

Be Prepared! — Lessons learned from the Great East Japan Earthquake and tsunami disaster

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Naruo UEHARA*¹

Introduction

Michael Lechat, a pioneer of disaster epidemiology, defined natural disasters as “ecological disruptions exceeding the adjustment capacity of the affected community.”¹ The impact of a disaster is determined by the destructive power of the natural phenomenon and the human capability to cope with it. The science of disaster prevention has been concerned with issues such as architecture and civil engineering, mainly investing in physical prevention; in contrast, public health science is concerned with disaster preparedness, which is meant to provide effective responses in order to reduce the avoidable death, suffering, and disability directly or indirectly caused by a disaster.

In the aftermath of the Great East Japan Earthquake on March 11, 2011, I was assigned to help with disaster response and health relief activities as a medical coordinator and advisor for the Public Health Department of the Miyagi Prefectural Government. I was in charge of the Support Office for Health Relief Operations, located on the 16th floor of the prefectural government building, where I served for 2 months. Then, I voluntarily continued the same function at my office in Tohoku University until August of the same year. The primary lesson I learned through these experiences was that *in post-disaster situations, it is very hard to do what has not been prepared for in advance*. Conventional disaster response plans and manuals lean heavily on mass-casualty management in earthquakes, but such a severe and extensive disaster—one caused by the tsunami that we faced this time—was not anticipated. What had

been prepared, based on the lessons of the Han-Shin Awaji Earthquake in 1995, were actually implemented to some degree, such as the Disaster Medical Assistance Team (DMAT) program, mental care teams, and support for continuation of dialysis treatment. However, other health relief operations, or even a coordination system for disaster health management, had not been prepared at the prefectural and national levels. It was extremely difficult to initiate and implement what were neither planned nor prepared for in advance in the midst of such a chaotic situation.

Nonetheless, physicians, nurses, public health nurses, and other civil workers who themselves were disaster victims fought hard to help other survivors. Also, many health professionals from all over Japan voluntarily rushed to the disaster areas to join in the health relief activities for the affected people. The danger due to the radiation from the Fukushima nuclear plant accident was of considerable concern at the time; therefore, choosing to be on the ground at local disaster sites in the Tohoku region must have taken much courage and determination. I am also deeply grateful to our peers who provided aid and heartening encouragement from overseas.

At the same time, I regret that, if we had been better prepared in advance, their enthusiasm would have reached the affected people more effectively, and could have reduced avoidable death and the pain.

I sincerely hope that the lessons we learned from this disaster will be used for the improvement of health disaster preparedness in Japan as well as in other countries.

*¹ Professor Emeritus, Tohoku University, Sendai, Miyagi, Japan (narouuehara@gmail.com).

This *Great East Japan Earthquake — A message from Japan Series* concludes with this article.

