An Analysis of Media Resources during Typhoon Hagibis

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Abstract Background: The passage of typhoon Hagibis over Izunokuni City, where our hospital is located, resulted in the city essentially becoming an island due to flooding and landslides. Objectives: To examine the sources used to obtain information on typhoon Hagibis with respect to the storm itself, safety, and health issues and to present data resources that can be used for disaster emergency mitigation among health workers. Methods: The survey inquired about respondents' age, sex, and occupation and asked the media to receive information about typhoon Hagibis and on damage induced by the typhoon in Izunokuni City. Results: The age of respondents ranged from 20 to 65 years old and the number of males was 97 and females 160. The number of clerks was 198, doctors 49, and nurses 10. The most frequently reported medium for obtaining information on the typhoon and damage induced by the typhoon in Izunokuni City were the television, followed by the internet (search engines like Yahoo or Google) and social networking services (SNSs). Conclusion: Television remains an important tool, but the internet and SNSs, have become similarly useful for obtaining information on disasters provided electric power is still available. One key point to consider in the future might be inter-connection through certain services between classic media and internet-based media for distributing information on disasters.

Keywords: *Typhoon Hagibis, disaster information, television, social media, Japan*

1. Introduction

Health and safety professionals and the public are interested in the best methods for providing timely information about disasters. People in affected areas seek information on warnings, the expected and actual damage incurred by the disaster, lifelines, evacuation routes, shelters, safety confirmation, assistance, and health issues using a variety of media outlets. Traditional media, including television, radio, loudspeakers, cable and satellite, newspaper, and billboards, has been used for decades. Among these outlets, television and radio remain key information sources, both before and during disasters [1,2]. These are tried-and-true methods that people have relied on for years, but they mainly announce general information one way and require a large advertising budget to maintain [3]. For this reason, people are beginning to diversify their strategies for obtaining information, including consulting less traditional media, such as social networking services (SNSs), offer a range of possibilities for establishing multidirectional communication and interaction, as well as quickly monitoring public sentiment and activity [4]. SNSs are also characterized by user-generated content, but their defining characteristic is the ability to generate direct communication and 2-way interaction between users; thus,

generating networks of users [5]. In the present study, social media was included in SNSs. Internet was defined as search engines like Yahoo or Google, and internet-based media included internet and SNSs. These new tools have the potential to help public health, including in disasters, meet many of its modern challenges and mandates regarding communicating with, educating, engaging, and monitoring a diverse public [4]. In a disaster response, risk communication to affected communities ensures that interventions are evidence-based and include a range of capacities at each stage of the emergency (i.e. preparedness, response and recovery) [5]. It encourages informed decision-making, positive behavior change and maintains the public's trust in the individuals handling the emergency [6,7,8].

Typhoon Hagibis hit Izu Peninsula on Saturday, October 12, 2019, as one of the most extreme typhoons on record. The typhoon struck Japan with torrential rainfall, storm surge flooding and strong winds hammering its largest main island, Honshu. Our facility (Juntendo University Shizuoka Hospital) is an acute critical care center located in Izunokuni City on the Izu Peninsula and the largest employer in the area, with more than 1600 workers on staff, including part-time employees. It serves as a disaster base hospital and emergency medical site servicing eastern Shizuoka (population: approximately 1,510,000) (https://www.hosp-shizuoka.juntendo.ac.jp/en/). The passage

of typhoon Hagibis over Izunokuni City resulted in the city essentially becoming an island due to closures of roads, bridges and public transportation following flooding of a branch of the main Kano River and landslides. As SNSs have been playing an important role in public health message dissemination in Japan, particularly as a tool in emergency preparedness and the emergency response [6], health and safety professionals and the public are interested in the best methods of providing timely information about disasters [2]. However, there have been few reports to investigate how often citizen use internet-based media during natural disasters, and few reports have compared SNSs to classic transmission media (e.g., television, radio or newspapers) [2,6,9,10,11,12].

