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Awareness of Disaster Reduction Frameworks and Risk Perception of Natural Disaster: A Questionnaire Survey among Philippine and Indonesian Health Care Personnel and Public Health Students

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As the impacts of natural disasters have grown more severe, the importance of education for disaster medicine gains greater recognition. We launched a project to establish an international educational program for disaster medicine. In the present study, we surveyed medical personnel and medical/public health students in the Philippines (n = 45) and Indonesia (n = 67) for their awareness of the international frameworks related to disaster medicine: the Human Security (securing individual life and health), the Sphere Project (international humanitarian response), and the Hyogo Framework for Action 2005-2015 (international strategy for disaster reduction). In both countries, more than 50% responders were aware of human security, but only 2 to 12% were aware of the latter two. The survey also contained questions about the preferred subjects in prospective educational program, and risk perception on disaster and disaster-related infections. In the Philippines, significant disasters were geophysical (31.0%), hydrological (33.3%), or meteorological (24.8%), whereas in Indonesia, geophysical (63.0%) and hydrological (25.3%) were significant. Moreover, in the Philippines, leptospirosis (27.1%), dengue (18.6%), diarrhea (15.3%), and cholera (10.2%) were recognized common disaster-related infections. In Indonesia, diarrhea (22.0%) and respiratory infection (20.3%) are major disaster-related infections. Water-related infections were the major ones in both countries, but the profiles of risk perception were different (Pearson's chi-square test, p = 1.469e-05). The responders tended to overestimate the risk of low probability and high consequence such as geophysical disaster. These results are helpful for the development of a postgraduate course for disaster medicine in Asia Pacific countries.

Keywords: disaster-related infection; education for disaster medicine; Human Security; natural disasters; risk perception
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Introduction

The impacts of natural disasters have been growing. Leaning and Guha-Sapir (2013) described it as follows: "There were three times as many natural disasters from 2000 through 2009 as there were from 1980 through 1989." The economic damage brought by natural disasters shows that the world suffers catastrophic disasters every several years (Leaning and Guha-Sapir 2013). Disaster risk reduction has become a global issue. The United Nations promoted the 1990s as the International Decade for Natural Disaster Reduction (Housner 1989). The United Nations International Strategy for Disaster Reduction was created in 1999 (Who we are: http://www.unisdr.org/who-we-are). The international community has recognized that disaster risk reduction is a mainstream concern.

As the Hyogo Framework for Action 2005-2015 (HFA) emphasized, education is important in order to provide citizens with knowledge on disaster risk reduction and preparedness (United Nations International Strategy for Disaster Reduction 2005). There are ongoing projects and research being carried out in terms of disaster response and preparedness. In terms of humanitarian responses, the consideration of quality and accountability of aid is important. A group of non-governmental organizations and, the International Red Cross and the Red Crescent Movement initiated the Sphere Project to improve the quality of humanitarian response in disaster. They published a handbook to provide principles and core standards (Sphere Project 2011). The impact of natural disasters to public health has been growing (Keim 2011). There are educational efforts being implemented in emergency medicine and family medicine to develop capacity in disaster medicine (Franc-Law et al. 2010; Huntington and Gavagan 2011). However, the current level of knowledge of disaster medicine among medical students and health professionals is not sufficient (Su et al. 2013).

We launched a project on human security with Asian Pacific countries to develop disaster studies and education in medicine (Hattori et al. 2012). Human security is a new paradigm of security that cannot be accomplished by securing the territory from external threats, which used to be the main goal of traditional means of security (United Nations Development Programme 1994; Ogata and Sen 2003). The United Nations Development Programme (UNDP) emphasized the importance of human security. Thus, whether human security has interdependency of its components, effectiveness of early prevention, and is people-centered, should be of universal concern. There are seven categories of threats for human security: economic, food, health, environmental, personal, community, and political. The UNDP also pointed out that "the rising tide of disasters (United Nations Development Programme 1994)" would be a significant threat to human security.

Globally speaking, the burden of infectious disease is still high, especially in low or middle-income countries (Lozano et al. 2012). There are many outbreaks of infectious disease following natural disasters (Kouadio et al. 2012). Outbreaks are avoidable with proper education (de Ville de Goyet 1991). Thus, we focused on education so that we could provide adequate knowledge for disaster-related infectious diseases in low or middle-income countries with high burdens of both infectious disease and natural disasters.