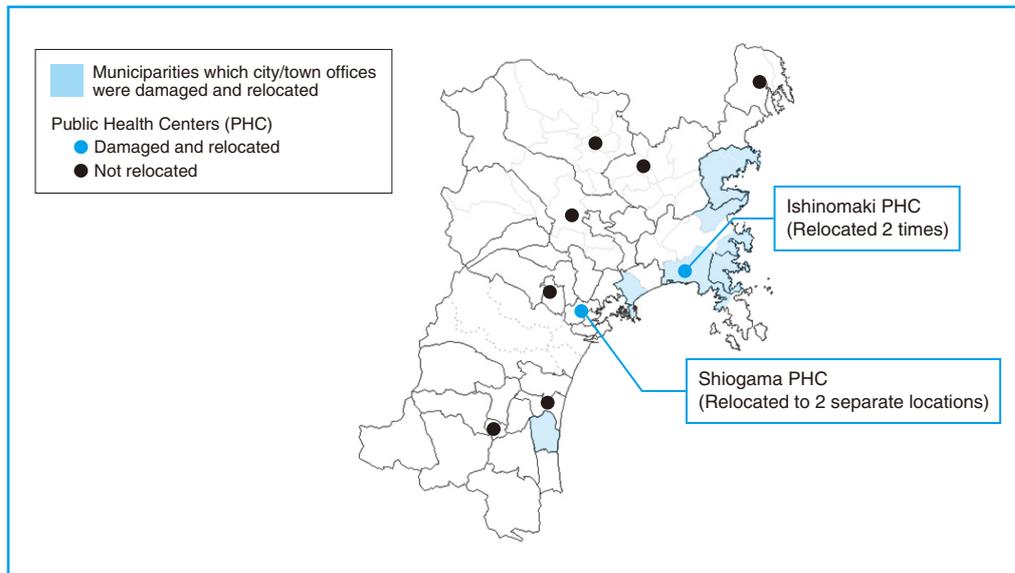


Fig. 1 City/town head offices and public health centers in Miyagi Prefecture that were damaged and relocated after the Great East Japan Disaster of March 11, 2011

Characteristics of the Disaster

The Great East Japan Earthquake brought a complex disaster to us, consisting of the earthquake that registered 9 on the Richter scale, the tsunami triggered by the earthquake, incidental fires, and the explosion at the Fukushima nuclear power plant. The cold climate of the Tohoku region, another unfavorable factor, added to the complexity of the disaster. The damage was especially significant in the 3 prefectures of Iwate, Miyagi, and Fukushima. A total of 18,574 people have been confirmed dead or missing to date, and about 60% (10,845) of them resided in Miyagi Prefecture. Most of the deaths were considered to be due to drowning, crash, or hypothermia during the tsunami or during the night after the tsunami. Unlike the Han-Shin Awaji Earthquake, few reportedly died from the collapsed buildings caused by the earthquake. Among those who survived the tsunami, 1,655 deaths (724 in Miyagi) during the 3 months following the disaster were recognized as being disaster-related.

The characteristics of the disaster were as follows. First, the tsunami was able to reach a considerable height and affect a wide area due to the deeply indented Tohoku coastline (a *ria* coastline), which is characteristic of the Pacific

coast in the Tohoku region. All towns along the coastline in the Miyagi Prefecture were damaged by the tsunami, and the maximum run-up height observed in Onagawa Town reached 40 m. Second, the tsunami caused many deaths and resulted in a large number of evacuees (320,885 evacuees in 1,323 shelters across 35 cities/towns/villages in Miyagi). Third, every system that sustained their daily living was disrupted or ceased to function, including utility lines and health service systems. In Miyagi alone, 5 hospitals along the coast and 186 healthcare institutions were damaged, and the lives of 9 doctors were lost. Among the 5 hospitals, 2 of them were totally swallowed by the tsunami; all of 40 patients and 24 staff were killed in the Ogatsu Hospital, leaving only 4 survivors, and 74 patients and 4 staff were killed in the Shizugawa Hospital, leaving 150 people in the icy night. Fourth, numerous buildings and organizations for disaster control, such as town halls and public health centers, were damaged in some areas, which forced the staff to find alternative places to function (Fig. 1). More than 40 people at the disaster control center in the Minami-Sanriku Town were killed by the tsunami. A total of 129 public officials went missing or died in Miyagi Prefecture alone. Finally, the evacuees included patients with vari-

ous diseases which required continued care and medication, including insulin, warfarin, antipsychotics, anticonvulsant, dialysis, and so forth. The more critical were those who were living on home oxygen therapy.

Health relief activities encountered the following problems during the emergency relief phase: (1) delay in the rescue and evacuation of patients and workers who were isolated in coastal hospitals; (2) delay in reaching evacuees at shelters and at homes; (3) the leadership and coordination system for disaster health management were undefined; (4) the input of logistic supports and non-clinical public health interventions (such as food sanitation, environmental hygiene, infection control, nutritional assessment, support for people requiring special care) were delayed and sometimes insufficient; (5) disaster control centers at towns and prefecture could not promptly respond to the requests from frontline operations; and (6) disparity in levels of hygiene, nutrition, and living environment among shelters were recognized even 3 weeks after the disaster event.

In the Shizugawa Hospital, 150 patients and staff were isolated in the damaged building until they were rescued by the Defense Force on March 12 and 13. Seven patients passed away before rescue because of hypothermia and hypoxemia. In the Ishinomaki City Hospital, 152 patients and 200 people including hospital staff and evacuees from neighbors had to wait for rescue until they were evacuated for over 3 days. Inoperable communications, insufficient information sharing, interruption of access to disaster sites, and unprepared rapid assessment measures all collectively resulted in the delay of rescue and health relief for the isolated people. Furthermore, the overwhelming shortage of personnel and lack of chain of command on disaster health management disabled disaster control centers at municipalities and prefectures, preventing them from handling the situations.

