

Original Paper

## Factors Determining Disaster Preparedness in Residents: Differences in Terms of Homeownership and Age

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**Key words:** emergency bag preparation, fear of floods, home ownership, extent of damage, the Tokai flood disaster

### Abstract

This study examined the factors that determine preparedness against floods, particularly in terms of home ownership and age. A questionnaire was sent to the residents of an area in Nagoya City and adjacent regions that were affected by the Tokai flood. Respondents were asked to rate the extent of their previous experiences with floods, extent of damage sustained in the Tokai flood, and level of fear of floods. They also were asked whether they prepared an emergency bag after the Tokai flood, owned a home, and their age. The results showed that for homeowners, the level of fear of floods was related to the preparation of emergency bags. However, for renters, emergency bag preparation had no relationship with their fear of and previous experience with floods. Furthermore, for elderly people, both prior experience and fear of floods were related to emergency bag preparation. These findings show that whether or not residents prepared an emergency bag depended on home ownership, fear of floods, previous flood experience, and age rather than the extent of damage sustained in the Tokai flood.

### Introduction

Japanese have suffered terrible disasters, including many typhoons and strong earthquakes. The Isewan typhoon killed 4,697 people in central Japan. In September 2000, the Shinkawa River overflowed its banks flooding Nagoya City and the nearby town of Shinkawa in what was later called the Tokai flood disaster. At the time of the flood, Nagoya City recorded its largest rainfall in history (566.5 mm) causing the Shinkawa River (drainage area: 1,010  $km^2$ ) to overflow its banks and flow into the city. Many houses were inundated and damaged.

Traditional measures to prevent floods include building dams, reservoirs and embankments. These so-called “hard measures” may seem effective. If the river had not overflowed, the adjacent areas would not have been damaged during the Tokai flood. Hard measures are considered to be the most effective means of combating floods despite the fact that they cannot prevent damage if water volume exceeds structural capacity. This was clearly demonstrated in the Tokai disaster.

It was important to raise the level of residents’ preparedness because hard measures and the actions of municipal authorities were often inadequate to prevent floods. Therefore, in addition to hard measures, public agencies must be involved. Generally, it was believed that previous flood experience and fear of

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floods were correlated with preparedness. In the case of the Tokai flood, many residents in the Shinkawa River drainage area were aware of the possibility of a flood before the disaster struck [1]. As many as 46% of Nagoya City and Shinkawa Town residents anticipated a flood before it struck. Oikawa and Katada [2] found that prior experience heightened awareness to the risk of floods. Furthermore, Oliver [3] observed that previous flood experience and its duration increased people's awareness of future hazards and influenced them to take preventive measures.

A common assumption was that people were naturally very concerned about flood disasters and that previous experience affected one's preparedness. However, other studies have found that the Japanese were insufficiently prepared. Hashimoto, Matsunaga, and Nanri [4] found that 78% of those affected by floods before the 1999 Fukuoka Flood had not taken special measures to protect themselves against future occurrences. These studies showed no direct relationship between risk perception and preparedness. For many people, the effect of prior flood experience did not lead to taking preventive action.

Some studies have suggested a link between home ownership and disaster preparedness. Mulilis, Duval, and Bovalino [5] showed that homeowners prepared for tornados more thoroughly than people living in rented accommodations. They concluded that homeowners valued their property and were more willing than renters to expend the resources needed to protect against future tornados. Takao, Motoyoshi, Sato, Seo, Fukuzono, and Ikeda [6] found that prior experience and anticipation of future floods did not necessarily affect preparation. Rather, it was the fear of floods that determined preparedness. Furthermore, those who lived in their own homes prepared for floods more thoroughly than those who rented homes. These findings suggested that home ownership and fear of floods determined preparedness for floods. Based on above findings, the author believes that prior flood experience, fear and home ownership affect preparedness. Additionally, age appears to be a factor. Previous experience with floods and knowledge about vulnerable areas that come with age enhance preparedness.

