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Factors influencing disaster response behavior of international tourists under the Tokyo Metropolitan Earthquake scenario

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As Japan continues to become a popular global tourism destination, its vulnerability to disasters cannot be overlooked. Although the Japanese government has implemented different disaster prevention policies and practices, there is a lack of investigation into disaster response behaviors, such as information seeking, evacuation, and the factors affecting these. This study clarified the factors influencing the disaster response behavior of international tourists in the context of the anticipated Tokyo Metropolitan Earthquake scenario. A questionnaire survey was conducted, and the logistic regression model was used to understand the causative factors. The results revealed that the variable knowledge on disaster response behavior in earthquakes influences individuals' evacuation decisions, especially when people choose to follow others. These findings will be beneficial for tourism stakeholders and policymakers to establish effective tourism crisis management planning, including information provision, shelter allocation, and collaborative initiatives.

KEYWORDS

tourism crisis management, evacuation behavior, disaster prevention consciousness, Tokyo Metropolitan Earthquake, information seeking, disaster response behavior

1. Introduction

Japan's tourism industry is positioned as one of the pillars of development of the Japanese economy. In 2018, the number of international tourists visiting Japan exceeded 30 million [Japan National Tourism Organizations (JNTO), 2019]. Although this number decreased in recent years due to the novel coronavirus pandemic, it is expected to recover as the impact of the pandemic subsides. Japan's tourism industry is unique due to its high attractiveness compounded by its high disaster vulnerability. Due to this high disaster vulnerability and numerous past disasters, Japan has continuously implemented advanced disaster prevention-related hard and soft measures. From the perspective of ensuring the safety of international tourists in the event of a disaster, preparing disaster prevention plans targeting international tourists is an important issue and topic of discussion.

The Tourism Nation Promotion Basic Plan, formulated in 2017, proposed strengthening actions and measures for the risks to the tourism industry presented by disasters (Cabinet Office, 2012). Oshida et al. (2018) investigated the regional disaster prevention plans of all 47 prefectures in the country and the availability of disaster prevention manuals for international tourists in order to summarize the status of regional disaster prevention plans. The study found that out of 47 prefectures, all have disaster prevention manuals for the residents, 30 prefectures described items related to international residents, and only 11 prefectures described items related to international tourists. As of October 2017, plans for Japan's tourism crisis management have been created in six prefectures, namely, Hokkaido, Akita, Mie, Hyogo, Kochi, and Okinawa. The Okinawa prefecture has the most advanced disaster preparedness for international tourists. Based on Japan's disaster prevention basic plan, each designated administrative agency, public institution, and local public organization has prepared a disaster prevention work plan and regional disaster prevention plan, but the items related to ensuring the safety of international tourists visiting Japan have not yet been given sufficient attention by all the prefectures. Therefore, it is evident that there is not enough discussion and preparedness on dealing with international tourists visiting Japan in the event of a disaster.

The disaster response activities in the aftermath of the 2011 Great East Japan Earthquake, 2018 Hokkaido Eastern Iburi Earthquake, 2016 Kumamoto Earthquake, and 2019 Northern Osaka Earthquake were criticized due to the lack of information provision in multiple languages. Past natural disasters that occurred in Japan were characterized by problems in disseminating disaster prevention information and response (Leelawat et al., 2017). This urged the need for the provision of appropriate evacuation guidance to international tourists. Moreover, the level of disaster awareness and preparedness of international tourists is largely unknown. During the aforementioned past disasters, the panicked behavior of international tourists visiting Japan was witnessed in the immediate aftermath of the earthquakes. To make matters worse, the evacuation of international tourists visiting Japan was delayed, which could be attributed to several reasons. Overall, it is clear that the evacuation behavior of international tourists may differ from that of the Japanese people (Tanaka et al., 2018).

Although various efforts are being carried out by the government and relevant tourism agencies to ensure the safety and security of international tourists visiting Japan, there is not enough discussion on dealing with international tourists in the event of a disaster. Furthermore, very few studies have explored disaster response behaviors such as evacuation, information seeking, and model construction to understand the behavior of international tourists visiting Japan in the event of a disaster. Against this background, we ask the following research question:

> What are the factors influencing the information-gathering and evacuation behavior of international tourists visiting Japan?

To answer this question, we took several steps in this study. First, we reviewed past studies on the disaster response behavior of international tourists, crisis management measures for international tourists visiting Japan, and Japan's responses targeted toward international tourists during past earthquakes and the issues they faced. Second, we conducted a questionnaire survey to understand the past earthquake experience, disaster prevention and response education and training, knowledge about earthquakes, and disaster response behavior of international tourists using the scenario of the Tokyo Metropolitan Earthquake. Finally, we ran a logistic regression model to analyze the factors influencing the disaster response behavior of international tourists visiting Japan in the event of an earthquake.

This study is structured as follows. Section 1 explains the background and purpose of the research. Section 2 summarizes past studies on the disaster response behavior of international tourists, crisis management measures for international tourists in Japan, and the theoretical model adopted in the study. We also introduce the disaster response behavior of international tourists during past earthquakes in Japan and the evacuation guidance given to international tourists visiting the country. Section 3 presents the study methodology, including the questionnaire survey design, data collection methods, and an overview of the logistics regression. Section 4 outlines the factors that influence disaster response behavior among Japanese tourists and international tourists visiting Japan by using a logistics regression analysis of the Tokyo Metropolitan Earthquake scenario. In Section 5, we present the findings of our analysis in the previous section, while Section 6 summarizes the results of the analysis, provides conclusions, and considers the direction of future research.

2. Literature review

In this section, we summarize past studies on the disaster response behavior of international tourists, the crisis management measures that are implemented for them, and the measures taken and issues they have faced during past earthquakes in Japan. Moreover, we outline the theoretical framework and clarify the position of this research.