In our feasibility study, we conducted a questionnaire survey in the Philippines. The purpose of our study was to collect data on opinions about disaster-related infectious diseases and education programs for disaster medicine. Our results suggested that there were relationships between risk perceptions of natural disasters and disaster-related infectious diseases (Usuzawa et al. 2013). The type of the disaster is one of the determining factors for an infectious disease outbreak following a disaster (Connolly et al. 2004).

We then conducted further surveys in the Philippines and Indonesia to investigate the awareness of frameworks for disaster preparedness and mitigation and to identify the need for education in disaster medicine, especially infectious disease. The Philippines and Indonesia are countries with a high burden of natural disasters in the number of events reported in 2012 (Guha-Sapir et al. 2013) and they are middle-income countries.

Methods

We administered an anonymous questionnaire on several issues related to disaster medicine to medical school students, public health school students, and medical personnel. The questions were on awareness of international frameworks related to disaster medicine (Human Security, Sphere Project, and HFA), and the need for prospective courses in human security and disaster medicine. To survey risk perceptions of disaster and disaster-related infectious disease, the survey also contained a question about disasters and disaster-related infectious diseases.

We distributed questionnaire sheets at lectures in universities and at conferences. They were collected either on site or via email later. R (version 2.15.0) on Windows 7 was used for statistical analysis.

Ethical consideration

We did not collect information about participants' health. Although, according to the definition of the Ethical Guidelines for Epidemiological Research by the Ministry of Health, Labor and Welfare, Japan, the survey was not an epidemiological study, we followed it. Participants were provided written documentation outlining the purpose of the survey, the data handling policy and the publication policy. They had the option not to participate by returning the questionnaire without answering any questions. We did not collect any information which could identify individuals. Those who did not involve in collecting the data processed the data to assure anonymity. The original questionnaire sheets were stored in a cabinet with a lock.

Results

The study initially included 46 Filipinos and 70 Indonesians; however, four questionnaires were returned

without all of the questions completed (one in the Philippines, three in Indonesia). In total, 45 Filipinos and 67 Indonesians participated. Of the 45 responders in the Philippines, 36% (n = 16) were medical students, 27% (n = 12) were laboratory staffs, 11% (n = 5) were academic staffs or managers, 9% (n = 4) were medical doctors, and 7% (n = 3) were government/non-government organization personnel working for disaster response. Of the 67 responders in Indonesia, 46% (n = 31) were public health school students, 36% (n = 24) medical school students, 12% (n = 8) medical doctors, and 3% (n = 2) local government officers. Two respondents chose not to identify their position.

The participants' awareness of international frameworks is shown in Table 1. In both countries, more than half were aware of human security. Far fewer were aware of the Sphere project and HFA (Table 1). Various subjects were listed as being preferable for prospective courses of human security in disaster medicine. In the Philippines, infectious disease was the preferred subject, and in Indonesia, disaster studies and public health, were preferred subjects (Table 2). Table 3 shows the risk perceptions of significant disasters. In the Philippines, water-related disasters, floods (24.8%, 32/129) and typhoons (23.3%, 30/129), were recognized as significant disasters. Twenty-three percent (23.3%, 30/129) pointed out earthquakes as a significant disaster caused by natural hazards. In Indonesia, earthquakes (24.7%, 38/154) were considered the most significant disasters in this survey. Volcanic eruption (22.1%, 34/154), flood (22.1%, 34/154), and tsunami (16.2%, 25/154) followed it. To investigate the difference between the two profiles, we recounted the data and categorized it according to the criteria, which is shown in the Annual Disaster Statistics Review 2012 (Guha-Sapir et al. 2013). In the Philippines, significant disasters were geophysical (31.0%, 40/129), hydrological (33.3%, 43/129), or meteo-

Table 1. Awareness of international frameworks related disaster response.

	Human Security	The Sphere Project	HFA
Philippines (N = 45)	26 (58%)	1 (2%)	5 (11%)
Indonesia (N = 67)	35 (52%)	8 (12%)	7 (10%)

Each cell shows the number of responders who were aware of the framework and its percentage in blanket.

