

# Health Lessons Learned from the Recent Earthquakes and Tsunami in Asia

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## Abbreviations:

GDP = gross domestic product  
IDP = internally displaced person  
NGO = non-governmental organization  
PAHO = Pan American Health Organization  
TEC = Tsunami Evaluation Coalition  
UN = United Nations  
WHO = World Health Organization

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## Abstract

The evaluations following the Tsunami that affected 12 countries (December 2004) and the earthquakes in Bam, Iran (2003), and in Pakistan (2005) offered valuable lessons for public health preparedness against all types of risks (natural, complex, or technological) in all countries (regardless their level of development).

The lessons learned, needs assessments, effectiveness of external life-saving assistance, disease surveillance and control, as well as donations management, were reviewed.

Although hundreds of surveys or studies were conducted, the needs assessments were partial and uncoordinated. The findings often were not shared by individual agencies.

The evaluations in each of the three disasters point to some additional issues:

1. Foreign mobile hospitals rarely arrived in time for immediate trauma care. Existing international guidelines for the use of field hospitals often were ignored and must be updated and promoted. Local and neighboring facilities are best at providing immediate, life-saving care;
2. Occasionally, the risk of epidemics was grossly overestimated by the agencies and the mass media. Surveillance and improved routine control programs work without resorting to costly, improvised immunization campaigns of doubtless value. Improving or re-establishing water and sanitation must be the first priority;
3. Health donations were not always appropriate, nor did they follow the World Health Organization guidelines. The costly destruction of inappropriate donations was a recurrent problem; and
4. Medical volunteers from within the affected country were abounding, but did not benefit from the external logistical and material support. The international community should provide logistical and material support before sending expatriate teams that are unfamiliar with the area and its health problems.

Investing in the preparedness of the national health services and communities should become a priority for disaster-prone countries and those assisting them in their development.

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The International Strategy for Disaster Reduction (ISDR) defines a disaster as “a serious disruption of the functioning of a community or a society causing widespread human, material, economic, or environmental losses which exceed the ability of the affected community or society to cope using its own resources.”<sup>1</sup> The key difference between a disaster and an adverse incident is that the coping capacity of the affected community is overwhelmed during a disaster. The threshold between an incident and a disaster will vary according to the size and amount of resources of each society. A storm with 50 casualties may be a manageable event in a large country, but could be considered a major disaster in a local community or a small nation. In practice, the public, the mass media, and many practitioners are labeling disasters as any sudden, dramatic event, regardless of the coping capacity of the affected community,

Country	Date	Killed
PRC	27 July 1976	242,000
PRC	22 May 1927	200,000
PRC	16 December 1920	180,000
Japan	01 September 1923	143,000
Soviet Union	05 October 1948	110,000
Italy	28 December 1908	75,000
Pakistan	08 October 2005	73,338
PRC	26 December 1932	70,000
Peru	31 May 1970	66,794
Pakistan	31 May 1935	60,000

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**Table 1**—Ten most destructive earthquakes<sup>21</sup>  
(PRC = People's Republic of China)

thereby confusing the issue. The three events reviewed in this paper (2003 Earthquake in Bam, Iran; the 2004 Tsunami in Asia; and 2005 Earthquake in Kashmir, Pakistan) clearly exceeded the capacity of the national community and required external assistance.

Natural hazards and disasters are distinct concepts. A powerful earthquake in the middle of nowhere is not a disaster. Similarly, the presence of pathogens in the nature without a susceptible population does not result in an epidemic. The occurrence of floods, typhoons, earthquakes, or other hazards requires a vulnerable population in order to become disasters. This vulnerability often is the result of humans, such as poor land-use management, inappropriate building techniques, or unsafe development practice. Therefore, the so-called "natural" disasters basically are human-made.

"Natural" disasters are best known for their sudden health and social impact: death, injuries, loss of housing, food, and water, and a large internal displacement of the population. However dramatic the immediate effect of sudden-onset disasters may be, perhaps it is their long-term impact on the health infrastructure and the economy that leads to more lasting consequences. These include damage to health facilities that result in long-term disruption of services, loss of income for the poor, and a general set-back in the progress of economic development of the affected region.