Factors that influence individual behavioral decisions include personal attributes such as information, experience, knowledge, gender, and age. According to Friedman (1953), individual behavior affects rational choices among the options one can take to maximize their utility. However, the theory of these action decisions often does not apply to events such as disasters characterized by high uncertainty, imminent danger, and lack of time to judge actions. Mawson (2005) states that human behavior during emergencies and disasters can be analyzed by mass panic, which is called collective behavior in emergencies. Kuligowski and Mileti (2009) also showed that individuals' behavior during crisis situations is the result of a decision-making process in which the risk awareness felt by individuals such situations plays an important role.

2.1. Theoretical background and research positioning

This study adopts the disaster prevention consciousness model of Ozeki et al. (2017) as in Figure 1, which is constructed based on extensions of the protection motivation theory (Rogers, 1983), disaster prevention action model (Paton, 2003), and on interview

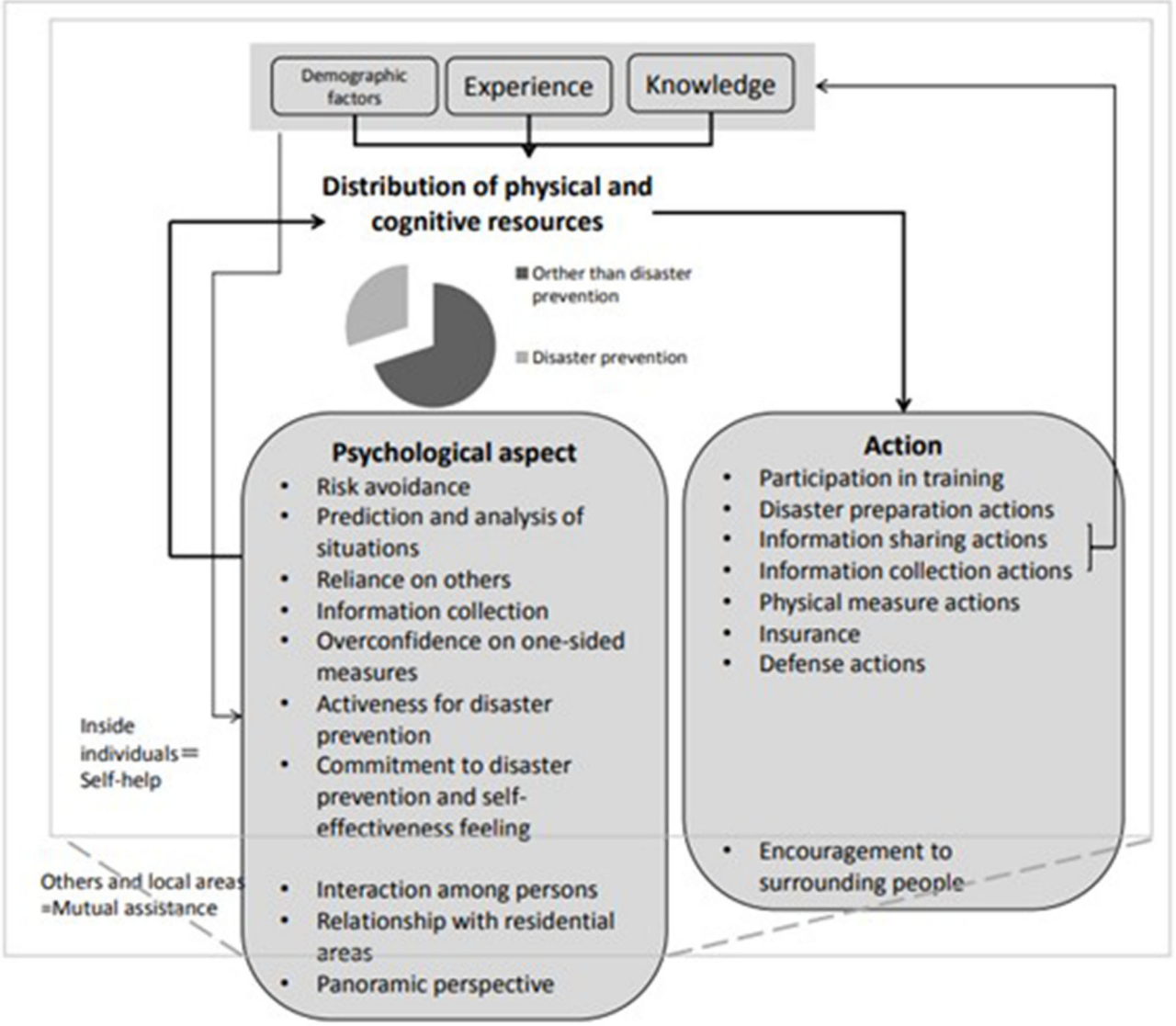

FIGURE 1
A theoretical model of disaster prevention consciousness and actions (Ozeki et al., 2017; Shimazaki and Ozeki, 2022). Spelling errors from original source.

results. Although there are several models on factors affecting disaster prevention behavior (Rogers, 1983; Paton, 2003; Lindell and Perry, 2012; Fujimoto et al., 2019), these models focus on disaster preparedness and evacuation behavior as forms of physical self-protection immediately before and after disasters (Shimazaki and Ozeki, 2022). In Japan, active mutual assistance is considered during disasters to protect not only oneself but also one's neighbors, communications, and culture. This attitude is incorporated as an expression of disaster prevention consciousness in this model in relation to individual and collective response actions (Shimazaki and Ozeki, 2022). The model separates knowledge, experience, and demographic factors from the disaster prevention consciousness, which is a psychological process that decides the distribution of physical and psychological resources to suitably select disaster response actions. Disaster response actions are diverse, and they include collecting information, confirming the safety of family members and relatives, preparatory actions for evacuations, and evacuation movement (Makinoshima et al., 2020). To the best of the authors' knowledge, no study has explored the relationship between disaster prevention consciousness and disaster response actions, such as information collection and evacuation actions. Therefore, this study attempts to fill this gap by conducting a regression analysis along with a survey.

