kawata, 1997). These findings highlighted that families and communities needed to be prepared to mitigate earthquake losses. In addition, disaster damage can make it extremely difficult for rescue team services to reach victims; therefore, the preparedness and readiness of the community are crucial (Matsuda and Okada, 2006). In 2011, when the Great East Japan Earthquake hit, it was found that public help was restricted. Consequently, self-help and mutual help were included in disaster resilience education (Cabinet Office, 2015b).

There are several reasons why CBDRR and foreign residents in Japan needed to be taken into account. DRR education can enable communities to become resilient (Shaw, 2016; Habiba, Shaw, and Abedin, 2013). CBDRR prioritizes vulnerable groups in the community, such as the elderly, children, and women. Other studies have identified foreign residents as a vulnerable group for a variety of reasons, including social status, financial status, lack of knowledge of the local environment, disaster experience, language barriers, cultural differences, laws, social networks, restricted mobility, discrimination, and a lack of trust in the host country (Leleito et al., 2015; Guadagno and Twigg, 2017), which means that the local Japanese need to be able to assist their foreign neighbors. However,

because Japanese people are somewhat reserved they are not always confident in talking with foreigners (Nippon News, 2019). For example, Eiraku (2019) found that only 17 percent of Japanese greeted their foreign neighbors and only 7 percent had participated in community activities with foreign residents. Osumi (2019) found that foreigners in Japan did not have any common knowledge about what to do during earthquakes.

The White Paper on Disaster Management 2020 that was issued by the Cabinet Office (2020) stated that community-based disaster planning in Japan emphasized a community-based approach called “Citizen-led initiatives”. These community-based disaster plans are intended to be a tool for the local residents to make their communities safer and enhance their self-help and mutual help abilities. The National Council for Promoting DRR (NCPDRR) also promotes community preparedness, self-help, and mutual help.

As a result, for effective CBDRR, community vulnerabilities must be reduced, which means that both foreigners and Japanese in a community must receive education and/or training to deal with potential earthquakes and work together to make the community resilient.

(3) Disaster Information and Education in Japan

Several programs have been introduced focused on the needs of foreign residents. For example, the Japanese government is encouraging the use of simplified Japanese to provide foreign residents with information during emergencies (Osumi, 2019), and several websites provide information in foreign languages, such as the Tokyo Intercultural Portal Site (TIPS) that has prepared animated earthquake preparation videos in multiple languages (TIPS, n.d.). Some prefectural organizations also offer disaster drills or lectures aimed specifically at the foreign resident population. For example, the Tokyo Metropolitan Government holds disaster drills for foreigners (Takahashi, 2019), and Kyoto conducts easy-to-understand classes and provides illustrated disaster resilience cards for foreign residents (Cabinet Office of Japan, 2015a). DRR education is also being provided for international university students, such as the Nagoya University and Tohoku University joint 3-month course. It was found that field trips motivated student interest in disaster preparedness but that lectures were sometimes too difficult and dull (Leleito et al., 2015). Co-creation disaster education workshops, in which international students collaborated with local residents to develop tourist disaster management plans, were found to provide students with hands-on experience with CBDRR management (Leleito and Kawabata, 2018).

However, while some disaster information and education are provided for foreign residents and students, translations and simplified Japanese are not enough to help during emergencies (Osumi, 2019). Further, as most disaster education has been generally only conducted among foreign residents and student groups, there has been little mutual help practice, which is very important for effective CBDRR, between foreign residents and local people. Therefore, foreigners and locals must be provided with the skills and knowledge to work together in times of emergency.

(4) Community-Based DRR for Foreign Residents in Japan

Even though the importance of mutual community help has been acknowledged by the Japanese government, the government tends to focus on the language barrier problems. Foreign residents, on the other hand, have been found to have a low awareness of evacuation sites and procedures, limited knowledge of disasters, low participation in disaster activities, and low experience with disasters (Adu-Gyamfi and Shaw, 2021). Therefore, they need to learn to cooperate with the local residents in

their communities (Parzniewski and Phillimore, 2017).

This does not mean that cooperative community activity with foreign residents and local Japanese is nonexistent. For example, Nagoya's multicultural coexistence plan II (Nagoya City, n.d.) included six plans for foreign citizen community participation and included cooperative projects with the local community, the local government, and the foreign residents. The annual Disaster Preparedness Awareness Projects for Foreigners, for example, include both locals and foreign residents, and the Networking with Community and Organizations, Knowledge of Designated Evacuation Centers in Times of Disaster also includes both foreign residents and local participants; however, while these projects are more likely to be language-focused, they are a good indication that foreign residents are being considered in CBDRR plans. Although there were attempts to incorporate foreign residents and Japanese locals in disaster learning activities together, existing research that studied foreign residents in Japan tended to focus on disaster knowledge and awareness and rarely extended to investigate their knowledge or awareness at a community level. For instance, the previous study by Xin, Sugiki, and Matsuo (2017) investigated foreign employees' disaster awareness to prepare better disaster management for them, yet the study did not include community aspects. Like another previous study by Wang, Iwata, and Hatakeyama (2020), before developing a disaster learning tool for foreign residents, they conducted a survey concerning only disaster preparedness and awareness. Another study, conducted by Shah and Murao (2013), focused solely on the evacuation behavior of foreigners in Fukushima. Although the study surveyed foreign residents' desire to participate in community activities, such activities were offered after the earthquake incident, which most likely did not reflect foreign residents' community ties. Other studies sought out multiple factors such as foreign residents' demographics, disaster experience, and training experience impact on the emergency plan and household preparedness (Green et al., 2021). Another study investigated international students' reaction to the Great East Japan Earthquake, and the author also suggested that a deeper relationship with Japanese society will be a future challenge (Gomez, 2013). Previous studies, as stated above, did not investigate any community-related aspects among foreign residents in Japan. So, this study investigated foreign residents residing in Japan and their DRR, which included community-related aspects, as the results could help develop community-based disaster learning activities between foreign residents and local people in the future, as mutual help is important. In addition, if foreign residents' lives are adversely affected by disasters, this could give a negative image of the host communities; therefore, to develop more resilient communities, increasing foreign residents' skills, experiences, capacities, and community engagement could lead to improved CBDRR (Guadagno, Fuhrer and Twigg, 2017).