Table 2. Preferable subject for human security in disaster medicine.

	Community management	Disaster medicine	Disaster study	Infectious diseases	Medicine	Public health	Risk studies	Other	Total
Philippines	0 (0.0)	2 (3.4)	9 (15.3)	28 (47.5)	6 (10.2)	4 (6.8)	2 (3.4)	8 (13.6)	59 (100.0)
Indonesia	3 (5.9)	0 (0.0)	20 (39.2)	0 (0.0)	6 (11.8)	12 (23.5)	0 (0.0)	10 (19.6)	51 (100.0)

Multiple answers were allowed. Each cell shows number of those who though the subject as preferable. Participants in the Philippines were students and medical staff. Those of Indonesia were public health students. It may affect the results. Each cell shows number and its percentage in blankets.

Table 3. Awareness of significant disaster.

	Earthquake	Flood	Volcanic eruption	Typhoon	Tsunami	Landslide	Infectious disease	Storm	Other	Total
Philippines	30 (23.3)	32 (24.8)	10 (7.8)	30 (23.3)	0 (0.0)	11 (8.5)	5 (3.9)	2 (1.6)	9 (7.0)	129 (100.0)
Indonesia	38 (24.7)	34 (22.1)	34 (22.1)	0 (0.0)	25 (16.2)	5 (3.2)	8 (5.2)	3 (1.9)	7 (4.5)	154 (100.0)

Multiple answers were allowed. Each cell shows number of those who thought the disaster as significant. Earthquake was significant disaster in the two countries. Whereas typhoon was thought significant disaster in the Philippines, eruption and tsunami were regarded as significant disaster. Each cell shows number and its percentage in blankets.

Table 4. Awareness of significant disaster recollected by category.

	Biological	Climatological	Geophysical	Hydrological	Meteorological	Other	Total
Philippines	6 (4.7)	6 (4.7)	40 (31.0)	43 (33.3)	32 (24.8)	2 (1.6)	129 (100.0)
Indonesia	10 (6.5)	3 (1.9)	97 (63.0)	39 (25.3)	3 (1.9)	2 (1.3)	154 (100.0)

The data in Table 3 was categorized as appeared in Annual Disaster Statistics Review 2012. Fisher's exact test showed significant difference (p = 1.1156e-10) in the two countries. Each cell shows number and its percentage in blankets.

Table 5. Awareness of significant infectious disease related natural disaster.

	Diarrhea	Leptospirosis	Dengue	Respiratory infection	Influenza	Cholera	Skin infection	Tuberculosis	Other	Total
Philippines	18 (15.3)	32 (27.1)	22 (18.6)	6 (5.1)	10 (8.5)	12 (10.2)	4 (3.4)	2 (1.7)	12 (10.2)	118 (100.0)
Indonesia	27 (22.0)	5 (4.1)	11 (8.9)	25 (20.3)	11 (8.9)	2 (1.6)	8 (6.5)	6 (4.9)	28 (22.8)	123 (100.0)

Multiple answers were allowed. Each cell shows number of those who thought the infectious disease as significant and its percentage in blankets.

Table 6. Awareness of significant infectious disease recollected by route of transmission.

	Respiratory infection	Water-related infection	Other	Total
Philippines	16 (13.6)	88 (74.6)	14 (11.9)	118 (100.0)
Indonesia	36 (29.3)	55 (44.7)	32 (26.0)	123 (100.0)

The data in Table 5 was categorized by route of transmission. Respiratory infection and influenza in Table 5 were integrated in Respiratory infection in Table 5. Tuberculosis was excluded because it is chronic rather than acute in terms of disaster-related infection. Diarrhea, leptospirosis, dengue, cholera, skin infection and dysentery (Others in Table 5) were classified as water-related infection. Pearson's chi-square test showed significant difference (p = 1.469e-05) in the two countries. Each cell shows number and its percentage in blankets.

