



International Strategy for Disaster Reduction



World Health
Organization



THE WORLD BANK



2008-2009 World Disaster Reduction Campaign

Hospitals Safe from Disasters

Reduce Risk, Protect Health Facilities, Save Lives



United Nations



Message from Mr Sálvamo Briceño

Director, International Strategy for Disaster Reduction

A safety net for everyone, at all times

When disasters strike, aid agencies, communities, the media, and governments focus immediately on the victims. But if our focus on victims is to have real meaning, we must prioritize a deeper understanding and support of medical care.

Those who are injured need urgent medical attention, but those who escape injury have not escaped the long-term need for medical care and public health after the disaster is forgotten. When health services and hospitals fail due to disaster, people die and suffer needlessly both during the disaster and long into the future.

Health sector damage can cause devastating secondary disasters. For example, the December 2004 Indian Ocean tsunami disaster affected entire national healthcare systems and millions of beneficiaries, particularly the poor, at an untold cost. It damaged 61% of health facilities in northern Aceh province, and killed approximately 7% of its health workers and 30% of its midwives. As a consequence, Aceh's primary care, maternal health and neonatal care was sent into a crisis, and public health system recovery has required intensive investment.

From a human perspective, all disasters are a health issue, and damage to health systems affects every part of society and nations as a whole. As such, everyone should be made aware of the importance of the issue and be committed to helping ensure that hospitals and health facilities are resistant to natural hazards. Awareness and commitment are the major ingredients: awareness and commitment from both policy/decision makers and the public at large.

The difference in expense between building a safe and an unsafe hospital can be negligible. But that tiny investment can be the difference between life and death, or between a community's impoverishment and its sustainable development.

Because of this, the secretariat of the International Strategy for Disaster Reduction (UN/ISDR) and the World Health Organization (WHO), with some support from the World Bank, are dedicating the 2008-2009 World Disaster Reduction Campaign to 'Hospitals Safe from Disasters.' As in the education sector, UNICEF's role in the health sector will also be very important in this Campaign.

The Campaign's objectives are to effect change that helps to: (1) protect the lives of patients and health workers by ensuring the structural resilience of health facilities; (2) make sure health facilities and health services are able to function in the aftermath of emergencies and disasters - when they are most needed; (3) improve the risk reduction capacity of health workers and institutions, including emergency management.

As disaster risk reduction is everyone's business, and unsafe hospitals are potentially damaging to everyone, I would like to call on all members of our global community – decision makers, decision implementers and the public at large – to join the Campaign.



Message from Dr Ala Alwan

Assistant Director General, Health Action in Crises
World Health Organization

Don't let hospitals become a casualty of disasters

As news of a disaster or emergency reaches the global community, our thoughts turn immediately to the human consequences; and at the forefront are concerns for the health and wellbeing of the disaster-stricken population. For decades, the World Health Organization has worked to save lives and reduce suffering in times of crises. One way in which this is accomplished is by strengthening the capacity and resilience of health facilities, health systems and countries to mitigate and manage disasters.

For this reason, I am pleased that WHO is partnering with the secretariat of the International Strategy for Disaster Reduction (UN/ISDR) on the 2008-2009 World Disaster Reduction Campaign on Hospitals Safe from Disasters.

The message of this Campaign is clear: when hospitals, health facilities or health systems fail in disaster and emergency situations, whether for structural or functional reasons, the result is the same: they are not available to treat the victims at precisely the moment they are most needed.

The 168 countries that adopted the Hyogo Framework for Action in 2005 recognized the importance of “making hospitals safe from disasters by ensuring that all new hospitals are built with a level of resilience that strengthens their capacity to remain functional in disaster situations and implement mitigation measures to reinforce existing health facilities, particularly those providing primary health care.” Yet despite significant strides to recognize and correct the problem, in some parts of the world an alarming number of health facilities - from large complex hospitals in megacities to small rural clinics that may be the only source of health care – are still built in highly disaster-prone areas. In other regions, emergencies and crises continue to leave health facilities unable to function, depriving communities of the care they need.

Hospitals and health facilities are about much more than bricks and mortar. They are home to critical health services such as public health laboratories, blood banks, rehabilitation facilities or pharmacies. They are the setting in which health workers work tirelessly to ensure the highest level of service. Their importance extends far beyond their role in saving lives and safeguarding public health in the aftermath of disasters. Health facilities have a symbolic social and political value and contribute to a community's sense of security and wellbeing. As such, they must be protected from the avoidable consequences of disasters, emergencies and other crises.

Today, we have learned that with current knowledge, a strong political commitment and even with limited resources in developing countries, it is possible to protect health facilities from such adverse events.

The World Health Organization, through its six regional offices across the world, is committed to seeing this become reality. Please join us in tackling this challenge, which is essential to meeting the Millennium Development Goals.



All about the 2008-2009 World Disaster Reduction Campaign

Welcome to the 2008-2009 World Disaster Reduction Campaign. The theme of the Campaign is Hospitals Safe from Disasters: Reduce Risk, Protect Health Facilities, Save Lives. During these two years the secretariat of the International Strategy for Disaster Reduction (UN/ISDR) and the World Health Organization (WHO), with some support from the Global Facility for Disaster Reduction and Recovery of the World Bank, will partner with governments, international and regional organizations, non-governmental organisations and individuals worldwide, to raise awareness about why and how to redouble efforts to protect health facilities and ensure they can function during and in the aftermath of disasters.

This Campaign addresses Hospitals Safe from Disasters in line with the UN/ISDR secretariat's mandated focus on natural hazards. It does not address broader issues of hospital or medical safety, such as patient and staff infections, reduction in medical errors or the capacity to deal with mass epidemics; all of which are important in their own right and contribute to the overall safety of hospitals, but which fall beyond the primary scope of the Campaign.

As you read through this kit, you will find examples of what countries have done to reduce the vulnerability of their health facilities to disasters, either by applying lessons learned to build safer hospitals, identifying and correcting risks that threaten their ability to remain functional, or preparing and training the health workforce to act in emergency situations.

We invite you to take an active role in this Campaign. There are many ways to become involved. Learn more about making hospitals safe from disasters and visit the following web sites:

www.unisdr.org/wdrc-2008-2009 and www.who.int/hac/techguidance/safehospitals



What is a hospital safe from disasters?

Hospitals safe from disasters come in all shapes and sizes. All health facilities - large or small, urban or rural – are the target of this Campaign. Hospitals safe from disasters are about more than just protecting physical structures. Hospitals are safe from disasters when health services are accessible and functioning, at maximum capacity, immediately after a disaster or an emergency. A safe hospital ...

- ... will not collapse in disasters, killing patients and staff;
- ... can continue to function and provide its services as a critical community facility when it is most needed; and
- ... is organized, with contingency plans in place and health workforce trained to keep the network operational.

Ensuring that our hospitals and health facilities are safe from disasters requires strong commitment from the highest political level, and support and contribution from all sectors of society.

Why focus the Campaign on “Hospitals Safe from Disasters”?

Hospitals, health facilities and health services are a community’s lifeline in normal times and are especially critical in times of disaster. Yet time and again, they have been severely damaged or left unable to function in the aftermath of disasters. There are countless examples of health infrastructures — from sophisticated hospitals to small but vital health centres — that have suffered this fate.

