Disaster Risk Reduction and Preparedness of Health Facilities

A literature review prepared by the
WHO Kobe Centre, Japan

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I. Executive Summary

Health facilities, including hospitals, are facilities exposed to natural hazards. Considering the critical need for these institutions in the aftermath of disasters, priority should be put on identifying and reducing the weaknesses of existing facilities and on improving the building standards for new construction.

When it comes to disaster resiliency standards, the bar is inevitably raised in the case of health facilities: not only should they remain structurally viable but they must also allow the continuity of healthcare activities.

The Hyogo Framework for Action 2005–2015

The Hyogo Framework for Action (HFA) 2005–2015, borne out of the UN World Conference on Disaster Reduction, acknowledged that efforts to reduce disaster risks must be systemically integrated into policies, plans and programmes for sustainable development and poverty reduction through international cooperation. Its strategic goals are: 1) the integration of disaster risk reduction into sustainable development; 2) development and strengthening of institutions, mechanisms and capacities to build resilience to hazards; and 3) the systematic incorporation of risk reduction approaches into the implementation of emergency preparedness, response and recovery programmes.

It explicitly states that there is a need to 1) integrate disaster risk reduction planning into the health sector; 2) promote the goal of “hospitals safe from disaster” by ensuring that all new hospitals are built with a level of resilience that strengthens their capacity to remain functional in disaster situations; and 3) implement mitigation measures to reinforce existing health facilities, particularly those providing primary health care. Five priority action areas were set out in the HFA, namely: 1) governance; 2) risk identification, assessment, monitoring and early warning; 3) knowledge management and education; 4) risk management; and 5) preparedness for effective response.

The WHO Kobe Centre's Priority Project

The WHO Centre for Health Development (WHO Kobe Centre/WKC), taking into account the goals and priority actions of the HFA, has focused on a specific priority project entitled "Preparing health facilities for disasters in cities", which builds on the HFA's goals and priorities for action promoting work in the goal of "hospitals safe from disasters". The project seeks to contribute to the generation and dissemination of scientific knowledge on how priorities for disaster reduction actions can best be embedded in emergency preparedness policies and programmes of selected health facilities and eventually throughout health systems.

The objectives of the priority project are: 1) to conduct a situational analysis on the preparedness of selected health facilities to withstand and respond to disasters; 2) to characterize the features and attributes of effective health facility disaster preparedness policies and programmes; and 3) to advocate effective health facility disaster preparedness policies and programmes within the context of health systems development, using the disaster risk reduction framework.

This literature review was prepared to assess the extent of our knowledge on health facility disaster risk reduction and disaster preparedness to better achieve the goals of the HFA by identifying the priority areas of action for the WHO Kobe Centre.

II. Reviewing evidence

Limitations of the review

The results presented are by no means exhaustive, but provide a starting point for a more systematic review of evidence on disaster risk reduction and preparedness of health facilities. Most of the publications and articles reviewed were in English and related to inputs and outputs on the occasion of the World Conference on Disaster Reduction in 2005, the work of the UN International Strategy for Disaster Reduction (ISDR)[1], the Regional Offices for the Americas/Pan-American Health Organization (AMRO/PAHO), Europe (EURO), South-East Asia (WHO/SEARO), Western Pacific (WPRO) and web literature.

Organization of the review

The review is divided into the five priorities for action that were set out in the Hyogo Framework for Action (HFA) 2005–2015. The HFA, borne out of the UN World Conference on Disaster Reduction, acknowledged that efforts to reduce disaster risks must be systemically integrated into policies, plans and programmes for sustainable development and poverty reduction through international cooperation. Its strategic goals are: 1) the integration of disaster risk reduction into sustainable development; 2) development and strengthening of institutions, mechanisms and capacities to build resilience to hazards; and 3) the systematic incorporation of risk reduction approaches into the implementation of emergency preparedness, response and recovery programmes.

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Five priority action areas were set out in the HFA, namely: 1) governance; 2) risk identification, assessment, monitoring and early warning; 3) knowledge management and education; 4) risk management; and 5) preparedness for effective response (Please see Annex 1. Summary of the Hyogo framework for action 2005–2015: Building the resilience of nations and communities to disasters).

1. Governance

Countries that develop policy, legislative and institutional frameworks for disaster risk reduction and that are able to develop and track progress through specific and measurable

[1] The ISDR, founded in 2000 by the UN General Assembly, is the successor to the IDNDR (International Decade for Natural Disaster Reduction). There are two mechanisms for the implementation of ISDR, the Inter-Agency Secretariat and the Inter-agency Task Force on Disaster Reduction.

indicators have greater capacity to manage risks and to achieve widespread consensus for, engagement in and compliance with disaster risk reduction measures across all sectors of society.

Unfortunately, the concern for making health facilities safe from disaster, whilst leading to prominence on the political agenda at different levels, has been more reactive than proactive. In fact, the 1985 earthquake in Mexico City, with a loss of life of 10 000 persons and the destruction of 13 hospitals, was the main trigger in the Latin American and Caribbean region to put health facility mitigation high on the agenda.

It is important to note, nevertheless, that in the countries of Latin America and the Caribbean, many hospitals damaged by natural disasters were already designed in accordance with seismic, wind and flood-resistant building standards. This suggests that the design of hospitals should apply even higher standards than those relevant to buildings meant for housing or offices. Both the architectural and the structural design of health facilities should consider not only the physical aspects of any given adverse event, but also the social, economic and human implications of the functions played by hospitals in a community.

Nepal is another context where, despite being located in a highly seismic region, initiatives on earthquake risk management started only after massive destruction and the loss of 721 human lives due to an earthquake in 1988. Out of the initiatives implemented in the country since then, those implemented by the National Society for Earthquake Technology (NSET) have been especially effective due to their contribution toward raising the awareness of both the authorities and the general population. For example, NSET conducted a survey in 2000–2003 of the structural and nonstructural vulnerabilities of the 14 major hospitals of Nepal. As a result, mitigation and intervention options have been identified and planned for implementation. The methodology developed during the study is now published as "Guidelines for Seismic Vulnerability Assessment of Hospitals".[2]

Good governance

Good governance implies having a policy, allocating the necessary resources, enforcing implementation and assigning accountability for failures and facilitating participation from civil society to private sector. Following the December 2004 tsunami in Thailand, for example, a national tsunami hazard mitigation plan now awaiting cabinet approval was conceptualized establishing the National Earthquake Committee of Thailand and calling for collaboration between government and universities. One of the policies being revised is the building regulation on seismic resistant design and research on tsunami loading on shelters with funds allocated by the Department of Public Works.