Table 7. Comparison of disaster risk perception and disaster statistics.

categories	a) Numbers of events				b) Numbers of people killed				c) Average numbers of people killed per one event; a/b				d) Responders' risk perception of disaster			
	Philippines		Indonesia		Philippines		Indonesia		Philippines		Indonesia		Philippines		Indonesia	
	n	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)	*n*	(%)
biological	18	(3.2)	35	(8.0)	1,283	(2.1)	3,966	(1.6)	71.3	(14.9)	113.3	(5.2)	6	(4.7)	10	(6.5)
climatological	9	(1.6)	18	(4.1)	10	(0.0)	9,629	(4.0)	1.1	(0.2)	534.9	(24.6)	6	(4.7)	3	(1.9)
geophysical	55	(9.9)	165	(37.8)	13,083	(21.3)	216,887	(89.9)	237.9	(49.7)	1,314.5	(60.5)	40	(31.0)	97	(63.0)
hydrological	165	(29.6)	206	(47.2)	5,910	(9.6)	8,719	(3.6)	35.8	(7.5)	42.3	(1.9)	43	(33.3)	39	(25.3)
meteorological	311	(55.7)	12	(2.8)	41,154	(67.0)	2,013	(0.8)	132.3	(27.7)	167.8	(7.7)	32	(24.8)	3	(1.9)
other	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	NA		NA		2	(1.6)	2	(1.3)

Columns marked a) showed reported numbers of event and b) showed reported numbers of people killed in each category of disaster. The data were obtained from "EM-DAT: The OFDA/CRED International Disaster Database, www.emdat.be-Université catholique de Louvain-Brussels-Belgium". Columns c) indicate the calculated numbers of people killed per one event. In columns d), the data in the Table 4 were recounted according to ADSR classification (the Philippines, N = 129 and Indonesia, N = 154). They show risk perception of the responders of our survey. Each cell shows number and its percentage in blankets. NA, not applicable.

rological (24.8%, 32/129). In Indonesia, geophysical (63.0%, 97/154) and hydrological (25.3%, 39/154) were the top two answers (Table 4). Fisher's exact test showed that two profiles were sampled from different populations (p = 1.1156e-10). We concluded that risk perception of disaster differs between the Philippines and Indonesia.

In the Philippines, leptospirosis (27.1%, 32/118), dengue (18.6%, 22/118), diarrhea (15.3%, 18/118), and cholera (10.2%, 12/118), outbreaks of which occurred after water-related disasters, were recognized common disaster-related infectious diseases. In Indonesia, diarrhea (22.0%, 27/123) and respiratory infection (20.3%, 25/123) are major disaster-related infectious diseases. Dengue and influenza represented 8.9% (11/123) of the responses, respectively (Table 5). We classified the answers into three categories: respiratory infections, water-related infections, and other infections (Table 6). There was a significant difference in the profiles of risk perception about disaster-related infectious disease (Pearson's chi-squared test, p = 1.469e-05).

Discussion

Disasters, which are thought of as significant, were different in the two countries. This suggests that disaster risk perception in the two countries would be different. To investigate if there are relationships between risk perceptions obtained by our survey and disaster statistics, we compared them in the two countries. Disaster statistics (Table 7) show that significant disasters are hydrological, meteorological, and geophysical and they accounted for more than 90% (96% in the numbers of events; 98% in the number killed) in the Philippines. Our survey showed that they accounted for 89% of the disasters that were viewed as significant in the Philippines.

Disaster statistics in Indonesia showed that geophysi-

cal and hydrological accounted for 85% of the number of events and 94% of the number of people killed. Our survey showed that they accounted for 88% of the disasters that were considered significant in Indonesia. Our results seem to coincide with statistics.

The psychometric approach provided a framework for risk perception. Slovic showed that the factors of risk perception consisted of two factors, controllable/uncontrollable and known/unknown (Slovic 1987). Starr found that people overestimated the risk of low probability and high consequence hazards (Starr 1969). Each country has different profiles of disaster. Hence, according to the psychometric approach of risk perception research, we will find the difference in their risk perception. In disaster risk perception, people tend to overestimate the risk of disasters, which occurs rarely but kills many people when it does occur.