Groping Our Ways for Health Relief

The aforementioned problems occurred as combined effects of the magnitude of the event and the lack of proper preparation for such an extensive disaster. These problems caused great

risks to the health and life of a large number of evacuees. What filled this void was the spirit of public service exhibited by civil workers in the disaster areas, and the professionalism of the health workers who rushed in from all over Japan.

In the cold, snowy weather, with no landline or mobile phone connections, under a shortage of water, food, clothing, and blankets, and without electricity, fuel, cars, gasoline, computers and other common commodities, doctors, nurses, and civil workers including public health nurses and administrative staff continually provided support to the evacuees and affected communities, while they themselves often lost their houses or families.

The 383 DMAT teams (consisting of 1,852 members) were dispatched on the day of the disaster. They gathered in the prefectures of Iwate, Miyagi, and Fukushima; 146 teams went to Miyagi (**Fig. 2**). However, the Disaster Base Hospitals*² were not experiencing the mass casualty situations they had anticipated. Because the Search & Rescue and DMAT teams were separated in action, the whole view of the damages were not apparent to them, and the teams could not get access to the isolated hospitals and shelters. Consequently, what they had been trained to do could not be fully implemented in the first few days, although DMAT and air evacuation teams actively provided assistance for evacuating patients from isolated hospitals and radiation-risk areas once the actual situations became apparent.

Once Miyagi Prefecture requested aid on March 14, many healthcare teams (which usually consists of physicians, nurses, and pharmacists) from across the nation gathered and then dispersed to the disaster shelters. Public health nurses were also dispatched from both affected and non-affected prefectures to help their peers in public health centers and municipalities.

These professionals made full use of their ingenuity and creativity to provide care for evacuees and disaster victims in local areas, even though lines of command and logistic support were insufficient then. On-site medical coordinators were appointed to take charge of coordination at each of the 3 key locations (2 at Base

*2 Disaster Base Hospitals = hospitals designated by prefectural governors that are expected to take charge of emergency care for the surrounding districts after a disaster strikes.