There are other examples but experience has shown that disaster reduction in general and health facility disaster risk reduction and preparedness in particular will have succeeded when governments and decision-makers primarily understand that a disaster is above all a failure of foresight and sadly, evidence of neglected governance responsibility. The best argument for demonstrating that it is possible to have health facilities safe from disasters is to show that some countries have accomplished or are actually accomplishing this.

[2] Guidelines for Seismic Vulnerability Assessment of Hospitals. WHO Emergency and Humanitarian Action and National Society for Earthquake Technology-Nepal. Kathmandu, April 2004.

Japan, for example, learning extensively from the Great Hanshin-Awaji Earthquake of 1995, has proceeded with work on preparing facilities such as "earthquake-proof construction for base hospitals" and has deemed it necessary to strengthen collaboration between base hospitals, to organize a Disaster Medical Assistance Team in Hyogo Prefecture (of which Kobe is prefectural capital) and strengthen the role of each base hospital. The Hyogo Emergency Medical Center was also established as the base for a prefecture-wide disaster system.[3] Similarly, India's Gujarat State Disaster Management Authority (GDSMA) has developed a number of guidelines for vernacular and heritage buildings to make them disaster resistant, in addition to updating existing building codes.

The loss of lives and property as a result of earthquakes and other extreme natural hazards can be mitigated by applying existing technologies without incurring enormous financial cost. All that is required is to have the political and social will to apply the right techniques. Although it has been stated that the cost-effectiveness of retrofitting existing health facilities is evident, this should not be the main reason to adopt mitigation measures in health facilities. The social benefit of a hospital that remains operational in the wake of a disaster is a far more powerful argument.

Making new health facilities safe[4]

Ensuring that all new hospitals meet the most stringent and modern safety requirements is feasible and cost-effective and will directly contribute to achieving the Millennium Development Goals (MDGs). Incorporating disaster mitigation measures into the construction of new health facilities is a matter of political will rather than an issue of cutting-edge scientific knowledge or an unlimited budget. Politicians armed with the necessary knowledge of risks, the need for risk reduction and a reasonable amount of investment to reduce the risk will listen and respond to public demand and awareness for making new health facilities safe and strengthening old health facilities to make them safe. At the international level, the Ministers of Health of the Americas passed a resolution in 2004 urging Member States to strengthen their own disaster preparedness and mitigation programs by allocating resources and garnering political support to ensure that the health sector remains operational when a disaster-affected population most needs it.[5] Disaster preparedness should be considered in all aspects of new health facilities planning[6] [7].

2. Risk identification, assessment, monitoring and early warning

The starting point for reducing disaster risk and for promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic and environmental vulnerabilities to disasters that most societies face, and of the ways in which hazards and

[3] The Great Hanshin Awaji Earthquake: The Report of the 10-Year Reconstruction – Overall Verification and Recommendations, March 2005.
[4] Safe Hospitals: A collective responsibility, a global measure of disaster reduction, PAHO, 2005.
[5] Disasters: Preparedness and mitigation in the Americas. October 2004
[6] Guidelines for Vulnerability Reduction in the Design of New Health Facilities. PAHO, 2004.
[7] Protecting New Health Facilities from Natural Disasters: Guidelines for the promotion of disaster mitigation. PAHO, 2003.

vulnerabilities are changing in the short and long term, followed by action or actions taken on the basis of that knowledge.

Risk assessment encompasses the systematic use of available information to determine the likelihood of certain events occurring and the magnitude of their possible consequences. As a process, it is generally agreed that it includes: identifying the nature, location, intensity and probability of a threat; determining the existence and degree of vulnerabilities and exposure to those threats; identifying the capacities and resources available to address or manage threats; and determining acceptable levels of risk.

Almost 8 million earthquake-related deaths have occurred in the past 1000 years. Many of these deaths occurred on the world's tectonic plate boundaries where the plates collide. Most of these occurred where large cities coincided with the Alpine/Himalayan, Andes and East Asian seismic belts.

In the approach adopted for hazard mapping and risk assessment in the Kathmandu Valley Earthquake Risk Management Project, emphasis was placed on utilizing the geological and seismological data already available. The project built upon on the only prior earthquake scenario methodology developed in a developing country (Quito, Ecuador) and adapted it to suit the conditions prevailing in Nepal. It also adopted simple technical approaches (e.g., plastic laminated maps) and during the whole process of assessing the earthquake risk, the research team interacted closely with the management of the critical municipal facilities and the emergency response services. As a result, the whole activity proved to be an effective awareness-raising tool and the 30 institutions that participated in the process accepted the earthquake scenario and the loss estimation positively.

The Risk Assessment Tools for Diagnosis of Urban Areas against Seismic Disasters (RADIUS) provided a good example of hazard-specific tools that contribute to defining urban risk scenarios. The seismic damage scenarios developed describe human loss, damage to buildings and infrastructure and their effects on urban activities for nine cities.[8] An evaluation of RADIUS found that significant progress has been made in the management of earthquake risk in RADIUS cities. There has been an important increase of public awareness about the need to reduce urban risk, and new risk management programmes are underway.

Many other handbooks with detailed checklists for appraisal are available[9] [10] [11] [12]. In 2006, the WHO Regional Office for Europe (WHO/EURO) published a handbook it developed with the Institute of Earthquake Engineering and Engineering Seismology which provides practical guidance to hospital managers in assessing the vulnerabilities of health facilities, identifying structural and functional gaps and weaknesses, and collaborating with technical experts to ensure that hospitals and health facilities are constructed in a way that ensures that health services remain functional in the aftermath of disasters.[13]

[8] Addis Ababa, Ethiopia; Antofagasta, Chile; Bandung, Indonesia; Guayaquil, Ecuador; Izmir, Turkey; Skopje, Macedonia; Tashkent, Uzbekistan; Tijuana, Mexico and Zigong, China.
[9] Disaster Mitigation for Health Facilities: Guidelines for Vulnerability Appraisal and Reduction in the Caribbean, PAHO 2000.
[10] Guidelines for Seismic Vulnerability Assessment of Hospitals, NSET-WHO-USAID, 2004.
[11] Non-Structural Vulnerability Assessment of Hospitals in Nepal, Ministry of Health Nepal, 2003.
[12] Burón, C. Hospital Damages Evaluation, Instituto Superior Politécnico José Antonio Echeverria, Cuba, 2002.
[13] Health facility seismic vulnerability evaluation: a handbook, WHO 2006.

