

International Family Medicine

Medical Needs of Tsunami Disaster Refugee Camps: Experience in Southern Sri Lanka

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Background and Objectives: *In response to the massive tsunami disaster in South Asia, two Korean medical relief teams provided emergency medical care in the southern coastal area of Sri Lanka. Their findings are reported here to provide a realistic picture of medical needs created by the tsunami disaster and to enable a better-prepared medical response to future disasters of this type. **Methods:** All victims of the tsunami in the area of operation of the two medical relief teams were encouraged to receive medical care. Care provided to each victim was documented in individual medical records. All medical records were reviewed and classified by age, gender, and diagnosis. **Results:** A total of 4,710 people were treated by the two Korean medical relief teams for 9 days of operation in southern Sri Lanka. Respiratory problems were common, but diarrhea was diagnosed in an average of only 4.3 patients per day. Minor skin trauma and wound infection in the extremities were frequent as long as 3 weeks after the disaster. The proportion of skin trauma in relation to total trauma decreased as days elapsed from the disaster. **Conclusions:** Because of the provision of adequate quantities of potable water, the likelihood of waterborne diarrhea was low. Acute respiratory problems and chronic problems were prevalent in tsunami refugee camps. Despite concerted international relief efforts, inadequate treatment of minor skin trauma and skin infections was evident.*

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On December 26, 2004, a strong earthquake with a magnitude of 9.0 on the Richter scale occurred in the Indian Ocean off the west coast of Northern Sumatra. A subsequent tsunami hit South and Southeast Asia and East Africa, causing serious damage and loss of life. Several countries bordering the Indian Ocean were affected, including Indonesia, Sri Lanka, Maldives, India, Thailand, Malaysia, Bangladesh, Myanmar, and Somalia. The total confirmed death toll by this tsunami was more than 150,000, making this one of the world's worst natural disasters. Moreover, more than 525,000 were injured, more than 20,000 were missing, and more than 1.6 million were displaced.¹

The tsunami struck Sri Lanka by 9 am. The high waves affected coastal areas deep inland on the north-

east, east, south, and southwest coast areas, with enormous damage and destruction caused by the force of the waves. In Sri Lanka, the total number of deaths was 30,920 as of January 18, 2005.² The maximum total number of displaced people was 888,000. The total number of missing persons was 6,020 and total number of injured was 15,256, as reported on the World Health Organization Web site.³

The population of Sri Lanka is 19.3 million, with life expectancy at birth of 73 years, considerably above the world average. Child mortality rate is 18/1,000, which is relatively low among South Asian countries.⁴ But malaria, tuberculosis, dengue fever, Japanese encephalitis, diarrhea, and acute respiratory infections are still prevalent, and cardiovascular and cerebrovascular diseases, diabetes, and cancer are also emerging.⁵

This unprecedented disaster alerted global medical relief. Major epidemics were predicted for millions of people as a result of the damaged sanitation system, sea water contamination, and congested and crowded condition of displaced persons.^{1,6} Concerns about

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increased risk of waterborne diseases, such as cholera, typhoid fever, shigellosis, and hepatitis A and E were increased. Concerns were also raised about the hampering of relief action by possible land mines that could have been dislodged or migrated away from marked areas and because of warning signs that were swept away or destroyed.¹

Many humanitarian organizations responded, and many medical relief teams were deployed to tsunami-hit areas, including Sri Lanka. Among them were two Korean teams—Greendoctors and a team from Korea University were consecutively deployed to the Southern province of Sri Lanka. They provided medical relief and kept medical records with special emphasis on waterborne communicable diseases, trauma, and their trends.

Methods

Study Design and Selection of Participants

All patients cared for by these two Korean teams were enrolled in the study. The Greendoctors team consisted of 14 persons, including two family physicians, three general practitioners, four nurses, two paramedics, and three administrative personnel. The Greendoctors team arrived in Hambantota state, a southernmost state of Sri Lanka, at the end of the first week of the disaster. On January 1, 2005, 6 days after the tsunami, the Greendoctors team started medical relief and consultation until January 6, 11 days after the disaster. The total number of days devoted by the Greendoctors team for medical relief was 6 days.