Emergency preparedness in the health sector is a relatively new concept. For many decades, the focus was exclusively on preparing the medical response to mass casualties. Health preparedness, often known as: "disaster medicine", was limited to formulating hospital plans, stockpiling surgical supplies, and organizing drills. "Disaster medicine" was primarily a clinical discipline for firefighters, rescuers, emergency department physicians, anesthesiologists, and other hospital clinicians. It was, and still is, mostly devoid of public health or health services management content, and therefore, of limited application outside of the hospitals.

The emergence of public health preparedness dates from the early 1970s. The heavy death tolls along with the massive international response to the Bangladesh Cyclone in 1970 and the earthquake in Peru in 1971 shook the health community worldwide, highlighting the lack of attention given to the epidemiological management of disasters and to the preparedness of the public health sector. The pioneering survey performed in the aftermath of the Bangladesh Cyclone demonstrated the importance and promising potential of scientific studies of the impact of natural disasters.<sup>2,3</sup> As a consequence of these major disasters, a conference was convened in Belgium in 1974 that led to the establishment of the Center for Research on Disaster Epidemiology (CRED), with the mission to systematically apply epidemiological methodology to the study of disasters.

Progress made at a scientific level was slowly matched by changes at the country level. Disasters continued to be viewed only as mass-casualty incidents rather than as a public health risk that can be mitigated and managed professionally. Initially, countries prone to disasters were reluctant to invest in and adopt measures to strengthen their capacity to respond. As often has been the case, it was the occurrence of another major disaster that triggered action from the health sector. In 1976, following an earthquake killed 23,000 persons in Guatemala, the Ministries of Health from the Americas unanimously requested the Pan-American Health Organization (PAHO), the World Health Organization (WHO) Regional Office for the Americas, to launch a regional program to assist the Ministries of Health of the region to prepare for all types of disasters. This preparedness program, a precursor of the modern public health preparedness approach to risk management, has been emulated in Asia by the WHO with the support of the Asian Disaster Preparedness Center (ADPC) in Bangkok and the Asian Disaster Research Center (ADRC) in Kobe, Japan.

Asia is a region with a high risk of catastrophic events. For instance, among the top 10 most deadly earthquakes in the past 100 years, four occurred in the People's Republic of China, two in Pakistan, and one in Japan (Table 1). Asia also is a region with sophisticated institutions and high quality human resources. How well-prepared is the public health sector in Asia? How effectively coordinated was the international response during recent disasters? A review of lessons learned following the earthquakes in Bam, Iran (2003), Pakistan (2005), and above all, the Earthquake and Tsunami in 2004 offer an insight into the evolving situation and the changes to be anticipated.

### Earthquake in Bam (Iran 2003)

On 26 December 2003, an earthquake in Bam, Iran resulted in 26,271 deaths and the nearly complete destruction of this city of 80,000 inhabitants. It was a dramatic reminder that safety resulting from building techniques is paramount to reduce the negative health impact of earthquakes. Traditional mud brick constructions were responsible for the high mortality rate observed (approximately 30%). The health infrastructure, mostly non-reinforced, did not sustain the shock and also was almost completely destroyed.

This earthquake provided several lessons:

1. *However large the number of casualties, life-saving trauma care should be provided by local or national health services and not by outside rescuers*—The number of injuries was estimated to be around 15,000. In a matter of a few days, 11,972 casualties were air evacuated by the military and transported to the medical institutions of the 13 provinces.<sup>4</sup> An unknown number of casualties was transported by relatives to the general hospital in the capital of Kerman Province. Only a few victims remained in Bam. When foreign field hospitals and medical teams became operational three days after the Earthquake, their caseload consisted of minor injuries or health problems not related directly to the Earthquake. The challenge for the generous international solidarity was not to save the lives of the trauma victims, but to re-establish a modicum of routine health care for a population living under temporary shelters. Only one 100-bed field hospital provided by the Red Cross movement was particularly suited for this purpose, and it remained available long enough to cover the needs pending reconstruction of the damaged healthcare facilities. Ironically, as estimated by the Ministry of Health, the cost of dispatching 12 foreign field hospitals was more than (US)\$10 million, an amount similar to the (US)\$10.7 million reconstruction cost of all primary and secondary care facilities (including a nursing school).<sup>5</sup>
2. *The best prepared health agency de facto shall assume the leadership*—Preparedness in the Ministry of Health of Iran was not an overwhelming priority before the Earthquake, whereas the National Red Crescent Society was regarded as one of the strongest and best prepared societies in the region. Not surprisingly, the Red Crescent Society assumed the leadership for the coordination of all medical activities, including the provision of primary and secondary medical care during the extended recovery. The federal Ministry was not in a position to overcome the impact on the provincial health management structure and staff (reportedly 200 out of 500 doctors were killed). Thus, it could not assume its normal role as head of the health sector. Aware of this shortcoming, the Ministry later established a strong disaster risk management program with a clear mandate to lead disaster risk management in the health sector. The establishment of such a program in a Ministry of Health is an indispensable prerequisite for public health preparedness.
3. *Psychosocial needs are best attended by local health staff*—Following years of advocacy, the psychosocial needs of the affected population now are recognized and are receiving considerable attention from the health providers, especially international non-governmental organizations (NGOs). Distinct approaches were adopted in Bam: one was aimed at capacity building and training of local health personnel, and another consisted of the dispatch of expatriate volunteers to provide direct psychosocial assistance.

This influx of western social workers and medical personnel had several consequences: (1) a tendency to overestimate the number of cases requiring specialized attention by labeling as post-traumatic stress disorder (PTSD) any intense emotional reaction; and (2) counseling of a conservative Islamic population by inexperienced, young social workers from developed countries working through interpreters. Clearly, the option of capacity building is preferable and should become part of the public health preparedness programs.

4. *A formal lessons-learned exercise is critical*—In April 2004, the Ministry of Health of the Islamic Republic of Iran invited external actors to participate in a workshop on the public health lessons learned from the Bam Earthquake. This practice of transparently reviewing the response to a major disaster is a valuable contribution to better preparedness in the future. The international community and neighboring countries shared their experiences. Even so, drills or exercises are no substitute for the experiences of a real event.

#### Tsunami in Asia

On 26 December 2004, a massive earthquake generated a series of tsunamis that affected 14 countries around the Indian Ocean. Indonesia, Sri Lanka, the Maldives, India, and Thailand were hit the hardest. Over 227,000 people lost their lives, and some 1.7 million persons were displaced. In Indonesia and Sri Lanka, the Tsunami occurred during a civil conflict, so access to some areas was limited for security reasons.

The almost simultaneous occurrence of this disaster in several countries offers an opportunity to compare both the domestic and national public health responses, and to draw the respective lessons. Few events have been studied so intensively; hundreds of independent reviews and evaluations were performed. Among them are the comprehensive evaluations organized by the Tsunami Evaluation Coalition (TEC), a group of >40 United Nations (UN) agencies, donors, and humanitarian organizations. These thematic evaluations focused on coordination, needs assessment, impact on local capacity, and long-term development and funding. The findings and conclusions of the five TEC thematic evaluations are used extensively in this report.