The Regional Office for the Western Pacific (WHO/WPRO) published in the same year a manual to serve as a management tool for health professionals evaluating the preparedness of their respective health facilities for dealing with disasters.[14] The field manual presents a series of evaluation checklists – main questionnaire, assessment of general emergency preparedness and a check-up of preparedness for specific emergencies – keeping in mind the needs of health professionals who manage health facilities.

Many efforts are also directed on the development and improvement of early warning systems. The failure or absence of communication systems between the affected areas and health facilities is another target for improvement[15].

3. Knowledge management and education

Effective disaster risk management depends on the informed participation of all stakeholders. Integrating new developments in information management with established and more traditional methods can help to create a much better understanding about hazards and risk at all levels of responsibility. This information can be disseminated through the formal school system and through public awareness programmes. Information is also instrumental in achieving more comprehensive early warning systems and effective mitigation efforts.

WHO Kobe Centre's participation with the Disaster Reduction Alliance (DRA), along with 13 other local stakeholders in the city of Kobe in the Hyogo Prefecture, promotes collaboration among Kobe/Hyogo actors in achieving the goal on developing and strengthening institutions, mechanisms and capacities to build resilience to hazards. The DRA provides a roundtable to exert synergistic effect in promoting international cooperation towards disaster reduction.

Vulnerability reduction in the design of new health facilities

Knowledge does exist in the area of vulnerability reduction in the design of new health facilities but how much of this knowledge is being applied in actual situations is not yet clear. Stated in a different way, how much of the "Guidelines for vulnerability reduction in the design of new health facilities"[16] are known and being adopted at global, regional, national and local levels to ensure that new health facilities cover three levels of protection from adverse events, namely life safety, investment protection and functional protection is a valid question to ponder on.

Life safety entails ensuring that the building will not collapse and that any injuries that occur are not life-threatening to patients and staff. Investment protection denotes significantly reducing structural and nonstructural damage, even though the facilities may be rendered

[14] Field manual for capacity assessment of health facilities: responding to emergencies. WHO, 2006.
[15] Dengler L, Preuss J. Mitigation Lessons from the July 17, 1998 Papua New Guinea Tsunami. Pure & Applied Geophysics, Oct 2003, 160(10/11):2001-31.
[16] Guidelines for vulnerability reduction in the design of new health facilities. WHO, Pan-American Health Organization, the World Bank Group, ProVention. April 2004.

temporarily non-operational. Meanwhile, functional protection guarantees that the facilities will continue to operate and serve the community with a minimum of disruption. PAHO/WHO has recommended that essential areas and components of hospitals be built to retain the third and most demanding performance objective (i.e., functional protection) and that new health facilities be built entirely so as to meet, at least, the first level of protection, namely life safety.

"Protecting new health facilities from natural hazards: guidelines for the promotion of disaster mitigation (2003)" summarizes the guidelines emphasizing how they may be used, by whom, and for what purpose. Potential users of the guidelines include, but are not limited to: (1) initiators of health facility construction projects; (2) executors and supervisors of health facility construction projects; and (3) financing bodies in charge of funding health facility construction projects.

The guidelines include the following: (1) implications of natural phenomena for the health infrastructure; (2) guidelines for vulnerability reduction for incorporation into development project cycles; (3) definitive phases and stages within the phases for development projects including: (I) Projects Assessment (needs assessment; assessment of options, the preliminary project); (II) Investment (project design, construction); and (III) Operational Activities (operations and maintenance). In addition, investment in damage reduction measures, policies and regulations, training and education, and the role of international organizations in the promotion and funding of mitigation strategies were addressed.

Improving the safety of existing facilities[17]

The need to reduce the nonstructural vulnerability of existing facilities is now widely recognized in many countries, mostly in Latin America but increasingly in other regions of the world also. Further progress is deemed more a matter of awareness and attitude than of science or money.

Since the mid-1980s, earthquake prone countries including Chile, Colombia, Costa Rica, Ecuador, India, Mexico and Peru have been retrofitting hospitals. Although it would be extremely expensive and disruptive to retrofit all existing hospitals, the most critical areas such as operating rooms and blood banks of selected facilities have been the ones targeted at first. It is recommended that an incremental approach be applied where gradually an inventory of health facilities is done in order to prioritize the most vulnerable structures where retrofitting should take place as soon as possible.

Does retrofitting actually protect patients, reduce losses and allow operations to continue? The only irrefutable argument is how the structure behaves in an actual earthquake and the experiences in Costa Rica example and Cayman Islands provide illustrative examples.

An ambitious program to retrofit five major hospitals was underway in Costa Rica when a 6.8 magnitude earthquake struck in 1990. The partial retrofitting of one hospital is credited with saving the facility and its occupants. In the other four hospitals, those parts of the facility that had already been retrofitted came through the quake in excellent condition, while other parts which had not yet been reinforced showed evidence of structural failure, even though

[17] Safe Hospitals: A collective responsibility, A global measure of disaster reduction, PAHO, 2005.

allegedly they had been designed to withstand an even stronger quake. Nonstructural damage was concentrated in the buildings or departments that had not been retrofitted. The savings far exceeded the cost of retrofitting.

Health centres in the Cayman Islands were virtually undamaged by Hurricane Ivan's strong winds, torrential rains and storm surge in 2004. The behavior of retrofitted facilities in actual disasters such as the East Point Clinic, confirms that this approach is technically and politically feasible and effective in saving lives and reducing the disruption of essential services. Most of the disruption in retrofitted facilities was due to nonstructural damage and unnecessary evacuation.

There are many seismological and seismic engineering institutes around the world, widely known among practitioners involved in technical and information services. Two organizations that are particularly engaged in the dissemination of information about seismic hazards are 1) the Earthquake Hazards Program of the US Geological Survey (EHP/USGS) which is part of the National Earthquake Hazards Reduction Program led by the Federal Emergency Management Agency (FEMA) and 2) the US Earthquake Engineering Research Institute, recognized as the authoritative source for earthquake risk reduction information in the United States.