The Korea University team started medical relief on January 9, 2005, 15 days after the tsunami. The Korea University team consisted of 18 persons, including a family physician, an infectious disease specialist, a gastroenterologist, a pediatrician, a general surgeon, a psychiatrist, four nurses, three pharmacists, and five supporting persons. The Korea University team provided medical relief for 3 days until January 11, 2005, which was 16 days from the date of the tsunami. The Korea University team continued medical relief at the eastern state of Sri Lanka, but those data were not included because of regional differences in socioeconomic and disaster situation. To assure quality care and for health protection for both teams' members, health information from the US Centers for Disease Control and Prevention was consulted.⁷

Both teams visited one to two refugee camps per day and conducted medical care with their available equipment and medications. Local officials and representatives made several announcements to encourage all displaced persons who needed medical attention to receive care from the Korean teams. The total number of displaced persons in each refugee camp was ascertained from local representatives.

Patient care was provided with assistance from Sri Lankan persons who knew Korean from their work

experience in Korea. All patients were asked about their basic data, such as age, gender, chief complaint, duration of illness, past history, and family history. Consultations were usually held inside buildings but sometimes outside in the open air. At times, medical relief was not possible despite the needs of displaced persons because of lack of medication, equipment, or light.

Methods of Measurement

Medical records were created and kept for all patients seen by the two Korean medical teams. These medical records were reviewed later for data extraction, which was performed by one family physician and two nurses from each team. Medical diagnoses were classified as skin trauma, other trauma, acute respiratory problem, and chronic diseases. Any trauma that included laceration, abrasion, and infected skin wound was classified as skin trauma. Other traumas, such as contusion, hematoma, and sprain without skin trauma, were classified as other trauma. Acute upper respiratory infections and their symptoms and signs were regarded as acute respiratory problem. Patients who had chronic conditions such as diabetes, hypertension, or chronic skin diseases were classified as chronic problem. Conditions not fitting any of the above categories were classified as "other" problems.

Drinking water sources were identified for displaced persons at all refugee camps. We intended to purify water if suitable drinking water was not available.

Data Analysis

Because the data reported here were collected by two different teams during two different time frames in several different areas, only descriptive statistics are presented. A spreadsheet program was used to sort the data and plot the data.

Results

Medical Relief

Both teams moved from one refugee camp to another refugee camp daily at the southern state of Sri Lanka. Dates and locations are shown in Figure 1. Visited refugee camps and a brief description of the situation of each camp are described in Table 1.

All refugee camps had a potable water supply that seemed safe to drink, although bottled water was the only available potable water source for the displaced people in the Hettigoda Camp of Hikkaduwa on January 1, 6 days after the tsunami. All other refugee camps not only received bottled water but also had a safe potable water tank facility or chlorinated waterworks provided through the help of international or government organizations when we visited.

On January 1, 6 days after the tsunami, 247 patients visited the Greendoctors team. For the 5 days of the second week after the disaster, 2,915 patients were treated by the Greendoctors team. A total of 3,162

patients were consulted by Greendoctors team during 6 days of field operation from the end of the first week to the second week. A total of 1,548 patients were treated by the Korea University team during the first 3 days of the third week of the tsunami disaster. General characteristics of age and gender distribution of these patients are shown in Table 2.

Proportion of Medical Problems in Refugee Camps

Among the 4,710 total patients treated by these two medical relief teams, trauma-related illnesses accounted for 1,374 (29.2%). Most frequent, however, were patients seen for chronic medical problems (1,590 patients or 33.8%). Another major category was respiratory problem, with 1,310 (27.8%) displaced persons receiving medical treatment for acute respiratory problems. The relative proportion of these problems was maintained

from day 6 to day 16 of the tsunami disaster. Trend of relative proportions of these problems by days from tsunami are shown in Figure 2.

