

Practice Forum

The Tsunami Disaster in Asia

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On December 26, 2004, a devastating tsunami arising from an earthquake which had its epicentre near Indonesia in the Indian Ocean attacked many countries along the Indian Ocean: India, Indonesia, Malaysia, Maldives, Seychelles, Somalia, Sri Lanka and Thailand. The tsunami resulted in more casualties than any in history. As of mid-February, 2005, an estimated 214,000 people were dead, 142,000 reported missing, and more than 3,400 injured. A natural phenomenon, tsunamis are giant sea waves caused by a submarine earthquake or slope collapse into the sea bed. The giant sea waves reach the coast after traveling thousands of miles at speeds of 300-600 mph and making inroads at great force into the shoreline. Waves lash out at built structures, plants, trees and human habitations causing massive flooding and destruction.

Trauma from Tsunami

Trauma resulting from a tsunami includes near drowning, abrasion, superficial or deep laceration, open or closed fractures, blunt abdominal and chest injuries. The severity of trauma was at 3 levels, mild, moderate and severe. Causes of illness among hospitalized patients were lacerated wounds, near drowning complicated with pneumonia, fractures of long bones, injury of head, abdomen or chest, and sprains.

Wound and wound infections

Wounds resulting from a tsunami are unique. The wound entry is effected by the explosive force of the water carrying with it debris such as mud, sand, stones, and twigs. Wounds are also bathed in high saline concentrations with high osmotic pressure. Wounds deteriorate rapidly despite outwardly appearing slight. Severely infected with multiple organisms, the treatment requires empiric antibiotic coverage for a range of organisms until results from wound tissue cultures are available to guide therapy.

Post Tsunami Infection Risks Along with the devastating destruction, infection risks both at the community level and individual level are increased. Infection risks after the tsunami disaster may be considered as direct or indirect.

- Direct risks are due to the lashing of water with great force, along with sand and other debris, causing trauma and wounds. The wounds are unusual in that they are very prone to infection and healing is delayed, being in forced contact with contaminated saline water. Near drowning and ingestion or inhalation of contaminated water may result in ear, nose and throat infections and pneumonia. Skin infection and dermatitis result from wetting of the skin and compromise in its integrity.
- Indirect risk of infection occur in the aftermath and are due to disruption of water supply, lack of sanitary conditions and lack of hygiene due to flooding. Water borne diseases such as typhoid, cholera, leptospirosis, and Hepatitis A virus infection are a major risk. Vector borne diseases occur when the water begins to recede, leaving standing pools of water which are a breeding ground for the vectors of malaria, dengue, and West Nile Fever.
- The disaster leaves large numbers of individuals dead. The corpses need to be removed and disposed of properly. This increases the risk of infection to the workers. Infection risks include tuberculosis (from aerosolisation of aspirated fluid from the lungs), blood borne infections (contact with blood and body fluids with non intact skin and mucous membranes), injury from bone fragments and gastro-enteric infections (through contact with leaking faeces). Infection occurs through direct contact with infected bodies, soiled clothes, equipment and vehicles used in their transportation.

The Disaster in India:

The December tsunami caused extensive damage to the South Eastern Coast of India, including Andaman and Nicobar Islands, the coastal states of Tamil Nadu, Andhra Pradesh and Kerala and the Union Territory of Pondicherry. It affected nearly 2,260 km of coast line and the entire Nicobar Islands. Tidal waves 3-10 m high penetrated inland ranging from 300 m to 3 km. 157,393 dwelling units in 897 villages were damaged, 638,297 persons were evacuated and the total population affected was about 3.6 million. 10,881 persons lost their lives, 5,792 persons were missing and 6,913 injured. Overall damages were expected to be \$574.5 million with losses of \$448.3 million. Maximal damage was incurred by coastal fisheries. The housing and livelihood of 645,000 families was affected. These families were mainly from the resource poor, fishing communities in which basic sanitation, water and shelter is inadequate in the best of times. In the health sector, damages were estimated to be over \$15.7 million. Damages to health infrastructure included 80 subcentres, 13 primary health centres and 7 partly damaged district hospitals.

How the Health System coped

- Initially, rescue efforts involved the mass removal and burial of corpses and providing first aid and referrals for the injured. Later concerns were providing potable water and sanitation, disease surveillance, vector control, and vaccination and mobilizing medicines and supplies.
- All levels of health care facilities, including government run primary health centres, subcentres, and district health centres, private clinics and dispensaries, provided medical assistance to the overwhelming numbers of injured people. Several non governmental organizations also came forward. In addition to State level health services, more than 290 doctors (including physicians, psychiatrists, general duty medical officers, public health specialists, health administrators) and 100 paramedics (nurses, technicians, sanitary inspectors) were deputed in the field from Central Government (Federal) institutions to the affected areas. Medical and paramedical units from the army assisted in the efforts. Over 50,000 patients were attended to by the medical teams. Trauma, injuries and infections following trauma were the major immediate conditions. Diarrhea, respiratory infections and various types of fever were the other infections seen.
- National Institute of Mental Health and Neurosciences, Bangalore coordinated the psycho-social relief and rehabilitation work along with other centres in the country and the World Health Organization. About 2,250 patients with severe mental health problems were treated, 3,500 counseled individually and 35,000 through group counseling.