If a megalopolis suffered serious damage in a flood, people might not be able to get food and water for some time. With unexpectedly heavy rainfalls, such as during the Tokai flood, public agencies cannot protect all residents and require time to rebuild the damaged areas. Hence, people need to prepare emergency bags. These should contain a portable radio, food, flashlight, and emergency medical supplies. However, little data are available to establish a quantitative relationship between prior flood experience and preparation of emergency bags. Factors that influence the preparation of an emergency bag must be identified. The purpose of this study was to examine some of these factors including the effects of home ownership and age.

## Methodology

### 1. Survey area and subjects

During the Tokai flood, the Shinkawa River overflowed into Nagoya City and Shinkawa Town claiming several lives. Four houses completely collapsed, 98 partially collapsed, 11,142 flooded above floor level, and 21,852 houses flooded below floor level. In Shinkawa Town, 2,391 houses flooded above floor level, and 1,244 houses flooded below floor level. Questionnaires were sent to 5,979 residents of Nagoya City and Shinkawa Town of which 235 were not received (Fig. 1). Responses were received from 2,051, a response rate of 35.7%.

### 2. Survey methodology

A chi-square test was performed to examine factors that determined the preparation of emergency bags after the Tokai flood disaster. The respondents were asked the following: "Had you ever experienced a flood before the Tokai flood disaster?"; rate your fear of floods (very fearful, fearful, not so fearful); rate



Fig. 1 Map of the area surveyed

the damage sustained in the Tokai flood (complete or partial collapse, flooded above floor level, flooded below floor level, no damage); and “Have you ever prepared an emergency bag?” In addition, they were asked to provide personal information including their age (under age 40, between 40 and 60, over age 60) and whether they owned their home or lived in rented accommodations.

## Results

### 1. Factors that determine flood preparedness

The relationship between previous flood experience prior to the Tokai flood and residents’ preparation of emergency bags was examined. Preparation was found to be correlated with previous experience ( $\chi^2_{(1)} = 6.11$ ,  $p < .05$ ; Fig. 2a). Those who had previously experienced a flood were more likely to prepare emergency bags. Also, residents’ fear of floods was related to their preparation of an emergency bag ( $\chi^2_{(2)} = 15.62$ ,  $p < .01$ ; Fig. 2b). Those fearful of floods were more likely to prepare emergency bags. No relationship was found between the extent of damage sustained in the Tokai flood and emergency bag preparation ( $\chi^2_{(2)} = .30$ , n.s.; Fig. 2c), i.e., the damage sustained in a previous flood had no bearing on residents’ preparation of emergency bags.

