DEVELOPING AND IMPLEMENTING EMERGENCY RESPONSE PLAN OF A ZONAL HOSPITAL IN NEPAL

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SUMMARY
Nepal is prone to almost every type of disaster. Earthquakes remain of the highest concern, as seismic faults pass through the country. Despite the very critical role in disaster, hospitals in Nepal are not prepared to respond to the predicted disaster situation. Seismic vulnerability assessments of 19 major hospitals showed 80% of the hospitals will be out of function in a major earthquake. Bheri Zonal Hospital, the largest referral government hospital in the mid western region, is amongst those most vulnerable to earthquakes. The cause of non-functionality of the hospital is not only attributable to structural components, but also non-structural and functional components. Realizing this, a comprehensive emergency response plan was developed, followed by implementation of key activities. This paper highlights the processes and methodologies adopted in making the hospital safer, enabling it to cope with disaster as a replicable model for other health institutions.

Keywords: Non-structural mitigation, Comprehensive emergency response, Functionality of hospital

1. BACKGROUND

1.1. Hazard and Seismic Risk of Nepal

Nepal has one of the highest risk profiles of natural hazards in the world. Complex geology with active tectonic processes, rugged and fragile geophysical structure, very high peaks, high angle of slopes and variable climatic conditions, combined with the existing poor socio-economic conditions, unplanned settlements, rapidly increasing population and low level of awareness, make the country vulnerable to almost all types of hazards. Though floods, landslides and epidemics are the most recurrent, earthquakes remain a major concern, as Nepal is located in a seismically active area. Nepal is divided, by level of shaking hazard, into three major seismic zones from south to north (Figure 1), separated by major thrusts and faults. These zones are elongated in a general east-west direction, with the middle part of the country slightly more prone to shaking than the northern and the southern parts. A study (UNDP/UNCHS/MPPW, 1994) has identified 92 faults in Nepal.

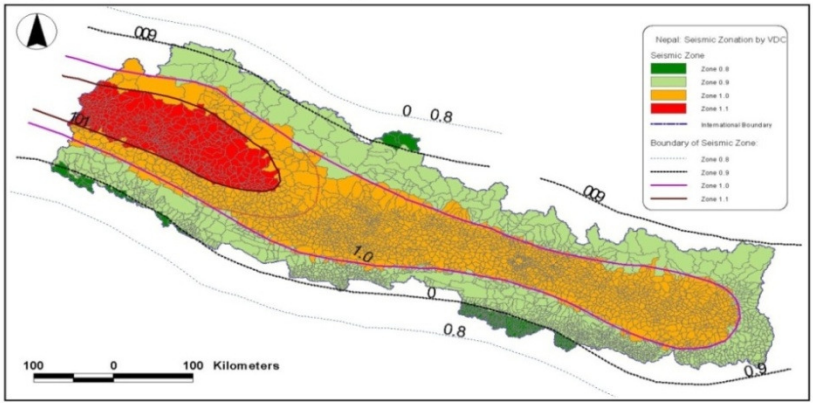


Figure 1: Seismic Zoning Map of Nepal with the lowest governance unit in different seismic zones

The first recorded major earthquake in Nepal's history dates back to 1255 AD. Later records of several devastating earthquakes include those in 1408, 1681, 1810, 1833, 1866, 1934, 1980, 1988 and 2012

A.D., with those dating back to1934 still in the living memory. The earthquake of 1934 A.D., also known as Great Nepal-Bihar Earthquake, was the most destructive.

1.2. Vulnerability and Nepalese Hospitals

The seismic record of the country suggests that a major earthquake, on par with that of 1934, occurs approximately every 75 years, indicating that a devastating earthquake is inevitable and likely in the near future. The risk of disaster is more acute in the urban centers including Kathmandu, the capital. A number of earthquake risk assessment studies have been conducted for Nepal and Kathmandu Valley (UNDP/UNCHS/MPPW 1994, Adpc 2000, JICA 2002). Comparative vulnerability studies of earthquake prone countries (UNDP/BCPR, 2004) ranked Nepal, in terms of relative vulnerability to earthquakes, as the 11th most vulnerable in the world. Another study puts Kathmandu Valley as the worst performing city (Figure 2) among 21 cities around the world, in terms of potential earthquake risk (GESI, UNCRD/GHI, 2001).