Specifically, the vulnerability of health facilities to potential hazards involves six major areas:[18]

1. Buildings. The location and building specifications, particularly regarding design, the resiliency of the materials, and physical vulnerability, determine the ability of hospitals to withstand adverse natural events. The slightest structural or architectural element that collapses or fails entails both financial and human costs;
2. Patients. It is customary for health facilities to work 24 hours a day at about 50% of their service capacity. Any disaster will inevitably increase the number of potential patients and amplify their level of risk. Waiting lists get longer, since it becomes impossible to meet both routine demand and that generated by the emergency. Patients also suffer from the decline in the provision of services as a result of damaged, partially evacuated or non-operational facilities.
3. Hospital beds. In the aftermath of a disaster, the availability of hospital beds frequently decreases even as demand goes up for emergency case of the injured.
4. Medical and support staff. It is hardly necessary to describe the significant disruption to the care of injured caused by the loss of medical or support personnel. In order not to suffer a concomitant loss in response capacity, outside personnel must be hired temporarily, adding to the overall economic burden. Sometimes, the death of a specialist can entail major technical costs for the country affected by the disaster.
5. Equipment and facilities. Damage to nonstructural elements (such as equipment, furniture, architectural features and medical supplies) can sometimes be so severe as to surpass the cost of the structural elements themselves. Even when the damage is less costly, it can still be critical enough to force the hospital to stop operating.
6. Basic lifeline and services. The ability of hospitals to function relies on lifelines and other basic services such as electrical power, water and sanitation, communications, and waste management and disposal. It is not a given that self-contained backup

[18] Pan American Health Organization (PAHO/WHO), Protecting New Health Facilities from Disasters: Guidelines for the Promotion of Disaster Mitigation, Washington D.C., 2003.

emergency services are available at all health facilities. When a natural disaster affects some of the services, the performance of the entire hospital is affected.

These breakdowns confirmed the need for improved nonstructural restraints in conjunction with structural provisions. This approach represents a departure from the current one, which emphasized improved structural resistance of buildings[19].

E-learning and e-Health as a capacity building strategy[20]

The advent of electronic learning (e-learning), distance learning, self-paced learning and any learning that is diametrically opposed to traditional learning in a formal set-up with a physically present instructor has been trumpeted by some sectors as the alternative to costly international courses and meetings where knowledge sharing and analysis have been done effectively. Recent events have shown, however, that some e-courses have quietly faded away. The insight was that no matter how complete or authoritative a textbook or publication or e-module is, some concepts including that of safe health facilities will always require an instructor or facilitator to effectively transform ideas, information and knowledge into action. This means that e-learning needs to be combined with traditional methods for learning and subsequent application of learning.

While technology itself will never be the driver for developing e-learning opportunities for disaster risk reduction in a community, e-learning initiatives, particularly web-based initiatives that incorporate some form of live interaction that stimulates face-to-face encounters are likely to become an important component in building capacity for safe health facilities. This can go hand-in-hand with e-Health that is focused on disaster risk reduction, disaster preparedness of health facilities as well as crisis management.[21]

4. Risk management

The main obstacle to a building code's effectiveness as a tool for disaster mitigation is its actual application. Some countries in Latin America and the Caribbean, for example, have not developed their own regulations but have, instead, adopted European or US standards that do not match local conditions. Others such as Colombia, Costa Rica, Mexico and several Caribbean countries, which have developed outstanding codes, do not always enforce them, either because they are not legally required or because oversight is lax. Similarly, other measures such as land use restrictions in hazardous areas depend not only on whether the laws have "teeth" but on the institutional capacity to monitor their application.

When it comes to health facilities, experience has shown that one of the most likely impacts of a disaster may not be structural but functional collapse. Effective preventive maintenance programmes can alleviate this problem. Maintenance, as a planned activity, not only reduces

[19] Nagasawa Y, Sweitzer G. Earthquake damage to hospitals and clinics in Kobe, Japan. In: Earthquakes and People's Health, Proceedings of a WHO symposium. WHO/WKC 1997.
[20] Planeamiento hospitalario para desastres. PAHO, 2005.
[21] Velasquez, Irma. First draft proposal on eHealth Descriptive Research on Disaster Management in Cities. 2006.

the degradation of the facilities but can also ensure that public services such as water, gas, and electricity and nonstructural components such as roofs, doorways, etc, continue to function properly during an emergency. The cost for preventive maintenance is not high if seen as part of the normal operating budget of a facility.

Investment in disaster risk reduction measures[22]

One of the main challenges consists in awakening the interest of countries in incorporating prevention and mitigation measures when allocating resources for investments in infrastructure. A key problem with mitigation projects is the belief that they will significantly increase the initial investment, affecting eventual profits or health care budgets. The reticence of governments and the private sector alike is aggravated when financial resources are scarce or mitigation technology is expensive, forcing mitigation projects down the list of priorities when it should be just the opposite: protecting significant investments requires high safety and performance standards.

A mitigation investment that increases the structural integrity of a hospital will increase total construction costs by no more than 1–2%. If to this we add the cost of the nonstructural elements (which account for about 80 percent of the total cost of the facility), it is estimated that incorporating mitigation elements into the construction of a new hospital accounts for less than 4% of the total initial investment. Clearly, a vulnerability assessment will indicate the advisability of such a small marginal investment, if only as an alternative to expensive insurance premiums or replacement costs, all this without taking into account the human and social losses that are likely to occur if mitigation measures are not taken into account. It is sad to note that the reasonable cost of such investment is not known to most Member States.

Retrofitting[23]

Retrofitting means reinforcement of structures to become more resistant and resilient to the forces of natural hazards. It involves consideration of changes in the mass, stiffness, damping, load path and ductility of materials as well as radical changes such as the introduction of energy-absorbing dampers and base isolation systems.

This is an emerging area of technology application related to strengthening of partly damaged building stock vulnerable to or affected by natural disasters to appropriately strengthen or retrofit the structural and nonstructural elements of construction instead of full rebuilding. In many cases, the complete replacement of buildings in a given area is just not possible due to a number of social, cultural and financial problems.[24]

[22] Pan American Health Organization (PAHO/WHO), Protecting New Health Facilities from Disasters: Guidelines for the Promotion of Disaster Mitigation, Washington D.C., 2003.
[23] Suresh, V. Promoting Safer Building Construction, Regional Workshop on Best Practices in Disaster Mitigation, Preliminary Database of "Good Practices for Recovery", International Recovery Platform, 2006.
[24] Guidelines for Earthquake Resistant Design, Construction and Retrofitting of Buildings in Afghanistan. Ministry of Urban Development and Housing, Government of Afghanistan. June 2003, p153.

The 10-year reconstruction report and recommendations following the Great Hanshin-Awaji Earthquake[25] not only encourages seismic diagnosis, the evaluation of seismic retrofitting, the inclusion of seismic strength data in information given to building purchasers, it also provides information on the new seismic retrofitting engineering methods and encourages the use of such methods.

New systems to encourage communities to strengthen their infrastructure should be developed. One example was to guarantee a certain value for the buildings should they be damaged by a natural hazard[26].