The objective of this study was to examine the information sources used during typhoon Hagibis to obtain news on the storm, safety, and health issues and to offer data resources to use for disaster emergency mitigation among health workers. We hypothesized that internet-based media might play a major role in the dissemination of local disaster and/or personal emergency information, before, during, and after a disaster, particularly among younger generations. As our hospital is the largest employer in Izunokuni City, we investigated how our hospital staff obtained information concerning typhoon Hagibis and the resulting damage in Izunokuni City to survey how often classic transmission media and internet-based media are used in disasters, the purpose of the use, and the characteristics of users. We found that television remains an important tool, but the internet-based media, has become similarly useful for obtaining disaster information.

2. Material and Methods

The protocol of this study was approved by Shizuoka Hospital, Juntendo University.

We first perused previous reports concerning disaster communication tools and created a questionnaire [1,2]. We performed our questionnaire survey via in-person distribution using a printed copy with anonymity on October 20, 2019, after obtaining the director's permission. The persons that were targeted for the questionnaires were under the management of the general coordination division, most of these individuals were off duty on the disaster day, and thus the disaster information was obtained from them while they were at home on the disaster day. The questionnaire forms were collected on the same day. No incentives were given to obtain a response. As the population of Izunikuni City was approximately 48,000 people, the required sample size was ≥245 surveys to have a confidence level of 95%, a margin error level of 5%, a population proportion level of 80%, and a population size level of 48,000. When typhoon Hagibis hit Izunokuni City, roads were closed due to flooding from a branch of the Kano River, which resulted in the city essentially becoming an island; however, a blackout was avoided. The survey inquired about respondents' age, sex, and their occupation (clerk, doctor or nurse), and all were asked the following questions:

1) What kind of media did you use to receive information about typhoon Hagibis (multiple choice method with possible responses of television, radio, newspaper, internet [e.g. search engines like Yahoo or Google], Twitter, Facebook, Line, Messenger, e-mail, acquaintances [via in-person meetings], or others [free answer]); 2) What kind of media did you use to receive information on damage induced by the typhoon in Izunokuni City (multiple choice method with possible responses of television, radio, newspaper, internet [e.g. search engines like Yahoo or Google], Twitter, Facebook, Line, Messenger, e-mail, acquaintance, or others [free answer]); and 3) What was the most useful medium for obtaining information on damage induced by the typhoon in Izunokuni City (single choice method, with the same choices as above). Regarding Question 3, the most useful types of media for obtaining disaster information in Izunokuni City according to age, sex, and occupation between selectors and non-selectors, were evaluated. "Line" is a messaging platform and the most popular social media channel in Japan (https://line.me/en/). Television, radio, newspaper and acquaintances were classified as classic media; and internet, Twitter, Facebook, Line, Messenger and e-mail were classified as internet-based media. Based on these classifications, we investigated the number of respondents who used (or did not use) media from each of the two categories, and compared the selection of the two categories in the responses to Questions 1 and 2. We felt that classic media tended to announce general information (Question 1) whereas SNSs tended to communicate more local information (Question 2 and 3). To clarify the characteristics of subjects who selected a given media form, we chose 'selectors' and 'non-selectors' for the analysis. The questionnaire survey included simple questions and was conducted among our staff. The Ethics Committee of our hospital agreed not to utilize any third parties to check this research. When the questionnaires were collected, the collectors checked whether the respondents replied to all questions. If they found any questions that had not been answered, then a request was sent to request a reply.