The importance of hospitals and all types of health facilities extends beyond the direct life-saving role they play. They are also powerful symbols of social progress and a prerequisite for stability and economic development. As such, special attention must be given to ensuring their physical and functional integrity in emergency conditions.

The good news is that with current knowledge and strong political commitment, countries can reduce risk in hospitals and health facilities and make them safe from disasters by reducing their vulnerability to natural hazards.

What are the objectives of the Campaign?

The World Disaster Reduction Campaign on Hospitals Safe from Disasters aims to raise awareness and effect change that will:

- Protect the lives of patients and health workers by ensuring the structural resilience of health facilities;
- Make sure health facilities and health services are able to function in the aftermath of emergencies and disasters, when they are most needed; and
- Improve the risk reduction capacity of health workers and institutions, including emergency management.



How can we make this happen?

- Keep the spotlight on this important issue. Take every opportunity to raise awareness by including the topic on the agendas of high-level summits and technical meetings and documenting and sharing good practices of making hospitals safe from disasters.
- Take into consideration all key components of health service networks such as primary health care centres, blood banks, laboratories, warehouses and emergency medical services.
- Involve the widest possible variety of professionals - all health disciplines, engineers, architects, managers, maintenance staff and more - in identifying and reducing risk and building the resilience of communities.
- Identify health services' safety as a specific target for policy action and facilitate formulation of strategic action plans involving governments, health sector and any other actors to address it.

What are the key messages of the Campaign?

The most expensive hospital is the one that fails: Hospitals and health facilities represent an enormous investment for any country. Their destruction imposes major economic burdens.

Disasters are a health and a social issue: All disasters are a health issue, and damage to health systems affects every part of society and nations as a whole.

Protecting critical health facilities from disasters is possible: By including risk reduction in the design and construction of all new health facilities, and by reducing vulnerability in existing health facilities through selecting and retrofitting the most critical facilities.

The health workforce must be agents of disaster risk reduction: Health workers are central to identifying potential health risks from natural hazards and promoting personal and community risk reduction measures.

Who are we trying to reach?

- Policy and business decision makers in countries worldwide
- Health workers who provide critical services in these facilities and who should see themselves as agents of change in their communities
- Architects and engineers and other professionals who can contribute to ensuring that the health facilities they design are resistant to natural hazards
- Politicians at local and national levels who must be committed to providing the population with safe hospitals and effective health facilities in all circumstances, especially following disasters or emergencies
- Development banks and lending agencies that finance the construction, reconstruction or retrofitting of health facilities, which should push for the incorporation of disaster risk reduction (prevention, mitigation and preparedness) measures to ensure that hospitals and health facilities are as safe from disasters as possible.
- Donors and health development programs of a variety of funding and implementing agencies.



Who is organizing the Campaign?

The World Disaster Reduction Campaign is coordinated by the secretariat of the International Strategy for Disaster Reduction (UN/ISDR) in partnership with the World Health Organization (WHO). Every two years, the ISDR system selects a topic that reflects one of the five priorities of the Hyogo Framework for Action 2005-2015. The theme of the 2008-2009 world campaign is Hospitals Safe from Disasters: Reduce Risk, Protect Health Facilities, Save Lives.

A wide range of activities will be carried out together by the UN/ISDR secretariat, WHO and their respective regional offices within the framework of the Campaign. Other ISDR system partners will be involved, in particular the World Bank, UNDP, WMO, UNEP, UNESCO, UNICEF, FAO, ILO, WFP, IFRC and the various ISDR networks of NGOs, private sector, academic institutions, parliamentarians and local authorities. At the national level, the main responsibilities belong to the National Platforms for disaster risk reduction, which are focal points for the Hyogo Framework for Action and the Ministries of Health.

How long will the Campaign last?

The World Disaster Reduction Campaign lasts for two years, from January 2008 through December 2009. Although a number of countries are already undertaking risk reduction activities on health facilities, the momentum gained during this period will help sustain and mainstream disaster risk reduction into a broader array of health sector initiatives. Following the campaign, it is expected that a large number of governments will have developed strategic action plans to ensure that hospitals and health facilities will be made safe from disasters and that disaster risk reduction will be an integral component of health policies, with a view to facilitating the advancement of the goals of the Hyogo Framework for Action by 2015.

Where to go for more information?

Everything you need to know about the Campaign, including links to who is working on this issue in which countries, is on the UN/ISDR secretariat web site at www.unisdr.org/wdrc-2008-2009 and on the WHO web site at www.who.int/hac/techguidance/safehospitals



Making the Case for Hospitals Safe From Disasters

The price we pay for the failure of hospitals or health facilities due to disasters is too high. In comparison, the cost of making hospitals safe from disasters is tiny. Disaster damage to health systems is a human and health tragedy, results in huge economic losses, deals devastating blows to development goals, and shakes social confidence. Making hospitals and health facilities safe from disasters is an economic requirement, and also a social, moral and ethical necessity.

The Economic case

Hospitals and health facilities represent an enormous investment for any country. Their destruction and the cost of reconstruction and recovery impose a major economic burden.

Indirect costs of damaged health infrastructure are often not completely accounted for, but can be higher than the direct costs of replacement and rebuilding. Indirect costs measured in studies have included:

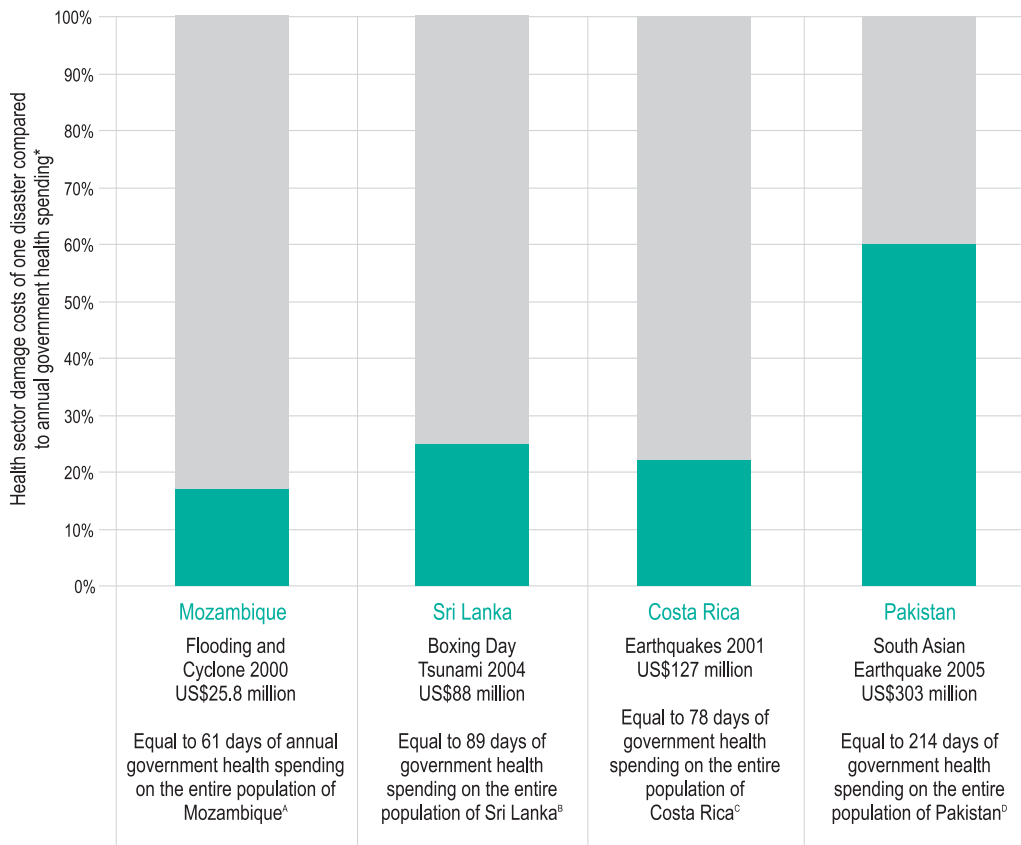
- Efficiency losses due to interruption of hospital network services like laboratories or blood banks
- increased costs of providing emergency health and shelter services
- the cost to individuals of lost opportunities, income, time and productivity.