1. *The availability of funding is not the main obstacle to an effective response*—The economic costs of the damages and the consequent losses were estimated at (US)\$9.9 billion across the affected region, with Indonesia accounting for almost half of the total cost.<sup>6</sup> However, absolute figures have little meaning in humanitarian terms. What matters more is the proportional amount of the losses. In the Maldives, damage and losses accounted for over four-fifths of their gross domestic product (GDP), a fact that did not prevent their response from being one of the best coordinated by the authorities. In Aceh, Indonesia, damage and losses nearly were equivalent to the entire GDP of the province, but were relatively modest compared to the GDP of Indonesia.<sup>7</sup>

A massive media-fueled global response that followed the Tsunami produced an estimated

(US)\$13.5 billion in international aid, far exceeding the total cost of damage and losses. It is noteworthy that the Asian countries generously contributed cash and in-kind assistance. Medical personnel and other experts from Asian countries often were more timely and better adapted than traditional, western sources of assistance. At the global level, an average of (US)\$7,300 per affected survivor was committed, compared to the meager (US)\$3 per victim of the Bangladesh flood in 2005.<sup>7</sup> In spite of this overwhelming budget, the external responses were plagued by serious shortcomings, suggesting that the availability of financial resources and technology is not, in itself, a guarantee of effectiveness. This conclusion is strengthened by the domestic response to Hurricane Katrina (losses of (US)\$125 billion, a mere 0.1% of the GDP).

2. *Few decisions are made based on needs assessments*—As documented by the TEC evaluation teams, within the first six months, hundreds of reports were written on the magnitude of the damage, the estimated needs of selected communities and some of the gaps in the aid provided.<sup>8</sup> However, the process of assessing the situation was coordinated poorly. Humanitarian responders were reluctant to share information within this competitive environment. United Nations agencies were unable to provide an objective view of the overall situation. Foreign donors interviewed by the TEC evaluators admitted that decisions were made on political grounds rather than based on needs and priorities. The coverage by the mass media had a considerably greater influence on the decision-making of donors and agencies than did the results of any survey or report.<sup>8</sup> It is not surprising that the local population felt that the needs, as they perceived them, were overshadowed by the priorities and interests of the assisting organizations. As some victims said: “We have been surveyed, but not consulted”. Accountability of many NGOs and some UN agencies was to their donors rather than to the beneficiaries and local authorities.
3. *The national public health capacity was not affected significantly by the Tsunami*—With the exception of the Aceh Province, the public health and hospital capacities of the affected areas were impacted marginally. Damages and losses were circumscribed to a narrow band of coastal areas, while neighboring communities and infrastructures were untouched by the waves. However, in the city of Banda Aceh, the Tsunami destroyed the office of the Provincial Health Department, affected hospital facilities, and incapacitated the health personnel. In Sri Lanka, the administrative and technical structure of the Ministry of Health was intact and operational. The response was mostly at the provincial level. Patients referred to the university hospital in Colombo mostly were foreign tourists who were in the process of evacuating. The fact that tidal waves or tsunamis result in relatively few injuries, that can be cared for locally did not prevent the influx of international medical volunteers to the affected areas. When tidal waves or tsunamis hit the coast, victims either drown or survive with limited injuries. This first was observed following the cyclone of Bangladesh (1970; 250,000 deaths). The number of injuries in the city of Banda Aceh was somewhat higher than expected, due to the extraordinary amount of debris (houses, buses, car, trees, etc.) carried by the wave in the urban environment. In India and Thailand, the Ministries of Health preventively discouraged offers of medical assistance and mobilized the considerable expertise that was available nationally. This local response was outstanding and should serve as a model for countries with a large reservoir of human and material resources.
4. *International humanitarian standards were not adapted to a local context*—The international humanitarian agencies adopted global humanitarian standards for nutrition and food security, health care, shelter, and water and sanitation. These standards were collectively developed by a group of humanitarian NGOs and the Red Cross and Red Crescent Movement with inputs from UN agencies and academics. In contrast, a needs-based approach looks at what has been lost due to the disaster and attempts to compensate the losses. These are published in the “Sphere Handbook”.<sup>9</sup> These standards reflect a strong, rights-based commitment to disaster-affected populations, but describe aspirations that are not met in normal times in any of the countries affected by the Tsunami. The authors of the Handbook clearly recognize the need to adapt to local conditions, but indicators and standards may develop a life of their own.<sup>10</sup> The rigid application of these well-intended standards caused some unintended negative consequences:
  - a. *Targeting easy-to-reach populations in which standards can be met, like internally displaced persons or refugees in urban areas*—This resulted in over-concentration of NGOs on the most visible beneficiaries, who, in many instances, remain far from receiving the minimum-level of services envisaged by these global standards;
  - b. *Providing an incentive to request more funding, provide more handouts (clinics, boats, houses, food, etc)*—This resulted in overstretching the emergency phase and delaying the recovery process;
  - c. *Diverting resources away from the development-oriented agencies that would settle for less ambitious but achievable and more sustainable recovery goals, thereby benefiting a larger number of households; and*
  - d. *Posing a delicate dilemma to the Ministry of Health, which will not be able to, nor should be expected to sustain higher medical standards than in the rest of the country.*
5. *The public health authorities should learn how to differentiate among humanitarian responders*—Humanitarian assistance was provided by governments, including many from Asia, the UN, NGOs, the Red Cross Movement, and the private sector. Many of these specialized humanitarian agencies offer a depth