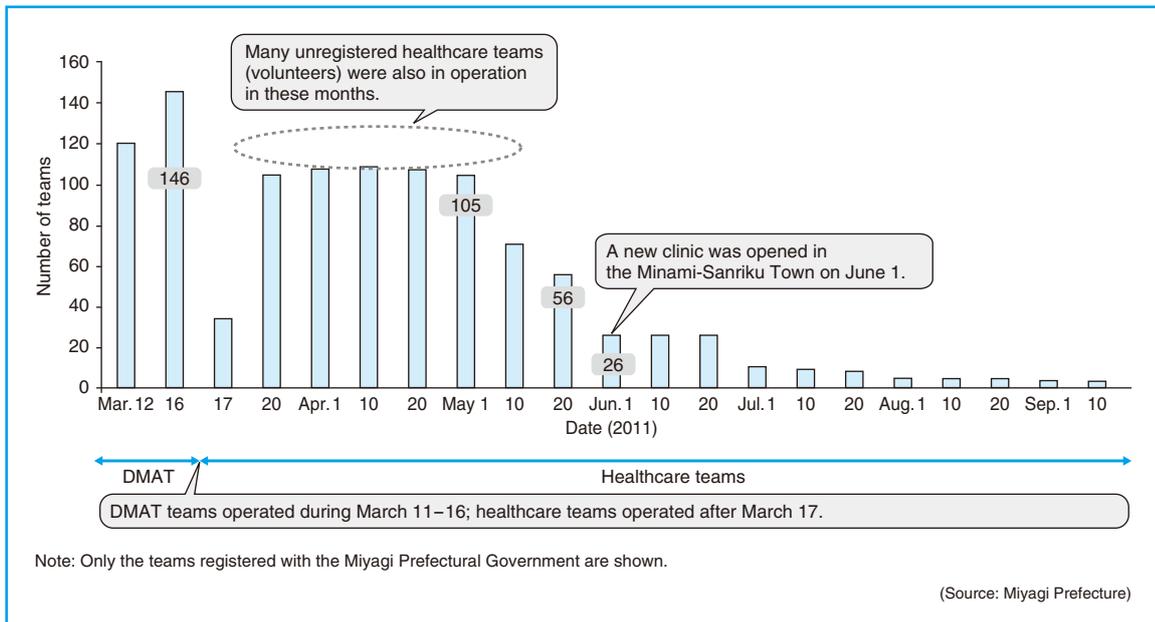


Fig. 2 The number of DMAT and healthcare teams dispatched to Miyagi Prefecture

Hospitals and 1 at a major shelter) where medical relief teams were concentrated, and those locations started to function as local centers for health relief operations. Eventually, we were successful in establishing a command and coordination system locally for medical services; however, integrated management of medical and public health services was still required. At the local center located at the Japanese Red Cross Ishinomaki Hospital alone, over 955 teams participated before the program ended in September 2012.

According to a survey by the Association of Public Health Directors, approximately 6,000 teams of over 23,000 people were involved in assisting the affected prefectures and municipalities (these numbers includes DMAT teams, healthcare teams, and civil workers such as public health nurses and administrative staff).²

Psychological care teams began to arrive about a week after the disaster event, when psychiatric healthcare was more urgently needed as the psychiatric patients in shelters were beginning to present symptoms due to lack of medicine. Owing to the deployment of healthcare teams and the establishment of a local coordination system, other interventions also began to make progress, such as the prevention of DVT/PE (deep vein thrombosis and pulmonary embolism) among evacuees, medication for epilepsy, and creating special shelters for people with disabilities and elderly people, who required careful aid. Thanks to a well-prepared support network, 600 patients who had lost access to dialysis were given appropriate care, including the transfer of 78 patients to Hokkaido.

Healthcare teams also conducted basic surveys of shelters and disease surveillance. The drug supply system was restored almost within a week, and pharmacist teams helped in issuing and filling the prescriptions and delivering medicines to shelters.

Because cars and motorcycles had been washed away by the tsunami, public health nurses and town employees initially had to reach the shelters on foot; this forced them to take much more time in assessing the situations and needs of the affected people. Furthermore, some public health nurses were occupied by attending patients or assisting doctors in the shelters to which they were initially evacuated. The establishment of the above-mentioned local coordination system released them from these extra duties at shelters and allowed them to return to their professional tasks including public health assessment, thus enhancing such surveys for shelters and communities.

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Table 1 Aims and activities of the Health Relief Support Office in Miyagi

1. Assessment of needs for health relief in disaster areas.
2. Briefing/debriefing for health relief teams.
3. Networking of frontline relief work with backup supporters for matching needs and assistance.
4. Logistic support for healthcare teams, public health workers, and medical coordinators on-site.
5. Assistance for shelter survey and disease surveillance.
6. Procurement and supply for health relief activities at municipalities; satellite phones, laptops with modem, vehicles and motorbikes, medical equipment, nutrients, air cleaners, pesticides, etc.
7. Dispatch of professional/nonprofessional volunteers for support of shelter management and public health management at municipalities.
8. Assistance in restoring immunization and regular health check-up programs for infants.
9. Assistance in re-opening a clinic and wards of hospitals destroyed by the tsunami.
10. Coordination and implementation of projects for environmental hygiene.

Activities of the Support Office for Health Relief Operations in Miyagi

As mentioned earlier, I was engaged in assisting the disaster response mainly at the Support Office for Health Relief Operations. The activities of the office included the following: assessment of health needs at disaster areas; the briefing and debriefing of medical relief teams; urgent procurement of satellite phones and their distribution to first-aid stations; provision and setup of computers with modems for public health centers; operation of the mailing list that connected medical relief teams and public health workers working in the disaster areas with the prefectural government and supportive organizations and networks; setup of and assistance in conducting shelter surveying and disease surveillance; dispatch of volunteer teams for data entry and relief goods management; logistic support including transport arrangements; and procurement and distribution of equipment requested by public health centers and health relief teams working in the disaster areas (e.g., vehicles, computers, hygiene/sanitation supplies such as water tanks for hand-washing, and cleaning equipment). The office also arranged the dispatch of expert teams for conducting surveys on dusts in shelters and on suspected Sick Building Syndrome in temporary housing, as well as volunteer teams (which we called the “will-do-anything teams”) who stayed at the shelters for