Other kinds of indirect costs are difficult to measure, but have significant impact:

- Longer-term damage to public health, wellbeing and productivity
- the blow to overall national economic development and business confidence
- the disincentive to future external investments.

During a 1990 earthquake in Costa Rica, five major hospitals were in the midst of being retrofitted. Retrofitted areas came through the quake in excellent condition and saved lives, while the incomplete areas suffered extensive damage. The preventive savings far exceeded the cost of the retrofitting.

Source: Safe Hospitals: A Collective Responsibility, PAHO & WHO, 2005



* Based on 2007 population, and per capita US dollar government expenditure on health in World Health Statistics, World Health Organization, 2007.

Sources:

- A Republic of Mozambique: A Preliminary Assessment of Damage from the Flood and Cyclone Emergency of February-March 2000, World Bank, 2000.
- B Sri Lanka 2005 Post-Tsunami Recovery Program: Preliminary Damage and Needs Assessment, ADB, JBIC and World Bank, Colombo, Sri Lanka, 2005.
- C Loan for emergency reconstruction of hospitals only, Earthquake Reconstruction and Health Services Extension Project, World Bank, 2007.
- D Pakistan 2005 Earthquake, Preliminary Damage and Needs Assessment, Asia Development Bank and World Bank, Islamabad, Pakistan, 2005

Indirect costs from disasters in Latin America and the Caribbean between 1991-2002 have been calculated to be nearly US\$ 13 billion - more than costs of direct damage.

Handbook for estimating the socioeconomic and environmental effects of disaster. LC/MEX/G.5, Mexico City: ECLAC, 2003.

Prevention is cost-effective

Building disaster-safe hospitals or protecting existing hospitals is surprisingly cheap. The small investments required are nothing compared to the risk of partial or complete destruction during a disaster, the death of patients and staff, and the equally high health, economic and development impacts in the aftermath.

Low cost design safety: New hospitals

The cost of a disaster-safe hospital or health facility is negligible when included in early design considerations. For the vast majority of new health facilities, incorporating comprehensive disaster protection from earthquake and weather events into designs from the beginning will only add 4% to the cost.¹ Planning processes for new hospitals can be easily targeted by advocacy, and should be a priority.

¹ Protecting New Health Facilities from Disasters: Guidelines for the Promotion of Disaster Mitigation, Washington D.C., PAHO/WHO 2003.



Low cost retrofitting: targeted protection

The cost of retrofitting existing health facilities can vary greatly depending on context, but prioritizing the protection of critical care and hospital functionality reduces potential costs and provides excellent examples of cost-effectiveness. For example, non-structural elements – the contents, rather than the building – represent most of the value of hospitals. Damage to non-structural elements is also what most often renders a hospital inoperable during a natural disaster. **Retrofitting non-structural elements costs only about 1%² while protecting up to 90% of the value of a hospital.³**

Retrofitted health centers in the Cayman Islands were virtually undamaged during Hurricane Ivan in 2004.⁵ Had they not been retrofitted, specialists estimate that the Hurricane could have caused 20% worth of damage to structures, and 40% of damage to the contents of the facilities.²

The Health case

Hospitals and health facilities need to remain functional during disasters. The human cost of hospital failure is made very clear in the aftermath of disasters, as the immediate focus is on fatalities, search and rescue, and the need to tend to the injured.⁴ When hospitals are unable to fulfill their emergency function at the time when most needed, critical care is compromised and lives are lost needlessly.

However, health services are not only critical emergency centers; they play a vital role in recovery, social cohesion and economic development. The long-term impact of the loss of public health services on the Millennium Development Goals exceeds the impact of delayed treatment of trauma injuries. Hospitals, primary health centres, and other health facilities are central to sustainable recovery from disaster, and to health-driven development goals, taking key roles in:

- ongoing health surveillance to prevent outbreaks
- public health and sanitation campaigns, particularly preventive medicine
- attracting health research and hosting reference laboratories, driving innovation
- acting as focal points for community organization.

Disasters can wipe out huge swathes of the health systems in developing countries or vulnerable regions.

- After the 2003 Algerian earthquake, 50% of the health facilities in the affected region were no longer functional due to damage.⁵
- In the region of Pakistan worst affected by the 2005 South Asia Earthquake, 49% of health facilities, from sophisticated hospitals to rural primary care clinics and drug dispensaries, were completely destroyed.⁶

These levels of damage seriously compromise developing countries' potential to achieve the Millennium Development Goals of reducing child mortality, improving maternal health, and combating HIV/AIDS, tuberculosis, malaria, and other diseases.

² Tony Gibbs, Consulting Engineers Partners Ltd.

³ Guidelines for Seismic Vulnerability Assessment of Hospitals, WHO & NSET, Kathmandu, April 2004.

⁵ Safe Hospitals: A Collective Responsibility, PAHO & WHO, 2005.

⁶ Algeria: Earthquake, Emergency Appeal 14/03, IFRC, June 27 2003.

⁷ Ministry of Health, Pakistan.



The Social case

The social implications of hospital failure carry immense risks. Hospitals, health facilities and health services have a unique symbolic value as touchstones of public faith Government and society. They are sanctuaries for the community's most vulnerable people, meaning that there is a moral imperative to provide hospitals and health facilities with adequate protection. Deaths of the sick, elderly and children in hospitals during disasters, and the failure of emergency services when they are most needed, can have a crippling effect on public morale and can ignite political dissatisfaction.

However, an effective response and functional health service following a disaster can reinforce a sense of stability and social cohesiveness. Functioning hospitals and health facilities are powerful symbols of social progress, and are prerequisites for stability and economic growth.

Public confidence in all levels of the United States government dropped after perceived inadequacies of the emergency response to Hurricane Katrina in New Orleans,⁸ during which the country witnessed the recovery of 44 dead bodies from an abandoned and damaged hospital. At least 140 elderly patients of hospitals and nursing homes died in the wake of the hurricane, and health and aged care facilities were later accused of euthanizing or abandoning their elderly charges.⁹

Approval ratings of President Alan García of Peru rose five points on public perception of effective government response and management immediately after the Peruvian earthquake of 2007.¹⁰ The Peruvian Government indicated that hospital needs were covered one week after the quake.¹¹

Whether health services function or fail is an area of great political risk for governments, but also an area of great potential political gain.