To collect data and perform analyses, we used the Excel® software program (Microsoft Japan, Tokyo, Japan) and JMP® software program (SAS Institute Japan, Tokyo, Japan). A Wilcoxon's analysis for the age, chi-squared test for the sex and media and contingency table analysis for the occupation were used for the statistical analyses. P values of <0.05 were considered to be statistically significant.
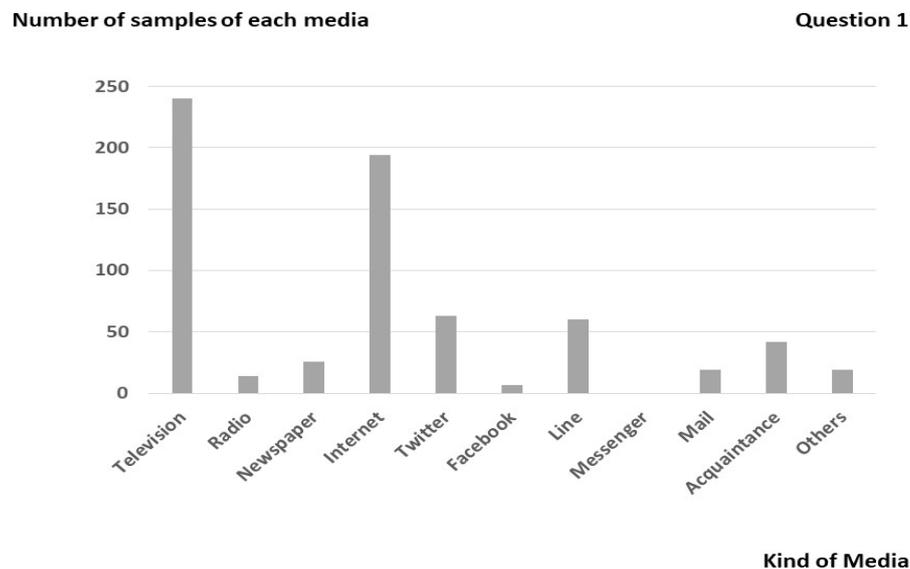
3. Results

The survey was administered to 257 staff members belonging to the general affairs division, Department of Acute Critical Care and medical residents. The collection rate was 100%. As there were no missing data, we did not clean the data. The age of respondents ranged from 20 to 65 years old (median 41 years old), and the number of males was 97 and females 160. The number of clerks was 198, doctor 49, and nurses 10. The background characteristics of the respondents are shown in Table 1.

Table 1. Background characteristics of the subjects and results of the questionnaire

| Age	Range 20-65, Median 41
Sex	**Female 160, Male 97**
Occupation	**Clerk 198, Doctor 49, Nurse 10**
Question 1	
Television (yes/no)	240/17
Radio (yes/no)	14/243
Internet (yes/no)	194/63
Twitter (yes/no)	63/194
Facebook (yes/no)	7/250
Line (yes/no)	60/197
Messenger (yes/no)	0/257
Mail (yes/no)	19/238
Acquaintance (yes/no)	42/215
Others (yes/no)	19/238
Question 2	
Television (yes/no)	197/60
Radio (yes/no)	6/251
Internet (yes/no)	137/120
Twitter (yes/no)	50/207
Facebook (yes/no)	3/254
Line (yes/no)	46/211
Messenger (yes/no)	0/257
Mail (yes/no)	15/242
Acquaintance (yes/no)	55/202
Others (yes/no)	22/235
Question 3	
Television (yes/no)	104/153
Radio (yes/no)	3/254
Newspaper (yes/no)	0/257
Internet (yes/no)	76/181
Twitter (yes/no)	31/226
Facebook (yes/no)	1/256
Line (yes/no)	19/238
Messenger (yes/no)	0/257
Mail (yes/no)	1/256
Acquaintance (yes/no)	17/240
Others (yes/no)	11/246

The results of the multiple-choice question regarding the media used to obtain information on typhoon Hagibis are shown in Figure 1. The most frequently reported medium for these purposes was the television (n=240), followed by the internet (n=194), Twitter (n=63), Line (n=60), acquaintances (n=42), newspaper (n=26), e-mail (n=19), others (n=19), radio (n=14), Facebook (n=7) and Messenger (n=0). There were 225 (87.5%) multiple-choice answer respondents. The total number of responses for "classic media", consisting of television, radio, newspaper and acquaintances, was 246, while the total number of responses for "internet-based media", consisting of the internet, Twitter, Facebook, Line, Messenger and e-mail, was 219.

Number of samples of each media   **Question 1**

Television was the most frequently reported medium, followed by the internet, Twitter, Line, and acquaintances.