(5) Summary

The Sendai framework emphasizes the need to implement DRR at all levels. However, in Japan, CBDRR policies and activities are mostly implemented with local residents, despite the fact that foreign residents have been identified as vulnerable. While some attempts have been made to implement activities for foreign residents or students, these have frequently been language-based and isolated from the local community. Therefore, regular cooperative earthquake activities that involve both foreign residents and local people are required to ensure that mutual help is available in times of crisis. Previous studies on foreign residents in Japan have been limited to disaster preparedness and awareness; therefore, before developing these CBDRR earthquake awareness activities, it is necessary to examine the current state of DRR and CBDRR for foreign residents and identify the factors that

contribute to better CBDRR knowledge.

3. Methods

This section outlines the study sampling process, research instrument, and data analysis procedures.

(1) Study Design and Study Participants

The questionnaire respondents were 400 foreign residents of Japan recruited through an online platform provided by GMO Research, a survey company, from October 8-15, 2021. Foreign respondents held permanent residence (PR) visas, working visas, family residence visas, student visas, and other types of visas. The maximum respondent age was 72 years old and the minimum was 15 years old, with the average being 39.81 years old. The company distributed the questionnaire to the foreign residents based on the visa type holder at a 95 percent confidence interval. The number of respondents was based on the actual number of visa holders as of the end of 2020, according to data from the Portal Site of Official Statistics of Japan, with 110 holding PR visas, 110 holding working visas, 100 holding residence family visas, 40 holding student visas, and 40 holding other visa types. 51.2 percent of respondents were male, and females were 48.8 percent. The questionnaire was distributed to 19,498 foreign residents. However, the response rate was 19 percent or 3,722 answers. Some of them tried to respond to the questionnaire, but the aforementioned capacity was already reached. The percentage of participation in the platform by visa types was 12.3 percent for working visas, 4.8 percent for student visas, 23.3 percent for PR visas, 3.9 percent for permanent residence families, and 3.6 percent for others.

(2) Measurements

For this research a questionnaire was designed for foreign residents residing in Japan to clarify the current situation and identify the factors that could contribute to better DRR and CBDRR as a preliminary to designing cooperative foreign residents and local people's earthquake activities. The questionnaire was based on several DRR studies conducted both within and outside of Japan that targeted either local or foreign residents (Tuladhar et al., 2015; Niwa and Burgess, 2018; Matsuda and Okada, 2006; Xin, Sugiki, and Matsuo, 2017).

As shown in Table 1, there were three parts to the questionnaire. Part one gathered sociodemographic characteristics, such as age, visa status, accommodation type, household members, Japanese language ability, and period of stay in Japan. Part two had a checklist of questions on earthquake experiences and earthquake education both in Japan and before living in Japan. Part 3 included 50 questions on nine DRR aspects centered on earthquake insights and safety measures that had been identified in previous studies or taken from Japanese community-related questionnaires that asked locals to identify important DRR elements and the challenges a foreign resident might face during an earthquake. The insights into earthquakes section required respondents to answer using Likert-type rating-scale questions from 1 = strongly disagree to 5 = Strongly agree. For the safety measure questions, the respondents had to choose between Yes or No. Table 1 shows the questionnaire structure.

Table 1. Summary of Questionnaire Structure

Part 1. Sociodemographic characteristics	Demographic details
Part 2. Earthquake experience and education	Check-list questions on earthquake experience and education in Japan and before started living in Japan
Part 3. Disaster risk reduction	Part 3.1 Likert scale questions (1 to 5) on insights into earthquakes; Disaster-related knowledge (3 questions) Disaster awareness (7 questions) Disaster risk perception (4 questions) Disaster information (6 questions) Community linkage (7 questions) Community awareness (8 questions)
	Part 3. 2 Yes/No questions on safety measures Disaster preparedness and readiness (7 questions) Disaster evacuation (6 questions) Community cooperation (2 questions)

(3) Data Analysis

To examine the demography, earthquake experiences, and education in Japan and before living in Japan affecting DRR, a multiple regression analysis was conducted. Furthermore, multiple regression analysis was used to examine statistically significant education to significant DRR aspects in order to determine which types of education affect DRR. Before the analysis, descriptive statistics were shown next.

