ORIGINAL RESEARCH

Current Status of Disaster Preparedness of Pharmacies and Differences in Disaster Awareness Based on Pharmacy Size

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ABSTRACT

Objective: The prevention of deaths caused indirectly by disasters is important, especially for evacuees requiring medication. Pharmacies play a major role in providing medication to disaster victims. Therefore, this study evaluated the current status of disaster preparedness among pharmacies, the extent of disaster awareness and knowledge of disaster mitigation measures, and any associations of these with the characteristics of pharmacies.

Methods: Questionnaires about disaster preparedness were sent to 337 pharmacies in Japan, in a region at high risk of major earthquakes. Tabulation analyses were carried out to examine the characteristics of pharmacies and then a logistic regression analysis was performed to examine the relationship between disaster awareness and the level of preparedness of pharmacies. Furthermore, to examine in detail any differences associated with pharmacy size, subgroup analyses were performed.

Results: High disaster awareness was significantly correlated with adequate disaster preparedness. However, in the subgroup analyses, no significant differences were observed among large pharmacies. In contrast, disaster awareness was significantly related to the disaster preparedness of small pharmacies.

Conclusion: The findings suggest that the disaster preparedness of pharmacies is related to the level of disaster awareness, highlighting the importance of disaster awareness activities in ordinary times before a disaster. (*Disaster Med Public Health Preparedness.* 2019;13:753–757)

Key Words: disaster awareness, disaster preparedness, pharmacy, pharmacy size

Pharmacies are very close to the communities they serve. Important functions of pharmacies typically include dispensing prescription medications and selling over-the-counter drugs. Many people regularly visit their family pharmacy. Given the potential for natural disasters to inflict major damage within a community, pharmacies have an important responsibility to provide aid to disaster victims who need medicine to maintain their health and well-being.

Recent disasters, such as earthquakes and floods, have caused major damage at various locations worldwide.[1,2] Because disaster mortality can be very high, it is important to implement disaster mitigation measures to minimize loss of life. It is also important to prevent disaster-related deaths caused indirectly by disasters (ie, in secondary disasters) due to, for example, deteriorating health condition while living in an evacuation shelter. In particular, for evacuees who require medication to maintain their health, the timely provision of medication in disaster situations can be a matter of life or death.[3] Pharmacies play a major role in providing medications to disaster victims, and it is expected that pharmacies will become storage and supply sites not only for medications, but also for other health-care-related products.[4]

Previous studies on disaster preparedness have focused on health care personnel and hospitals,[5,6] and few studies have examined the current status of pharmacies in disaster preparedness or the extent of disaster awareness among pharmacists. Given that pharmacies have an important role in maintaining a continuous provision of required medication to disaster victims, this study evaluated the current status of disaster preparedness of pharmacies, the extent of disaster awareness and knowledge of disaster mitigation measures among pharmacy employees, and any associations of these with the characteristics of pharmacies.

METHODOLOGY

Disaster preparedness questionnaires were mailed to 337 store managers and managing pharmacists in September and October 2016. The survey focused on

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health insurance pharmacies in Hamamatsu, Shizuoka Prefecture, Japan. The city is located in a region that is expected to be affected by a so-called Nankai Trough earthquake, with an expected magnitude of 8–9.[7] Health insurance pharmacies are pharmacies approved by the National Health Insurance of Japan, and they prepare and dispense medications covered by health insurance. These include pharmacies in major drug stores or in shopping centers.

Questionnaire items included the year that the pharmacy was built and the building structure, whether the store furniture is secured to walls or the floor, whether an emergency power supply and emergency water supply are available, whether the pharmacy has a disaster protocol in place for pharmacists, and the level of disaster awareness for natural disasters among employees.

Tabulation analyses were performed to study the characteristics of pharmacies regarding these factors. A logistic regression analysis was also performed to examine the relation between disaster awareness and the level of preparedness of pharmacies. A pharmacy was defined as well prepared for disasters if it had secured furniture, a disaster protocol in place, access to an emergency water supply, and an emergency stockpile of medicines available. In terms of building sturdiness, pharmacies were considered strong if built with reinforced concrete or a steel frame and constructed in 1982 or after, when the Building Standards Act was drastically revised and earthquake resistance standards were reformed, and pharmacies were considered weak if built with wood or if constructed in or before 1981. Pharmacies were determined to be "large" when there were at least 6 employees, a waiting room for at least 9 people, and a stockpile of at least 1200 types of medication; all others were defined as "small." The level of disaster awareness was categorized as either *very aware*, *aware*, *neither aware nor unaware*, *unaware*, or *completely unaware*. The *very aware* and *aware* categories were combined into a high awareness group, and the *unaware* and *completely unaware* categories were combined into a low awareness group.