Figure 1. How hospital staff obtain information on typhoon Hagibis

The results of the multiple-choice question regarding the media used to obtain information on damage induced by the typhoon in Izunokuni City are shown in Figure 2. The most frequently reported medium for these purposes was the television (n=192), followed by the internet (n=137), acquaintances (n=55), Twitter (n=50), Line (n=46), others (n=22), e-mail (n=15), newspaper (n=14), radio (n=6), Facebook (n=3) and Messenger (n=0). There were 188 (73.1%) multiple answer respondents. The total number of responses for "classic media", consisting of television, radio, newspaper and acquaintances, was 217, while the total number of responses for "internet-based media", consisting of internet, Twitter, Facebook, Line, Messenger and e-mail, was 185.

Number of samples of each media　　　　　　**Question 2**
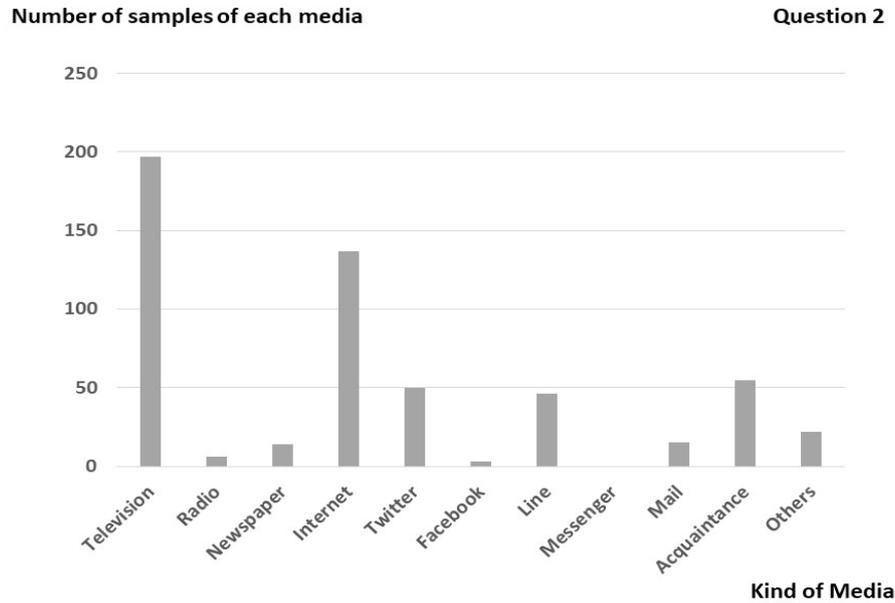
Television was the most frequently reported medium, followed by the internet, acquaintances, Twitter, and Line.

Figure 2. How hospital staff obtained information on damage induced by typhoon Hagibis in Izunokuni City