4. Results and Discussions

1) Sociodemographic Characteristics

Table 2 shows the sociodemographic characteristics of 400 respondents. Overall, 38.5 percent of respondents lived in condominiums, followed by 28.2 percent living in detached houses and 22.5 percent in rental apartments. Next, respondents were asked to answer about household members in multiple-choice questions. Approximately 38.3 percent of respondents lived with their spouses, whereas 24.8 percent lived alone, 23.0 percent lived with child/children, and only 3.9 percent lived with a roommate or housemate. Their Japanese language proficiency was relatively high, with 52.5 percent of the respondents holding a proficient level and 16.5 percent holding an advanced level of the Japanese language. However, 12.8 percent held intermediate, 7.5 percent elementary, and 7.0 percent, beginner levels, and only 5.5 percent had no Japanese language skills. In terms of the residence period of the respondents, 52.0 percent had lived in Japan for more than 10 years, whereas 19.8 percent had lived in Japan for 1-5 years and 16.5 percent for 6-10 years. Moreover, 8.0 percent of the respondents had lived in Japan for 6-11 months and 3.8 percent for less than 6 months.

Table 2. Sociodemographic Characteristics Descriptive Statistics

	Frequency	Percent
Sex		
Male	205	51.2
Female	195	48.8
Visa		
Working	110	27.5
Student	40	10.0
Permanent	110	27.5
Permanent residence family	100	25.0
Others	40	10.0
Accommodation		
Detached house	113	28.2
Rental apartment	90	22.5
Condominium	154	38.5
Dormitory	20	5.0
Others	23	5.8
Language proficiency		
No Japanese	22	5.5
Beginner	28	7.0
Elementary	30	7.5
Intermediate	51	12.8
Advanced	59	14.8
Proficient	210	52.5
Period of stay in Japan		
Less than 6 months	15	3.8
6-11 months	32	8.0
1-5 years	79	19.8
6-10 years	66	16.5
More than 10 years	208	52.0
Household member (Multiple responses)		
Alone	126	24.8
Spouse	195	38.3
Child/Children	117	23.0
Parent(s)	35	6.9
Room/Housemate	20	3.9
Others	16	3.1

2) Earthquake Experience and Education

Table 3 gives information on the respondents' earthquake experience and education in Japan and before they started living in Japan in the mean score and standard deviation (S.D.). The descriptive results indicated that 0.86 (S.D. = 0.35) respondents had experienced earthquakes in Japan and 0.80 (S.D. = 0.40) before living in Japan. The S.D. was slightly different. The score of those who had experienced earthquakes before living in Japan varied from the mean score less than those who had experienced earthquakes in Japan, while the average for earthquake education was 0.59 (S.D. = 0.49) in Japan, and 0.52 (S.D. = 0.50) before living in Japan. The earthquake education in Japan differed compared to the earthquake education before living in Japan with almost the same S.D.

3) Disaster Risk Reduction

Table 3 shows the descriptive results for DRR aspects, which respondents rated from 1 to 5 on a Likert scale for knowledge, awareness, perception, information, community linkage, and community awareness and answered Yes/No for the safety measures, preparedness, and readiness, evacuation, and community cooperation.

The results showed that respondents' highest understanding of disaster-related knowledge was 3.75 (S.D. = 0.94), followed by a high disaster awareness at 3.37 (S.D. = 0.81). However, the lowest was community linkage at only 2.93 (S.D. = 0.90) which means they had quite low community engagement. Mutual help during disasters has been highlighted by the Japanese government as it can help victims when public help is restricted. As a result of this low community linkage, related governments or organizations must improve this aspect for foreign residents in government campaigns and policies.

The safety measure results showed that respondents' disaster evacuation knowledge was 0.52 (S.D. = 0.35), which indicated that a majority knew where they needed to go if they had to evacuate after an earthquake. The level of earthquake preparation was also high at 0.41 (S.D. = 0.31). However, community cooperation was again the lowest at 0.32 (S.D. = 0.42), which indicated that the respondents did not know where or how to participate in community-organized earthquake learning activities.

Table 3. Earthquake Experience, Education, and DRR Descriptive Statistics

	n	Mean	S.D.
Earthquake Experience in Japan	400	0.86	0.35
Earthquake Education in Japan	400	0.59	0.49
Earthquake Experience before Japan	400	0.80	0.40
Earthquake Education before Japan	400	0.52	0.50
DRR-Knowledge	400	3.75	0.94
DRR-Awareness	400	3.37	0.81
DRR-Perception	400	3.17	0.83
DRR-Information	400	3.20	0.77
DRR-Community linkage	400	2.93	0.90
DRR-Community awareness	400	3.00	0.82
DRR-Preparedness	400	0.41	0.31
DRR-Evacuation	400	0.52	0.35
DRR-Community cooperation	400	0.32	0.42

(1) Factors Affecting Disaster Risk Reduction among Foreign Residents in Japan

The objective of this study was to identify the factors that contribute to DRR in foreign residents in Japan. Although the hypotheses were focused on DRR earthquake experiences and education, it was still important to examine the sociodemographic characteristics of respondents to determine how background had an impact on DRR. Table 4 shows the regression analysis of the sociodemographic characteristics, earthquake experiences, and education for the DRR aspects.