of expertise that no affected country left to its own resources can assemble. The key to effective response is a selective and closely coordinated use of this expertise, as was done in India and Thailand. In Indonesia and Sri Lanka, the NGOs, provided with considerable direct funding, had little incentive to abide with coordination from the government or the UN. Some of those NGOs were poorly qualified or ventured into technical areas for which they had no particular expertise. National authorities, particularly the health ministries, were unfamiliar with the assets and capabilities of each partner and therefore, failed to exercise knowledgeable discrimination. As a result, inexperienced but well-funded agencies embarked on ill-conceived projects, such as the supply of small boats (some of them unsafe for coastal fishing), leading to an excessive number of boats of questionable quality in Sri Lanka.

The construction of poorly designed or duplicate public health centers or clinics is another example of inappropriate aid. Those NGOs or well-intentioned individuals without experience in developing countries or disaster relief quickly overcrowded Aceh and Sri Lanka, confusing the authorities and adding to the frustration of the population with unmet expectations or pledges.

Discerning the qualifications of humanitarian agencies is difficult. Criteria must change over time; agencies effective in immediate search-and-rescue or emergency care are not necessarily most effective in providing support to the Ministries of Health during rehabilitation and recovery. According to the TEC evaluations, many agencies involved in the early Tsunami response lacked the qualities to make a contribution to the recovery. "The incentives of the aid industry need to change in order to encourage agencies to 'get out of the way' when critical tasks require skills and endurance that exceed what they can actually muster for field level operations."<sup>11</sup> According to the Red Cross, the humanitarian world is "the largest unregulated industry."<sup>12</sup> "A regulatory system is necessary to ensure predictably high quality, international, disaster response. One mechanism for such a regulatory system would be through an accreditation and certification system for aid agencies."<sup>6</sup> The implementation of a standardized international accreditation system in the health sector would assist the Ministries of Health in accepting only those responders who have the necessary competence and assets.

6. *Marginalization of the local authorities by the international actors*—The health institutions in Indonesia and Sri Lanka were unprepared for the magnitude of the Tsunami, and above all, for its international dimension. To compound this problem, the national authorities were marginalized unintentionally by the international community. On-site access to foreign assets, such as air transportation, equipment, and communications (including broadband Internet) was primarily available to international responders. Language barriers also played a role, as English is the international coordination language in disasters. As a result, the national authorities in Indonesia and Sri Lanka could not filter,

coordinate, or manage the overwhelming number of aid responders, or assume the technical lead in adapting indicators and standards to local realities. This also underlines the inadequate level of public health preparedness and planning.

Public health preparedness of the Ministry of Health is not limited to readying its own operational response. It also must cover the mandate of coordinating and overseeing all responders at the sectorial level.

7. *The risk of epidemics following natural disasters was overstated*—The Tsunami offered a remarkable confirmation that the occurrence of massive secondary epidemics after sudden-onset natural disasters is, indeed, a myth.<sup>13</sup> The Tsunami experience also confirmed that unburied dead bodies are not a public health hazard in the aftermath of natural disasters.<sup>14,15</sup> Although the MOH and the WHO conducted extensive disease surveillance, no significant outbreaks were found.<sup>8</sup> This finding confirms similar observations published by the Pan-American Health Organization over the last three decades and the experience following the earthquakes in Iran and Pakistan.