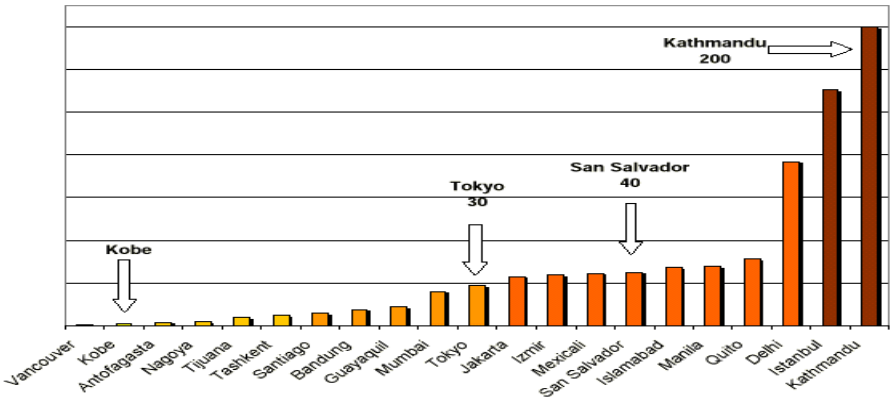


Figure 2: Relative Seismic Vulnerability in 21 cities around the world

Hospitals play a very important role in a disaster, as they must provide health services even more efficiently than when in a normal condition. Despite this important and critical role, hospitals in Nepal are not prepared to respond to such disaster situations. The Municipal Earthquake Risk Management Program (MERMP) estimated that 60% of buildings would be damaged, with 5-7% of the population injured and requiring hospitalization (NSET, 2004). However, seismic vulnerability assessments of 19 major hospitals (NSET/MOH/WHO, 2004) have predicted that 80% of them will be out of function in a major earthquake. The cause of non-functionality of the hospital is not only attributable to vulnerable structural components, but also to non-structural and functional components. Major damage to non-structural components and a lack of a proper organizational framework within a health system, with clear roles and responsibilities delegated to hospital personnel in disaster response, results in serious casualties, severe functional impairment and major economic losses, even when structural damage is not significant (PAHO 2004, USAID/NSET 2009). The absence of these aspects in Nepalese hospitals calls for the immediate initiation of hospital safety programs for emergency response.

2. PROJECT

2.1. Introduction

European Commission's Humanitarian Aid Department (ECHO) supported a project to assist Bheri Zonal Hospital (BZH) in emergency response. It was implemented jointly by Action-Aid Nepal (AAN) and BZH, under the DEPECHO V program in early 2010 with technical support from National Society for Earthquake Technology-Nepal (NSET). BZH was selected on its high vulnerability condition, exposure to a number of hazards, larger health service area coverage, and larger population to be serviced. BZH, a 150 bed hospital, is located in Nepalgunj Municipality, in the mid western

region of the Terai plains, an area vulnerable to flood, fire and epidemic, in addition to a very high seismic hazard. It is the largest referral government hospital and provides services to more than 100,000 people per year (BZH, 2010). It has the regional responsibility to provide uninterrupted health services during emergencies for two regions.

This project focuses on awareness and capacity building, in making the hospital safer and enabling it to cope with the pending disaster. This was a pilot project primarily developed to design and build a replicable model that can be used in future hospital safety-related programs, whilst also demonstrating and advocating for a higher level of hospital safety in the country, as per the first Flagship Program, a consortium developed by the donors and endorsed by GON for Disaster Risk Management in Nepal.

2.2. Objective

The overall goal of the project was to strengthen the mass casualty management system in BZH, to ensure the prompt and sufficient performance of the hospital after a disaster, building an effective, efficient and inclusive response mechanism. The specific objectives to achieve this goal were:

- To assess the seismic vulnerability of structural & non-structural components of hospital buildings
- To mitigate non-structural vulnerability in the hospital building
- To prepare a disaster response plan for the hospital, for a mass casualty incident
- To develop an effective methodology that introduces disaster awareness and promotes action for disaster risk reduction in hospitals
- To develop an approach that can easily be replicated in other health institutions

2.3. Major activities

2.3.1 Assessment for functionality of the hospital (Structural, Non-Structural and Functional)

A detail vulnerability assessment was conducted, with the following study results.