1) Sociodemographic Characteristics

Gender was found to only affect the DRR knowledge aspect, that is, the male respondents tended to disagree with common earthquake knowledge and general earthquake knowledge in Japan. Accommodation types were also found to affect some aspects which were evacuation and community cooperation. According to a prior study (Green et al., 2021) housing indirectly represented social status and likely DRR knowledge, and persons who lived in detached houses, were homeowners, and earned more were more protective of their properties. Therefore, compared to those who lived in detached houses, those who lived in rental apartments, condominiums, and dormitories tended to have less involvement in community cooperation and lacked knowledge about how to participate in community earthquake-related activities.

In Japan, there are community associations, the members of which work together to organize festivals, waste clean-ups, and disaster drills. According to Herbez et al. (2013), those who had lived in the community for a long time and had substantial savings were the ones who were most likely to join these groups. This may be one of the reasons why those who lived in detached houses had higher community participation; after all, they were more financially stable and had been residing in one place for a longer period. This result might also indicate that because the people who lived in apartment complexes and student dormitories were involved in their tenant activities, they knew little about the community activities.

DRR was also found to be affected by household members. Disaster awareness, risk perceptions, information, community linkage, community awareness, and evacuation knowledge were found to be positive for respondents who had child/children, possibly because having children means greater responsibilities and inevitable connections with other parents and schools. Living with roommates or housemates was also found to have a positive impact on perceptions of disaster risk, information, community connections, and community awareness. This may be because they felt more connected to the community than people who lived alone, who had more work and home duties that left them with no free time to interact with the community (Herbez et al., 2013).

Only the people with working visas were found to disagree with disaster-related knowledge compared to those with permanent residence (PR) visas, which may have been because the granting of PR requires people to have lived in Japan for longer than those with a working visa. Japanese language proficiency had a significant effect on DRR. No Japanese language ability negatively affected disaster knowledge, risk perception, information, community linkage, community awareness, preparedness, and evacuation when compared to a proficient level, which indicated that language ability was required to learn about local disasters, that is, the language barrier did not allow people to gain access to disaster information or participate in any community activities. However, compared to those who were proficient, individuals with an elementary to advanced level of Japanese had more ties to their community. Since basic to advanced language abilities are sufficient for daily communication, there may be other variables influencing their community connections, such as personal traits or the capacity to more readily integrate into a new community.

Those who had been in Japan for less than 6 months had lower levels of disaster awareness, information, and community awareness than those who had been residing in Japan for more than 10 years. This was related to the adaptability to the new culture, as it requires some time to get to know a new host country.

2) Earthquake Experience

The first hypothesis was that earthquake experience was a contributing factor to DRR in foreign residents; however, it was found that having an experience of earthquakes in Japan or before living in Japan was not significantly related to any DRR aspects.

Previous studies have also had mixed results regarding earthquake experience. A previous study on Japanese locals on the indirect earthquake experience impacts on earthquake preparedness found that those who had indirectly experienced earthquakes had higher household preparation than those who had not (Matsuda and Okada, 2006). However, the earthquake experience was not found to increase community linkages among local Japanese (Matsuda and Okada, 2006). Similar to research on locals in Turkey, it has been found that earthquake experience can occasionally improve earthquake preparation; nevertheless, there were still some people who had experienced severe earthquakes but had not increased their awareness or preparedness (Oral et al., 2015). This may have been related to differences in their psychology and post-experience education (Oral et al., 2015). It has been found that people who had experienced disasters and suffered from Post-Traumatic Stress Disorder were more likely to withdraw from regular social activities (American Psychological Association [APA], 2013) and deny that they had faced a major earthquake under the illusion that it would not happen again (Oral et al., 2015).

Another reason may be that the victims of disasters may not have received any education about earthquake preparation immediately after the event (Oral et al., 2015; Matsuda and Okada, 2006). When victims learn about disasters shortly after the event while they are still emotionally engaged with such a disaster, it has been observed that the earthquake experience may be a useful element in enhancing disaster awareness and protective actions (Yeon et al., 2020). This can be applied to foreign residents who might have experienced an earthquake long before coming to Japan who would either get educated or might never get educated at all.

Having experience of an earthquake in Japan was found to have no statistically significant effect. Previous studies have found that earthquake experience can be effective when earthquake victims are educated shortly after the experience. However, the government of Japan or organizations serving foreign residents are likely to concentrate on language barriers or may simply concentrate on pre-earthquake protective action and preparation. Therefore, it is crucial to give foreign residents earthquake education as soon as possible following an event if they want to benefit from their earthquake experiences.

In conclusion, it is possible that the earthquake experiences of the foreign residents did not affect their DRR because they did not receive adequate psychological support or proper post-experience education after the disaster events, which indicated that extra lessons and support for foreign residents after an earthquake experience are needed. However, further study is needed to understand the specific details of such experiences, such as the intensity of the earthquakes, the damage, and the emotional responses, as previous studies have claimed these could be effective factors (Moon et al., 2020; Yeon et al., 2020).

3) Earthquake Education

The second hypothesis was that earthquake education was the factor that contributed to DRR in foreign residents in Japan. As stated in Table 4, the findings showed that earthquake education in Japan and before living in Japan was significant to DRR, with earthquake education in Japan being found to positively affect disaster preparedness and readiness and community cooperation. However,

earthquake education before living in Japan was only found to positively affect community linkage. Therefore, education can contribute to foreign residents' DRR knowledge, regardless of where they obtained such knowledge.