days in rotation and performed any miscellaneous tasks required to assist in shelter operation and health protection. (This approach was quite useful for gaining an understanding of the reality and needs of the people at shelters when the prefectural office, and even concerned municipality office, had difficulty communicating with the people in shelters.) Other functions included assisting the restoring of key programs in public health centers including infant health checkups and immunization, implementation of public health measures before the climate change to a hot summer (e.g., change of bedding, major cleaning, pest control), and procuring the funds and equipment needed to open temporary clinics and wards (**Table 1**).

The activities of the support office had not been planned in advance; but these activities developed and expanded according to the needs of and requests from on-site operations. Four medical doctors and one researcher of disaster science, who were appointed by the governor after the event, were involved. Among the 4 medical doctors, 2 were emergency medicine specialists and the other 2 had careers in public health and international disaster relief. A colleague of mine in the Japan Medical Team for Disaster Relief (JMTDR) sent an emergency physician as a partner and another colleague dispatched logistic teams from his university.

A professor of Tohoku University kindly sent his secretaries to help us with the administrative

Table 2 The 4 main agendas for health clusters in disaster management

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| <p>A) Emergency care for mass casualties</p> <p>B) Health management for the evacuees and the affected population</p> <ol style="list-style-type: none"> 1. Provide healthcare for illnesses and injuries caused by the disaster 2. Respond to continual medical needs (e.g., for chronic diseases and emergency cases) 3. Protect the vulnerable (including house-bound and machine-dependent patients, etc.) 4. Control health risks in the post-disaster environment (e.g., infectious diseases, post-tsunami pneumonia, DVT, and pulmonary embolisms) <p>C) Sustain the key functions of local health systems and their reconstruction</p> <p>D) Mid/long-term monitoring and control of the indirect effects of the disaster on public health</p> |
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work in the office. Until the end of August 2011, 150 professional and non-professional volunteers joined and contributed in the health relief efforts with dedication.

Improvement Proposals for Health Disaster Preparedness based on These Lessons

Disasters destroy local health service systems and are a major public health issue. Under the diminished structures and limited resources of these systems, the affected people need to be protected from avoidable death, suffering, and disability. There are 4 specific agendas for public health in times of disaster (**Table 2**). While mass casualty management is an important one, that is not all. The issues and requirement of each agenda vary depending on the type of disaster and post-disaster phase. They require the concerted efforts of health professionals, local and central governments, private sectors, and communities.

In this regard, the Great East Japan Earthquake revealed 2 major weak points in the current status of health preparedness in Japan. The first weakness was that the health preparedness planning was rather biased by the preoccupation that disaster means mass casualties—likely a consequence of vivid memories of the Han-Shin Awaji Earthquake (in which approximately 6,400 people died at the epicenter, of which 85% died from trauma mostly under collapsed buildings). The lack of programs for training experts specializing in disaster health management also contributed to this, despite the fact that the quality and quantity of emergency

medicine specialists trained in mass casualty management had expanded. The other weakness lies in disaster response plans in general. The Basic Act on Disaster Control Measures of Japan was enacted after Typhoon Vera hit the Gulf of Ise in 1959. The act anticipates damage of a much more limited scale. Under this act, the obligation for disaster response unequivocally lies with the basic units of the municipalities (i.e., cities, towns, and villages), and their prefectures are supposed to provide assistance upon request from affected municipalities. For this reason, prefectures were not prepared to replace the leadership for disaster response when the local municipalities were destroyed and ceased to function, as seen in the disaster after the Great East Japan Earthquake.

It is high time to revise the framework of disaster management and strengthen our resilience, not only by physical structures but also by well-prepared management systems. I propose distinguishing disasters by the required level of response systems: national, prefectural, or municipality. A national organization for disaster management is also indispensable for our nation.