- Emergency medical supplies were dispatched to the effected areas. To ensure sanitary conditions and safe water supply, adequate amounts of bleaching powder, Halazone tablets and ORS were distributed. Capacity building efforts included holding 110 training workshops and programs for health care workers.
- Disease surveillance: The National Institute of Communicable Diseases spearheaded the disease surveillance activity. It established surveillance and reporting through capacity building and infrastructure support. A surveillance unit was also set up in Port Blair in Andaman and Nicobar Islands. Surveillance was established for both water and vector borne diseases. No major outbreak was recorded
- Environmental concerns were also brought to the fore. Water for drinking was made readily available by supplies of bottled water and through a centralized water supply. Provision of bleaching powder for piped supplies, tanker distribution and water quality testing equipment helped to maintain the quality standards for water and prevented any major outbreak. On the whole, the sanitary situation was poor due to overcrowding in the temporary shelters and inadequate provision of latrines and waste disposal. Sanitation and hygiene promotion needed greater attention.

The Tsunami in Thailand

In Thailand, six provinces in the southern part of Thailand along the Andaman coastline (Krabi, Phang-Nga, Phuket, Ranong, Satun, and Trang) were impacted (See Figure 1). Among these provinces affected, the greatest damage was in Phang Nga. There are nearly 100 hotels in these areas; many of the hotels are on or near the beach. December is the highest season for tourism and almost all the resorts are full. As of January 25, in the six impacted provinces, 5,388 deaths had been confirmed, 8,457 persons were reported injured, and 3,120 persons remained missing. Among the 3,762 confirmed dead whose nationality was established, 1,814 (48%) were reported to be Thai nationals.



Figure 1: The six provinces in Southern Thailand impacted by the Tsunami



The impact and burden from the tsunami were serious, with both immediate and long term impact, including devastation of families, housing, infrastructure, jobs and the tourist industry. There was a lot of loss and problems were identified in the areas of health, social and the economy. From the health care perspective, the tsunami affected all levels of health care facilities. None of the hospitals and health centers had ever been exposed to or prepared for such massive casualties like this before.

The health impact included injury & disabilities, infections and mental health. Since this was an unexpected disaster, many victims were in shock due to the event. They lost close relatives, their houses, got severe illness and lost their jobs. This caused many public mental health problems including posttraumatic stress, depression, anxiety, alcohol and substance abuse, suicide and other non-specific distress.

Responses of Ministry of Public Health

The Ministry of Public Health (MOPH) responded with rapid mobilization of local and non local clinicians, public health personnel and medical supplies, assessment of health care needs, identification of the dead, injured and missing, active surveillance of diseases, population advice, and education and cooperation with other ministries for temporary shelter and environmental control. The MOPH issued a health warning and advice to prevent subsequent health problems. The program emphasized personal hygiene, water and food safety, and waste disposal.

Active Surveillance

A Surveillance and Rapid Response Team (SRRT) assessed health impact, risk of disease occurrence, rapid case detection and outbreak investigation, including establishing information flow and determining recommendations and guidelines for prevention and control of diseases.

Active surveillance was initiated by the Bureau of Epidemiology, MOPH, in all 20 districts in the six provinces impacted by the tsunami in order to identify disease occurrence and clusters requiring intensive investigation. Data for the 20 districts were collected from all medical facilities (77 health centers, 22 public hospitals, and four private hospitals), the two shelters for displaced persons, and the two forensic identification centers

The 24 diseases under active surveillance were

Acute diarrhea	Cholera	Dysentery
Food poisoning	Hepatitis	Influenza
Pneumonia	Measles	Typhoid fever
Malaria	DHF	Wound Infection
Meningococcal meningitis	Viral conjunctivitis	Animal bite
Pyrexia of unknown origin	Injury	Unknown death
Other disease	Sepsis/cellulites	Fever with rash
Chicken pox	ENT	Mumps

During one month of active surveillance, a total of 3823 cases were reported with 5 deaths (2 pneumonia, 1 septicemia, 1 patient with diabetes and diarrhea and 1 a child with diarrhea). The highest number of cases was diarrhoeal syndrome, followed by wound infections and pneumonia respectively. No significant outbreaks of gastrointestinal illness or respiratory infections were detected.