A novelty during the Tsunami response was the unduly alarmist public statements made by humanitarian agencies, including otherwise competent UN agencies. The press declaration that "more people will die from outbreaks than from the Tsunami itself", was issued in spite of the contrary opinion of local and international epidemiologists and experts. Stimulating fear of epidemics may raise international support for public health programs, but only damages credibility when blatantly unsubstantiated. This declaration also led to the waste of scarce operational resources through unnecessary and logistically complex cholera immunization campaigns. Priorities should be placed on providing balanced health education, strengthening the surveillance and response system, improving water supply quality, and adopting basic sanitation measures. In the long-term, the public did not benefit from the overly alarmist announcements.

### Earthquake in Pakistan

The earthquake that occurred on 08 October 2005 in Pakistan resulted in the deaths of >73,338 people, caused serious injuries to another 69,400 people, and left >3.3 million people homeless in a region already considered to be among the poorest in the country. According to experts, this disaster was well managed by the authorities who established an *ad hoc* coordination mechanism under the direct supervision of the President of the Republic. The approach adopted encouraged constructive participation of NGOs and other agencies, while attempting to maintain an overall national strategy and oversight. As in Iran, the institutional preparedness of the Ministry of Health was far from sufficient for a disaster of such magnitude. The support from the WHO was instrumental in asserting the leadership of the health authorities. Several public health issues invite further debate and analysis:

1. *Is temporarily providing a high level of health care always better?*—Considering that Pakistan's health

facilities were poorly equipped, understaffed, and few in number prior to the emergency, the level of post-event health care provided by the international community and Ministry of Health over the ensuing six months was far above what could be sustained, even under the best of the circumstances. One may question the wisdom of temporarily dispatching >50 field hospitals to provide routine health care for 6–9 months after the earthquake. Forty-one of those hospitals were provided and staffed by Cuban doctors willing to walk and offer basic services to the least accessible places. Remarkably, all Cuban teams included female doctors, a prerequisite for bringing attention to women in a strongly conservative society. Voluntary repatriation is a concept normally applied in complex disasters to ensure that refugees or IDPs are not forcefully returned when they feel that their security needs are not met. In Pakistan, security was not an issue. Refugees could choose to stay in the camp, receive all the assistance at standards never achieved before, or return to their mountain village with a substantial in-kind aid and “promises” of improved health infrastructure in a near future.

Will the demand created by temporarily providing a high level of health care have a positive impact in the long term? Was it not a disincentive for early return and recovery?

2. *When are handouts and services (health care, food, water, shelter, etc.) provided to internally displaced populations in the camps reduced?*—While amply justified during the winter season, this assistance became a disincentive to move out and re-establish a “normal” life at the next planting season. The insistence of some UN officials and NGOs to continue offering full services after the cold season under the principle of “voluntary repatriation” sharply contradicted the efforts of the Government of Pakistan to initiate resettlement and reconstruction as quickly as possible. Displaced populations had to choose between continuing to receive full assistance in the camps or returning to their homes with a resettlement allowance and a promise of improved services in the future. Is over-compensating the transient poverty caused by the earthquake in the best long-term interest of the victims? The answer is not a clear, black and white proposition; many refugees from urban settings had no place to return. The rubble was not cleared from their lots, and they did not have the means to do so themselves. Fear of new earthquakes was real for refugees in both the urban and rural settings. For farmers, skipping one planting season meant delaying their return to a self-supporting lifestyle for an entire year.

As a consequence of this traumatic experience, the Ministry of Health now is in the process of establishing a “Disaster Management Center” to promote public health preparedness and disaster risk reduction in the health sector. As often is the case, changes and reforms are occurring immediately following a major disaster.