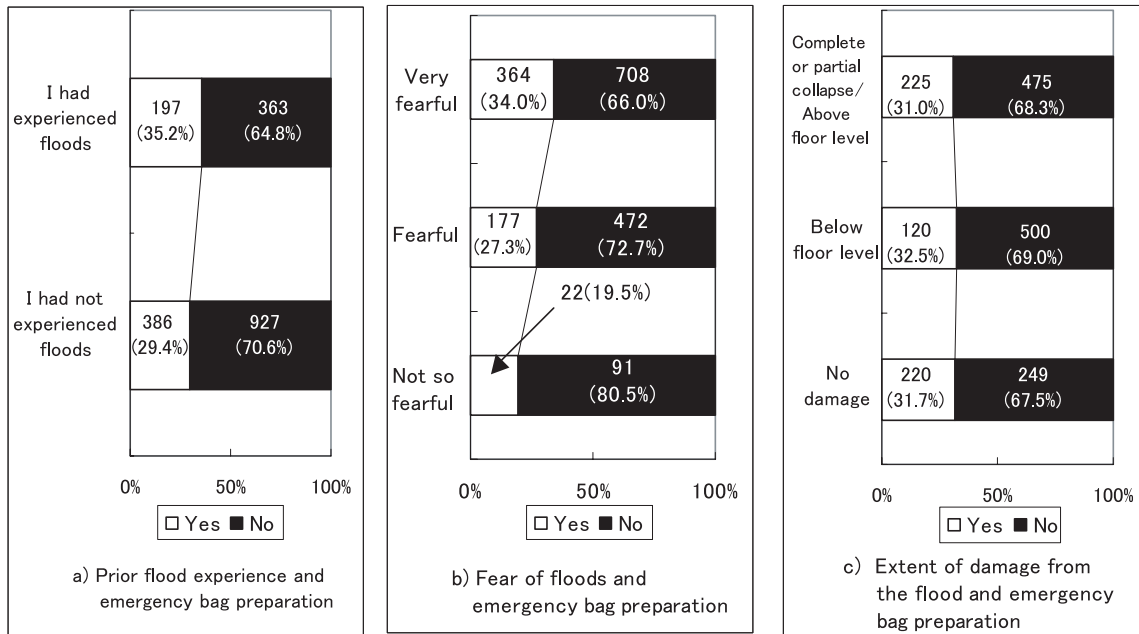


Fig. 2 Factors determining disaster preparedness

2. Factors that determine flood preparedness: homeownership

Differences in factors that determine preparedness also were found between homeowners and renters. There was no significant relationship in either group between prior flood experience and emergency bag preparation (homeowners:  $\chi^2_{(1)} = 3.75$ , n.s., Fig. 3a; renters:  $\chi^2_{(1)} = 6.34$ , n.s., Fig. 3b). However, a statistically significant relationship was found between fear of floods and emergency bag preparation among homeowners but not renters (homeowners:  $\chi^2_{(2)} = 14.14$ ,  $p < .01$ , Fig. 3c; renters:  $\chi^2_{(2)} = 1.25$ , n.s., Fig. 3d). No significant relationships were found between the extent of damage sustained in the Tokai flood and emergency bag preparation in either group (homeowners:  $\chi^2_{(2)} = .44$ , n.s., Fig. 3e; renters:  $\chi^2_{(2)} = .01$ , n.s.; Fig. 3f). Those who suffered little damage, i.e., those whose homes were flooded below floor level and those who suffered no damage made no special preparations for future floods.

3. Factors that determine flood preparedness: age

The relationship between prior flood experience and emergency bag preparation was significant for people over age 60 ( $\chi^2_{(1)} = 7.35$ ,  $p < .01$ , Fig. 4c). No relationship was found in the other two age groups (under age 40:  $\chi^2_{(1)} = .189$ , n.s., Fig. 4a; between ages 40 and 60:  $\chi^2_{(1)} = .005$ , n.s., Fig. 4b). In the relationship between residents' level of fear and their preparedness for floods, a statistically significant correlation was found for the two older age groups (between ages 40 and 60:  $\chi^2_{(2)} = 10.91$ ,  $p < .01$ , Fig. 4e; over age 60:  $\chi^2_{(2)} = 6.35$ ,  $p < .05$ , Fig. 4f). However, no such correlation was found for those under age 40 ( $\chi^2_{(2)} = .29$ , n.s., Fig. 4d). Generally, older residents were more likely to prepare emergency bags. Degree of damage sustained was not correlated with emergency bag preparation in any of the age groups (under age 40:  $\chi^2_{(2)} = .51$ , n.s., Fig. 4g; between ages 40 and 60:  $\chi^2_{(2)} = .36$ , n.s., Fig. 4h; over age 60:  $\chi^2_{(2)} = .44$ , n.s., Fig. 4i).

Discussion

1. The effects of prior flood experience and fear of floods

Results showed that residents' prior experiences with floods enhanced the likelihood of emergency bag