The results of the single-choice question regarding the most useful media for obtaining information on damage in Izunokuni City are shown in Figure 3. The medium reported most useful for obtaining information on damage induced by the typhoon in Izunokuni City was reported to be the television (n=104), followed by the internet (n=76), Twitter (n=31), Line (n=19), acquaintances (n=17), others (n=11), radio (n=3), Facebook (n=1), newspaper (n=0) and Messenger (n=0). The total number of responses for "classic media", consisting of television, radio, newspaper (n=0) and acquaintances was 124, while the total number of responses for "internet-based media", consisting of internet, Twitter, Facebook, Line, Messenger (n=0) and e-mail was 128. Most of the "other" responses were disaster prevention radio transmissions.
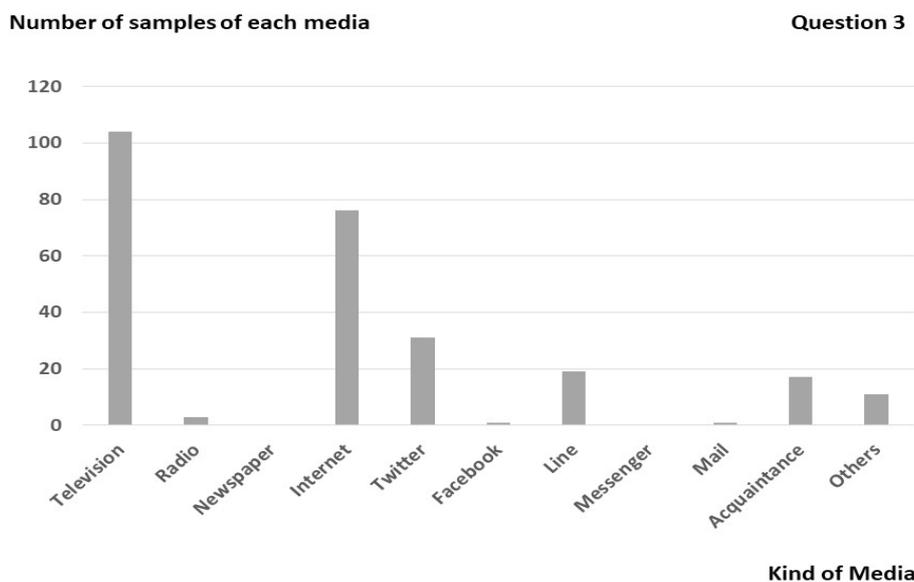
Number of samples of each media　　　　　　**Question 3**

Television was the most frequently reported medium, followed by the internet, Twitter, Line, and acquaintances.
The total number of responses for television, radio, newspaper (n=0) and acquaintances was 124, while the total number who answered internet, Twitter, Facebook, Line, Messenger (n=0) and e-mail was 128.

Figure 3. Which medium was the most useful for obtaining information on damage induced by typhoon Hagibis in Izunokuni City

Difference in the media deemed most useful for obtaining disaster information in Izunokuni City (Question 3) stratified by the age, sex, and occupation between selectors and non-selectors are shown in Table 2. The results of radio (n=3), newspaper (n=0), Facebook (n=1), Messenger (n=0), and e-mail (n=1) were excluded because each choice was selected by fewer than 5 respondents (selectors). Concerning television, internet, acquaintances and others, there were no significant differences in the age,

sex, or occupation between selectors and non-selectors. Concerning Twitter, there were no significant differences in the sex or occupation between the selectors and non-selectors. However, the average age of selectors of Twitter was significantly younger than that of non-selectors. Concerning Line, there were no significant differences in the age or sex between the selectors and non-selectors. However, the distribution of occupation was significantly different between selectors and non-selectors.

Table 2. Most useful media for obtaining disaster information in Izunokuni City by age, sex, and occupation between selectors and non-selectors

Television		Selector	non-Selector	p value
Age (year)		39.9 $\pm$ 11.7	39.0 $\pm$ 11.8	0.55
Sex (number)	Man/Female	39/65	58/95	0.94
Occupation (number)	Clerk/Doctor/Nurse	77/21/6	121/28/4	0.39
Internet		Selector	non-Selector	p value
Age (year)		40.8 $\pm$ 11.9	38.7 $\pm$ 11.7	0.11
Sex (number)	Man/Female	31/45	66/115	0.51
Occupation (number)	Clerk/Doctor/Nurse	77/21/6	121/28/4	0.56
Twitter		Selector	non-Selector	p value
Age (year)		33.9 $\pm$ 10.3	40.1 $\pm$ 11.8	0.002
Sex (number)	Man/Female	15/16	82/144	0.19
Occupation (number)	Clerk/Doctor/Nurse	23/7/1	175/42/9	0.86
Line		Selector	non-Selector	p value
Age (year)		40.4 $\pm$ 7.6	39.3 $\pm$ 12.0	0.68
Sex (number)	Man/Female	5/14	92/146	0.27
Occupation (number)	Clerk/Doctor/Nurse	15/0/4	183/49/6	0.004
Acquaintance		Selector	non-Selector	p value
Age (year)		38.5 $\pm$ 11.1	39.4 $\pm$ 11.8	0.76
Sex (number)	Man/Female	3/14	94/146	0.07
Occupation (number)	Clerk/Doctor/Nurse	14/2/1	184/47/9	0.68
Others		Selector	non-Selector	p value
Age (year)		40.1 $\pm$ 14.9	39.3 $\pm$ 11.6	0.93
Sex (number)	Man/Female	2/9	95/151	0.14
Occupation (number)	Clerk/Doctor/Nurse	7/3/1	191/46/9	0.54