Based on the disaster prevention consciousness model (Ozeki et al., 2017; Shimazaki and Ozeki, 2022), we designed the questionnaire survey on past disaster experience, disaster prevention consciousness, disaster prevention education and training, knowledge about earthquakes and disaster response behaviors during earthquakes, and information-seeking and evacuation behavior using the Tokyo Metropolitan Earthquake scenario (Cabinet Office, 2022a). The survey was conducted to analyze the factors influencing the evacuation behavior

of international tourists visiting Japan in the context of the earthquake scenario.

2.2. Past research on disaster response behavior of international tourists

Through the analysis of the evacuation behavior of international tourists in the event of a hurricane in Florida, Cahyanto et al. (2014) found that individual characteristics, travel-related variables, and the socio-demographic characteristics of tourists influence their decision on whether to evacuate. Phillips and Morrow (2007) found that in the event of a hurricane, the main reasons for delays in the evacuation of international tourists was their inability to speak or read the local language and lack of knowledge regarding the disaster risks of hurricanes. These studies reveal that international tourists have problems receiving information about disaster risks, interpreting this information, and taking evacuation action.

Cahyanto et al. (2016) stated that information gathering is one of the factors that influence the evacuation behavior of international tourists in hurricanes and classified it into two types: active and passive. Griffin et al. (1999) advised informants to provide individuals with the information they need rather than just what they find useful to those with specialized knowledge. The study also recommended creating a decision-making process that involves all at-risk parties in the event of a disaster.

Table 1 summarizes the studies on the evacuation behavior of international residents and tourists in the event of a disaster in Japan. We included research on international residents since they are taken as proxy for international tourists in certain cases. From Table 1, we observe that there are very few past studies investigating the evacuation behavior of international tourists in the event of a disaster, with studies often only targeting international residents and international students (Henry et al., 2012; Gómez, 2013; Shah and Murao, 2013; Henry and Kawasaki, 2014; Leelawat et al., 2017; Kawasaki et al., 2018). Arce et al. (2017) analyzed the risk awareness and evacuation behavior of international tourists in the event of a tsunami in Kamakura city and found that no specific disaster emergency strategies were aimed at tourists. Furthermore, the study also found that it was difficult for tourists to view warning signs and evacuation guidance signs, highlighting the need for better and more effective risk communication strategies aimed at international tourists. Generally, studies have analyzed information-gathering and evacuation behaviors separately, with only a few considering information-gathering behavior as a part of evacuation behavior. Furthermore, the verification of evacuation behavior using a model has not progressed much.

2.3. Responses and challenges of international tourists in past earthquakes in Japan

The following is a summary of the issues faced by international tourists during past earthquakes in Japan. According to a hearing survey conducted in 2012 on the provision of information to international tourists who visited Japan during the Great East Japan Earthquake, we found that the safety of tourists was confirmed only 2–3 days following the earthquake. With regard to the provision of information, until 1 week after the earthquake, information on rolling blackouts was only dispensed in Japanese, while multilingual support was not available. According to an email interview survey (Japan Tourism Agency, 2012) conducted through guest house, hotel, and travel agency networks to understand the kind of information that international tourists sought, it was found that they mainly asked about "what is happening now" (95.0%), "what should I do" (86.3%), and "how much aftermath will occur in the future" (83.8%).

After the 2016 Kumamoto Earthquake, an emergency shelter was set up at the Kumamoto City International Center to provide information and disaster support to international tourists staying in Kumamoto at that time. As of 16 April 2016, at 1:00 pm, around 50–53 people were evacuated to the Kumamoto City International Center. According to the survey conducted by the Survey Research Center (2016) for international tourists, 36.5% of the respondents stated that they could not understand the behavior because there was no evacuation manual for tourists, and 26.1% stated that they did not know what to do because of the language barrier. It also highlighted the need for evacuation guidance in multiple languages, information centers that provide traffic and airplane information, evacuation signs in multiple languages, English information on TV, and pamphlets on actions to evacuate. Based on the lessons learned from the Kumamoto earthquake, Kamei and Ishii (2017) proposed that efforts should be made to provide detailed information that is desired by international tourists in future efforts.

In the aftermath of the 2018 Hokkaido Iburi Earthquake, 310 evacuation centers were opened, which accommodated 10,297 evacuees, including international tourists. The Council of Local Authorities for International Relations (2019) summarized the support activities for foreigners, of which 60% were international tourists. It was recommended to set a rule that shelters must accept both Japanese and international tourists during disasters. It was confirmed that international tourists were using social network services such as Facebook and Twitter in their first language. As one of the future disaster response measures, it is necessary to build a cooperative system with accommodation facilities, secure places to accept tourists, and establish a system to disseminate information to international tourists in multiple languages.

Most of the previous studies on the disaster response behavior of international tourists have been conducted in the context of hurricanes in the United States. The rich results and findings of studies on Japan, which has experienced earthquakes and tsunamis, are not well-shared internationally due to the language barrier (Makinoshima et al., 2020). Thus, there are only a limited number of studies investigating the disaster response behavior of international tourists visiting Japan. Although some studies have analyzed the information-gathering and evacuation behavior of international residents during past disasters, these have rarely analyzed information-gathering behavior as part of evacuation behavior, while focusing mainly on international tourists. Furthermore, very few studies have clarified the factors that influence the disaster response behavior of international tourists in Japan. Therefore, the present study

TABLE 1 Research on disaster response behavior of international residents and international tourists during crises in Japan.