Design of health facilities to resist natural hazards

AMRO/PAHO has been recommending the use of independent check consultants to ensure adequacy in design briefs, site selection, preliminary designs, final designs, construction, commissioning, and evaluation in use.

Risk management in cities

Throughout the world, cities represent centres of authority, power and wealth for states. As such, they also include the greatest concentrations of resources and assets and are often the basis of national economies. For these reasons, one may consider that the protection of critical assets such as health facilities (general and specialty) and essential infrastructure should have a particularly high priority. Cities need to be more directly and strongly involved in disaster management themselves.[27]

While shifts in policy regarding disaster risk management are most frequently expressed in terms of national attention and the development agenda, useful practices are universally acknowledged as being measured in terms of local effectiveness. The specific conditions that exist within local authorities' realm of responsibilities invite more opportunities for local involvement if there is an explicit programme to address risk issues.

In Japan's disaster management system, for example, it is the responsibility of the affected municipalities and prefectures to deal with the situation and only in extreme situations do other prefectures support them and carry out overall coordination. The Hyogo Prefectural Government, for example, is keenly aware of the need for planning towns and cities that take safety into careful consideration.[28] Finally, when it is difficult even for those prefectures to take the necessary measures, the national government can step in to help.

The Great Hanshin-Awaji Earthquake that hit Kobe in 1995 provided rich lessons as public utilities as well as offices, schools and hospitals were damaged extensively, paralyzing services for several days. Some of the findings proven useful in improving earthquake countermeasures are the following: 1) promoting integrated risk management; 2) enhancing community involvement in the formulation of earthquake countermeasures and developing

[25] The Great Hanshin Awaji Earthquake: The Report of the 10-Year Reconstruction – Overall Verification and Recommendations, March 2005.
[26] "International Centre for Urban Safety Engineering" in Know Risk, UN/ISDR 2005, p376.
[27] Earthquakes in Latin America: the role of cities in disaster management, Earthquakes and people's health: Proceedings of a WHO symposium, WHO Centre for Health Development, 1997.
[28] Disaster management in Hyogo Prefecture, Hyogo Prefectural Government, March 2004.

cooperation between administrative organizations and residents; 3) continued efforts toward the creation of safe and disaster resistant towns; and 4) passing results to future generations and establishing a framework for international cooperation on earthquake countermeasures.

5. Preparedness for effective response

At times of disaster, impacts and losses can be substantially reduced if authorities, individuals and communities in hazard-prone areas are well-prepared and ready to act and are equipped with the knowledge and capacity for effective disaster management. In the field of hazard-resistant building codes including health facilities, the Asian Disaster Preparedness Center was able to enumerate slightly exaggerated perspectives of stakeholder that have made it difficult to achieve a safer built environment.[29]

Seismologists usually criticize the stipulations of existing building codes prepared years prior because evidence later emerges which suggests redefinition of the earthquake hazard. Engineers want to incorporate their recent research findings and press for stricter building codes. An investor or owner of a building does not want to spend the additional 2–4% of the building cost to provide additional hazard risk protection for an extreme event that "probably will not happen, anyway." Contractors cannot be bothered with extraneous regulations and troublesome building inspectors, especially if their demands are going to reduce the profit margin of construction.

The government, on the other hand, has not been able to implement even the existing building code because of the lack of suitable implementation mechanisms including building inspectors. Decision-makers are afraid that the implementation of building codes may result in cost increases and do not press implementation of building codes even for public construction; what is more, they tend to be preoccupied with other pressing matters. Politicians do not risk diminishing their popularity as the enforcement of codes is considered to be an unpopular and restrictive process of control.

The community may not understand the process and is confused especially after a disaster. The media recognizes a controversial topic when it sees one, particularly if people have been killed as a result.

A situation where none of the stakeholders seems to be discussing the problem with the same understanding paints of a grim scenario – more vulnerable structures will continue to be built. While this may not be true with countries in Latin America and the Caribbean and other settings which have learned their lessons well from past experience, promoting health facility mitigation in other settings should consider and resolve the aforementioned underlying issues in order to move forward.

[29] Living with risk: A global review of disaster reduction initiatives, New York and Geneva, 2004.

Preparedness of the health sector

The evidence of the effectiveness of health sector preparedness using the example of four earthquakes (two in California, one in Kobe and one in Armenia) was examined.[30] Case fatality and survival data were compared for four earthquakes, in relation to health sector emergency preparedness levels. It was found out that the two California systems, with a high preparedness index, had low case fatality rates (about one death per 100 injuries). Kobe, Japan, with mixed levels of preparedness, had 31 deaths per 100 injuries while Armenia (low preparedness index) had 167 deaths per 100 injuries.

The study serves to validate the importance of health sector preparedness for disasters and with the example of the California earthquakes, demonstrates that the combination of preparedness and mitigation is exceptionally strong. Nevertheless, it also highlights that it is only one of several factors that determine the health outcome of disaster victims.

Other earthquake studies also highlighted the need to secure evacuation sites, including stocking of goods and supplies and means of transport as part of disaster preparedness[31]. More recently, we have been reminded that ruptures in fuel and electricity supplies are another factor that can paralyze medical services.[32]

Priorities and allocation of resources

An important part of disaster preparedness research is to plan the allocation of resources during a disaster. While responding to a mass casualty event, the goal of the health and medical response is to save as many lives as possible. Rather than doing everything possible to save every life, it will be necessary to allocate limited resources in a modified manner to save as many lives as possible[33].

This could involve displacing previously hospitalized patients to prioritize more urgent cases or because of the destruction of long-term care centres and other health facilities. The establishment of a plan that deals with this possibility, in conformity with the values of the community, is necessary[34].

The definition of the roles and responsibilities of a hospital during a disaster requires additional planning precision. Some of the shortfalls that should be addressed are: 1) insufficient coordination between hospitals and civil/governmental response agencies; 2) insufficient on-site critical care capability; 3) a lack of "portability" of acute care processes (i.e., patient transport and/or bringing care to the patient); 4) education shortfalls; and 5) the inability of hospitals to align disaster medical requirements with other competing priorities[35].