Lately, concerns over the possibility of earthquakes occurring in the Tokai, Tonankai, and Nankai³ areas have been strongly voiced. The expected disaster areas will include many densely populated regions, and the total area affected and the scale of the anticipated damage is likely to be far greater than that observed in the Great East Japan Earthquake. **Table 3** summarizes the 10 proposals that make use of the lessons we have learned from this past disaster.³

Table 3 Urgent proposal to prepare for a large-scale disaster (appeal made at the 17th Conference of the Japanese Association of Disaster Medicine, February 2012)

1. Strategically develop well-trained directors and coordinators for health disaster management and establish appropriate coordination systems.
2. Establish a disaster relief information center to centralize and share information, equipped with multiple means of communication for use in emergency situations.
3. Build the capacity for search and rescue for health/medical institutions as well as that for rapid assessment in emergencies.
4. Develop an integrated contingency plan with standardized manuals that will enable seamless and efficient health relief operations.
5. Prepare practical plans and alternatives for supporting vulnerable people, including disease-specific measures for patients.
6. Prepare a support network with an inventory of pre-registered resources that can be mobilized for disaster response.
7. Establish a counterpart policy that will allow system-wide support by pairing-up affected municipalities with non-affected prefectures.
8. Empower the community by developing emergency response teams and PHC (primary healthcare) volunteers.
9. Establish programs for continual health support of the affected population.
10. Organize the basic knowledge and skills for health disaster management, and share those among health professionals and relevant agencies to be involved in disaster relief and preparedness.

Pre-Registered Support Networks for Disaster Health Relief by Preliminary Registration of Assistance and Aid Resources Available in Times of Disasters

Much support and encouragement was given after the disaster, not only from within Japan but also from overseas. However, I strongly feel that proper preparedness is crucial for support to be effective for the health relief of victims. I would like to propose fostering a network that makes use of preregistration of available assistance and resource in disasters.

[Procurement of assistance] In the 2 months following the disaster, the number of people locally involved in the relief efforts increased, which made it easy to respond to a variety of offers of assistance. At this point, the requested items were less urgently required, and there was some time available for procurement. On the contrary, promptness is the most important factor during the emergency relief phases. What is critically needed must be provided exactly when required;

if not, there is no option but to resort to alternative solutions. The needs in the disaster areas constantly changed in the aftermath of the Great East Japan Earthquake, and we repeatedly found that what had been needed one day was no longer of use a few days later. Our support office was not a donor agency, so we had to swiftly find an individual or organization that could procure and provide what was urgently needed in a timely manner.

For that purpose, the networks that had been developed through various past projects, along with various powerful supporters and support organizations with their own networks, greatly helped in mobilizing assistance. We quickly developed group e-mails to connect them and expanded the network by adding addresses of the organizations and individuals who might be of help, as well as those of healthcare teams and contact persons on site as they became apparent. Nonetheless, collecting vehicles through donations, sending technicians with computer skills at their own cost, and procuring equipment worth hundreds of thousands of US dollars were

*3 The southern coastal areas of the main island and Shikoku island of Japan, located along the Nankai Trough (the northern border of the Philippine Sea plate).

not easy tasks when no emergency funds were available at hand.

However, we were very fortunate: the Japan Committee for UNICEF promised strong support through the office partner who worked with UNICEF. Furthermore, the organizations with which I had been associated negotiated assistance from corporations such as Sony and Microsoft. A professor told me that the Malaysian Medical Relief Society was interested in medical aid. My classmates, alumni, and a disaster research group helped us by donating to the support activities. As the existence of the Support Office in Miyagi became known, we started to receive offers of assistance from corporations and organizations that wanted to help by providing, for example, rental cars free of charge or satellite communication tools, but had faced difficulty in finding people to contact to receive them. These offers were very helpful—but, I wished we had been aware of each other a week or even a month after the disaster, when such offers were desperately needed. Not only supplies and equipment, but also volunteers with various skills (e.g., computer skills, data entry, vector control, etc.) and assessments or advice by experts should be readily available when needed.

These experiences emphasized that an inventory of available assistance and resources that can be mobilized in emergencies should be prepared before a disaster strikes, so that we can avoid relying on luck at the time of a disaster.