Wound infections

The Bureau of Epidemiology collaborated with 4 hospitals in Phuket and Pang-nga province, conducting a descriptive study of post-tsunami wound infections to provide recommendations concerning preparedness for the next disaster. The results of the study revealed that the number of wound infection cases increased in the first few days after the event. About 65% of cases had discharge in the wound, suggested that the wound surface was contaminated with debris and multiple pathogens. Approximately 25% of cases had wound cultures performed. Preliminary results from an ongoing investigation of 33 patients at two government hospitals in Phuket Province indicated that approximately two thirds of the infections were polymicrobial. The most common organisms recovered included *Proteus* spp., *Klebsiella* spp., *Pseudomonas* spp., *Staphylococcus aureus*, *Enterobacter* spp., and *Escherichia coli*. *Aeromonas hydrophila* was recovered from two infections.

In order to prevent wound infections, wounds were cared for with strict aseptic technique and observed closely within the first few days post event. Broad spectrum antibiotics were used to cover Gram-negative bacteria and polymicrobial infections.

Problems and obstacles

In the beginning, there were a variety of problems and obstacles which needed to be overcome. These included:

- Insufficient personnel and medical devices and supplies which impacted quality of triage and care
- Over worked hospital personnel with fatigue, stress and depression
- Ineffective communication between relief teams. Many hospitals had a disaster plan and rehearsed it; however due to the unexpected numbers of victims, they could not follow the plan.
- Limited space, full wards, insufficient operating rooms. There were a lot of patients and wounds were highly contaminated. Patients had to wait for operations due to insufficient operating rooms, shortage of blood and blood products, surgical instruments and medical supplies
- Need for re-operation due to severe infection
- Inadequate hospital morgue facilities
- Language barrier, particularly in Thailand where major tourist sites were affected. There were tourists from over 40 countries including the United States, Canada, South America, Europe, Africa, Asia, and Australia.
- Difficulty in transferring patients, lack of transportation



- Lack of effective coordination and guidelines
- Difficulties in identification of patients and their level of illness
- Lack of information for decision-making and relief

Lessons learned from the Tsunami

The experiences from Thailand and other effected areas underscore the value of:

- Improvement of hospital's disaster plans (written disaster plans with periodical rehearsals)
- Establishing an effective information system for complete, reliable and timely information
- Improvement of communication systems
- Strengthening capacity for rapid mobilization
- Local coordination of relief activities
- Active public health surveillance initiated and maintained to assess disease occurrence and detect infectious diseases outbreaks
- Preparedness of resuscitation and medical devices, equipment and supply
- Revision of each hospital professional's role
- Preparedness and appropriate zoning for treatment in the hospitals
- Mental support teams for both victims and hospital personnel
- Teamwork is very important
- Incidence management command and delegation of teams in hospital
 - Emergency Medical Services team: Ambulance and evacuation from the outreach
 - First aids team in the Emergency Room: Resuscitation and initial wound care
 - Inpatient team: Find space to admit the patients and closely monitor the patient's illness and infections
 - Clinical management team: evaluate and manage triage cases with infection
 - control personnel
- Rapid relief from both governmental and private organizations.
- Centre for command, coordination and consultation between relevant and responsible organizations
- Effective treatment of wound infections, prevent posttraumatic injuries
- Maintaining safe drinking water and sanitation
- Assessment of mental health needs and mental health interventions

Recommendations

- *Capacity building*: Provision and training in areas of personal hygiene including hand hygiene, sanitation, waste management, safe water during non disaster times. Specific attention should be given to the poor, underserved and marginalized communities.

- Improvement of medical facilities geared to effective management of trauma and treatment of wounds and other complications.
- *Emergency preparedness and disaster response* mechanisms must be in place and established during non-disaster times which can be immediately mobilized when needed. Disaster preparedness involves improving community and individual reaction and responses so that the effects of a disaster are minimized.

Preparedness Activities for the future should include:

- An effective early warning system from two levels of coordination – community and national level. The system at the community level should be accessible, convenient and rapid.
- Community based disaster risk management includes population self preparedness, establishing prevention and relief groups in the community and village. Public education of disaster and disaster management.
- An effective communication system: telephone system, mobile phone, fax, radio, internet, telecommunications.
- Establishing national and regional disaster preparedness centers to coordinate with international organization. The establishment of an Asian Disaster Preparedness Centre
- Disaster can cause disruption of water supply and waste disposal and expose the community to environmental risks. Along with making provision for safe water and basic sanitation, emergency preparedness should also include education and training in standard precautions and handling of corpses.
- Several donors, governmental and nongovernmental agencies come forward in times of disaster with offers of aid in terms of material, supplies and human resources. Some times this aid is helpful and at other times inundating, overwhelming and even wasteful. Before arranging and shipping supplies, donors must carry out *multidimensional needs assessment* taking into consideration cultural sensitivities.
- *Improved coordination* is required between donors, government and the NGO's for better and efficient utilization of resources, and avoiding duplication.
- *Nationally accepted standards and guidelines* for emergency medical care, design of latrines, shelter, provision and disinfection of water should be available and widely distributed.
- Primary attention should be given to the *design of camps and temporary shelters* with particular care related to drainage, waste disposal and general sanitation.
- More attention to *food safety, security and distribution* to meet the nutritional needs of infants, small children and pregnant women. This should be coordinated by a single agency.



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