References	Purpose	Methodology	Research target
Henry et al. (2012)	To investigate the evacuation decision process of international residents and its relationship with disaster information-seeking behavior in the Great East Japan Earthquake	Survey Descriptive statistics	International residents Great East Japan Earthquake
Gómez (2013)	To clarify the responses of international students during the Great East Japan Earthquake	Survey Descriptive statistics	International students (Tohoku University) Great East Japan Earthquake
Shah and Murao (2013)	To analyze the impact of information-seeking behavior of international residents on evacuation in the Great East Japan Earthquake	Survey Descriptive statistics	International residents Great East Japan Earthquake
Arce et al. (2017)	To clarify the evacuation intention, risk perception, and risk communication of international tourists visiting Kamakura city	Interview Survey Descriptive statistics	International tourists Kamakura city
Henry and Kawasaki (2014)	To summarize the inbound tourism trends in Japan and identify problems that require reflection in disaster reduction and tourism	Literature review	International tourists
Kawasaki et al. (2014)	To investigate domestic and international evacuation behavior of international students in the Great East Japan Earthquake	Survey Statistical testing Logistic regression analysis	International students (Tokyo University) Great East Japan Earthquake
Leelawat et al. (2017)	To analyze how stakeholders functioned in evacuation guidance and understand how ICT was applied to support evacuation	Interview Case study	International residents (Thai) Kumamoto Earthquake
Kawasaki et al. (2018)	To understand information-seeking behavior and needs focusing on the language capability of Japanese and international residents	Survey Descriptive statistics	International residents Great East Japan Earthquake

aims to clarify the relationship between the disaster prevention consciousness, experience, knowledge, and disaster response behavior of international tourists during earthquakes in Japan.

3. Methodology

3.1. Questionnaire survey

We conducted a pre-survey to design the survey items and a main survey in which the survey items were modified based on the results of the pre-survey. The pre-survey targeted Korean tourists— who account for a high proportion of Japanese tourists—and international tourists visiting Japan, with 235 samples of Japanese tourists and 254 Korean tourists who have visited Tokyo. A total of 489 samples were collected. The subjects of the pre-survey were men and women aged 20 and older. The Korean tourists selected were those who had visited Japan at least once within the past 5 years, and Japanese tourists were those traveling in Japan for sightseeing purposes. The survey items included basic demographic attributes such as gender and age, disaster prevention consciousness regarding natural disasters, disaster prevention education, earthquake experience, knowledge about earthquakes and disaster response behavior in earthquakes, information sources to be used during each earthquake scenario, and disaster response behavior. The information sources to be used and disaster response behavior for each earthquake scenario were answered with free descriptions.

Based on the pre-survey answers and results, the survey items for the main survey were revised. We conducted an internet-based survey for international and Japanese tourists who visited Tokyo. It was conducted with support from the Economic and Social Research Institute of the Cabinet Office, Government of Japan. The targeted tourists were from China, Korea, Thailand, Indonesia, and the United Kingdom. We collected 300 samples per country from 2 September 2019 to 10 September 2019. These countries were selected considering they represent the main inbound and potential inbound tourists to Japan. The respondents were asked about their demographic information, disaster prevention consciousness, disaster response education and past experiences with earthquakes, knowledge and perception of earthquakes, and disaster response behavior in the context of the Tokyo Metropolitan Earthquake scenarios. The survey questions and choices were translated and distributed in the respondents' native languages through the survey company.

The study collected 300 samples for each country, evenly distributed according to age and gender, in order to prevent any such biases in data collection. Each survey item was translated into the language of each respondent so that international tourists could answer comfortably. In this study, since international tourists are being considered, the data collected from Japanese tourists are not listed in Table 2, which provides the outline of this survey.

3.1.1. Disaster prevention consciousness

In this survey, information on respondents' disaster prevention consciousness was sought in order to analyze the factors that would affect their information-gathering and evacuation behavior in the event of an earthquake. This study adopted the disaster prevention consciousness devised

TABLE 2 Survey content.

Survey respondents	International tourists who have visited Tokyo
Target countries	China, Korea, Thailand, Indonesia, United Kingdom
Method	Internet-based web survey
Survey items	Demographics (gender, age, number of visits to Tokyo, Japanese level) Earthquake experience Disaster prevention consciousness Disaster prevention drills and education Knowledge of earthquakes Knowledge of disaster response behavior in earthquakes Disaster response behavior under Tokyo Metropolitan Earthquake scenarios
Samples	300 per country (Total: 1,500)
Survey duration	From 2 September 2019 to 10 September 2019

by Ozeki et al. (2017). Shimazaki and Ozeki (2022) define disaster prevention consciousness as the psychological activities behind the disaster response decision and prevention behavior while recognizing the situation and surrounding problems during disasters.

The elements of the disaster prevention consciousness scale are based on interview surveys by multiple experts. It is composed of five elements: imagination of damage situation; sense of crisis in respect to current measures against disaster; other-directedness; anxiety; and indifference to disaster prevention. These factors were evaluated through the 20 question items listed in Table 3. Each question item was answered on a scale from 1 (indicating not at all applicable) to 6 (very applicable). The total score was estimated as a sum of scores to all question items. The disaster prevention consciousness scales of Ozeki et al. (2017) are aimed at Japanese people, and there are no cases of application to people from other countries. This study is one of the first attempts to apply it to international tourists.

3.1.2. Knowledge of earthquakes and disaster response behavior in earthquakes

In this study, respondents provided information on both their knowledge of earthquakes and knowledge of response behaviors in the event of earthquakes. Questions about their knowledge of earthquakes were constructed based on the basic knowledge of disasters in the disaster prevention information webpage (Cabinet Office, 2023) and the knowledge and commentary on disasters (Japan Meteorological Agency, 2023). The question items included six questions about earthquakes on a scale of six. Thus, the questions about knowledge of disaster response behavior during earthquakes were referred from the homepage of Prime Minister's Office of Japan entitled "How should I act in the event of an earthquake? (Prime Minister's Office of Japan, 2023)." The nine questions were designed to ask about knowledge of disaster response behavior on a scale of six.