The number of respondents who indicated that they selected (or did not select) each of the two categories (classic media versus internet-based media), and the comparison of the selection of the two categories in Questions 1 and 2 are shown in Table 3. There was no significant difference for Question 1. However, the rate of classic media selection among respondents who selected internet-based media was significantly smaller than that among respondents who did not select internet-based media in Question 2.

Table 3. Number of instances in which classic media and/or internet media were selected in Questions 1 and 2

Question 1		Classic media			p value
		yes	no	total	
	yes	208	11	219	
Internet media	no	38	0	38	
	total	246	11	257	0.15
Question 2		Classic media			p value
		yes	no	total	
Internet media	yes	149	36	185	
	no	68	4	72	
	total	217	40	257	p < 0.01

4. Discussion

This is the report to describe how often each medium and SNSs were used to obtain disaster information, and the characteristics of users of each medium and SNSs after a severe typhoon Hagibis 2019 hit Japan. The present study showed that television was also the most frequently used medium for obtaining information on the typhoon and the damage it caused, followed by the internet. Over 90% of households in Japan now have color television, and watching television is basically free outside of a fee paid to the Japan Broadcasting Corporation (NHK) [13,14,15]. In addition, television provides timely information on urgent alarms or information concerning disasters based on the Japanese disaster prevention system. Accordingly, television viewers can freely obtain useful information on disasters through their television both visually and by listening [16,17]. This may be why television was the most frequently reported medium used in the present study. Weak points of this approach to obtaining information may be that viewers must be near a television when they need information. In addition, most

televisions cannot function during a blackout. Furthermore, information from televisions is one-way discharge if broadcasting images are not recorded.

The present study showed that radio was hardly used by our respondents. However, previous reports indicated that radio was an important medium for collecting disaster information [2,12]. This difference may be based on the stability of the electricity supply [2]. In superstorm Sandy, people relied on whatever source was functioning, and in many communities, web access and cell phones were not operating. The length of loss of internet depended on not only local power outages but also the resilience of internet providers [2]. The present study collected data from areas that were not affected by blackouts and where the television worked normally. In the event of a power failure, televisions would not work, but radios, in addition to smart phones or personal computers, would be able to operate for some time using battery power. In such situations, different results would likely be obtained.

The present study showed that the internet was the second-most frequent medium used for obtaining information during this disaster. Notable, an increasing number of Japanese people are finding themselves in an internet-connected environment, especially among younger generations [14]. In addition, with a smartphone, one can be connected to the internet at any time. Over 90% of Japanese people in their 20s now have smart phones [14]. The Japanese government and mass media also recognize the importance of the internet as a useful venue for transmitting information in disasters and use it to such ends [18]. This may be why the internet was the second-most frequent medium used for obtaining information in the present study.

The age of selectors of Twitter tended to be younger in the present study than in non-selectors, and Twitter was reported as the third-most frequently useful medium for obtaining disaster information in Izunokuni City. In an analysis of Japanese users concerning their social networking service of choice, the age of Twitter users tended to be younger than that of users of Facebook or Line. In addition, the speed of information distribution with Twitter tends to be quicker than with Facebook or Line [19]. Furthermore, as Twitter has actually been used in disasters, previous studies have conducted analyses on Twitter specifically [9,10,11]. This might be why users of Twitter tended to be younger, with Twitter being reported as the third-most useful medium in our study. Interestingly, Japanese users of Line tend to be female [14]. Nursing is a female-dominant occupation, which may explain the dominance of nurses as selectors of Line.