- Retrofitting of the main block was found technically feasible; however it required large-scale intervention making it economically unviable.
- Two new RC frame buildings were recently constructed for the Maternity Ward and Operation Theatre to be shifted. Another RC frame building was under construction, for emergency and other important lab facilities following building code.
- Non-Structural items, such as hospital equipment (X-Ray Machine, Sterilization Unit and Incubator etc.), contents (Rack, ceiling fan, refrigerator etc.) and critical facilities (Water supply system, electricity system etc.), were seismically highly vulnerable.
- Recommendation to prepare a detail emergency response plan and implement mitigation measures including fixing of equipment and contents to structural elements, and enhancing the security of water pumping units and generator housing, considering the enhancement of overall functional safety of the hospital.

An orientation and interaction program was organized in the BZH on disaster preparedness planning, welcoming a larger audience including hospital management and other district level stakeholders. After the presentation, preparation of the disaster response plan began with the formation of three committees, that of Steering, Planning and Implementation, and Finance.

2.3.2 Preparation of Emergency Response Plan with Spatial Map

With the initiative and coordination of a hospital planning expert from NSET, the Planning Committee drafted the Disaster Response Plan of BZH. The hospital declares emergency when it receives 30 to 100 multi mass casualties or more than 10 to 15 all serious. The Plan included recommendations for various activities related to procurement, management, and safer construction that would support the Plan over all, each prioritized according to importance. This included the drawing up of a spatial plan, with evacuation flows and designated emergency areas for different types of disaster patients, for two types of scenarios (Fig 3).

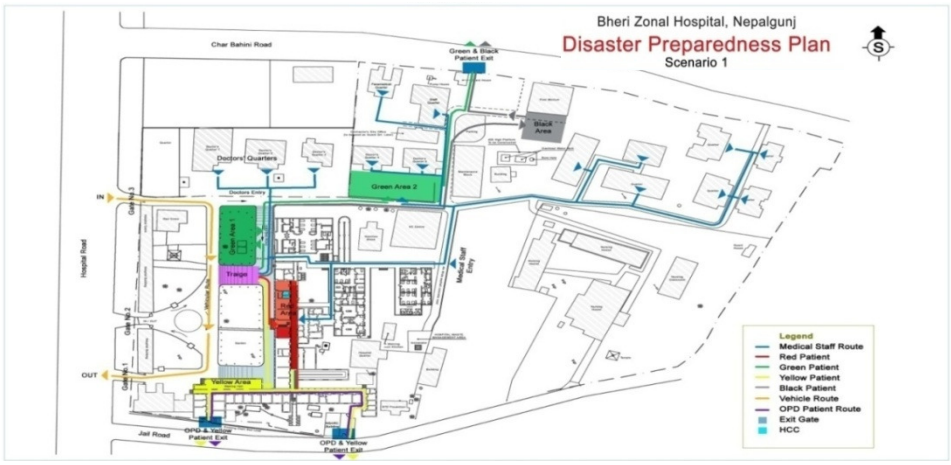


Figure 3: Spatial Plan for Emergency Response Scenario -1

2.3.3 Non-structural mitigation

As suggested by the assessment report, non-structural mitigation measures were carried out in June-July, 2010as the first phase of the project. Two staff from the maintenance division of the hospital worked together with a technical expert in implementing the non-structural mitigation works.

2.3.4 Implementation of key activities to support the plan

Works listed as Priority I such as putting sirens in four key locations around the hospital complex, construction of two emergency exit gates, two channel gates to guide the patient flow, clearing and planting of grass in the garden area to maintain as a lawn for allocating an overflow of patients, making and fixing of sign boards for quarters and the main entrance gates of the hospital, were carried out.

2.3.5 Strengthening of critical life line facilities

As suggested by the vulnerability assessment, lifeline facilities, including the generator and pump house, were strengthened by demolishing and reconstructing the housing and providing shelter for the generator. They were constructed incorporating earthquake resistant elements, to ensure they remain functional post-disaster.

2.3.6 Training and Drill

Orientation training and emergency response drills were conducted in November 2010 to test the plan based on possible real-life scenarios, in order to improve emergency management. It was an operations-based exercise to validate plans, policies, agreements and procedures, clarify roles and responsibilities and identify resource gaps in an operational environment. About 50% of the volunteers for drill patients were final year nursing students.