⁸ Poll results, Washington Post, p.A08, Tuesday, September 13, 2005; Poll Results: Hurricane Katrina, Time Magazine, Sep 10 2005.

⁹ '45 bodies found in a New Orleans hospital', New York Times, September 13 2005, 'Nursing home owners charged in Katrina deaths', Associated Press, September 13 2005.

¹⁰ Peru's political tremors, Economist Intelligence Unit, Sep 24 2007.

¹¹ 'Earthquake in Peru: Situation Report No. 6, Office of the Resident Coordinator, UN Country Team in Peru, 21 Aug 2007.



10 Basic Facts to Know

The following are 10 basic facts to know about keeping hospitals and health facilities safe from disasters:

1

Many factors put hospitals and health facilities at risk:

- Buildings: The location, design specifications, and resilience of the materials used, all contribute to a hospital's ability to withstand natural hazards.
- Patients: In normal times, health facilities are occupied 24 hours a day by highly vulnerable people, and are often full to capacity. In disaster situations, damage to hospital components compounds patient vulnerability, as well as increasing the number of patients.
- Hospital beds: Disasters often cause the loss of hospital beds, frequently just as the demand for emergency care increases.
- Health workforce: The loss or unavailability of health workers compromises care for the injured. Hiring outside personnel to sustain response capacity adds to the overall economic burden.
- Equipment: Damage to non-structural elements often surpasses the cost of damage to the building. Even less costly damage can still force a hospital to halt operations.
- Basic lifelines and services: A hospital's ability to function relies on lifelines and other basic services such as electrical power, water and sanitation, and waste management and disposal. The loss of even some services can affect the entire health facility.

2

Components of a hospital or health facility are typically divided into two categories:

- Structural elements: those essential elements that determine the overall safety of the system, such as beams, columns, slabs, load-bearing walls, braces or foundations.
- Non-structural elements: all other elements that enable the facility to operate. They include elements such as water heaters or storage tanks, mechanical equipment, shelving and cabinets and lifelines. In the case of hospitals, 80 per cent or more of the total cost of the facility can be the price of non-structural components.

3

Functional collapse, not structural damage, is the usual reason for hospitals being put out of service during emergencies:

Functional collapse occurs when the elements that allow a hospital to operate on a day-to-day basis are unable to perform because the disaster has overloaded the system. These include: architectural spaces such as laboratories or operating theatres; medical records; medical and support services; and administrative processes (such as contracting, procurement, and maintenance routines). Although the measures necessary to prevent a functional collapse (such as contingency planning, improved organization and staff training) require a significantly smaller financial investment, they nonetheless remain a major challenge.



4

Hospitals and health facilities can be built to different levels of protection:

- Life safety is the minimum level of protection and is the most common approach to protection in the construction of health facilities;
- Investment protection is designed to protect all or part of the infrastructure and equipment, although the facility itself may stop functioning. This level of protection ensures that the facility resumes operations within a reasonable timeframe and cost;
- Operations protection, which is the most costly level, includes life and investment protection but also seeks to ensure the facility continues to function after a disaster.¹

5

Making new hospitals and health facilities safe from disasters is not costly

Building a hospital is a significant capital investment. In calculating the cost, one must include both the structure itself and the non-structural elements (non-structural elements account for about 80 percent of the total cost). It has been estimated that the incorporation of mitigation measures into the design and construction of a new hospital will account for less than 4 percent of the total initial investment.

6

Field hospitals are not necessarily the best solution to compensate for the loss of a hospital or health facility

Field hospitals have been used successfully in complex disasters (civil conflicts and wars), but experience in the aftermath of disasters caused by natural hazards in developing countries has shown these extremely expensive solutions to be not satisfactorily cost-effective.

7

Seeking the right expertise: a check consultant

A “check consultant” is an independent consultant who, on behalf of a client, ensures that norms and building standards are in place. Check consultants can be contracted to oversee the construction of any building, but their thorough knowledge of building codes and natural hazard mitigation measures are particularly important to ensuring the disaster safety of critical facilities such as hospitals.

8

Building codes are of utmost importance

One of the earliest mentions of the importance of building codes is found in Hammurabi’s Code²:

- 232: “... he [the builder] shall make compensation for all that has been ruined, and inasmuch as he did not construct properly this house which he built and it fell, he shall re-erect the house from his own means.”

9

Creating safe hospitals is as much about having vision and commitment as it is about actual resources

The responsibility of creating safe hospitals must be shared among many sectors: planning, finance, public works, urban and land-use planning, together with the health sector. The political will to make this happen must match the knowledge that already exists.

10

The most costly hospital is the one that fails!

⁸ Pan American Health Organization (PAHO/WHO), Principles of Disaster Mitigation in Health Facilities, Mitigation Series, Washington, D.C., 2000.

⁹ Hammurabi was the ruler who chiefly established the greatness of Babylon, the world’s first metropolis. Many relics of Hammurabi’s reign (1795-1750 BC) have been preserved, and this king is recognized as a wise law-giver in his celebrated code of laws, the earliest known example of a ruler proclaiming publicly to his people an entire body of laws.



You Can Contribute!

Become Involved in the World Campaign!

Disaster-resilient hospitals and health facilities are everyone's right. They are also everyone's responsibility. Here are some ways in which you can play a role in making hospitals safe from disasters.

Governments

Take a leadership position — make this a national priority

Governments have the ultimate responsibility for the safety of their citizens. At the national level and in cities, municipalities, and communities, governments have much at stake when it comes to ensuring their health services are available should disaster strike. Strong political commitment can make a tremendous difference to whether or not hospitals are safe.

Create a framework in which all sectors and government levels can help make hospitals and health facilities resistant to natural hazards

The issue of “Hospitals Safe from Disasters” must figure

prominently on the national and local policy agendas and involve a wide variety of sectors including planning, finance, the environment, local authorities and others. The broader the participation, the greater the national commitment will be.

Draft, pass and enforce legislation in particular building codes that protect hospitals

It is not sufficient for countries to simply have building codes that take into account natural hazards. These must also be enforced. To do so requires the involvement of decision makers and legislators in countries worldwide and public awareness campaigns to engage the public.



UN, international and regional agencies and NGOs

Build on existing inter-agency mechanisms and strategic partnerships

The Campaign offers an avenue through which members of the ISDR Global Platform for Disaster Risk Reduction and other agencies can carry out activities that help achieve the Hyogo Framework for Action target of ensuring that all hospitals remain functional in disaster situations.

Highlight this cross-cutting issue on the agenda of agency or regional meetings

The last decade has witnessed a tremendous upswing in the involvement of international and regional agencies in all aspects of emergency management — from risk reduction and early warning to humanitarian interventions. The agencies and also NGOs should seek to mainstream health sector risk reduction into these efforts.

Collect, share and disseminate good practices

Identify your agency's or NGO's specialized niche within the framework of this Campaign and share your knowledge and expertise.