As earthquake education was found to be a factor contributing to the DRR among foreign residents, it was necessary to clarify which education affected DRR. The regression analysis for each type of seismic education is shown in Table 5 for the major factors in Table 4.

The analysis found that only earthquake lectures positively affected preparedness and readiness. This was probably because lectures teach how and what to prepare in advance. Green et al. (2021) also found that earthquake training could raise the level of disaster preparedness among foreign residents. However, neither Green et al. (2021) nor this study asked respondents to provide information about the lectures or training; therefore, it is possible that the content overlapped. The importance of earthquake education in Japan to DRR community cooperation was then evaluated, and it was discovered that compulsory earthquake education in Japan had a negative impact on community cooperation. The

Table 4. Factors Affecting DRR

	Knowledge Beta	Awareness Beta	Perception Beta	Information Beta	C-Linkage Beta	C-Awareness Beta	Preparedness Beta	Evacuation Beta	C-Cooperation Beta
Age	0.05	0.05	-0.06	-0.05	-0.02	0.04	-0.01	0.05	-0.04
Male	-0.14*	-0.08	0.01	-0.08	-0.02	-0.09	0.01	-0.07	-0.01
Accommodation (Ref: Detached house)									
Rental apartment	0.05	0.02	-0.06	0.01	-0.06	-0.02	-0.05	0.03	-0.13*
Condominium	0.04	0.09	0.05	0.05	-0.03	0.00	0.00	-0.01	-0.17*
Dormitory	-0.03	-0.04	-0.09	-0.02	-0.02	-0.06	-0.09	-0.11*	-0.14*
Other accommodations	0.03	0.04	-0.01	0.08	0.03	0.04	-0.06	0.00	0.01
Household member									
Alone	0.16	0.07	0.19	0.18	0.17	0.18	-0.13	0.04	-0.08
Spouse	0.07	0.01	0.14	0.10	0.13	0.04	-0.06	-0.05	-0.03
Child/Children	0.09	0.13*	0.12*	0.15*	0.18*	0.18*	0.07	0.23*	0.08
Parents	0.05	-0.01	0.09	0.10	0.05	0.02	-0.07	0.02	-0.05
Room/House mate	0.10	0.08	0.18*	0.20*	0.18*	0.18*	-0.05	0.07	-0.01
Others	-0.08	-0.12	-0.09	-0.13*	-0.12	-0.16*	-0.12	-0.04	-0.12
Visa (Ref: Permanent)									
Working Visa	-0.16*	-0.13	-0.04	-0.06	0.10	0.00	0.02	-0.08	0.08
Student Visa	-0.10	-0.09	-0.06	-0.09	0.02	-0.02	0.08	-0.05	0.02
Residence family visa	-0.08	-0.01	0.06	0.02	0.08	0.08	0.07	-0.03	-0.01
Other visas	-0.09	-0.11*	-0.10	-0.11*	-0.03	-0.05	-0.06	-0.13*	-0.05
Language Proficiency (Ref: Proficient)									
No Japanese	-0.36*	-0.30	-0.19*	-0.24*	-0.15*	-0.27*	-0.14*	-0.20*	-0.09
Beginner	-0.06	-0.02	0.05	-0.01	0.07	0.00	-0.08	-0.08	-0.05
Elementary	0.01	-0.02	0.04	0.06	0.13*	0.08	0.03	0.02	0.01
Intermediate	-0.04	-0.08	-0.02	-0.02	0.04	0.00	-0.01	0.03	0.01
Advanced	0.02	0.06	0.01	0.03	0.11*	0.07	0.04	-0.09	-0.03
Period of stay (Ref: > 10 years)									
Less than 6 months	-0.10	-0.12*	-0.08	-0.12*	-0.10	-0.11*	0.06	-0.01	0.06
Six to eleven months	0.01	-0.01	0.07	0.06	-0.01	-0.02	0.06	0.05	0.05
One to five years	0.08	0.10	0.15*	0.17*	-0.01	0.04	0.10	0.12	0.06
Six to ten years	0.06	0.01	0.08	0.06	-0.07	-0.01	0.08	0.06	-0.01
In Japan									
Experience	0.05	0.02	0.09	0.03	0.06	0.08	-0.03	0.07	0.05
Education	0.03	0.03	0.09	-0.02	0.05	0.04	0.20*	0.11	0.17*
Before living in Japan									
Experience	-0.05	-0.01	-0.06	-0.01	-0.03	-0.02	0.03	0.01	-0.02
Education	-0.04	0.07	0.04	0.10	0.18*	0.04	0.12	0.03	0.08
Adjusted R ²	0.22	0.19	0.17	0.21	0.18	0.21	0.15	0.13	0.09
n	400	400	400	400	400	400	400	400	400

* $p \leq 0.05$,

Beta = Standardized coefficients,

C = Community

respondents who had attended a compulsory earthquake course may have been international students living in a dormitory or a school environment. In addition, the compulsory course in Japan perhaps only offered disaster prevention and disaster training (Fujioka and Sakakibara, 2018), that is, it did not include the importance of community linkages or how and where to engage in community-organized earthquake activities.

A positive effect with community linkage was only found in respondents who had attended earthquake workshops before living in Japan, which may be due to the fact that these workshops encouraged participant interaction and group discussion, which may have included the significance of community assistance during earthquakes.