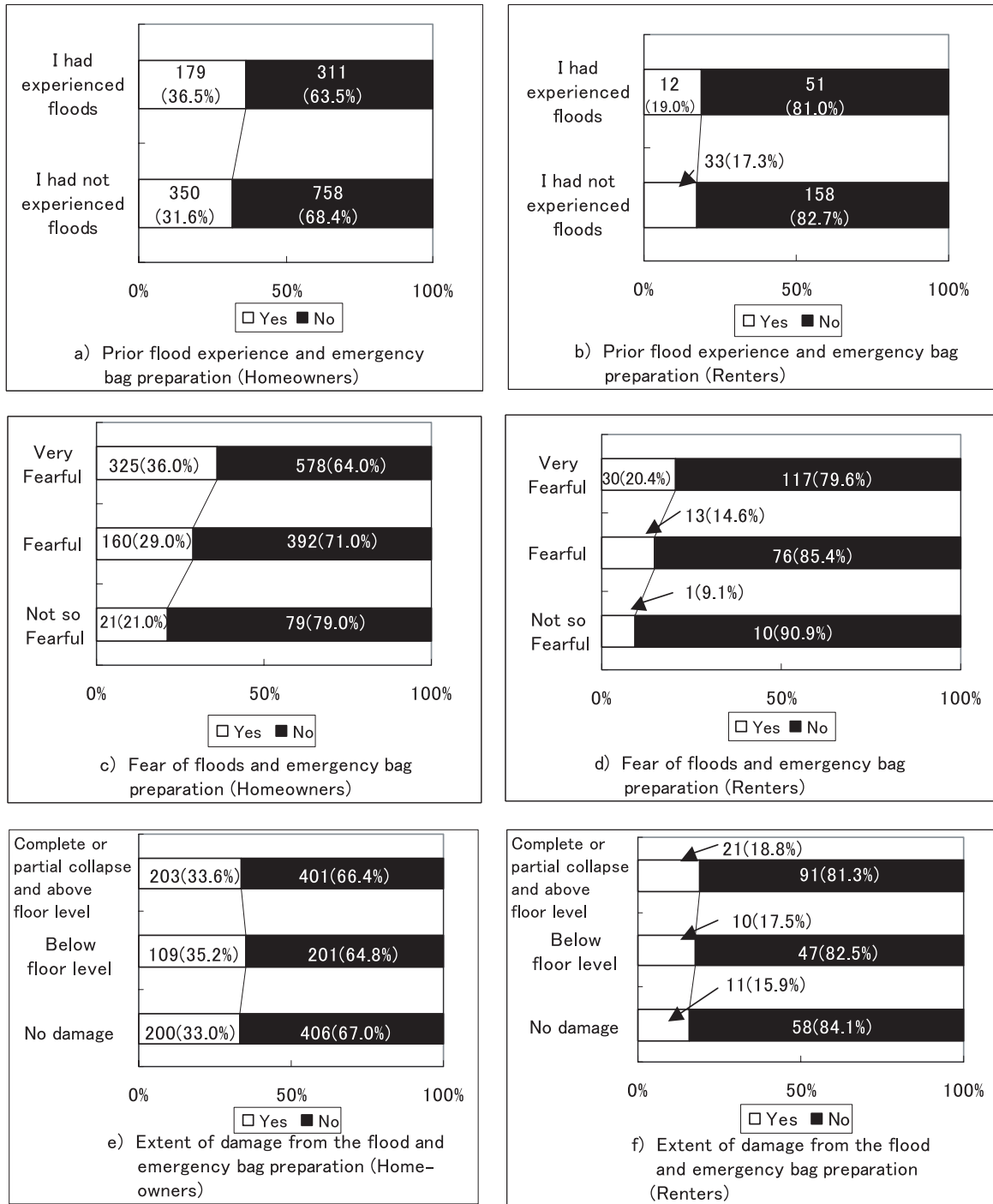


Fig. 3 Factors determining disaster preparedness (homeownership)

preparation (Fig. 5). Other studies have suggested that such experience does not always determine preparedness for floods. The observed effect of prior flood experience in this study was insufficient to permit conclusions about the relationship. Furthermore, fear of floods was related to emergency bag preparation. This suggests that preparing a bag is an emotional response. The extent of damage from the Tokai flood did not lead to emergency bag preparation. This may indicate that damage sustained from previous floods does not contribute to flood preparedness as much as previous experience and fear of floods. Takao, Motoyoshi, Sato, Seo, Fukuzono and Ikeda [6] suggested that those who sustained serious damage during the