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[30] Bissel, Richard and Mathew Nelson. Evidence of the Effectiveness of Health Sector Preparedness in Disaster Response. Family Community Health, 2004, 27(3):193-203.
[31] Sharing Japan's Experience in Natural Disasters: Anthology of Good Practices. Government of Japan, 2005
[32] Fuel Shortages in Lebanon: A Grave Threat to People's Health. WHO, Media Release WHO/36 of 7 August 2006.
[33] Mehta, S. "Disaster and mass casualty management in a hospital: How well are we prepared?" *Postgraduate Medicine*, Apr-Jun 2006, 52(2):89-90.
[34] Konigsmark AR, Johnson K. "Katrina killings charged." *USA Today*, 19/07/2006, p01a.
[35] Farmer, JC. Providing critical care during a disaster: the interface between disaster response agencies and hospitals. *Critical Care Medicine*, Mar 2006, 34(3):S56-9.

Special attention must be addressed in the planning of resources that in the past could be considered as given. For example, many hospitals may share the same part-time personnel; that could seriously affect staffing capabilities in disaster situations because they may have to respond to another facility's call first[36].

Involving the community

Educating the community and building a society that works together to reduce disasters have been two of the best practices and priorities for disaster mitigation[37] [38]. Communities are often the first to respond to disasters and are very effective, notably because of their knowledge of the community.[39]

The assessment of community emergency preparedness linkages among hospitals, public health officials and first responders showed that the relationships are often not adequately robust.[40] The role of computer-based simulation as been advocated[41], but more research and new collaborative tools are expected.

[36] Krajewski, M, Sztajnkrycer, M. Hospital Disaster Preparedness in the United States: New issues, New Challenges. *Internet Journal of Rescue & Disaster Medicine*, 2004, 4(2):32-40.
[37] The Great Hanshin-Awaji Earthquake: The report of the 10-Year Reconstruction. Hyogo Prefecture Department: The Office of the 10th Year Restoration Committee, 2005, p4.
[38] Glick D, Jerome-D'Emilia B et al. "Emergency Preparedness." *Family & Community Health*, Jul-Sep 2004, 27(3):266-73.
[39] Shaw R. "From Disaster to Sustainable Civil Society: The Kobe Experience." *Disasters*, 2004, 28(1) 16-40.
[40] Braun B, Wineman N et al. "Integrating Hospitals into Community Emergency Preparedness Planning." *Annals of Internal Medicine*, 6/6/2006, 144(11):799-W194.
[41] Hoard M, Homer J et al. "Systems modeling in support of evidence-based disaster planning for rural areas." *International Journal of Hygiene & Environmental Health*, Apr 2005, 208(1/2):117-25.

III. Priority areas of action for WHO Kobe Centre

The priority areas of work for the WHO Kobe Centre on disaster risk reduction and preparedness of health facilities are derived chiefly from the five priority actions already set forth in the Hyogo Framework for Action and discussed in Section II. Attention to both global and local (city) actions is therefore needed in the following five complementary areas:

1. Governance. For any community, municipality or city, the main hospital or health centre has significant symbolic and social value. The emotional repercussions of losing a hospital are devastating and can lead to a loss of morale and a sense of insecurity and social instability which have not yet been fully appraised or understood. Once the public realizes, both in developed and developing settings, that disaster mitigation measures were both possible and affordable, it will not be quick to forgive or tolerate a political failure to act, which is a responsibility and accountability issue for people involved in governance. The WHO Kobe Centre needs to inform selected cities and strategic stakeholders of its work, especially the "doability" of disaster risk reduction and preparedness of health facilities.

2. Risk identification, assessment, monitoring and early warning. This is a relatively well-defined area with a significant base of knowledge on methods for risk assessment. A mission report[42], for example, of an engineering assessment of the vulnerability of health facilities (hospitals, health centres, etc) in Mongolia concentrating on Ulaanbaatar and done in 2005 showed that risk identification was being done exclusively through the National Emergency Management Agency. The WHO Kobe Centre needs to work on increasing the diffusion of this kind of knowledge and responsibility as well as the current base of knowledge on risk identification. Cities need to be assisted in risk identification as it is crucial to the application of the risk reduction measures.

3. Knowledge management and education. It is proposed that the WHO Kobe Centre further examine existing evidence, policies and actions at the city (local) level in the aim of delineating best practices, identifying challenges and opportunities, developing an interdisciplinary framework for collecting evidence and measuring it, exploring strategies and motivating the application of knowledge to action. This approach uses the "evidence-informed policy and practice pathway" model, which is also used in the Centre's Healthy Urbanization Project (HUP).[43] Policy ideas from multiple and varied sources provide the starting point for the sourcing of evidence. Using the evidence includes 1) interpreting and applying knowledge in specific contexts and 2) considering the capacity to implement from the perspective of the individual, the organization and the system.

4. Risk management: the WHO Kobe Centre needs to disseminate lessons identified and learned from previous experiences as well as best practices arising from recovery and development efforts and to use its influence to advocate the enforcement of standards, since this appears to be one of the main requirements for applying existing knowledge bases into action. Building up governance, risk identification as well as knowledge management and education entails focused and sustained work on disaster risk reduction such as 1) vulnerability assessment; 2) development of management tools that help reduce disaster risks; and 3) building the capacities of responsible stakeholders/beneficiaries.

[42] Mission Report: Engineering assessment of earthquake damage, WHO Regional Office for the Western Pacific. Mongolia, August 2005.
[43] Proposed Plan of Work 2006-2007. WHO Centre for Health Development, Kobe, Japan. November 2005.

5. Preparedness for effective response. Most of the research currently available focuses solely on a particular aspect of disaster preparedness planning. Through a logical flow from literature review, continuing collection and study of lessons learned and best practices, development of a methodology for health facility assessment, health facility assessment report/s, an initial inventory of health facilities that are structurally and programmatically prepared for withstanding and responding to disasters, an initial database of experts and resource centres and use of advocacy materials, the WHO Kobe Centre should be able to contribute to showcasing and/or improving the preparedness of selected health facilities in selected urban settings (with Kobe/Hyogo as starting point).

The criticality of these five priority actions is at the heart of the Centre's priority project for the biennium 2006–2007. Taking into account the goals and priority actions of the HFA and reflecting on evidence presented in this literature review, the project, entitled "Preparing health facilities for disasters in cities", builds on the HFA's goals and priorities for action promoting the area of work on health facilities and "hospitals safe from disasters".

The priority project seeks to contribute to the generation and dissemination of scientific knowledge on how priorities for disaster reduction actions can best be embedded in emergency preparedness policies and programmes of selected health facilities and eventually throughout health systems.

The objectives of the priority project then are: 1) to conduct a situational analysis on the preparedness of selected health facilities to withstand and respond to disasters; 2) to characterize the features and attributes of effective health facility disaster preparedness policies and programmes; and 3) to advocate effective health facility disaster preparedness policies and programmes within the context of health systems development, using the disaster risk reduction framework.