In the univariate logistic regression analysis, disaster preparedness of the pharmacy was used as the dependent variable; disaster awareness, building sturdiness, and pharmacy size were used as independent variables. In the multivariate analysis, disaster awareness, building sturdiness, and pharmacy size were used simultaneously in the analysis. Furthermore, to examine in detail differences associated with pharmacy size, pharmacies were divided into 2 groups based on size, subgroup analysis was performed using disaster awareness and building sturdiness as independent variables, and both univariate and multivariate analyses were conducted. A logistic regression analysis was conducted to examine the relationship between disaster awareness and building sturdiness. SPSS20 (IBM Corp., Armonk, NY) was used for statistical analysis, with significance set at $P < 0.05$.

Ethical Standards

The Clinical Research Ethics Committee of the Hamamatsu University School of Medicine approved this study (Approval No. 16-133). The purpose of the study was explained in writing to each pharmacy, and the completion of the survey was regarded as consent to participate.

RESULTS

Responses were received from 269 pharmacies (response rate was 79.8%). The responding pharmacies and the status of their preparedness are shown in Table 1. In terms of the year that the pharmacies were built, 84.4% were constructed in 1982 or later and thus followed earthquake resistance standards. Regarding building structure, 39.1% were made of wood and 46.8% were made of either reinforced concrete or steel framing. The vast majority of pharmacies (82.8%) lacked access to an emergency power supply, which is necessary for medications requiring refrigeration. In addition, 32.1% of pharmacies had no access to an emergency water supply, which is needed both for drinking water and for taking medications. Store furniture not secured to walls or the floor, which can lead to serious injuries and even deaths in a disaster, was reported by 43.3% of pharmacies. Disaster protocols for pharmacists were available in 40.9% of pharmacies; most pharmacies (50.0%) did not have a protocol, and the remainder (9.1%) was unsure. More than 50% of pharmacies responded that disaster awareness was high, around 30% responded that employees were "neither aware nor unaware," and about 15% responded that disaster awareness was low.

Table 2 shows the results of the analysis for disaster awareness, building sturdiness, pharmacy size, and items related to disaster preparedness. Pharmacies with low disaster awareness, non-sturdy building structure, and small size were used as the reference, and odds ratios (ORs) indicated the likelihood that pharmacies with high disaster awareness, sturdy building structure, and large size were well prepared for disasters. High disaster awareness was significantly correlated with adequate preparedness for disasters (univariate analysis: OR 3.51, 95% CI 1.69–7.28, $P = 0.001$; multivariate analysis: OR 3.52, 95% CI 1.69–7.32, $P = 0.001$).

Table 3 shows the results of a stratified analysis of the relationships between disaster awareness and building sturdiness and between disaster awareness and disaster preparedness in large and small pharmacies. No significant differences were seen between the independent variables and disaster preparedness in large pharmacies, in either the univariate or multivariate analysis. In contrast, in small pharmacies, disaster awareness was significantly related to disaster preparedness in both the univariate and multivariate analysis. Although neither the single nor multiple variable analysis showed a significant relationship between disaster awareness and disaster preparedness in large pharmacies with a sturdy building structure, there was an OR of 0.41, suggesting that large pharmacies tended not to be well