The present study showed that classic media was predominantly used to obtain typhoon information; however, most subjects used both classic media and internet-based media including SNSs together. SNSs tools or websites are generally distinguished by the creation of individual public profiles and multidirectional communication and collaboration, which allows users to connect to one another within the site [4]. These qualities give SNSs the potential to expand and enhance core public health functions. For instance, the Centers for Disease Control and Prevention (CDC) provides tools for SNSs to expand and enhance research, surveillance, health education, and to link people with health resources, similarly to Japanese government [4]. In the Louisiana floods of 2016, SNSs were utilized for a wide range of purposes, including locating family and loved ones, requesting help, disseminating information, and psychosocial interaction [9]. While broadcast media have represented important sources of information immediately before and during disasters [12], the present study showed that a significant number of the subjects used SNSs to obtain information about the typhoon. The Japanese government also promoted awareness of the role of broadcast networks in disasters and encouraged general household disaster preparedness [12]. These background characteristics support that most of subjects used both classic media and SNSs together in the present study. In the event of a disaster, people tend to use multiple functioning modalities to obtain disaster information, and time-critical information can be exchanged among any people or organizations simultaneously, with the capability to receive feedback [20]. Accordingly, a further integrated communication strategy with redundancies is needed to obtain appropriate information in disaster setting. One key point to consider in the future might be inter-connection through certain services between classic media and internet-based media for distributing information on disasters. Social television is a consequence of the convergence of TV and internet. Twitter, Facebook and a growing list of tablet applications allow ratings, checking in and instantaneous communication between viewers, actors and characters. The application of classic and internet-based media will allow the sharing of snippets of programming. [21] Such changes might facilitate disaster communication.

The present study showed that there was no significant difference in the rate of selection between classic media and internet-based media concerning information about typhoon Hagibis; however, there were significant differences concerning the damage information distributed in Izunokuni City. Although the number of respondents who selected both classic and internet-based media was the largest, the rate of classic media selection among respondents who also selected internet-based media was significantly smaller than that among respondents who did not select internet-based media concerning damage information in Izunokuni City. The present study classified SNSs as internet-based media. SNSs tend to communicate more local information than classic media [22,23]. Some people searching for information on local damage might use SNSs and not classic media. Such a trend might explain the difference seen in Table 3.

There present study was associated with several limitations. First, it employed a retrospective study design and included a small number of subjects. Second, we surveyed the staff members of our hospital, who were off duty on the disaster day, and collected the disaster information from them while they were at home. As we felt this approach was certain to obtain a high response rate to the questionnaire, would be easy to perform and would not be costly to conduct quickly. In addition, most

workers on duty were not using any SNSs devices while they were busy treating patients Accordingly, the results of the present study may have some selection bias in comparison with general citizens, and we lacked data on children or elderly people who were not familiar with SNSs. Third, we did not check the validity of reliability of the questionnaire, as this would require another study and might have resulted in missing the time frame when the subjects' memories would be best preserved. Fourth, there are 5 Japanese references in the present study, which makes it difficult to refer back to them for a future study. Fifth, SNSs are still developing, and we included only certain representative SNSs used frequently in Japan. The penetration ratio and SNS types differ among countries, which might result in different results compared with the present study. Finally, we did not include a concrete plan as to how this research could be used to aid in disaster emergency mitigation among health workers, even in the context of Izunokuni City. Accordingly, to improve risk communication in natural disasters, further studies are needed to determine the most effective media for disaster communication, including SNSs, based on a nationwide survey.

5. Conclusion

We reported the results of our investigation into how our staff obtained information on typhoon Hagibis and its ensuing damage in Izunokuni City. Television remains an important tool, but the internet-based media, has become similarly useful for obtaining disaster information when electric power was still available. In the event of a disaster, people tend to use multiple functioning modalities to obtain disaster information, and time-critical information can be exchanged among any people or organizations simultaneously, with the capability to receive feedback. As such, a more integrated communication strategy with redundancies is needed to obtain appropriate information in disaster setting. One key point to consider in the future might be inter-connection through certain services between classic media and internet-based media for distributing information on disasters.

Acknowledgements

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