3.1.3. Disaster response actions under Tokyo Metropolitan Earthquake scenarios

Japan estimates a 70% chance that an earthquake of class 7 magnitude will occur in the Tokyo metropolitan area within the next 30 years and that more than 100,000 casualties will occur due to the earthquake and consequent fires. The respondents were asked to watch a short video clip of the Tokyo Metropolitan Earthquake simulation (Cabinet Office, 2022b) as in Figure 2. The available choices were designed after revising the pre-survey.

After watching the video, the respondents were meant to assume they were visiting Tokyo and that the earthquake would occur at their location as seen in the previous video. The earthquake magnitude was assumed as an M7.3 in the southern part of the city with a seismic intensity of 10 MMI, following the disaster scenario set by the Cabinet Office, Japan (Cabinet Office, 2022b). Assuming this disaster situation, the respondents were asked about the first five disaster response actions they would perform immediately after the occurrence. There were four different scenarios to consider depending on the current location—touristic spots or on public transportation—and the availability of internet and telephone services. Since international tourists in Japan use public transportation as the main mode of transport, this setting was also considered in the scenario. Each participant responded to all four disaster scenarios in the survey. Even though we asked respondents for their first five disaster response actions, we only considered the first action selected because this was the most likely action that international tourists would take in the event of a disaster. The respondents' first response action is directly related to securing their safety during the immediate disaster response phase.

3.2. Logistic regression model

Disaster response behaviors were categorized as information-seeking and evacuation behavior. Information-seeking behavior includes information gathering through non-face-to-face and face-to-face means. We also categorized evacuation behaviors as self-moving and following guidance. In four different disaster scenarios, depending on the assumed current location and availability of internet and telephone services, it was confirmed that the disaster response behavior of Japanese tourists and international tourists visiting Japan are different, as seen in Figure 3. In all four cases, international tourists visiting Japan selected following guidance as their first disaster behavior. However, the Japanese tourists tended to select information seeking as the first action, especially when internet and telephone services are available.

The targets in the model focused on international tourists to Japan. The dependent variable is the behavior selected under different disaster scenarios. Based on the above results, following guidance as the first disaster response behavior was considered as the dependent variable in the study. The dependent variable was quantified as 1 when the respondent selected following guidance as the first disaster response and 0 if they selected another behavior. The significance levels used for the regression analysis was set at 1 and 5%. The data were analyzed using SPSS Statistics 26.0.

The explanatory variables used for the logistic regression analysis included demographics such as whether or not they

TABLE 3 Detailed questions regarding disaster prevention consciousness (source: Shimazaki and Ozeki, 2022).

	Items
Imagination of damage situation	• I have a concrete image of how people behave at the time of occurrence of a disaster • I have a concrete image of the necessary materials at the time of occurrence of a disaster • I have a concrete image of how I should respond at the time of occurrence of a disaster • I have a concrete image of how the town would go at the time of occurrence of a disaster
Sense of crisis in respect to current measures against disaster	• It is not strange that disasters would occur tomorrow • If disaster should occur once, I think it would be in serious trouble I think it would be difficult to mitigate the damage of disaster only through the efforts of individuals • I think disaster prevention should not be completed within one's own region but in coordination with other regions
Other-directedness	• I like to communicate with others • I like places where people gather • I want to have various friends • I want to do something for others
Indifference to disaster prevention	• I do not want to do anything that does not benefit me • Usually, I do not think about a disaster • I only think about what would likely happen around me • I think physical measures such as earthquake strengthening and improvement of seawalls would be enough to manage earthquakes
Anxiety	• I often feel anxiety • I think I am a worrywart • Once I think about a disaster, I imagine various patterns of damage • I always care about the danger around me

FIGURE 2
Tokyo Metropolitan Earthquake simulation (Obtained from: Cabinet Office, 2022b).

are repeaters, Japanese level, earthquake experience, disaster prevention drills and education, knowledge of earthquakes, knowledge of disaster response behavior in earthquakes, and disaster prevention consciousness as in Table 4. In setting the explanatory variables, the repeaters were considered as those who had visited Tokyo more than once. The Japanese level at intermediate and above was considered as 1 and the others as 0. For disaster prevention drills and education, the number of times respondents received disaster prevention drills and education were used as a numerical value. Earthquake experience was set as 1 if they had experienced earthquakes in the past and as 0 if they had no prior experience. Knowledge of earthquakes was scored based on the average of each question item and knowledge of disaster response behavior in earthquakes. The disaster prevention consciousness was estimated based on the methodology mentioned in the previous section.

Before performing a logistic regression analysis, Pearson's correlation analysis was used to confirm the correlation coefficient between the explanatory variables. This simple approach to observe multicollinearity was employed to calculate the correlation (Thakur et al., 2022). Table 5 summarizes the results of the internal correlation of the explanatory variables. There was no value >0.7, and a set of selected explanatory variables was used in the logistic regression analysis (Hirano et al., 2014).