["Kizuna"] Private channels (which are called *kizuna* in Japanese) played an important role for the people in shelters, and also for our activities as mentioned above. However, it indicates that people who did not have private channels outside might have faced greater difficulties. For example, some private hospitals did receive quick assistance from affiliated institutions outside the disaster areas, but this was not the case for public hospitals when their owners (cities or towns) had been damaged as well. Furthermore, we learned that many people, organizations, and corporations were willing to help the victims and relief efforts, but did not have the appropriate channels to do so. Had we known of their will before the disaster occurred, more dynamic relief measures could have been taken.

[Responsiveness] During the 24–48 hours immediately after a disaster event hits, we should do

whatever we can, using options from what we have already prepared by then. However, after that period, the mindset must switch from “do what you can” to “do whatever must be done” to prevent avoidable death and suffering. One must be capable of responding to a variety of needs and situations, equipped with effective management, and mobilize resources on a broad scope. Our experience taught me that potential aid providers possessed various resources and remained flexible at the time of disaster; however, they often missed the opportunity for their aid to be most effectively used. Those receiving aid, on the other hand, were often obliged to count on luck on whether they would obtain what they needed in a timely manner.

[Burden of formalities] Obtaining funds to purchase necessary items involved a great deal of administration. If we go through formalities, it will take days and sometimes even months to settle a purchase, leading to an atmosphere of resignation in the disaster areas. Most recipients, such as municipalities, health centers, health relief teams, and prefectures, did not have the time or personnel to spare for cumbersome formalities. I was very grateful that overseas donors who deal in international humanitarian aid were aware of the situation and prioritized solving problems by rapidly settling accounts.

[Concierge with a magic pocket] For these reasons, we need to have an effective procurement system, just like “a magic pocket” that is capable of providing supplies, money, or people immediately when they are required. That is, those aid resources possibly needed in disasters should be registered and prepared in warehouses, put on a list of relief goods or accompanying supplies, so that they can be provided on time with the proper specifications and in the necessary amount. Agencies, corporations, and organizations that are willing to assist, or expected to provide assistance, could pre-register their commitments so that their offers would be transparent. Such registration would include information on (1) the situations in which assistance will be provided; (2) contact details; (3) what will be provided (e.g., relief goods or technology, personnel, conducting surveys); (4) the quantity of assistance to be provided; and (5) how soon the assistance can be provided. There will be a coordination office that will, like a concierge, respond to requests, coordinate the process, guarantee the credibility of

the information, match the needs and resources, and completely assume the burden of carrying out the administrative procedures on the behalf of recipients. The support office of the prefecture affected by the disaster will become the counterpart of this network, which serves as node to connect frontline operation with available assistance, hopefully bypassing the formalities.

[Asian network with an inventory of pre-registered available resources] This proposed network may be equally, or even more useful, if it is developed jointly by various Asian nations. The governments, non-governmental organizations, foundations, and corporations that are ready to provide assistance will pre-register their commitments to allow mapping and visualizing the expected aid, in the effort to make international response as efficient as possible.

Several countries may be interested in sharing roles for support of health relief in disasters. Let me present some possible and expected examples of registration. Japanese teams might offer to establish a communication system within a week after a disaster event. Korean teams would supply emergency power generators for essential medical devices. India could be ready to provide up to 50 vehicles for mobile clinic and patient transfer. Singaporean teams would be able to provide mobile laboratory services within 3 weeks after request. UNICEF would be always ready to supply essential drugs and vaccines.

WHO would help by information management. The Field Epidemiology Teams in the Philippines would be ready to support disease surveillance. Thailand would dispatch up to 20 expert teams for logistic support for public health management and vector control. The Microsoft Corporation could offer to provide 500 laptops and 50 local staff to deliver and set up those computers. The Red Cross Society would take charge of securing safe water and water-quality control.

Conclusion

Disaster reduction and preparedness is now a global agenda for the 21st century. Disasters can and do destroy local health service systems. We may realize how systems normally function and what role they actually play only when those systems cease to function. Disaster may strike at any time and in any form. We learned that it is extremely difficult to do what we must in times of disaster, unless we have prepared in advance. By taking full advantage of the experience, knowledge, and imagination that we have gained, we have to prepare now so that we can always do our best to respond to any disaster in the future.

Lastly, I would like to express my deep gratitude to the people worldwide who provided encouragement and sent their heartfelt regards and tremendous support to Japan.

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