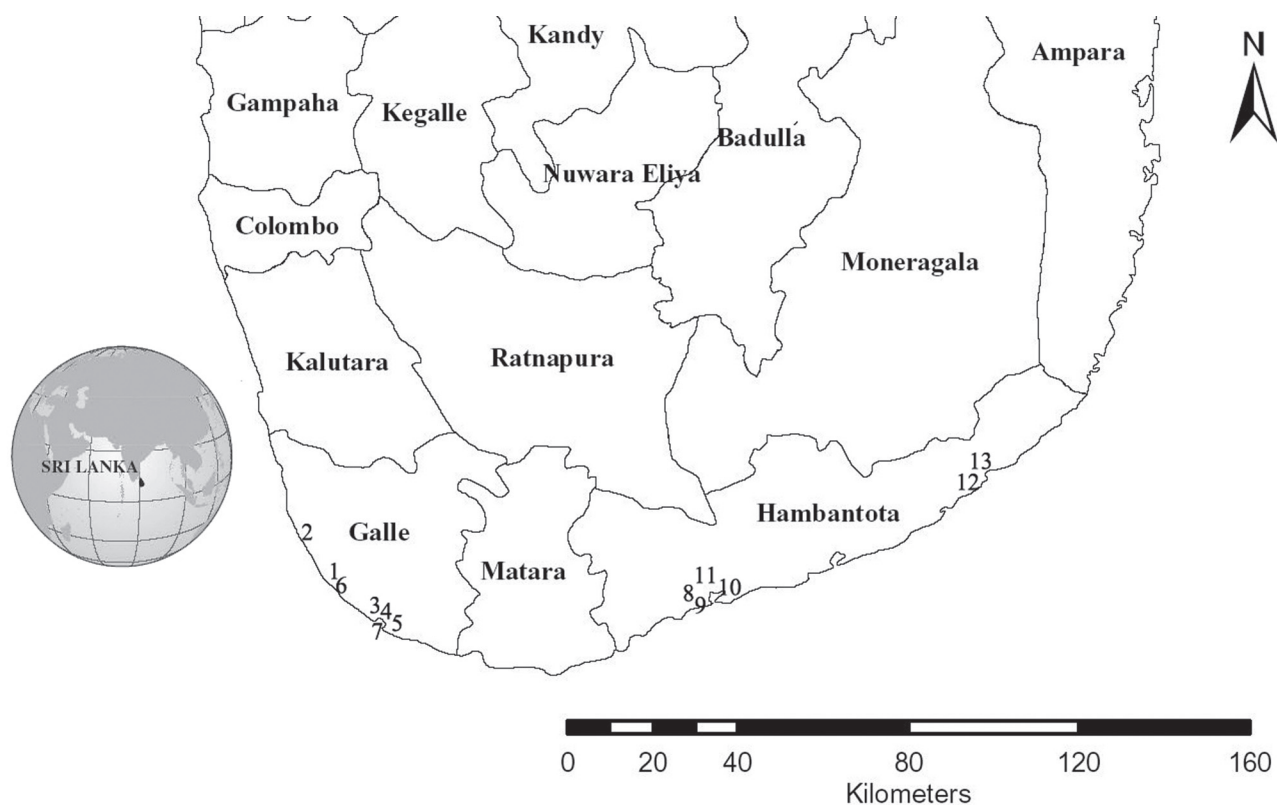
Chronic problems included diabetes, hypertension, chronic asthma, and chronic skin problems. Many displaced people with chronic problems sought care because they had lost their usual medications during the tsunami. New-onset headache, insomnia, gastrointestinal symptoms, and skin problems not related to trauma were the main components of other problems.

We saw only 39 patients with diarrhea during the 9 days of medical relief service. Occurrence of diarrhea was relatively constant, with an average of 4.3 patients a day.

Skin laceration and abrasion were the main components of skin trauma. Other trauma such as

Figure 1

Medical Relief Operation Team Location and Dates



1. Hettigoda, Hikkaduwa, 6 days after tsunami, January 1, 2005
2. Kuleegoda temple, Amblangoda, 7 days after tsunami, January 2, 2005
3. Gangarama temple, Magalla, Galle, 8 days after tsunami, January 3, 2005
4. Kachiwatta temple, Magalla, Galle, 9 days after tsunami, January 4, 2005
5. Dewatte school, Galle, 10 days after tsunami, January 5, 2005
6. Dodanduwa, Hikkaduwa, 11 days after tsunami, morning, January 6, 2005
7. Mahamadra, Galle, 11 days after tsunami, afternoon, January 6, 2005