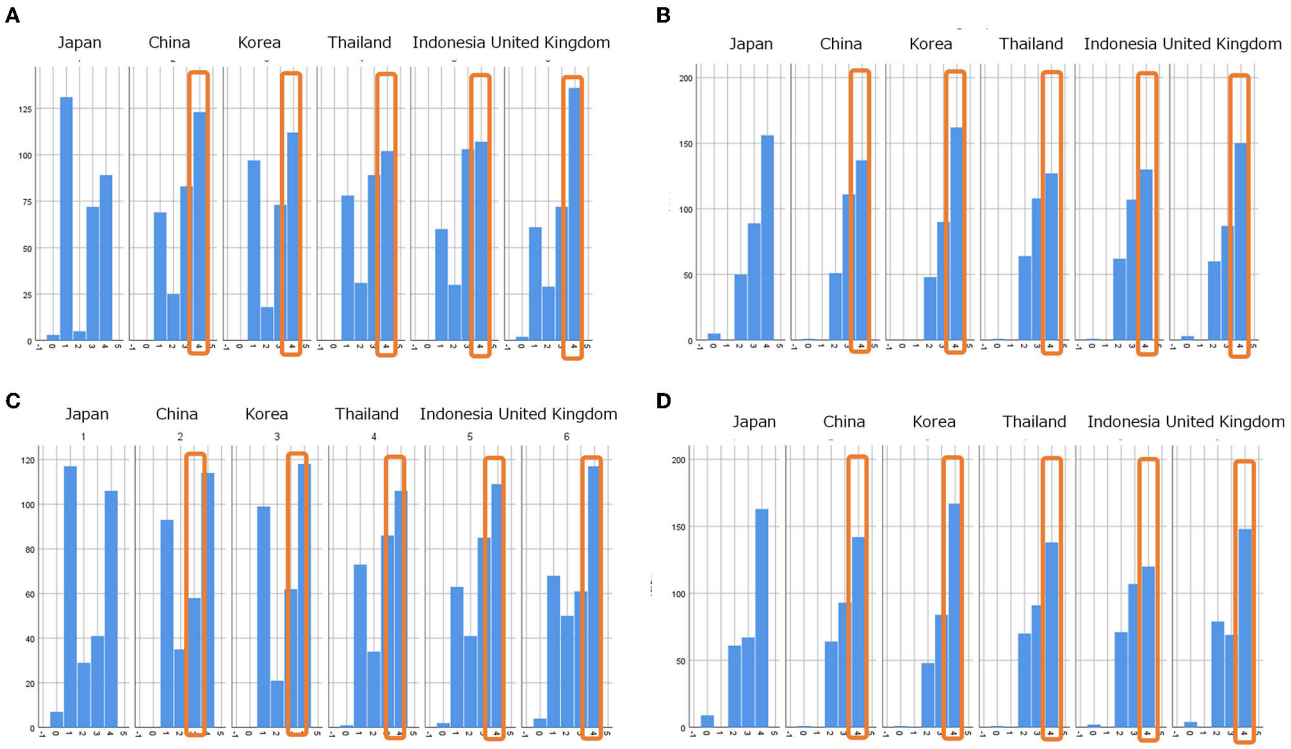

FIGURE 3
Disaster response behavior of Japanese and international tourists under different scenarios. **(A)** "At touristic spots" and "Internet and telephone available." **(B)** "At touristic spots" and "Internet and telephone unavailable." **(C)** "Public transportation" and "Internet and telephone available." **(D)** "Public transportation" and "Internet and telephone unavailable." 0: Do nothing, 1: Non-face-to-face information collection, 2: Face-to-face information collection, 3: Self-moving, 4: Following guidance.

4. Results

In this chapter, we will analyze the factors influencing disaster response behavior in the event of an earthquake by a logistic regression analysis using the forced entry method. Using the dependent variables and explanatory variables described in the previous section, logistic regression analysis was performed in four cases under the Tokyo Metropolitan Earthquake scenario. The regression analysis confirmed that the significance and goodness of fit of the logistic regression model were guaranteed in all four cases through the omnibus test of model coefficients and the tests of Hosmer and Lemeshow. However, since the value of the coefficient of determination of Nagelkere is low, it is necessary to pay attention to the interpretation of the result (Koyama, 2017).

In the first case, which involved "Traveling around touristic spots" and "Internet and telephone are available," the variables of earthquake experience and knowledge of disaster response behavior in earthquakes were found to be significant at $p < 0.05$, as demonstrated in Table 6. The odds ratio for the variable of knowledge of disaster response is 1.176. The partial regression coefficient of earthquake experience is −0.305, and the odds ratio is 0.737. In other words, those who have experienced an earthquake in the past are less likely to follow guidance by 26.3%.

The second scenario was "Traveling around touristic spots" and "Internet and telephone cannot be used due to temporary power failure." In this scenario, knowledge of earthquakes and knowledge of disaster response behavior during earthquakes were found to be significant at $p < 0.05$ as in Table 7. It was observed that that the odds ratio of knowledge about behavior in the event of an earthquake is 1.390, which is the highest value among the others. The partial regression coefficient of knowledge of earthquakes is −0.306, and the odds ratio is 0.736. In other words, the more knowledge respondents have about earthquakes, the less likely they are to follow guidance as a disaster response behavior.

The third scenario is when the respondent is using "Public transportation" and "Internet and telephone available"; Japanese level and knowledge of disaster response behavior during earthquakes were significant variables, as seen in Table 8. It can also be seen that the odds ratio of "knowledge on disaster response behavior in earthquakes" is 1.202, which is the highest. The partial regression coefficient of Japanese level is −0.351, and the odds ratio is 0.704. In other words, the higher the proficiency in Japanese, the less likely tourists are to follow guidance.

The results of last scenario of "Public transportation" with "Internet and telephone unavailable" are summarized in Table 9. In this case, earthquake experience, knowledge of earthquakes, and knowledge of disaster response behavior during earthquakes were found to be significant variables. It can be seen that the odds ratio of knowledge of disaster response behavior during earthquakes is 1.390. The partial regression coefficient of earthquake experience is −0.415, and the odds ratio is 0.660. In other words, the more seismic experience one has, the less likely they are to

TABLE 4 Descriptive statistics for explanatory variables.