Health institutions and the health workforce

Participate in National Platforms for Disaster Risk Reduction

The health sector should take a proactive role in National Platforms for Disaster Risk Reduction or similar coordination mechanisms.

Become agents of disaster risk reduction

An intimate knowledge of one's own work environment can help make a health facility safe from disasters. Hospital plans are everyone's business and all health workers must contribute to their preparation.

Seek opportunities to update skills and knowledge

Health workers and all staff working in health facilities — from the largest to the smallest — must constantly update their knowledge and skills about hazards and risk reduction to improve their leadership role in emergency situations.

Mentor the next generation of health professionals

In the health sector, disaster risk reduction is still not a household word. Schedule presentations with universities, professional associations and other outlets to build awareness of issues concerning health facilities' safety from disasters.

Conduct media events in and outside of hospitals and health facilities



The donor community

Consider how donor-funded development projects can contribute to achieving the goal of hospitals safe from disasters

The international donor community can also give priority to fund activities that contribute to protecting health facilities from the avoidable consequences of disasters — which is essential to meeting the Millennium Development Goals.

Look for ways to mainstream health sector risk reduction into project design

In much the same way that the cross-cutting issue of gender is mainstreamed into a variety of projects, so too can issues related to hospitals' safety from disasters be included in other development projects.

Make “hospitals safe from disasters” a component of the larger disaster and development portfolio

Financial institution

Propose that all health construction projects have incorporated risk reduction measures

It is possible to design and construct new health facilities that are capable of protecting not only lives but also the investment in complex facilities such as hospitals. In some cases, the cost is negligible, since all that is needed is to choose a different location or change the underlying design philosophy.

Promote research and studies from an economic point of view

Help measure the magnitude of the problem and the cost effectiveness of introducing disaster risk reduction (prevention, mitigation and preparedness) measures in hospitals and health facilities.

Solicit government enforcement of existing legislation on building codes

To protect investments in health infrastructure, encourage health facility construction projects to take into account and incorporate all necessary risk reduction measures.



Universities, schools and professional associations

Develop modules or courses that contribute to hospital safety into university and professional curricula

Review and make changes to existing school and university curricula. A much-needed contribution, and one that would lend sustainability to these initiatives, is the development and delivery of continuing education courses, certification programmes and supporting technical publications.

Act as repositories of specialized expertise

Universities, as well as professional associations of engineers, architects, nurses, medical doctors and others, have a wealth of knowledge and specialized expertise. Add to a global knowledge base or knowledge management system by systematically collecting and sharing this knowledge with established information centres, thus providing a how-to blueprint for countries with similar risks and resources.

Encourage innovations and cutting-edge designs

Professional associations and institutions of higher learning can also stimulate innovations and cutting-edge designs by encouraging countries to continuously experiment with new courses of action to improve the performance of health facilities.

Publish articles for scientific and technical publications and journals

Encourage research into the magnitude of the problem and the cost effectiveness of introducing disaster risk reduction measures.

Contribute to the development and periodic review of national building standards



St. Kitts & Nevis

Ensuring design, construction standards for a paediatrics unit

The event that prompted action

Citizens of the small Caribbean nation of St. Kitts and Nevis in the Eastern Caribbean had a sense of déjà vu as they awoke on 21 September 1998 to survey damage caused overnight by Hurricane Georges. Roofs were lost and other buildings seriously affected at Joseph N. France Hospital. The laboratory roof was gone and support services such as storage facilities, laundry and the central sterile supplies department all had sustained damage. An estimated 90 per cent of the hospital could not function. With its 174 beds, Joseph N. France Hospital is the only referral hospital on the island, serving a population of 33,000 people on St. Kitts and 9,000 on Nevis.

Three years earlier, almost to the day, Hurricane Luis had ripped through the island, damaging the same hospital severely. In fact, JN France Hospital has suffered moderate to severe damage from hurricanes on no less than 10 separate occasions since it opened in 1966.

Action taken

A phased redevelopment plan of the Joseph N. France Hospital, which called for incorporating disaster mitigation measures into the building of a new accident and emergency and outpatient department, operating theatres, a laboratory and radiology unit, medical records and a pharmacy, was already on the drawing board.

In the phased redevelopment plan, the paediatrics ward was slated to be replaced by a new building at a later date. In the interim, certain disaster mitigation measures, such as strengthening the roof and reinforcing the walls, were taken and equipment was replaced. Yet some key items of equipment continued to deteriorate due, in large part, to the longer-term effects of water damage.

The arrival of Hurricane Georges (1998) forced the Ministry of Health and Environment to step up its plans for the JN France paediatrics ward and, within the framework of the larger development project, work was completed in 2001 to:

- Construct a new 24-bed paediatrics unit, using appropriately modified design standards and incorporating disaster mitigation and risk reduction measures with respect to natural hazards;
- Procure and install equipment for the JN France and Alexandra hospitals to support paediatric service at these institutions; and
- Provide training in post-disaster stress management for up to 25 persons, disaster management training for 20 persons, and training on equipment maintenance for up to five people.

A key step to building a safer hospital

Building standards to protect facilities have been around for years, but unfortunately, simply incorporating risk reduction (prevention, mitigation and preparedness) measures into the design is no guarantee that they will be followed during construction. Cost restrictions and time constraints can lead to shortcuts to meet deadlines. However, in the rebuilding of the JN France paediatrics ward, one important measure was taken to ensure that design standards were adhered to. A bureau de contrôle (quality control firm) was hired. A bureau de contrôle is an independent firm, licensed by the state to check designs and make site visits during construction. Certification by a bureau de contrôle determines whether or not insurance coverage and a mortgage may be obtained for a building. The earlier Hurricane Luis (1995) revealed an important lesson about this concept.

In addition to St. Kitts and Nevis, Hurricane Luis also impacted neighbouring Saint Martin/Sint Maarten, an island jointly administered by France and the Netherlands. Interestingly, there were clear differences in the amount of damage on the two sides of the small island, and there was a reason for this. As it happened, the French side fared much better than the Dutch and it was suggested that this was due, at least in part, to the French custom of using bureaux de contrôle to monitor design and construction of infrastructure. In fact, based on the apparent success of this approach in Saint Martin, the use of independent check consultants has become a standard recommendation with respect to the design and construction of retrofitting and new health facility projects.

A check consultant was also used during the rebuilding of the JN France paediatrics unit. A consultant reviewed the design in terms of the disaster mitigation and other risk reduction measures proposed for natural hazards and provided supervision and advice during construction. An initial report was provided to the architects early in the process and modifications were made to the designs. Site visits during construction were carried out and reports submitted to the architects and the Ministry of Health and Environment.

Lessons learned

1. The redevelopment of Joseph N. France Hospital was already underway and an overall master development plan for the site had been prepared when Hurricane Georges struck St. Kitts and Nevis in 1998. The subsequent decision to rebuild the paediatrics ward, and the speed at which it was developed and implemented, illustrated the importance of having such a master plan in place to coordinate multiple projects and funding sources.
2. The main project partners, national and international, were based in different countries. A Project Steering Committee representing all interested parties met regularly and this was important to monitor timelines and facilitate communication and decision making.
3. The use of an independent check consultant engineer to review the designs and audit the construction with regard to natural hazard mitigation ensured, to the extent possible, the construction of a health facility safe from natural hazards. This approach continues to be promoted in the Caribbean with governments and funding agencies. Fortunately, the measures incorporated into the construction of the paediatrics unit—primarily to reduce the risk and impacts of hurricanes and earthquakes—have not yet been tested in an actual disaster situation.