Recommendation

The priority areas for action at the macro-level (Hyogo Framework for Action 2005-2015) and at the micro-level (e.g., WHO Kobe Centre's Priority Project on Preparing Health Facilities for Disasters in Cities) appear to be coherent. Available knowledge on disaster risk reduction and preparedness of health facilities is quite extensive. Nevertheless, it is recommended that further research be undertaken on illustrating, learning and managing effective and best practices on health facility disaster risk reduction and preparedness through a network of stakeholders globally and locally.

Annex 1. Summary of the Hyogo Framework for Action

International Strategy for Disaster Reduction

SUMMARY of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters (Hyogo Framework)

Expected outcome, strategic goals and priorities for action 2005-2015

Expected Outcome

The substantial reduction of disaster losses, in lives and in the social, economic and environmental assets of communities and countries

Strategic Goals

- The integration of disaster risk reduction into sustainable development policies and planning
- Development and strengthening of institutions, mechanisms and capacities to build resilience to hazards
- The systematic incorporation of risk reduction approaches into the implementation of emergency preparedness, response and recovery programmes

Priorities for Action

Key Activities

1. Ensure that disaster risk reduction (DRR) is a national and a local priority with a strong institutional basis for implementation	2. Identify, assess and monitor disaster risks and enhance early warning	3. Use knowledge, innovation and education to build a culture of safety and resilience at all levels	4. Reduce the underlying risk factors	5. Strengthen disaster preparedness for effective response at all levels
• DRR institutional mechanisms (national platforms); designated responsibilities • DRR part of development policies and planning, sector wise and multisector • Legislation to support DRR • Decentralisation of responsibilities and resources • Assessment of human resources and capacities • Foster political commitment • Community participation	• Risk assessments and maps, multi-risk: elaboration and dissemination • Indicators on DRR and vulnerability • Data & statistical loss information • Early warning: people centered; information systems; public policy • Scientific and technological development; data sharing, space-based earth observation, climate modeling and forecasting; early warning • Regional and emerging risks	• Information sharing and cooperation; • Networks across disciplines and regions; dialogue • Use of standard DRR terminology • Inclusion of DRR into school curricula, formal and informal education • Training and learning on DRR: community level, local authorities, targeted sectors; equal access • Research capacity: multi-risk; socio-economic; application • Public awareness and media	• Sustainable ecosystems and environmental management • DRR strategies integrated with climate change adaptation • Food security for resilience • DRR integrated into health sector and safe hospitals • Protection of critical public facilities • Recovery schemes and social safety- nets • Vulnerability reduction with diversified income options • Financial risk-sharing mechanisms • Public-private partnership • Land use planning and building codes • Rural development plans and DRR	• Disaster management capacities: policy, technical and institutional capacities • Dialogue, coordination & information exchange between disaster managers and development sectors • Regional approaches to disaster response, with risk reduction focus • Review & and exercise preparedness and contingency plans • Emergency funds • Voluntarism & participation

Cross Cutting Issues

- Multi-hazard approach
- Gender perspective and cultural diversity
- Community and volunteers participation
- Capacity building & technology transfer

Contributing to the achievements of the internationally agreed development goals (including the MDGs)

DRR= disaster risk reduction

www.unisdr.org

Implementation and Follow-Up

In order to achieve the goals and act upon the priorities identified in this Framework, the following tasks have been identified to ensure implementation and follow-up by States, regional and international organizations in collaboration with civil society and other stakeholders. The ISDR partners, in particular the Inter-agency Task Force on Disaster Reduction and secretariat, are requested to assist in implementing this Framework for Action.

General Considerations

- Implementation by different stakeholders, multi-sectoral approach; participation of civil society (NGOs, CBOs, volunteers), scientific community & private sector is vital
- States primarily responsible; an enabling international environment is vital, incl. strengthened regional capacities
- Build multi-stakeholder partnerships
- Particular attention to:
  - Small island developing States: Mauritius Strategy;
  - Least developed countries;
  - Africa
- States, regional and international organizations to foster coordination among themselves and a strengthened International Strategy for Disaster Reduction (ISDR)
- Follow-up integrated with other major conferences in fields relevant to DRR; reviews as appropriate

Actors

Critical tasks

States

- Designate national coordination mechanisms for the implementation and follow up, communicate to the ISDR secretariat;
- National baseline assessments of the status of DRR;
- Publish and update a summary of national programme for DRR including international cooperation;
- Develop procedure for reviewing national progress including systems for cost benefit analysis and ongoing monitoring on risk;
- Consider acceding to, approving or ratifying relevant international legal instruments and to make sure they are implemented;
- Promote the integration of DRR with climate variability and climate change into DRR strategies and adaptation to climate change; ensure management of risks to geological hazards.

Regional Organizations and Institutions

- Promote regional programmes including for technical cooperation, capacity development, the development of methodologies and standards for hazard and vulnerability monitoring and assessment, the sharing of information and effective mobilization of resources;
- Undertake and publish regional and sub-regional baseline assessments;
- Coordinate and publish reviews on progress and support needs, and assists countries in preparation of national summaries;
- Establish specialized regional collaborative centers;
- Support the development of regional mechanisms and capacities for early warning, including for tsunami

International Organizations (including UN System and IFIs)

- Engage in the implementation of the ISDR by encouraging integration of DRR into humanitarian and sustainable development fields;
- Strengthen the capacity of the UN system to assist disaster-prone developing countries in DRR and implement measures for assessment of progress;
- Identify actions to assist disaster-prone developing countries in the implementation of the Hyogo Framework, ensure their integration and that adequate funding is allocated; assist in setting up national strategies and programmes for DRR;
- Integrate actions into relevant coordination mechanisms (UNDG, IASC, RCs and UN Country Teams);
- Integrate DRR into development assistance frameworks such as CCA/UNDAF, PRSP;
- In collaboration with networks and platform support: data collection and forecasting on natural hazards and risks; early warning systems; full & open exchange of data;
- Support States with coordinated international relief assistance, to reduce vulnerability & increase capacities;
- Strengthen international mechanisms to support disaster stricken States in post-disaster recovery with DRR approach
- Adapt & strengthen inter-agency disaster management training for DRR and capacity building.