Variables	Respondents (1,500)	Mean/ percentage (%)	Standard deviation
Repeat visitor			
Repeater	1,154	76.9%	
Non-repeater	346	23.1%	
Japanese level			
Can speak Japanese	453	18.5%	
Cannot speak Japanese	1,047	81.5%	
Disaster prevention education and drills	1,500	4.21	3.25
Earthquake experience			
Has experience	1,259	83.9%	
Does not have experience	241	16.1%	
Knowledge of earthquakes	1,500	4.36	1.05
Knowledge of disaster response behaviors in earthquakes	1,500	4.82	0.93
Disaster prevention consciousness	1500	86.52	12.28

follow guidance. The partial regression coefficient of knowledge of earthquakes is −0.243, and the odds ratio is 0.784. Therefore, the more knowledge one has of earthquakes, the less likely they are to follow guidance.

As an overall tendency, it was found that the more knowledge international tourists have about disaster response behavior in earthquakes, the more likely they are to choose to follow guidance as their first disaster response behavior. However, it was also found that the knowledge about earthquakes, past earthquake experience, and Japanese level have an adverse influence on choosing to follow guidance as the first behavior.

The findings revealed a negative effect of earthquake experience and knowledge of earthquakes in the scenario, which is supported by previous research on evacuation behavior. Past experiences or transferred knowledge affect an individual's threat perceptions and evacuation behavior (Makinoshima et al., 2020). The role of experience is still under the debate, with Esteban et al. (2013) considering it an important predictor for prompt evacuation, while Nakaya et al. (2018) find no relationship between the two (Arimura et al., 2020). Risk perception and self-efficacy positively affect intended evacuation behaviors, whereas physical preparedness, tsunami-relevant knowledge, and location perception have a negative influence (Buylova et al., 2020).

With regard to knowledge, Makinoshima et al. (2020) find that people misunderstand detailed and quantitative risk information when they do not possess enough knowledge of tsunamis. Gu et al. (2016) investigated the effect of knowledge on residents' avoidance behavior during different periods of earthquake occurrences and divided the knowledge into basic theoretical, emergency skills, and resistance skills knowledge. The study stated that strong theoretical knowledge of a disaster weakens residents' disaster avoidance preparation behavior prior to the disaster. This study confirmed that residents with strong emergency skills and knowledge are more willing to evacuate during a disaster.

Therefore, it is important for tourism stakeholders such as transportation operating companies, accommodation facilities, travel agencies, and municipalities to prepare and discuss the manner in which to convey the recommended disaster response behavior through various information channels to international tourists visiting Japan. Likewise, it is important for stakeholders to the predict disaster response behavior of international tourists, train employees and officers to enhance their crisis communications, and plan effective guidance strategies during disasters.

There also is a possible discrepancy between the actual situation of earthquakes in the future and the disaster scenario presented by the Cabinet Office (2022b), such that a majority of international tourists may not follow guidance in actual situations. On the other hand, international tourists may follow guidance since they do not understand the Japanese language. The governmental bodies and stakeholders need to provide more understandable crisis and tourism information to enhance communication during disasters. When the internet and telephone are not available, both international tourists and Japanese tourists also tend to follow guidance, which may constrain the capacity of evacuation sites and shelters. Therefore, nearby accommodation facilities can be set up as temporary evacuation sites and shelters, when necessary, to guide international tourists, along with cooperative operation among stakeholders.

5. Conclusion

In this study, we have we empirically investigated the factors influencing the disaster response behavior of international tourists under the Tokyo Metropolitan Earthquake scenario. We adopted the theoretical framework developed by Shimazaki and Ozeki (2022) and supplemented it with a questionnaire survey, correlation analysis, and logistic regression model. The questionnaire survey was conducted with tourists from China, the United Kingdom, Indonesia, Korea, and Thailand. We designed four disaster scenarios, considering the different locations of respondents and the availability of internet and telephone connectivity. The study findings reveal the relationship between repeaters, Japanese level, disaster prevention education and drills, earthquake experience, knowledge of earthquake, knowledge of disaster response behavior during earthquakes, disaster prevention consciousness, and the first immediate response action taken during disaster scenarios. The study finds that international tourists with higher earthquake knowledge are not likely to follow the guidance at both touristic spots and on public transportation when internet and telephones are available. Those with more earthquake experience are not likely to follow the guidance in touristic spots when internet and telephone are available and when public transportation, internet, and telephones are unavailable. This implies that international tourists who are self-educated about earthquakes

TABLE 5 Correlation analysis in explanatory variables.

	Repeater	Japanese level	Disaster prevention education and drills	Earthquake experience	Knowledge of earthquakes	Knowledge of disaster response behaviors in earthquakes	Disaster prevention consciousness
Repeater		0.274**	0.133**	0.187**	0.186**	0.064*	0.157**
Japanese level	0.274**		0.066*	0.189**	0.272**	0.096**	0.173**
Disaster prevention education and drills	0.133**	0.066*		0.208**	0.309**	0.326**	0.371**
Earthquake experience	0.187**	0.189**	0.208**		0.228**	0.113**	0.163**
Knowledge of earthquakes	0.186**	0.272**	0.398**	0.228**		0.527**	0.508**
Knowledge of disaster response behaviors in earthquakes	0.064*	0.096**	0.326**	0.113**	0.527**		0.596**
Disaster prevention consciousness	0.157**	0.173**	0.371**	0.163**	0.508**	0.596**	

*$p < 0.05$.
**$p < 0.01$.

TABLE 6 Scenario A: "at touristic spots" and "internet and telephone available."