Earthquake education is the factor contributing to DRR among foreign residents in Japan. However, only two types of education could positively affect DRR, whereas one even had a negative effect. As mutual help is important in rescuing lives, the results indicated that earthquake education that included community-related DRR was needed for foreign residents, as only those who had attended earthquake workshops before living in Japan were found to have a positive effect on community linkage.

Table 5. Earthquake Education Affecting DRR

	C-Linkage Beta	Preparedness Beta	C-Cooperation Beta
Accommodation (Ref: Detached house)			
Rental apartment			-0.13*
Condominium			-0.17*
Dormitory			-0.11*
Household member			
Child	0.18*		
Room/House mate	0.12*		
Language Proficiency (Ref: Proficient)			
No Japanese	-0.22*	-0.15*	
Elementary	0.11*		
Advanced	0.10*		
Education In Japan			
1. Attended earthquake lecture classes		0.17*	0.1
2. Participated in earthquake workshop		0.08	0.04
3. Participated in earthquake training		-0.01	0.02
4. Participated in earthquake evacuation drills		0.01	-0.08
5. Participated in site visit, field study		0.08	0.03
6. Shared experiences with firsthand earthquake victim		-0.03	-0.05
7. Received compulsory earthquake education		-0.04	-0.11*
8. Participated in an earthquake relief program as a volunteer		0.04	0.04
9. Never participated in such activities		-0.25*	-0.30*
10. Others		-0.20*	-0.22*
Education Before Living in Japan			
1. Attended earthquake lecture classes	0.00		
2. Participated in earthquake workshop	0.11*		
3. Participated in earthquake training	-0.01		
4. Participated in earthquake evacuation drills	-0.09		
5. Participated in site visit, field study	-0.05		
6. Shared experiences with firsthand earthquake victim	0.02		
7. Received compulsory earthquake education	-0.09		
8. Participated in an earthquake relief program as a volunteer	-0.02		
9. Never participated in such activities	-0.29*		
10. Others	-0.12		
Adjusted R^2	0.18	0.19	0.12
n	400	400	400

* $p \leq 0.05$,

Beta = Standardized coefficients,

C = Community

(2) Implications

This study sought to identify the factors that contributed to DRR in foreign residents in Japan. It was found that earthquake experiences in Japan or before coming to Japan were not a DRR contributing factor. This can be explained by the conditions of foreign residents that are probably different from local people.

To use past earthquake experiences effectively, post-earthquake education should be provided when people are still emotional about the incident. Therefore, as the earthquake experiences of the respondents did not contribute to any DRR aspects, it could be surmised that they had not received adequate or timely education.

Earthquake education before living in Japan and after living in Japan were both statistically significant, with attendance at earthquake workshops before coming to Japan being found to be a significant factor affecting community linkage; however, compulsory earthquake courses in Japan were found to have a negative relationship with community cooperation, suggesting that compulsory earthquake courses should review the content and methods to increase community linkage perceptions positively. While attendance at lectures in Japan was found to positively affect DRR preparedness and readiness, it was not enough to engender community linkages and resilience.

Overall, gender, accommodations, language abilities, visa types, period of stay, and household members were found to both positively and negatively affect DRR. However, as these are characteristics that cannot be easily manipulated, the best way to effectively increase DRR would be earthquake education. Although the previous study showed language ability to be a less significant factor affecting disaster preparedness (Green et al., 2021), this study discovered that having no knowledge of Japanese negatively affects many different areas of DRR. However, it is necessary to overcome the language barrier. Therefore, it is better to continue providing activities that are related to language barrier problems, but it is necessary to ensure that such activities will help increase other aspects of DRR, especially community-related aspects

Therefore, the Japanese government should consider providing post-earthquake-related lectures for foreign residents to increase their DRR preparedness; however, these lectures must include the importance of DRR community activities. Additionally, it is critical to enhance existing language programs for non-native Japanese speakers so that they can receive information about local disasters and engage with their communities.

5. Conclusions

This study sought to identify the factors affecting DRR in foreign residents in Japan. The results showed that earthquake experiences before living in Japan and in Japan were not statistically significant to DRR aspects. Therefore hypothesis (1) (the earthquake experience factor positively contributes to foreign resident DRR) was not supported. On the other hand, it was discovered that earthquake education before living in Japan and in Japan was statistically significant to several components of DRR. Earthquake education before moving to Japan was proven to have a favorable impact on community linkage. To be specific, the earthquake workshop held prior to moving to Japan was successful in fostering community linkage. While earthquake education in Japan was found to both positively and negatively affect some DRR aspects. The earthquake lecture positively affected DRR preparedness and readiness. In contrast, the compulsory earthquake course was found to negatively affect community cooperation. Therefore, hypothesis (2) (the earthquake education factor

positively contributes to foreign resident DRR) was partially supported. Characteristics of respondents were also found to affect DRR aspects. It was found that Japanese language ability was very important to obtain information and participate in the local community as zero Japanese language ability negatively affected multiple aspects of DRR compared to foreign residents who were proficient in Japanese. The amount of time spent in Japan also had an impact on DRR, with those who had been in Japan for less than six months having lower DRR than those who had been in Japan for more than 10 years. Respondents with a child or children, and those who lived with a roommate or housemate, were found to have greater DRR. Overall, it was concluded that to ensure foreign residents understand the importance of self-help and community mutual assistance, any earthquake education for foreign residents in Japan needs to include these elements.