8. Morakatiyara Diwara, Tangalle, 14 days after tsunami, January 9, 2005
9. Nakulugamuwa school, Tangalle, 14 days after tsunami, January 9, 2005
10. Kudawella temple, Tangalle, 15 days after tsunami, January 10, 2005
11. Rekawa school, Tangalle, 16 days after tsunami, January 11, 2005
12. Nidangalawalla, Kirinda, 16 days after tsunami, morning, January 11, 2005
13. Hajiyar, Kirinda, 16 days after tsunami, afternoon, January 11, 2005

Table 1

Date of Medical Relief Provided and Situation of Refugee Camps

<i>Days After Tsunami, Date</i>	<i>Name and Location of the Refugee Camp Visited for Medical Relief</i>	<i>Number of Displaced in Camp</i>	<i>Number Treated</i>
6 days, January 1, 2005	Hettigoda, Hikkaduwa	450	247
7 days, January 2, 2005	Kuleegoda temple, Amblangoda	1,800	778
8 days, January 3, 2005	Gangarama temple, Magalla, Galle	750	642
9 days, January 4, 2005	Kachiwatta temple, Magalla, Galle	1,200	583
10 days, January 5, 2005	Dewatte school, Galle	1,000	567
11 days, January 6, 2005	Morning: Dodanduwa, Hikkaduwa Afternoon: Mahamadra, Galle	400 600	126 219
14 days, January 9, 2005	Morning: Morakatiyara Diwara, Tangalle Afternoon: Nakulugamuwa school, Tangalle	400 400	120 86
15 days, January 10, 2005	Kudawella temple, Tangalle	1,400	824
16 days, January 11, 2005	Team 1: Rekawa school, Tangalle Team 2, morning: Nidangalawalla, Kirinda Team 2, afternoon: Hajiyar, Kirinda	1,500 120 250	439 21 58

contusion, hematoma, and sprain were also prevalent. Most traumas were directly or indirectly related with the tsunami disaster itself and the harsh life at refugee camps. Some were injured while running away from the tsunami, while others were injured while surviving in wreckages and refugee camps.

We did not see any patients with life-threatening major trauma. We did see nine patients with definite or suspected fractures. Six of them were suspected rib fractures, and none were open fractures. Two others were an ankle fracture and a fibular fracture, and both of them were also closed fractures. One open finger fracture was treated. Trauma patients made up 29.5% of all patients seen during the first week, 28.5% at the second week, and remained high at 31.0% to the third week of the tsunami disaster.

Skin Trauma Proportion Trend, by Days After Tsunami

When skin trauma is separated out from other trauma, the proportion of skin trauma among total trauma seemed to decrease with time from 65.6% at day 6 to 30.7% at day 16 after the tsunami. Daily proportions of skin trauma to total trauma are shown in Figure 3. Although exact numbers were not counted, many dressings previously provided by other medical teams were detached, and many previously treated wounds were infected.

Discussion

A tsunami is a series of waves that travel across the ocean with exceptionally long wavelength. It is one of the most potentially serious forms of coastal flood.⁶ Although tsunami disasters are part of the history of mankind, the number of victims from the tsunami that

Table 2
Age and Gender Distributions of Patients

Age Group	First Week January 1, 2005 6 Days After Tsunami			Second Week January 2-6 7-11 Days After Tsunami			Third Week January 9-11 14-16 Days After Tsunami		
	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)	Total (%)
0-9	17 (12.6%)	7 (6.3%)	24 (9.7%)	168 (11.0%)	136 (9.8%)	304 (10.4%)	150 (18.1%)	88 (12.3%)	238 (15.4%)
10-19	14 (10.4%)	16 (14.3%)	30 (12.1%)	201 (13.2%)	159 (11.4%)	360 (12.3%)	125 (15.0%)	90 (12.6%)	215 (13.9%)
20-29	19 (14.1%)	10 (8.9%)	29 (11.7%)	164 (10.8%)	194 (13.9%)	358 (12.3%)	115 (13.8%)	93 (13.0%)	208 (13.4%)
30-39	27 (20.0%)	13 (11.6%)	40 (16.2%)	245 (16.1%)	199 (14.3%)	444 (15.2%)	139 (16.7%)	112 (15.6%)	251 (16.2%)
40-49	26 (19.3%)	17 (15.2%)	43 (17.4%)	272 (17.9%)	223 (16.0%)	495 (17.0%)	108 (13.0%)	135 (18.8%)	243 (15.7%)
50-59	17 (12.6%)	22 (19.6%)	39 (15.8%)	278 (18.3%)	243 (17.4%)	521 (17.9%)	106 (12.8%)	85 (11.9%)	191 (12.3%)
60-69	7 (5.2%)	24 (21.4%)	31 (12.6%)	131 (8.6%)	163 (11.7%)	294 (10.1%)	51 (6.1%)	73 (10.2%)	124 (8.0%)
70+	8 (5.9%)	3 (2.7%)	11 (4.5%)	62 (4.1%)	77 (5.5%)	139 (4.8%)	37 (4.5%)	41 (5.7%)	78 (5.0%)
	135 (100%)	112 (100%)	247 (100%)	1,521 (100%)	1,394 (100%)	2,915 (100%)	831 (100%)	717 (100%)	1,548 (100%)