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TABLE 1

Pharmacy Characteristics and Their Preparedness Status

	n	%
Type of Pharmacy (multiple answers accepted)		
Pharmacy only	73	72.7
Pharmacy with pharmacy owner residence	28	10.5
Pharmacy with complex housing	14	5.2
Pharmacy in a drug store	21	7.9
Pharmacy in a shopping mall	5	1.9
Other	9	3.4
Number of Employees		
1–4	118	43.9
5–9	111	41.3
10 or more	36	13.4
Building Structure		
Reinforced concrete	48	18.4
Steel frame	74	28.4
Wood	102	39.1
Other	1	0.4
Unknown	36	13.8
Year Built		
Before 1971	12	4.5
1972–1981	8	3.0
1982–2000	69	26.1
After 2001	154	58.3
Unknown	21	8.0
Waiting Room Capacity (number of people)		
2–4	21	7.9
5–9	132	49.6
10–14	76	28.6
15–19	23	8.6
20 or more	14	5.3
Number of Stockpiled Medications		
10–499	13	4.9
500–999	90	34.2
1000–1499	106	40.3
1500–1999	33	12.5
2000 or more	21	8.0
Securely Fixed Furniture (multiple answers accepted)		
Medicine shelf	146	54.9
Medicine refrigerator	48	18.0
Copy machine	28	10.5
Automatic packaging machine	37	13.9
Other	8	3.0
Nothing fixed	115	43.3
Emergency Power Supply		
Accessible	36	13.7
Not accessible	217	82.8
Accessible to the entire building, including the pharmacy	9	3.4
Emergency Water Supply (multiple answers accepted)		
Water dispenser	114	43.0
Bottled water	85	32.1
Cistern	4	1.5
Other	8	3.0
None	85	32.1
Disaster Supplies (multiple answers accepted)		
Surgical spirit	164	61.9
Wet tissue	95	35.9
Portable toilet	30	11.3
Old newspaper	87	32.8
Bin bags	178	67.2
Vinyl seat	34	12.8
Emergency food for employees	40	15.1
Plastic wrap	103	38.9
Portable gas stove	25	9.4
Flashlight	136	51.3
Radio	67	25.3
Batteries	115	43.4
Other	13	4.9
None	53	20.0
Disaster Protocol		
Available	108	40.9
Not available	132	50.0
Unknown	24	9.1
Disaster Awareness		
Very aware	21	7.9
Aware	116	43.8
Neither aware nor unaware	89	33.6
Unaware	30	11.3
Completely unaware	9	3.4
Awareness of Natural Disaster Risks (multiple answers accepted)		
Earthquake	230	87.5
Typhoon	171	65.0
Heavy rain/flood	130	49.4
Tsunami	58	22.1
Tornado/strong winds	52	19.8
Landslide	13	4.9
None	7	2.7

Note: Total responses differ between items because of missing responses.

prepared. In contrast, small pharmacies with a sturdy building structure had ORs of 2.39 in the univariate analysis and 2.42 in the multivariate analysis, indicating a significant association with adequate disaster preparedness.

Though the data are not shown in the tables, no significant relationship was found between building sturdiness and disaster awareness.

DISCUSSION

To the best of the authors' knowledge, this study is the first to reveal that many pharmacies in Japan are currently inadequately prepared for a disaster, despite the important role they will play in the delivery of medications in the aftermath of a disaster. Previous studies have surveyed the disaster awareness of residents[8] and examined the role of pharmacists in times of disaster[9] and disaster preparedness of hospitals,[10] but few studies have examined the disaster preparedness of pharmacies.

In this study, employees in roughly half of pharmacies had high disaster awareness and the other half had low awareness. Moreover, the majority of pharmacies lacked disaster protocols – 43.3% did not have any secured furniture, 32.1% had

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TABLE 2

Relationships of Disaster Awareness, Building Sturdiness, and Pharmacy Size With Disaster Preparedness of Pharmacies

	Univariate Analysis			Multivariate Analysis		
Pharmacy Characteristics	**Odds Ratio**	**95% CI**	***P*-value**	**Odds Ratio**	**95% CI**	***P*-value**
Disaster awareness (high/low)	3.51	1.69–7.28	0.001	3.52	1.69–7.32	0.001
Building sturdiness (strong/weak)	1.70	0.89–3.26	0.11	1.62	0.82–3.20	0.16
Pharmacy size (large/small)	1.44	0.66–3.17	0.36	1.31	0.57–3.02	0.52

Note: A pharmacy was defined as well prepared for a disaster if it had secured furniture, a disaster protocol, access to an emergency water supply, and an emergency stockpile of medications available. *High disaster awareness:* very aware and aware. *Low disaster awareness:* neither aware nor unaware, unaware, and completely unaware. *Strong building sturdiness:* built of reinforced concrete or a steel frame and constructed in 1982 or after. *Weak building sturdiness:* built of wood or constructed in 1981 or before. *Large pharmacy size:* at least 6 employees, a waiting room for at least 9 people, and a stockpile of at least 1,200 types of medication. *Small pharmacy size:* all others. In multivariate analysis, disaster awareness, building sturdiness, and pharmacy size were used simultaneously.
95% CI: 95% confidence interval.