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Nepal

Awareness triggers action at a major public hospital

The event that prompted action

Nepal is highly prone to disasters, particularly to earthquakes, which claimed more than 11,000 lives in the 20th century alone. Data suggest that earthquakes of the magnitude of the Great Bihar Earthquake in 1934 occur approximately every 75 years and although this is only a statistical estimate, a devastating earthquake is inevitable in the long run and likely in the near future. This is particularly troublesome because the Kathmandu Valley Earthquake Risk Management Action Plan suggests that as many as 60 per cent of buildings in the area are likely to be heavily damaged if the ground motion of the 1934 earthquake is repeated today.

How would Nepal's health services cope with such an event? To find out, an earthquake mass casualty scenario was used for Kathmandu Valley to estimate the number of people that would require hospital services, based on: (1) expected damage to buildings; (2) a one-to-five ratio of deaths to injuries; and (3) the Kathmandu Valley's population of 1.5 million (in 2002). The estimates ranged as high as 22,500 dead (up to 1.5 per cent of the population), with up to 112,500 injured.

Even the best of health systems would be hard pressed to deal with this scale of injury. And in the most severe intensity earthquakes, chances are that even the combined capacity of all emergency departments in Kathmandu Valley would only be able to serve a fraction of those requiring care. The limited number of patient beds and the fact that hospitals would be damaged, unable to function or even collapsed are aggravating factors that would put thousands of patients and health workers at risk.

Action taken

Recognizing the gap between current hospital capacity and predicted medical needs in a post-earthquake scenario, a seismic assessment of 14 hospitals was conducted in 2001 in Kathmandu Valley, including Patan Hospital. Subsequently, Patan was one of four priority hospitals to undergo a more rigorous study. Unlike most other hospitals in Nepal, Patan Hospital's earthquake resilience was considered relatively good. Nonetheless, it was almost a foregone conclusion that a major earthquake would leave the hospital unable to function due to structural and non-structural damage. Therefore, the study recommended a detailed structural analysis to assess how the hospital would fare during high-intensity earthquakes. It also called for backup generators with an adequate fuel supply to provide an uninterrupted supply of electricity if external power is interrupted, response scenarios that simulate handling at least 200 casualties (the potential consequences of mid-scale earthquakes) and plans and procedures that contemplate a hospital that has been out of service.

Hospitals are more than concrete blocks and steel beams. They are made up of people and services and systems, all of which go into making a safe hospital. Patan Hospital was one of the first hospitals in Nepal to develop a hospital emergency plan, and so it is not surprising that it became one of the first health facilities to take part in a mass casualty mock drill. Civil society organizations and

health officials worked together in a simulated rescue chain, from incident site to emergency ward, thus strengthening the links between community and hospital, including the critical pre-hospital response. Equally important, the mock drill created awareness of the need for mass casualty management in host communities and among community-based organizations. Since that first drill in 2002, Patan Hospital has conducted annual drills to test and refine its emergency plan.

Patan Hospital has also taken measures to reduce seismic risk. The hospital abandoned its original plan to expand the

maternity wing by adding an extra floor to existing buildings when the roof was deemed structurally too weak to carry the extra load during earthquake ground motion. Instead, a new maternity wing is being built as a separate structure, in compliance with earthquake-resistant standards. The new maternity wing will be completed next year and will add 120 beds to the present 320 beds.

The 2001 assessment included rough cost estimates and plans for priority retrofitting. Subsequently,

Patan Hospital submitted to donors a detailed funding proposal for a comprehensive structural assessment and design drawings needed to accurately estimate the cost of retrofitting existing structures so they would be functional after moderate to severe earthquakes. While the hospital itself made some of the required modifications, they were less successful in securing the needed financial support, pointing to the need to increase awareness of investing in safety measures before disaster events occur rather than undertaking costly rebuilding projects afterwards.

The WHO has worked with the National Society for Earthquake Technology-Nepal (NSET) to raise awareness of the need to incorporate seismic mitigation measures in hospitals in Kathmandu Valley, conducting ongoing assessments since 2001, disseminating their results and developing hospital vulnerability assessment guidelines. In 2006-2007, assessments were made of six Red Cross blood banks, the National Public Health Laboratory and the Epidemiology and Disease Control Division of the Department of Health Services. High-level meetings between senior health policy makers, the donor community and international banks have helped to keep the issue of disaster-resilient hospitals and health facilities on the agenda.

Snapshot of Patan Hospital

- Type and Size: A General Public Hospital that annually treats 300,000 patients
- Staff: 60 doctors and 250 nurses
- Critical and essential facilities: Emergency department (5 beds, 100 % occupied), operating theatre (4 beds, 30 surgeries daily)
- Other facilities: ICU, maternity unit, gynaecological unit, radiology, pathology
- Total number of beds: 320
- Bed occupancy rate: 90–100 %
- Ambulances: none
- Annual patients seen in Emergency Department: 33,000

Lessons learned

1. Studies have shown the economic and social returns of improving the structural and non-structural behaviour of vulnerable hospital buildings. Structural retrofitting and non-structural measures can save lives and significantly increase the reliability of health services when they are most needed.
2. Even when there is a strong evidence base and a high level of earthquake risk, health planners and policy makers do not put seismic assessments and risk reduction measures at the top of their list of concerns. Often, buildings are viewed as “completed projects” that should not be modified; reconstruction is considered to expand space. Convincing health professionals of the need for seismic assessments and retrofitting is a long-term process, unless it is directly linked to disaster rehabilitation, as was the case following the 2001 Gujarat earthquake or the 2006 Kashmir earthquake.
3. In Nepal, concerns about disaster risk reduction in the health sector had their origins in local institutions, and this may be one of the key factors in the subsequent success achieved. Support from WHO helped to consolidate many initiatives taken over the previous 15 years. Health officials came on board when it was clear that risk reduction in health was a mutual concern of WHO, external development partners and civil society.
4. One of the key reasons that Patan Hospital was so receptive to the recommendations stemming from assessments and other initiatives (mass casualty drill, triage, etc.) was that it was – and still is – a well-functioning facility with close links to the surrounding community, which helped to create the necessary support base and sustainability for pursuing seismic safety.

Although there is still a long way to go, the hospital has taken steps and proved that awareness can trigger assessments, assessments result in planning and planning in mitigation; a cycle that ultimately helps minimize the consequences of living with earthquake risks in Nepal.

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Mexico

How safe is your health facility? The “Hospital Safety Index”

The event that prompted action

How can you determine if a hospital or health facility is safe when faced with the threat of disasters? And what exactly does “safe” mean? What can be done when health facilities are deemed not safe? For many years, the issue of hospitals safe from disasters has raised more questions than it has answered.

The job of developing indicators, providing baseline data and measuring progress has also proven difficult, given the diversity in size, location, staff, operating budget and vulnerability to natural hazards and crises. As not all hospitals face the same risks, nor are they built using the same methods, a wide range of elements needs to be taken into consideration to help give a snapshot of where the facility stands.