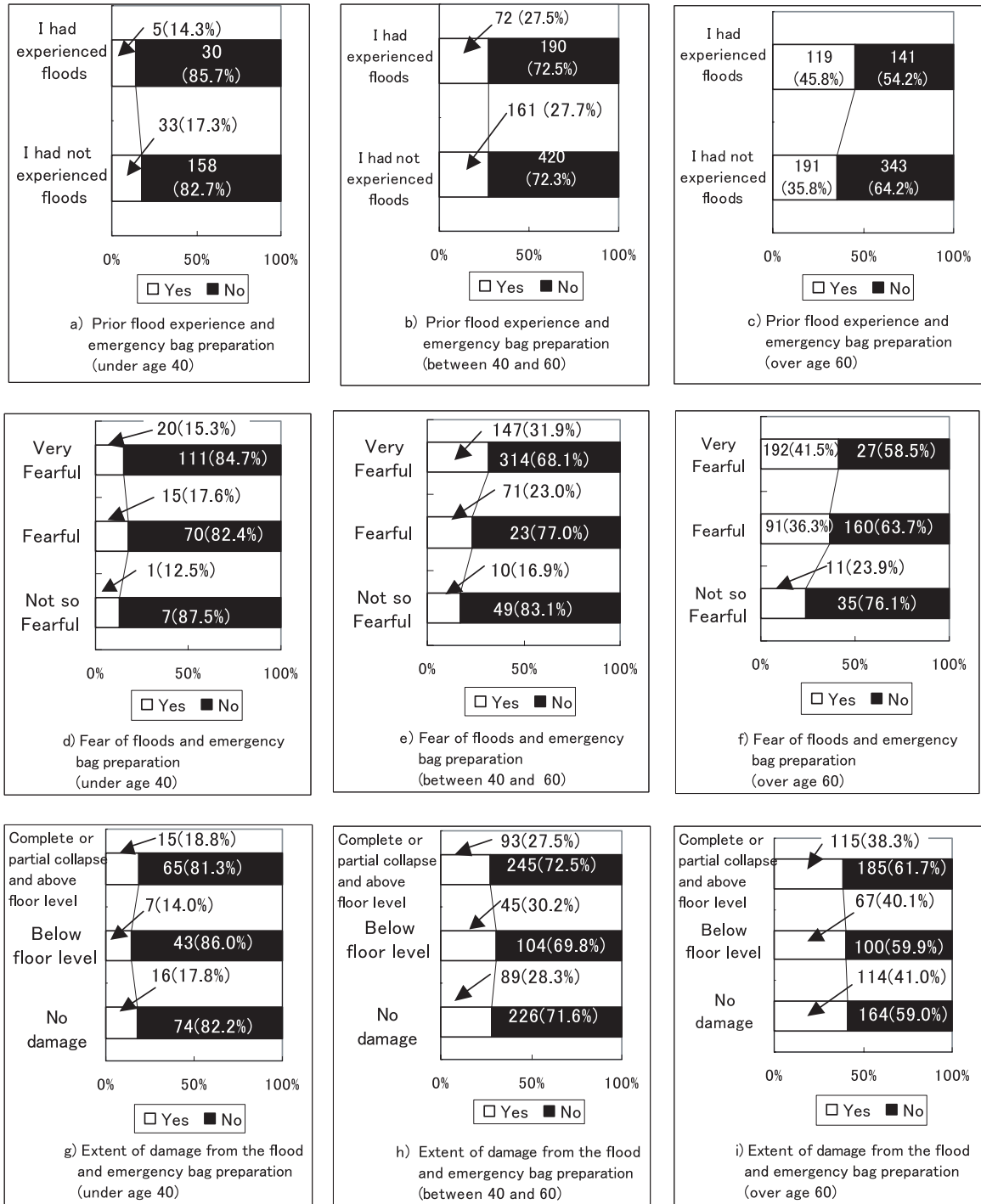


Fig. 4 Factors determining disaster preparedness (age)

Tokai flood were more likely to take special measures for future ones. Their results, along with that of the present findings, indicate need for further study.

2. Effect of homeownership

The relationship between prior flood experience and emergency bag preparation was not dependent on homeownership. Furthermore, the extent of damage from the Tokai flood did not promote emergency bag preparation among either homeowners or renters (Fig. 6). Homeownership, in itself, was not a major factor in emergency bag preparation. However, fear of floods was related to emergency bag preparation