Acknowledgments

This research has been supported by JSPS KAKENHI Grant Number 21K04614, JSPS KAKENHI Grant Number 20KK0302, Individual Research Allowance from Ritsumeikan University, the Support for Research Facilities from the Promotion and Mutual Aid Corporation for Private School of Japan, and the Research Grant by Policy Science Association of Ritsumeikan University.

References

- ADB. 2019. Recent Significant Disasters in the Asian and Pacific Region. Retrieved July 13, 2022, from <https://www.adb.org/news/infographics/recent-significant-disasters-asia-and-pacific-region>
- ADRC. 2018a. Japan Heat Wave 2018/07/09. Retrieved October 30, 2020, from https://www.adrc.asia/view_disaster_en.php?NationCode=&Lang=en&Key=2277
- ADRC. 2018b. Japan Earthquake, Tsunami 2011/03/11. Retrieved October 30, 2020, from https://www.adrc.asia/view_disaster_en.php?NationCode=&Lang=en&Key=1497
- Adu-Gyamfi, B., and Shaw, R. 2021. Utilizing Population Distribution Patterns for Disaster Vulnerability Assessment: Case of Foreign Residents in the Tokyo Metropolitan Area of Japan. *International Journal of Environmental Research and Public Health*, 18(8). <https://doi.org/10.3390/ijerph18084061>
- APA. 2013. Recovering Emotionally from Disaster. Retrieved December 24, 2021, from <https://www.apa.org/topics/disasters-response/recovering>
- Cabinet Office, Government of Japan. 2015a. Implementation Handbook for Disaster Resilience Education at the Regional Level. Tokyo: Cabinet Office, Government of Japan.
- . 2015b. White Paper on Disaster Management in Japan. Tokyo: Cabinet Office, Government of Japan.
- . 2020. White Paper on Disaster Management in Japan. Tokyo: Cabinet Office, Government of Japan.
- . 2021. Disaster Management in Japan. Tokyo: Director General for Disaster Management Cabinet Office, Government of Japan.
- Eiraku M. 2019. The Changing Views of Foreigners in Japan. Retrieved November 20, 2020, from NHK World Japan, <https://www3.nhk.or.jp/nhkworld/en/news/backstories/336/>
- Fujioka, T., and Sakakibara, Y. 2018. School Education for Disaster Risk Reduction in Japan After The 2011 Great East Japan Earthquake and Tsunami (GEJET). *Terrae Didactica*, 14(3), 313-319. <https://doi.org/10.20396/td.v14i3.8653531>
- Gómez, O. A. 2013. Lessons from International Students' Reaction to the 2011 Great East Japan Earthquake: The Case of the School of Engineering at Tohoku University. *International Journal of Disaster Risk Science*, 4(3), 137-149. <https://doi.org/10.1007/s13753-013-0015-9>
- Green, D., Linley, M., Whitney, J., and Sano, Y. 2021. Factors Affecting Household Disaster Preparedness among Foreign Residents in Japan. *Social Science Japan Journal*, 24(1), 185-208. <https://doi.org/10.1093/ssjj/jyaa026>
- Guadagno L., Fuhrer, M., and Twigg, J. 2017. Introduction: A Case for Migrant-Inclusive Disaster Risk Reduction.