In the Philippines, geophysical disaster was 10% of the numbers of events and responsible for 21% of the number of people killed (Table 7). In geophysical disasters, the average number of people killed per event was 237.9. This was more than the number of people killed in hydrological (35.8) and meteorological (132.3) disasters, combined. The same applied to geophysical disasters in Indonesia. The average number killed per one geophysical disaster was 1,314.5. This was more than the number of people killed in hydrological (42.3) and meteorological (167.8) disasters (Table 7). In terms of numbers killed, geophysical disasters in both counties are more severe than other disasters. This might affect risk perception. More precise, future research is needed if we shift our focus to risk perception research.

Researchers on risk perception are interested in subjective risk perception of people and its psychological mechanism (Slovic et al. 1979; Smith et al. 2011). Smith and his colleagues analyzed risk perception of disasters, which included both natural and technological disasters, and drew their results in a plot diagram whose axes were fear/no fear and familiar/no familiar (Smith et al. 2011). Their analysis showed comparisons between the risks perceived by people. We measured risk perceptions of disaster and disaster-related infectious disease. Our results suggested that risk perception of disasters and disaster-related infectious diseases were different in the Philippines and Indonesia and the psychometric approach to risk perception might provide a hypothetical explanation, which pointed out a connection between the disaster statistics and the risk perception of the participants. The limitation of our study was that it was not designed to verify the risk perception theory; thus, we could not show the mechanism of the risk perception that led to the obtained results.

In Table 3, we found no answers that mentioned storm surge as a significant disaster in the Philippines, although 30 out of 129 did mention typhoons, which induces a storm surge. This suggests a topic for disaster preparedness and mitigation education. If individuals were to learn that a storm surge induced by a typhoon could reach up to several meters high, they could acquire practical knowledge for disaster mitigation. In November 2013, Typhoon Haiyan struck the Philippines. The storm surge destroyed the coastal area of Tacloban, Leyte province. The International Research Institute of Disaster Science (IRIDeS), Tohoku University, organized a research project to clarify the damage done by the typhoon. According to the preliminary survey, people in Tacloban were forewarned via television or radio broadcasts that the storm surge would strike the town but they did not understand how severe it would be. This project anticipates conducting further scientific research on this topic in an effort to develop an effective early warning system.

In this article, we focused on disaster related infectious disease as a topic of education for disaster medicine in human security. Outbreaks of infectious disease are not the sole issue posed by disasters. On March 11, 2011, severe earthquakes followed by tsunamis, struck East Japan. This disaster was named the 2011 Great East Japan Earthquake and Tsunami (GEJET). At least 18,500 were killed and missing (Shibahara 2011). The tsunami, which was the largest in the past 1,000 years, destroyed a vast part of the coastal areas of Iwate, Miyagi, and Fukushima (Ishigaki et al. 2013). Although UNDP had already pointed out that a disaster would be a significant threat to human security (United Nations Development Programme 1994), the disaster was far beyond anything anticipated and demonstrated that human security was threatened in the affected areas.

In addition, there is a lot to be done before the recovery and reconstruction from the GEJET is complete. According to the Reconstruction Agency, Government of Japan, "some 470,000 people were evacuated, and over 320,000 people have been displaced on a longer-term basis" (Progress to Date. Housing Redevelopment: http://www.reconstruction.go.jp/english/topics/2013/03/housing-redevelopment.html). Although, multiple levels of government and local communities are making an effort to rebuild the lost communities, they have to cope with many difficulties (Iuchi et al. 2013). The accident in the Fukushima Dai-Ichi Nuclear Power Plant is extremely severe and not everyone has come together yet to solve it (Tanaka 2012). We cannot ignore the experience of the GEJET and the lessons learned from it when we study disaster science here in Sendai, Japan. The concept of human security is expected to be the core of education for disaster medicine.

Conclusion

In this study, we showed that risk perception of disaster and disaster-related infectious diseases are different in the Philippines and Indonesia. The results are expected to contribute to the development of a postgraduate course in disaster medicine based on the concept of human security in Asia Pacific countries.

Contributions

M.U., S.E., Y.O. and T.I. designed the questionnaire,

T.H., S.E., M.F., E.T., C.D., B.A. and R.K. conducted the survey, M.U. analyzed the data, and M.U., S.E., Y.O., Y.A. and T.H. wrote the paper. All authors read and approved the final manuscript.

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Conflict of Interest

The authors declare no conflict of interest.

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