occurred on December 26, 2004, was unprecedented.⁸ Because hospitals were damaged by this disaster, including severe loss of lives of doctors and nurses,⁹ foreign medical aid was essential to save lives from the secondary effects of this disaster.

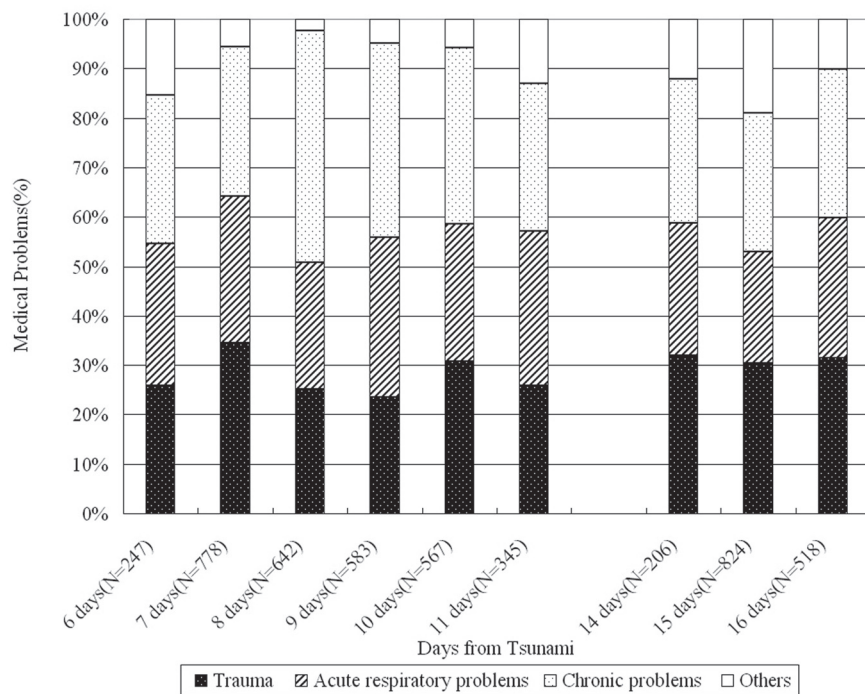
Because overcrowding, poor water supplies, and inadequate hygiene and sanitation in a disaster setting can lead to communicable diseases, including water-borne diseases,⁸ providing safe water is essential to prevent disease in refugee camp.¹⁰ We saw few cases of diarrhea, a finding consistent with the reportedly low rate of diarrhea from this disaster in Thailand.¹¹ Although further observation is needed to declare that the diarrhea rate is low, prompt provision of safe water was the most important contribution to achieve this relatively low diarrhea rate in this tsunami disaster. Another reason for the low rate of diarrhea may be that we observed most displaced persons treating fecal matter properly.

When we classified medical problems in refugee camps into trauma, acute respiratory problems, chronic problems,

and others, the most prevalent problems were chronic problems. Damaged or collapsed health facilities leading to shortage of medical personnel, medications,

Figure 2

Medical Problems by Days from Tsunami Disaster



and equipment partly explain this relatively high proportion of chronic problems. Loss of medications and medical equipment from homes during the flood also explains this finding.