2.4. Fund Required

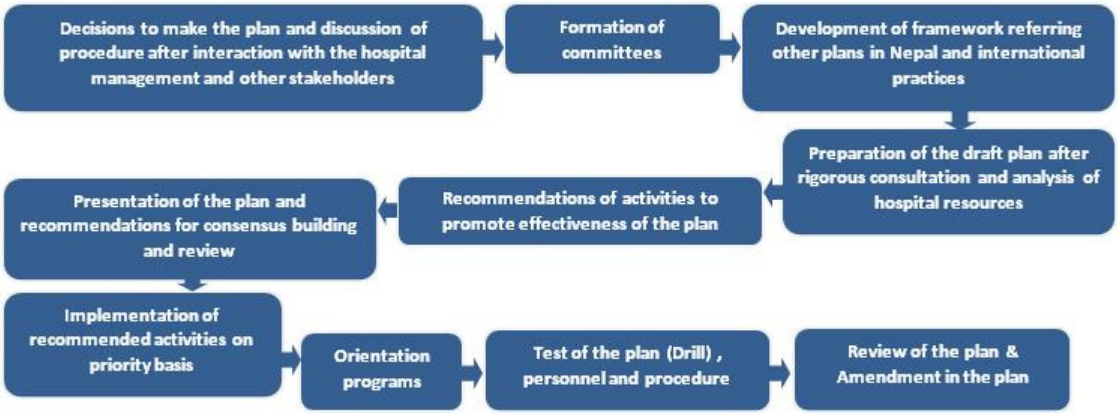
The total cost of the project was NRs 8, 88,085.00 (US$ 12,000) which included the implementation of hospital assessment, preparation of disaster risk management plan and implementation and supervision of selected actions of the plan as discussed in 2.3. This was a small project with small amount of fund involvement. However, the functionality of the hospital was greatly enhanced as it can now serve even during major disasters. This signifies the feasibility of improving non-structural aspects of hospital for reducing the overall seismic risk.

3. APPROACH

The following approaches were adopted in the implementation of the program at BZH, to ensure functionality during a disaster:

3.1. The Holistic Planning Process

The planning process of developing and implementing the emergency response plan of BZH is given below.



3.2. Formation of Committees

The project involved multi-stakeholders and diverse of expertise. Therefore, the following three committees were formed to ensure a universal level of understanding, transparency and ownership of the project viz.

Steering Committee **-** to provide overall guidance and direction to the project whilst also establishing links with other initiatives related to emergency response at the district and national level. It guided the planning committee on existing emergency response frameworks and preparedness activities in other sectors. It also facilitated in sharing the lessons and outcomes of the project with other concerned stakeholders during implementation, and after completion.

Planning/Implementation Committee **-** the main working body responsible for preparation of the disaster preparedness plan; to identify the key elements to implement and the eventual implementation of some of the priority activities of the plan. It was responsible for inviting the steering committee to meet regularly and provide a brief of their activities.

Financial Committee - primarily for the purchase of quality materials and to maintain financial transparency whilst implementing financial activities.

3.3. Prioritization and Phase-wise Implementation of Works

BZH had been built over 50 years prior to this study and required large-scale intervention to ensure functionality through disasters. This included structural and non-structural mitigation and other preparedness planning. It was not possible for one organization to complete all required works in one wave of implementation. Hence the overall works were prioritized on the basis of effectiveness towards improved functionality and cost, and a phase-wise approach was applied in implementation.

3.4. Transfer of Knowledge and Technology

Transfer of knowledge and technology is very important for the sustainability of any program. This became a key element of the BZH project. Two staff from the maintenance division were involved throughout in non-structural mitigation works under guidance from a technical expert. The acquired knowledge made them capable of carrying out such works in future without external help. Moreover, the local masons involved in building the pump and generator housing with earthquake safe

technology, learned the practice of earthquake resistant construction from the earthquake technician on site.

3.5. Awareness Raising on Hospital Disaster Preparedness at Various Levels

Awareness is the first step for any action, including the disaster preparedness planning of hospitals, and is required at all levels of involvement, from the highest decision makers to the lowest implementers. Hence, different types of awareness raising tools were used. They included presentations for the top level management of the hospital and district level stakeholders, involvement in the three committees, involvement of technical staff in implementing the mitigation measures, and knowledge and technology transfer through construction training and practice.

3.6. Integration with the Works of Other Stakeholders

There were many stakeholders working together in the BZH program including BZH itself, Action Aid-Nepal (AAN) with its partner organizations, Handicap International (HI), Department of Urban Development and Building Construction (DUDBC) and NSET. The works were integrated right from project conception stage to save time and money. The works designated to each stakeholder were integrated. Some of the elements were shifted from one to another's work, without having any cost implications.