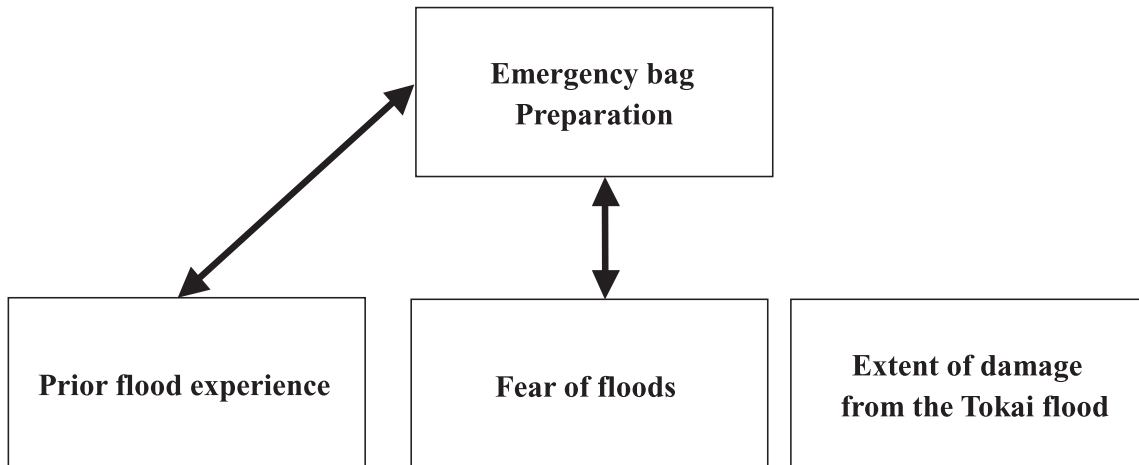


Fig. 5 Relationship between emergency bag preparation and the determining factors  
 Note: Arrows indicate a statistically significant relationship.

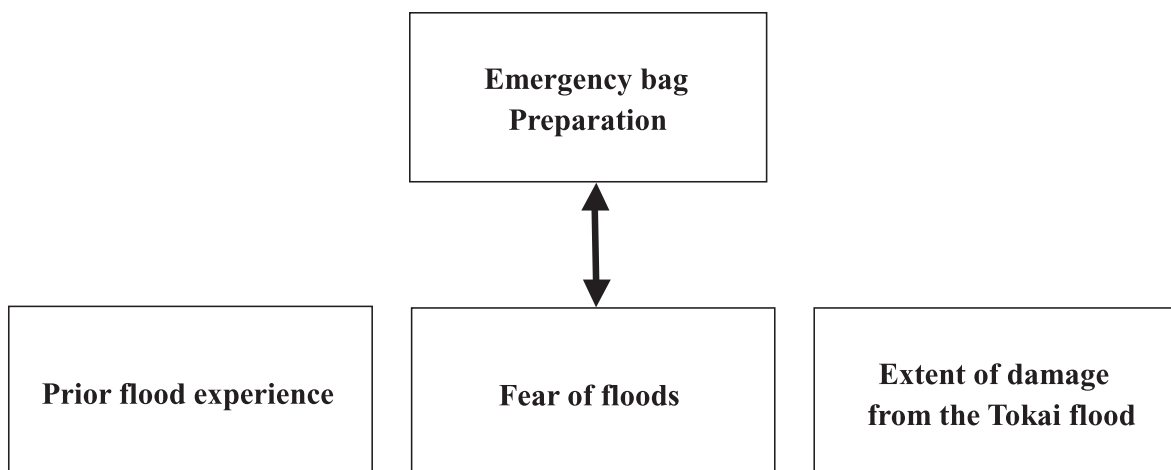


Fig. 6 Relationship between emergency bag preparation and homeownership  
 Note: Arrows indicate a statistically significant relationship.  
 (Homeowners :  $\longleftrightarrow$ )  
 The relationship between determinant factors (prior flood experience, fear of floods, extent of damage from the Tokai flood ) and emergency bag preparation was not significant for renters.

among homeowners. This implies that homeownership plays a role in the relationship between fear of floods and preparation of emergency bags. Why are flood-wary homeowners more willing to prepare them than renters? One of the main reasons is that they need to protect their families and property. Mulilis, Duval, and Bovalino [5] concluded that homeowners felt more in control of their lives and tended to be more responsible than renters with respect to preparedness against tornados. The present study suggested a different conclusion in the case of floods, i.e., homeowners are more fearful of floods than renters and, therefore, are better prepared.