Acute respiratory problems were the most frequent single category of problems in refugee camps. Although communicable respiratory illnesses were not evident, crowding and the dusty environment of refugee camps may have led to such high incidence of respiratory illnesses.¹²

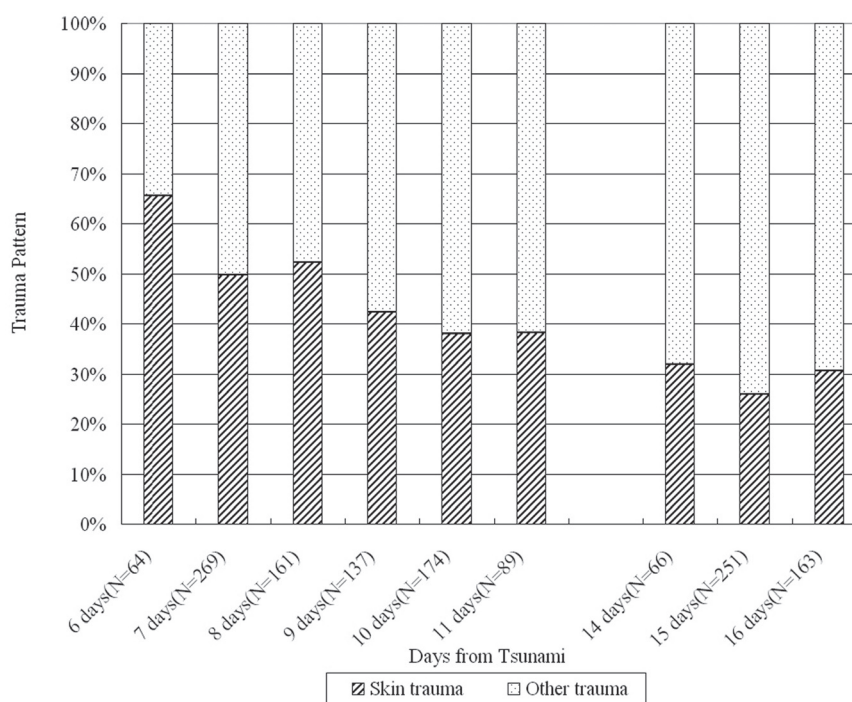
Trauma is a frequent medical problem in refugee camps, not only from this tsunami disaster but also from other types of disasters.^{13,14} Major trauma was not evident among our patients. Because the two Korean teams involved in this report provided medical relief during the second and third week of the disaster, major trauma patients either could not come to the refugee camps, were already evacuated, or had died. The proportion of trauma to total medical problems remained stable through the third week after the disaster, perhaps reflecting the harsh life in tsunami refugee camps. Because some of the displaced persons worked in home wreckage to find their relatives, and others helped to clean up the flood-damaged environment, injuries were frequent and likely to continue. Poor hygiene, shortage of shoes, and inadequate treatment of previous trauma contributed to this persistence of trauma.

The high proportion of skin trauma to total trauma may mean that many of the displaced were actually injured during the tsunami. Though the proportion of skin trauma to trauma decreased as time passed after the tsunami, it remained high at 31.2 % of total trauma at the end of our relief service. This may be due to continued injuries or inadequate treatment. Increased rate of wound infection is also described in other areas of this disaster.¹¹

Several limitations of this report are inherent in such emergency medical relief effort. This report is based on our medical care in refugee camps for internally displaced persons. The more severely wounded patients either could not come to the camps or were already evacuated, leading to selection bias. Some problems classified as other problems may be related to posttraumatic stress disorder as in other disasters,¹⁵

Figure 3

Pattern of Trauma, by Days After Tsunami Disaster



but their identification and treatment were limited because of time and resources limitation. Because of the differences in the specialty mix of medical care providers of these two teams, a different set of diagnoses between the second and third week is highly likely. Also, our main mission of providing medical relief in refugee camps did not allow us to conduct systematic and comprehensive survey of all areas for prevalent medical conditions. Despite these limitations, this report will be helpful for future medical responders to such a natural disaster.

Conclusions

With the provision of adequate quantities of potable water, the rate of waterborne communicable disease was low. Acute respiratory problems and chronic problems were also prevalent in tsunami refugee camp. Trauma to the skin was particularly common. Although many volunteers still labor to relieve the displaced in the disaster-stricken areas,¹⁶ more medical support, both in geographic breadth and duration, would be needed in response to this type of disaster.

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