Explanatory variables	*B* (coefficient)	SE	Wald	Odds ratio	Sig.
Repeater	−0.198	0.132	2.234	0.820	0.135
Japanese level	−0.160	0.127	1.582	0.852	0.208
Disaster prevention education and drills	−0.003	0.018	0.029	0.997	0.864
Earthquake experience	−0.305	0.150	4.124	0.737	0.042*
Knowledge of earthquakes	−0.110	0.064	2.957	0.895	0.086
Knowledge of disaster response behavior in earthquakes	0.162	0.077	4.390	1.176	0.036*
Disaster prevention consciousness	0.002	0.006	0.119	1.002	0.730
Constant	−0.470	0.409	1.316	0.625	0.251

*$p < 0.05$.

TABLE 7 Scenario B: "at touristic spots" and "internet and telephone unavailable."

Explanatory variables	*B* (coefficient)	SE	Wald	Odds ratio	Sig.
Repeater	−0.090	0.154	0.342	0.914	0.559
Japanese level	−0.092	0.136	0.457	0.912	0.499
Disaster prevention education and drills	0.000	0.020	0.000	1.000	0.990
Earthquake experience	0.193	0.195	0.984	1.213	0.321
Knowledge of earthquakes	−0.306	0.076	16.062	0.736	0.000**
Knowledge of disaster response behavior in earthquakes	0.329	0.098	11.230	1.390	0.001**
Disaster prevention consciousness	0.002	0.007	0.053	1.002	0.818
Constant	−0.615	0.501	1.505	0.541	0.220

**$p < 0.01$.

take protective action by themselves. Notably, knowledge on disaster response behavior in earthquakes was found to be significant and to positively affect the adherence to behavior guidance in all four scenarios, thus demonstrating the importance of disaster prevention education and drills for international tourists.

This study contributes to the relevant literature in various ways. First, the findings add to the literature on the information seeking,

TABLE 8 Scenario C: "public transportation" and "internet and telephone available."

Explanatory variables	*B* (coefficient)	SE	Wald	Odds ratio	Sig.
Repeater	−0.151	0.133	1.286	0.860	0.257
Japanese level	−0.351	0.129	7.388	0.704	0.007**
Disaster prevention education and drills	−0.024	0.019	1.678	0.976	0.195
Earthquake experience	−0.241	0.151	2.547	0.786	0.111
Knowledge of earthquakes	−0.051	0.064	0.636	0.950	0.425
Knowledge of disaster response behavior in earthquakes	0.184	0.078	5.527	1.202	0.019*
Disaster prevention consciousness	0.000	0.006	0.001	1.000	0.970
Constant	−0.633	0.414	2.341	0.531	0.126

*$p < 0.05$.
**$p < 0.01$.

TABLE 9 Scenario D: "public transportation" and "internet and telephone unavailable."

Explanatory variables	*B* (coefficient)	SE	Wald	Odds ratio	Sig.
Repeater	−0.099	0.132	0.560	0.906	0.454
Japanese level	−0.030	0.123	0.060	0.970	0.807
Disaster prevention education and drills	0.016	0.018	0.824	1.016	0.364
Earthquake experience	−0.415	0.152	7.484	0.660	0.006**
Knowledge of earthquakes	−0.243	0.066	13.660	0.784	0.000**
Knowledge of disaster response behavior in earthquakes	0.288	0.077	13.984	1.333	0.000**
Disaster prevention consciousness	0.000	0.006	0.001	1.000	0.970
Constant	−0.036	0.401	0.008	0.964	0.928

**$p < 0.01$.

evacuation planning, disaster response, and prevention behavior of international tourists. Second, it applies the theoretical model of disaster prevention consciousness and actions (Ozeki et al., 2017; Shimazaki and Ozeki, 2022) and provides empirical evidence through a questionnaire survey and logistics regression. Finally, by exploring the behavior of international tourists in the context of an anticipated earthquake scenario in Japan, the study brings to light the influence of various predictors such as earthquake experience, disaster prevention education and drills, knowledge of earthquakes and disaster response behavior in earthquakes, disaster prevention consciousness, travel-related variables such as being a repeater or not, and language capability in respect to evacuation behavior.

The findings of our study have highlighted the importance of disaster prevention education and evacuation drills for international tourists. Hall et al. (2019) also emphasize the importance of tourist education and securing safe places and shelters in highly touristic areas. Therefore, sharing disaster prevention information, including recommended actions during disasters, with international tourists is important from the perspective of effective disaster management. As a policy and practical implication, the government of Japan and the concerned stakeholders, such as accommodation and transportation operators, restaurants, and others, are recommended to provide disaster-related information to international tourists alongside the usual tourism-related information. The recommendation of a hybrid information provision approach, which through the development of an information tool that combines tourism information and disaster prevention information can benefit both central and local governments, is in line with the solution developed by Iwahara et al. (2018) for the Kagawa Prefecture. In addition to information provision, transient shelter to support tourist evacuation needs to be considered in securing the safety of tourists. One example of the building of temporary evacuation shelters in tsunami-prone areas can be found Indonesia; however, it is still far from the main tourist points and needs to consider an appropriate location.

Some limitations of this study include the limited number of countries, limited sample size, and the sole use of an earthquake scenario. Since tourists from all over the world visit Japan, it is imperative to include more countries, which is a consideration for the scope of future research. Understanding the unique response behaviors of people of different nationalities and their comparison could enable the development of better and clearer disaster prevention and response strategies for the government of Japan and concerned authorities. Furthermore, because of Japan's high disaster vulnerability, future studies should include scenarios of floods, tsunamis, and typhoons, etc. From a methodological point of view, further studies should also explore the benefits of inclusion of additional sets of explanatory variables for the logistic regression model to better gauge the disaster response behavior of international tourists. Further research is needed to investigate the characteristics of disaster response behavior in different countries and to compare international tourists' behavior to Japanese tourists.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the participants was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

SC conceptualized the study, collected the data, performed analysis and interpretation, and wrote the article. KY, HY, and HS collected the data and contributed to the analysis and interpretation. RM contributed to the analysis and interpretation and writing of the article. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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