Action taken

The above-mentioned issues are being tackled by the Disaster Mitigation Advisory Group (DiMAG), a group of expert engineers, architects, health services administrators and disaster specialists. The DiMAG is developing a low-cost, easy-to-use tool called “Hospital Safety Index”. This tool will allow countries to quickly measure and rank a health facility’s level of safety, prioritize actions that would improve safety and monitor progress.

How does the Hospital Safety Index work? First, general information is gathered on each facility’s level of complexity, the population it serves, the number of health staff it has, natural hazards prevalent in the area, and disaster history. Evaluators then use a checklist to measure aspects that contribute to the facility’s safety: structural components (load-bearing walls, foundations, columns, etc.), non-structural components (architectural elements such as laboratory equipment, furnishings, ventilation or electrical systems) and organizational/functional elements such as the emergency operations centre, contingency plans, backup systems for water and electricity. Each component’s safety is ranked as high, medium or low, following a series of pre-determined standards. These scores are weighted according to the importance of the aspect being evaluated. A programme automates and standardizes the assessment and evaluation phase, reducing bias and lessening the chance of mathematical error.

Applying the Hospital Safety Index takes very little time (several hours) and gives an accurate although general idea of which safety level the facility falls into and what improvement measures are recommended. However, this tool does not replace an in-depth vulnerability assessment conducted by experienced engineers.

Mexico, a large country with more than 3,000 public and private hospitals, offers an interesting example of how this process works. In 2006, Mexico created a “National Committee on Safe Hospitals,”

made up of representatives from a variety of institutions such as the Mexican Hospital Association, the Social Security Institute and the Secretary of Health.

More than 400 people have been trained to use the Hospital Safety Index, which classifies the hospital's safety level into categories A, B or C according to a numerical ranking. What does this score mean?

Hospital Safety Index Score	Necessary Measures
C = 0 – 0.35	Urgent measures must be taken immediately, as the health facility's current level of safety is insufficient to protect patients and staff during and after a disaster or emergency.
B = 0.36 – 0.65	Short-term measures are required, as the health facility's current level of safety could potentially put patients, staff and the facility's ability to function at risk during or after a disaster or emergency.
A = 0.66 – 1	Although it is likely that the hospital will continue to function in emergency situations, it is recommended that measures continue to be taken in the medium and long term to reduce risk and incorporate mitigation measures particularly for structural safety.

The Index was then applied in more than 100 health facilities, which were determined to be at risk, either because of their geographic location or due to their critical importance in the health network. The results showed that more than 60 per cent of these hospitals were classified as "safe" in terms of structural and non-structural components. However, almost the same percentage was deemed to require improvements in the functional/organizational aspects (disaster planning, organization, training, critical resources, etc.) After reviewing the results, the coordinator of the Mexico's Civil Protection System committed to include "Safe Hospitals" as a national disaster reduction priority, for which he received the backing of the country's president. Mexico is committed to applying the Hospital Safety Index to all high-risk facilities (slightly over 1,000) in 2007 and to begin the process of certifying those facilities with an "A" rating.

In the Caribbean — where a single hospital can be of vital importance, as it may be the only one in a country, additional considerations have been added to the required survey form to measure the degree of disruption to a health facility if the recommendations are implemented, and the cost associated with doing so. Authorities can appreciate at a glance that, with limited funds and minor disruption, their safety score can be improved. The box to the right shows a sample of this expanded form.

Although the Hospital Safety Index is just getting off the ground, it has proved to be a powerful instrument for rallying country support around the issue of safe hospitals. Rating the safety of a health facility (as opposed to focusing on vulnerability) requires

Next steps

striking an appropriate balance between providing a secure environment for the patients, making health care accessible and factoring in economic considerations. This is a complex process and the Hospital Safety Index is only one of a variety of tools that managers can use to gather the information they need for sound decision making.

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Pakistan

Rebuilding better through compulsory risk reduction designs

The event that prompted action

A 7.6 magnitude earthquake struck a wide region of South Asia on the morning of 8 October 2005, affecting parts of Afghanistan, India and northern Pakistan. The epicentre of the earthquake was located 95 km northeast of the Pakistani capital, Islamabad. In a matter of seconds, 85 per cent of the infrastructure in towns such as Balakot was destroyed. Other cities such as the Kashmiri capital, Muzaffarabad, lost between 40 to 50 per cent of its buildings. Strong aftershocks threatened structures already damaged by the initial quake.

More than 73,000 people lost their lives and at least 150,000 others were injured. Demand for emergency medical care was overwhelming. The earthquake left an estimated 3.2 million people homeless.

At the time of the quake, 796 health facilities — ranging from sophisticated hospitals to small rural clinics — were operating in the area. Of that number, 388 (almost 50 per cent) were completely destroyed. Thirteen of the destroyed facilities were hospitals, and four of these were regional or district referral hospitals¹. An additional 106 primary health clinics and 50 dispensaries were completely lost — and often these were the only sources of health care within a five-hour walking distance in the affected rural areas. The remaining facilities that were able to continue functioning were overwhelmed. Even if the area had not lost 50 per cent of its capacity, the sheer number of seriously injured people that required medical care would have overwhelmed even the most sophisticated health system. Because of this, more than 14,000 persons were evacuated by helicopter to Islamabad for treatment — about 425 per day in the first month alone. And, in addition to physical damage to health facilities, the health sector itself was adversely affected, as many health professionals suffered direct losses, or worse, lost their lives.

¹A referral hospital is a facility that can provide a wide variety of health care. Often patients are sent to referral hospitals for specialized treatment or because a smaller facility cannot provide the care required.

Could lives have been saved?

If vulnerability assessments had been systematically carried out, if hospital disaster plans had been better prepared, tested and widely disseminated, and if health staff was better prepared in areas such as mass casualty management, many lives might have been saved and health facilities might have been able to function better, in spite of damage and the impact on health staff. The town of Balakot, which saw 85 per cent of its infrastructure destroyed, including the hospital, is an example. In retrospect, it was learned that the town itself was built on unstable (unsafe) terrain. After the earthquake, the Government of Pakistan declared a 600-hectare area a “red zone”, meaning that no construction was allowed. Had earthquake vulnerability assessments been conducted beforehand, the risk would have been known and the existing hospital could have been retrofitted. In other instances, if proper triage systems had been in place, unnecessary evacuations

— which separated many families already in a chaotic situation, forcing them to travel significant distances to search for injured relatives — could have been avoided.

Could lives have been saved? Most of the deaths were instantaneous and only could have been prevented if buildings had not collapsed. The earthquake struck on a Saturday morning, catching many people unaware at home. The majority of the houses that killed the inhabitants were poorly constructed with materials of inferior quality. As in almost all disasters, the majority of the affected people were poor.