3. Effect of age

A clear correlation was found between preparation of emergency bags and age (Fig. 7). Those over age 60, who had experienced a flood before the Tokai disaster, were more likely to prepare an emergency bag

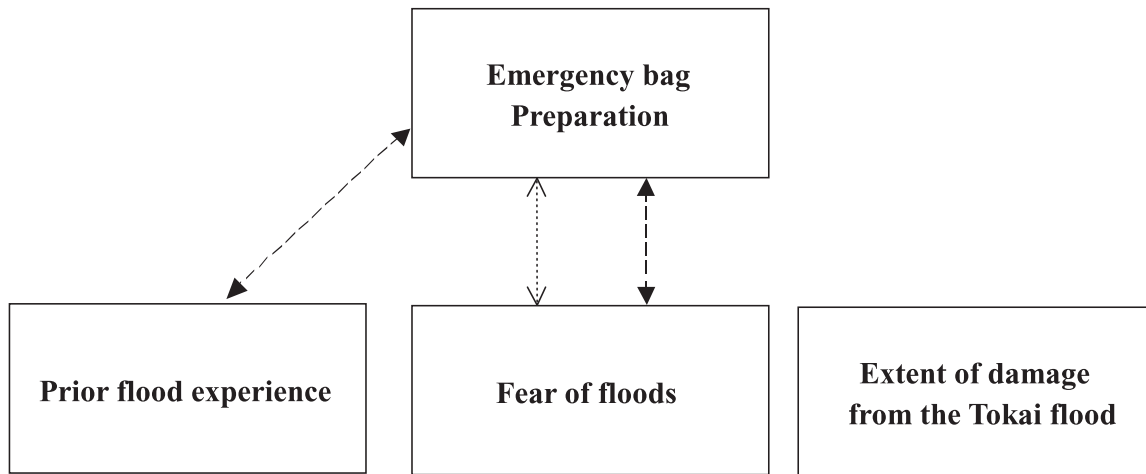


Fig. 7 Relationship between emergency bag preparation and age

Note: Arrows indicate a statistically significant relationship.

(between 40 and 60 years old : <-----> ; over age 60 : <----->)

The relationship between determinant factors (prior flood experience, fear of floods, extent of damage from the Tokai flood) and emergency bag preparation was not significant for people under age 40.

than younger residents. Furthermore, fear of floods influenced bag preparation among those who were over age 40. Thus, older people were more likely to prepare an emergency bag based on their prior flood experience and fear of floods. On the other hand, the extent of damage from the Tokai flood had no effect, i.e., age was not the determining factor in predicting whether those who sustained damage prepared bags. Experience was correlated with emergency bag preparation for residents over age 60 years.

#### 4. Government action and residents' preparedness

The above discussion suggests that there are significant differences between homeowners and renters, on the one hand, and older and younger people on the other regarding emergency bag preparation as a precaution for future floods. Public agencies need to take this point into account when designing disaster prevention plans. If these findings are valid, they will help public agencies develop appropriate measures to help residents better prepare for floods. Another important task is increasing public awareness about floods. Special educational programs should be developed to inform residents about the history of floods in their area and improve understanding about flood risk. Lave and Lave [7] suggested that knowledge about floods and willingness to purchase an insurance policy are related to educational level, employment status, and how much he or she reads. Thus, it is important to educate residents through prevention training and other programs that improve preparedness. To minimize damage in a disaster, people need to be prepared. This includes purchasing property insurance, checking hazard maps and studying emergency evacuation routes.

#### Conclusion

This study revealed several factors that contributed to preparation of emergency bags by residents in the Tokai flood area. Prior flood experience and fear of floods were correlated with bag preparation. However, the extent of damage sustained was not a factor in motivating residents to prepare for future floods. In addition, homeownership and age differences were found to affect preparedness. The relationship between



fear of floods and emergency bag preparation depended on whether a person was a homeowner or renter. A correlation was found between fear of floods and preparing emergency bags for homeowners but not for renters. In addition, age played a role: older persons were more likely to prepare emergency bags based on their experience with and fear of floods. Further investigations are needed to study the effects of both psychological and socio-economic factors on flood preparedness.

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