TABLE 3

Relationships Between Disaster Awareness and Building Sturdiness, and Disaster Preparedness of Large and Small Pharmacies

		Univariate Analysis			Multivariate Analysis		
Pharmacy Size	**Pharmacy Characteristics**	**Odds Ratio**	**95% CI**	***P*-value**	**Odds Ratio**	**95% CI**	***P*-value**
Large	Disaster awareness (high/low)	1.50	0.36–6.23	0.58	1.57	0.37–6.71	0.54
	Building sturdiness (strong/weak)	0.41	0.10–1.69	0.22	0.41	0.10–1.75	0.23
Small	Disaster awareness (high/low)	4.66	1.94–11.20	0.001	4.76	1.96–11.55	0.001
	Building sturdiness (strong/weak)	2.39	1.15–4.98	0.02	2.42	1.10–5.19	0.02

Note: In the multivariate analysis, disaster awareness and building sturdiness were used simultaneously.

no emergency water supply, and as high as 20% had no emergency stockpile, revealing inadequate disaster preparedness on many levels.

As with any questionnaire survey, non-response bias is a potential concern. For example, it is possible that unprepared pharmacies were also less likely to respond to the survey. However, the response rate was high (79.8%), and high percentages of responding pharmacies reported not securing any furniture (43.3%) and not having an emergency water supply (32.1%), suggesting that the impact of non-response bias was minimal.

In terms of disaster awareness and preparedness of pharmacies as a whole, even when adjusting for building sturdiness and pharmacy size, which are thought to affect preparedness, pharmacies with high disaster awareness tended to show adequate preparedness. However, when stratified by pharmacy size, no association between disaster awareness and preparedness was found in large pharmacies. In contrast, disaster awareness was significantly associated with preparedness in small pharmacies. It seems that, in large pharmacies, such as those located in drug store chains and shopping centers, the pharmacy manager is not likely to be the pharmacy owner and thus may not have a high awareness of the disaster preparedness for a pharmacy that he or she does not own. Indeed, the analysis of disaster awareness based on pharmacy size revealed that 26.1% of respondents who had a low awareness worked in large pharmacies, which was significantly higher than the 12.3% in small pharmacies ($P = 0.027$, chi-square test). Although not statistically significant, large pharmacies with a sturdy building structure tended not to be adequately prepared, whereas small pharmacies with a sturdy building structure showed a significant association with adequate preparedness. These results suggest that, in large pharmacies, building sturdiness may lead to a false sense of security and a tendency toward poor disaster preparedness. A previous study investigating the relationship between type of home ownership and disaster awareness and preparedness found that residents who are the homeowner have significantly higher disaster awareness than residents who are renting.[11] The results of this study appear to be in line with the scenario that small pharmacies, where the store managers are likely also the owners, have a high disaster awareness. Thus, pharmacy size appears to affect disaster awareness.

An important point in this study is that it was conducted in a region expected to experience a major earthquake in the near future, because the level of disaster awareness among residents in such an area is likely higher than in other areas. Indeed, according to a survey on resident awareness of disaster prevention and mitigation, an Internet-based survey

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conducted in September 2016,[12] the percentage of residents who think it is highly probably that they will experience a large-scale, high-magnitude earthquake disaster (at least upper-6 on the Japanese seismic intensity scale) in a city was greatly different from that of residents who think there is a low probability of experiencing such a disaster in a city, revealing a regional difference in the resident awareness level. Nevertheless, the results of the present study highlight the important need to increase disaster awareness and to reinforce disaster preparedness in pharmacies even in regions with a high likelihood of experiencing a disaster. The results of stratification by pharmacy size suggest that the level of disaster awareness still needs to be increased even among small pharmacy owners, and that headquarters overseeing pharmacies in large chain stores need to increase the disaster awareness levels of their employees in individual stores.

Pharmacies must prepare thoroughly for disasters to ensure they can quickly provide medication to disaster victims in need. Based on the present findings, that preparation is currently inadequate at many pharmacies in a region expected to experience a major earthquake, and pharmacies in all regions should be alerted of the need for disaster preparation, even those in regions not expecting a major disaster.

CONCLUSION

This survey found that many pharmacy buildings were relatively new, but that nearly half of pharmacies did not secure any furniture, and a third of them had no emergency water supply. This indicates that many pharmacies must improve their disaster preparedness. Because the disaster preparedness of pharmacies is related to the level of disaster awareness among employees, this study suggests the importance of disaster awareness activities during non-disaster times.

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Conflict of Interest Statement

Authors declare no conflicts of interest.

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