## Conclusions

The abundance of resources available to respond to the Tsunami, as well as to Hurricane Katrina, confirms that “Preparedness is primarily a matter of building institutional capacity and human resources, not one of investing heavily in advanced technology and equipment. Building the local coping capacity is one of the most cost-effective measures to improve the quality of the national response and the external interventions.”<sup>5</sup>

Public health preparedness, above all, is a matter of good governance and management based on evidence and experience. The challenges to good disaster management suggest that a multi-hazard (natural, biological, technological, or other) approach should be adopted. Technical knowledge of the specific risks of disaster is only one, albeit important, element of this approach. In other words, there is a need for a permanent and stable program within the Ministries of Health to prepare for and coordinate the response to any type of disaster. Specialized responses to potential new threats such as avian influenza or terrorism, should be integrated into this all-hazards approach. This approach may benefit from the main lessons learned from recent, major, natural disasters in regard to needs assessment and external assistance coordination.

## Needs Assessment

The response to sudden-impact disasters must be as evidence-based as possible. Needs assessments require special attention, as demonstrated during the international evaluation of the Tsunami.<sup>8</sup> In the aftermath of a sudden-onset disaster, the first task of the health sector is to assess the needs in order to maximize the use of its scarce resources. Decision-making based on impressions, myths, or political imperatives without collecting evidence on the nature and extent of the needs is unlikely to be effective. Essentially, disaster management is information management. The training of the Ministry of Health must be improved to ensure the coordination of the health intelligence collection. The increased involvement of major donors in supporting the needs assessment by the WHO and other UN Agencies is most encouraging.

## External Health Response

Few countries have sufficient resources to respond rapidly to all health needs in the aftermath of large-scale, sudden-impact disasters. External health response may be extremely generous, but must be supportive of and accountable to the health authorities of the affected country.<sup>16,17</sup> Experiences during recent Asian disasters suggests the following guiding principles:

1. Local and neighboring health facilities are best at providing life-saving treatment. Foreign mobile hospitals rarely arrive in time for immediate emergency trauma care. If necessary, medical assistance should be organized on a regional basis with larger, neighboring countries playing an increasing leadership role in this matter. Existing international guidelines for the use of field hospitals often are ignored.<sup>18</sup> Current guidelines may need updating and further promotion with the participation of major donors; and

- In Asia, medical volunteers from within the affected country are plentiful and most willing to assist. However, they require logistical and material support. The international community should provide this support rather than sending expatriate teams unfamiliar with the area and its health problems. The key is preparing those national volunteers prior to the event.

Preparing the national health services and communities should become a priority for both disaster-prone countries and those assisting them in their development. Funding for public health preparedness is comparatively modest when compared to the financial assistance offered once the disaster has occurred. Funding should be included in development plans and a pre-determined proportion of humanitarian funding (so generously provided once the crisis has happened) should be allocated to the post-event assessment of the lessons learned from the response and for preparing the country for the next emergency.<sup>6</sup>

Preparedness should not merely be a tool to ready the health sector to respond promptly to an emergency. Future

preparedness should focus on comprehensive health-risk management, including measures to reduce the vulnerability of the population.<sup>19</sup> This requires that the health sector be involved with multi-sectorial preventive measures such as building codes, land use management, and/or early warning systems. While not the lead agency in those areas, the health sector has a vested interest in reducing casualties and minimizing losses and thus, has allied goals and purposes. It also has the direct responsibility to ensure that its own infrastructure (hospitals, health centers) be reasonably resilient to the prevalent hazards. Following earthquakes, the health facilities of the countries are among those most affected. Not only should these facilities be able to structurally protect the lives of its occupants, but they should remain operational when they are needed most.<sup>20</sup> The mitigation of damage to health facilities must be part of the mandate of health preparedness.

Thirty years of preparedness of the health sector in Latin America and the Caribbean have demonstrated that comprehensive disaster risk management is effective in all countries, regardless of size and resources. It now is part of the disaster preparedness strategy of the WHO at the global level.

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