ISDR (Inter-Agency Task Force on Disaster Reduction & secretariat)

- Develop a matrix of roles and initiatives in support of follow/up to the Hyogo Framework;
- Facilitate the coordination of effective actions within the UN system and other international and regional entities to support the implementation of the Hyogo Framework, identify gaps, facilitate processes to develop guidelines and policy tools for each priority area;
- In broad consultation, develop generic, realistic and measurable indicators. These indicators could assist States in measuring progress in the implementation of the Hyogo Framework;
- Support national platforms & regional coordination;
- Register relevant partnerships with Commission on Sustainable Development;
- Stimulate the exchange, compilation, analysis and dissemination of best practices, lessons learnt;
- Prepare periodic review on progress towards achieving the objectives of the Hyogo Framework and provide reports to the UNGA & other UN bodies

Resource Mobilization: States, Regional and International Organizations

- Mobilize resources and capabilities of relevant national, regional and international bodies, including the UN system;
- Provide and support the implementation of the HFA in disaster prone developing countries, including through financial and technical assistance, addressing debt sustainability, technology transfer, public-private partnership and North-South and South-South cooperation;
- Mainstream DRR measures into multilateral and bilateral development assistance programmes;
- Provide adequate voluntary financial contribution to the UN Trust Fund for DR to support follow-up activities to Hyogo Framework; review usage and feasibility for the expansion of this fund;
- Develop partnership to implement schemes that spread out risks, reduce insurance premiums, expand insurance coverage and increase financing for post-disaster reconstruction, including through public and private partnerships. Promote an environment that encourages a culture of insurance in developing countries.

Source: Outcome of the World Conference on Disaster Reduction, Hyogo, Kobe Japan, 18-22 Jan 2005

www.unisdr.org

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WHO Regional Office for Africa

Healthy Environment & Sustainable Development (DES) / Health Systems & Services Development (DSD)
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WHO Regional Office for the Americas - Pan American Health Organization

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Annex 3: Bibliography

Bissel R, Nelson M. Evidence of the Effectiveness of Health Sector Preparedness in Disaster Response. Family Community Health, 2004, 27(3):193-203.

Braun, B, Wineman, N & al. Integrating Hospitals into Community Emergency Preparedness Planning. Annals of Internal Medicine, 6/6/2006, 144(11):799-W194.

Burón, C. Hospital Damages Evaluation, Instituto Superior Politécnico José Antonio Echeverria, Cuba, 2002.

Dengler L, Preuss J. Mitigation Lessons from the July 17, 1998 Papua New Guinea Tsunami. Pure & Applied Geophysics, Oct 2003, 160(10/11):2001-2031.

Disaster management in Hyogo Prefecture. Hyogo Prefectural Government, Mar 2004.

Disaster Mitigation for Health Facilities: Guidelines for Vulnerability Appraisal and Reduction in the Caribbean. PAHO, 2000.

Disasters: Preparedness and mitigation in the Americas. PAHO, October 2004.

Earthquakes in Latin America: the role of cities in disaster management, Earthquakes and people's health: Proceedings of a WHO symposium, WHO Centre for Health Development, 1997.

Farmer, JC. Providing critical care during a disaster: The interface between disaster response agencies and hospitals. Critical Care Medicine, Mar 2006, 34(3):S56-S59.

Field manual for capacity assessment of health facilities in responding to emergencies. WHO, 2006.

Fuel Shortages in Lebanon: A Grave Threat to People's Health. WHO, Media Release WHO/36 of 7 August 2006.

Glick, D, Jerome-D'Emilia, B & al. Emergency Preparedness. Family & Community Health, Jul-Sep 2004, 27(3):266-73.

Guidelines for Earthquake Resistant Design, Construction and Retrofitting of Buildings in Afghanistan. Ministry of Urban Development and Housing, Government of Afghanistan. June 2003, 153 pp.

Guidelines for Seismic Vulnerability Assessment of Hospitals. WHO Emergency and Humanitarian Action and National Society for Earthquake Technology-Nepal. Kathmandu, April 2004.

Guidelines for Vulnerability Reduction in the Design of New Health Facilities. PAHO, 2004.

Health facility seismic vulnerability evaluation: a handbook. WHO, 2006.

Hoard, M, Homer J. & al. Systems modeling in support of evidence-based disaster planning for rural areas. International Journal of Hygiene & Environmental Health, Apr 2005, 208(1/2):117-25.

Konigsmark, AR, Johnson, K. Katrina killings charged. USA Today, 19/07/2006, p01a.

Krajewski, M, Sztajnkrycer, M. Hospital Disaster Preparedness in the United States: New issues, New Challenges. Internet Journal of Rescue & Disaster Medicine, 2004, 4(2):32-40.

Living with risk: A global review of disaster reduction initiatives, New York and Geneva, 2004.

Mehta, S. Disaster and mass casualty management in a hospital: How well are we prepared? Postgraduate Medicine, Apr-Jun 2006, 52(2):89-90.

Mission Report: Engineering assessment of earthquake damage, WHO Regional Office for the Western Pacific. Mongolia, August 2005.

Nagasawa Y, Sweitzer G. Earthquake damage to hospitals and clinics in Kobe, Japan. In: Earthquakes and People's Health, Proceedings of a WHO symposium. WHO/WKC 1997.

Non-Structural Vulnerability Assessment of Hospitals in Nepal, Ministry of Health Nepal, 2003.

Pan American Health Organization (PAHO/WHO), Protecting New Health Facilities from Disasters: Guidelines for the Promotion of Disaster Mitigation, Washington D.C., 2003.

Planeamiento hospitalario para desastres. PAHO, 2005.

Proposed Plan of Work 2006–2007. WHO Centre for Health Development, Kobe, Japan. November 2005.

Protecting New Health Facilities from Natural Disasters: Guidelines for the promotion of disaster mitigation. PAHO, 2003.

Report of the International Centre for Urban Safety Engineering in Know Risk, UN/ISDR 2005, 376 pp.

Safe Hospitals: A collective responsibility, a global measure of disaster reduction. PAHO, 2005.

Sharing Japan's Experience in Natural Disasters: Anthology of Good Practices. Government of Japan, 2005.

Shaw, R. From Disaster to Sustainable Civil Society: The Kobe Experience. Disasters, 2004, 28(1) 16-40.

Suresh, V. Promoting Safer Building Construction, Regional Workshop on Best Practices in Disaster Mitigation, Preliminary Database of "Good Practices for Recovery". International Recovery Platform, 2006.

The Great Hanshin-Awaji Earthquake: The report of the 10-Year Reconstruction. Hyogo Prefecture Department: The Office of the 10th Year Restoration Committee, 2005.

Velasquez, Irma. First draft proposal on eHealth Descriptive Research on Disaster Management in Cities. 2006.