- Migrants in Disaster Risk Reduction Practices for Inclusion*. 9-12.
- Habiba U., Shaw, R., and Abedin, M.A. 2013. Community-Based Disaster Risk Reduction Approaches in Bangladesh. In: Shaw, R., Mallick, F., and Islam, A. (eds) *Disaster Risk Reduction Approaches in Bangladesh. Disaster Risk Reduction (Methods, Approaches and Practices)*. Springer, Tokyo. https://doi.org/10.1007/978-4-431-54252-0_12
- Herbez, P., Asami, Y., and Lee, S. 2013. Community Participation in Tokyo and Its Suburbs: The Importance of Savings and Interaction Effects. 123, 1-11.
- Hoffmann, R., and Muttarak, R. 2017. Learn from the Past, Prepare for the Future: Impacts of Education and Experience on Disaster Preparedness in the Philippines and Thailand. *World Development* 96, 32-51.
- Itabashi. H. 2020. Foreign Population in Japan Reaches Record 2.93 million at the End of December. Retrieved November 8, 2021, from The Asahi Shimbun, <https://www.asahi.com/ajw/articles/13256541>
- Japan Meteorological Agency. 2019. *Earthquakes and Tsunamis Observation and Disaster Mitigation*. Tokyo: Japan Meteorological Agency.
- JICA. 2018. Disaster Risk Reduction Building a Foundation for Our Future. *JICA's World*, 10(1), 1-16.
- Jiji. 2019. Japan's Population Continues to Slide even as Foreign Resident Numbers Increase. Retrieved January 8, 2020, from The Japan Times, <https://www.japantimes.co.jp/news/2019/07/10/national/japanese-population-falls-10th-straight-year/#.XippgshLhPa>
- Kawata, K., 1997. Estimate of Human Casualties by Great Earthquake Disaster. *Journal of Natural Disaster Science*, 16(1), 8. (In Japanese)
- Leleito, E., Shimasaki, K., Watanabe, R., and Kawabata, H. 2015. Disaster Risk Reduction Education for International Students through Inter-University Collaboration. *Nagoya University International Education and Exchange Center*, 2, 37-47.
- Leleito, E., and Kawabata, H. 2018. *Value Co-Creation in Disaster Education for International Students*. 24-27.
- Matsuda, Y., and Okada, N. 2006. Relativity Analysis Between Indirect Disaster Experience and Household Earthquake Preparedness. *Infrastructure Planning Review*, 23(49), 243-252. <https://doi.org/10.2208/journalip.23.243>
- Moon, J. W., Hwang, H., and Chung, J. B. 2020. Factors Affecting Awareness of Preparedness After Moderate Earthquakes: An Analysis of the Pohang Earthquake in Korea. *Disaster Prevention and Management: Disaster Prevention and Management*, 29(3), 405-420. <https://doi.org/10.1108/DPM-07-2019-0209>
- Nagoya City. n.d. Nagoya Multicultural Coexistence Promotion Plan II. Retrieved October 28, 2021, from <https://www.city.nagoya.jp/en/page/0000092673.html>
- Nippon News. 2019. Disaster Message Not Getting Through to Foreign Residents. Retrieved November 6, 2020, from <https://www.nippon.com/en/news/fnn20190930001/disaster-message-not-getting-through-to-foreign-residents.html>
- Nippon News. 2020. Foreign Students in Japan Increase to Record High. Retrieved July 15, 2022, from <https://www.nippon.com/en/news/yjj2020042201089/>
- Niwa, Y., Burgess, A., Ito, K. 2018. Questionnaire Study on the Relationship Between Disaster Awareness and the Recognition of Evacuation Points. *Urban and Regional Planning View*, Volume 5, 43-66.
- Okada, Y. 2018. Japan's Foreign Population Hitting a Record High the Government Announces the Acceptance of More Foreign Workers. Tokyo: Mizuho Research Institute Ltd.
- Oral, M., Yenel, A., Oral, E., and Aydin, N., Aydin, N. 2015. Earthquake Experience and Preparedness in Turkey. *Disaster Prevention and Management*, 24(1), 21-37. <https://doi.org/10.1108/DPM-01-2013-0008>
- Osumi, M. 2019. Japan's Emergency Advisories are too Complex and Hard to Understand, even for Fluent Japanese Speakers, Experts Say. Retrieved December 27, 2020, from The Japan Times <https://www.japantimes.co.jp/news/2019/08/30/national/japans-emergency-advisories-complex-hard-understand-even-fluent-japanese-speakers-experts-say/>
- Parzniewski, S., and Phillimore, J. 2017. Multilingual Disaster Support Volunteer Training in Japan: Participant Observation of Methods and Practice in Toyama Prefecture. *Migrants in Disaster Risk Reduction Practices for Inclusion*. 36-40.
- Shah, M. F., and Murao, O. 2013. Foreigners' Evacuation Behavior in the Great East Japan Earthquake: A Case of Iwaki City in Fukushima Prefecture. *Journal of Disaster Research* 8, 802-813.
- Shaw, R. 2016. *Community-Based Disaster Risk Reduction*. Oxford University Press. USA

- Singer, M. 2014. 2013 State of the Climate: Record-breaking Super Typhoon Haiyan. Retrieved July 14, 2022, from <https://www.climate.gov/news-features/understanding-climate/2013-state-climate-record-breaking-super-typhoon-haiyan>
- Takahashi, R. 2019. Tokyo's Foreign Residents Prepare for Worst at Multilingual Disaster Drill. Retrieved December 27, 2020, from The Japan Times <https://www.japantimes.co.jp/news/2019/01/16/national/tokyos-foreign-residents-prepare-worst-multilingual-disaster-drill>
- The University of Tokyo. n.d. Life in Japan. Website for International Students. Retrieved July 5, 2022. from <https://www.u-tokyo.ac.jp/adm/inbound/en/life-safety-dp.html>
- TIPS. n.d. Information to Help When Disaster Prevention and Disaster: for Foreign Residents. <https://tabunka.tokyo-tsunagari.or.jp/english/information/howto.html>
- Toyoda, Y. 2017. Gaming Simulations as the Medium for Disaster Education in Schools and Community-based Disaster Risk Reduction. *Internet Journal of Society for Social Management Systems*, 11(2), 80-89.
- Tuladhar, G., Yatabe, R., Dahal, R. K., and Bhandary, N. P. 2015. Disaster Risk Reduction Knowledge of Local People in Nepal. *Geoenvironmental Disasters*, 2(1). <https://doi.org/10.1186/s40677-014-0011-4>
- Wang, S., Iwata, J., and Hatakeyama, H. 2020. A Survey on the Disaster Preparedness Status of Foreign Residents in Japan. *Proceeding of the 28th International Conference on Computers in Education. Asia-Pacific Society for Computers in Education*, 246-253.
- Xin, T. Y., Sugiki, N., and Matsuo, K. 2017. The Disaster Prevention Awareness of Foreign Residents and Disaster Management of Organizations for Foreign Employees. *AIP Conference Proceedings*, 1892. <https://doi.org/10.1063/1.5005740>
- Yeon, D. H., Chung, J. B., and Im, D. H. 2020. The Effects of Earthquake Experience on Disaster Education for Children and Teens. *International Journal of Environmental Research and Public Health*, 17(15), 1-14. <https://doi.org/10.3390/ijerph17155347>