Action taken

Rebuilding health facilities became a priority. To help ensure that a future disaster of this magnitude would not cause the same devastation, the Government of Pakistan introduced a series of disaster risk reduction and preparedness measures at local, provincial and national levels. One of these was the creation of the Earthquake Reconstruction and Rehabilitation Authority (ERRA). Under its programme “Knowledge and Capacity Building for Disaster Resilience: Earthquake-Affected Region in Northern Pakistan” UN/ISDR assisted ERRA in designing earthquake resistant buildings. Many of the designs, technologies and techniques introduced by the Citizen’s Foundation (a UN/ISDR implementing partner) were accepted and supported by ERRA as a standard to be followed by others. The standards were applicable and are being followed by many for housings as well as critical infrastructure (schools, health facilities, mosques etc). The program was complemented comprehensively by awareness raising (through knowledge centres at grassroots level) and training programs for home owners, craftspeople, village elders, and line departments of the government. The training included guidance on ensuring that heavy equipments or furniture such as racks/cupboards are fixed properly so that in case of earthquake they do not fall and cause damages. In the specific case of health facilities, ERRA looked at the geographical and population distribution of the health facilities that were scheduled to be rebuilt and concluded it was unnecessary to rebuild all pre-existing facilities. Rather, they chose to build back better by providing compulsory earthquake risk reduction designs for the 237 new basic health units, district and tehsil (sub-district) headquarter hospitals and rural health centres that are being rebuilt (the designs can be viewed on the Internet at http://www.erra.gov.pk/Reports/Construction_Guidelines_26may06.pdf). Another 105 health facilities have been or will be repaired using safety and seismic retrofitting.

However, the construction and retrofitting of earthquake-resistant buildings require much more than building codes and guidelines. Enforcement measures are critical to ensuring that health facilities are actually built according to seismic standards rather than simply conforming to a “paper” design. Enforcement implies meticulous control of ongoing construction and

Lessons learned

retrofitting projects by an independent agency.

The South Asia earthquake of 2005, like all disasters that cause massive damage and great human losses, created a real window of opportunity in terms of raising the awareness of national authorities on the need for disaster risk reduction in the health sector. In Pakistan, members of civil society also demanded that national, regional and local disaster mitigation and management strategies were developed based on lessons learned. The lessons learned include:

1. Lack of public awareness about hazard risk management leads many people to react inadequately in the immediate aftermath of an earthquake. Training and capacity building for health staff in crisis situations increases the chances of saving lives and allowing health services to remain up and running. Health personnel at all levels must become agents of risk reduction, helping to identify health risks and promoting strategies to minimize the impact of disasters on the affected population.
2. A decentralized disaster management plan needs to include all health facilities at the local level and provide them with the necessary means to ensure that health services remain functional in emergency and disaster situations.
3. The design and construction of all new hospitals and health facilities must be earthquake proof as well as for other hazards. Almost 50 per cent of health facilities in the October 2005 earthquake affected area in Pakistan were totally destroyed, causing a serious gap in health care delivery immediately after the earthquake, and in the medium to longer term.

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Grenada

Making homes for the elderly safer following back-to-back hurricanes

The event that prompted action

Hurricane Ivan was one of the most intense storms of the 2004 Atlantic hurricane season, at one point reaching category 5, with hurricane winds in excess of 248 kph. As the massive storm passed near the small Caribbean nation of Grenada in September, the sustained wind speed in the eye wall was 193 kph, with a degree of wind pressure 30-60 per cent greater than prescribed by the Caribbean Uniform Building Code (CUBiC). Fortunately, Hurricane Ivan was a fast moving storm. Had it lingered over Grenada, there would have been more structural damage and much greater rainfall. Hurricane Ivan badly damaged Grenada's Richmond Home for the Elderly, which also accommodates psychiatric patients. The entire roof of the three-story main building collapsed (the top floor had housed female patients). When this occurred, the Richmond Home had approximately 100 residents, but over the course of the next six months, some 30 residents died. Although one death was the direct result of collapsing structures during the storm, most of the deaths came about as a result of the increased stress faced by the elderly living in unsanitary cramped conditions following what must have been a traumatic event.

Action taken

Following Hurricane Ivan, a damage assessment of the Richmond Home was conducted. In addition to hurricanes, the study looked at a full range of natural hazards, including earthquakes and torrential rains. The cost of implementing the works recommended by the study was estimated at US\$1 million. In the meantime, as an emergency measure, the roof of the main building was replaced to permit female residents to reoccupy the upper floor. Volunteers and military personnel from a neighbouring country, without formal engineering input, carried out the roof replacement.

Ten months later, on 13 July 2005, Hurricane Emily (a category 1 event) struck Grenada, causing significant damage to the temporary roof that was installed after Hurricane Ivan. A post-Emily assessment revealed damage to the roofs of the main building and the physiotherapy room and water damage to floors, walls and electrical distribution systems. When Emily struck, not all of the damage from Hurricane Ivan had been repaired. In particular, the nurses' quarters had not been returned to full use, and the repairs that had been made, were emergency repairs and not intended to withstand future hurricane events.

At this point, there was general agreement that future repairs and retrofitting should aim to meet standards for a geriatric home to retain its functionality for the medium term (5 to 10 years). These standards should also be suitable for the long-term alternative use of the facility for other institutional purposes after the geriatric home is relocated to a more suitable site.

Synergy between design, checking and quality control

When repairs began to the Richmond Home in September 2005, a check consultant was recruited to review the design and make recommendations for improvements. The check consultant also was to review the construction quality control procedures and make occasional site visits to see whether the procedures were being followed.

Optimally, a check consultant should begin work when a design team is appointed, in order to avoid delays in the review and approval processes and the need to redo much of the work. However, in this case, Grenada's Agency for Reconstruction and Development was well advanced with its work before the check consultant was appointed. And so, when an initial review of the plans revealed that the conceptual design would replicate what was there before Ivan and Emily, it was clear that the drawings were far from complete for construction purposes. No calculations had been presented. The specifications required a great deal of revision. Much information remained to be completed before construction began.

Time was becoming a major issue, as the occupants of the Richmond Home needed to be accommodated in safer living quarters as soon as possible. In the best case scenario, there was a clear division of work: the designated engineer was responsible for the design and the check consultant for reviewing it.

The checking process involves a degree of assistance, guidance and transfer of knowledge. Indeed, check consultants help develop the construction industry by improving the design process and quality assurance systems. There is a real opportunity for technology transfer in this method of building standards control and the process works best if the designer does his/her part before submitting it for review. During this process the designer may seek information and guidance from the checker but the checker should not become the designer!

During the course of construction, the check consultant made four site inspections to review quality control mechanisms, observe the progress of the works, review proposals for works not yet defined in documents and address administrative matters. A little over a year from the time work began, the Richmond Home was re-commissioned, providing a structurally and functionally safe health facility for its vulnerable occupants who are even more at risk in emergency situations.

Lessons learned

1. Repairs made to buildings — particularly critical health facilities — damaged by the effects of natural hazards should aim to meet standards prescribed in current national codes, where these are available. Otherwise, the advice of specialists should be sought regarding appropriate standards.
2. Facilities that house confined or non-ambulatory persons require higher standards of safety than conventional buildings.
3. Check consultants should be employed for all major healthcare work projects. The checking consultant should be an engineer (or engineering firm) with considerable knowledge and experience in designing facilities to withstand natural hazards common to the geographic location of the project. The check consultant should commence work at the same time as the design team and carry out the checks in tandem with the design process.

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