3.7. Comprehensive Hospital Preparedness Planning

There are primarily three factors that make a hospital able to provide the required services in a disaster. They include the structural safety of the hospital buildings, non-structural safety of lifeline facilities, equipment, contents and architectural components, and the organization of hospital personnel in disaster response, critical for the functionality of a hospital during and after a disaster. All three aspects were incorporated in developing a comprehensive disaster response plan in BZH.

3.8. Planning Process as an Awareness Raising Tool

The planning process was used as an awareness raising tool. Most of the members in the various committees were from the BZH itself. The involvement of all committee members, particularly those of the planning committee involved in the preparation of the disaster response plan, raised awareness amongst all concerned on the functionality of the hospital and the necessity for preparedness.

4. METHODOLOGY

The various methodologies carried out in BZH to improve its functionality during a disaster, in the preparation of the disaster response plan and implementation of priority, non-structural, mitigation activities to support the plan, are as follows.

4.1. Coordination and Interactions with Various Stakeholders

The involvement of various stakeholders requires extensive interaction, to ensure all knowledge is shared and maintain a universal level of understanding and consensus. A series of interaction sessions were organized among AAN, HI, BZH, NSET, and DUDBC, inviting comments, inputs and suggestions on the activities to be done. Inputs and suggestions were also continuously gathered from the various committees. The works were completed incorporating pertinent feedback from the interaction sessions, presentations, and various committees.

4.2. Reference of Relevant Documents

Several documents were available on the functionality of hospitals during a disaster and suitable

disaster response plans. All were thoroughly reviewed and the most relevant referred, as mentioned in the reference.

4.3. Application of HICS

As organizational structure, with clear roles and delegated responsibilities, is one of the most crucial elements in managing an incident. A system known as the Incident Command System (ICS), has been recognized as the most effective incident management structure for organizing an effective response mechanism in major disasters. Applied to hospitals, the system is called Hospital Incident Command System (HICS). HICS was applied in BZH (Figure 4) to manage emergency operations in response to events affecting the facility and/or surrounding community. ICS has been used in Nepal in the past by national institutions such as Nepal Army (NA), Nepal Police (NP), Armed Police Force (APF) and Nepal Red Cross Society (NRCS). The organizations involved in disaster response therefore speak the same language and have a universal understanding and consistency in response mechanism works.

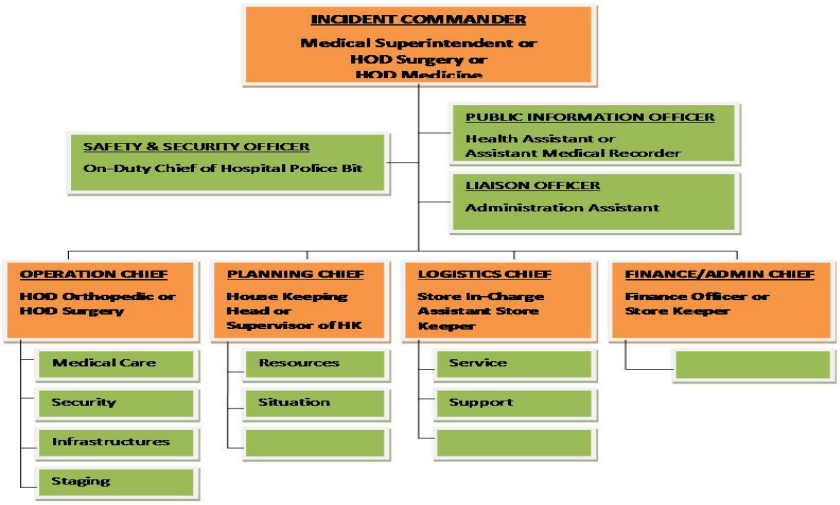


Figure 4: HICS of BZH with 5 basic components

5. LESSONS LEARNT

The development of the disaster response plan and its successful implementation at BZH was a learning experience in many respects. There were several aspects that satisfied the set goals and can be replicated in other health institutions in future however, there were also areas requiring improvement. The following are some such points as gleaned from the works of BZH.

5.1. Planning Possible, Even in Busy Operating Hospital

The very objective of developing the plan was to not disrupt the day-to-day function of the hospital in any way. Though challenging, planning for disaster preparedness is possible even amongst the activity of the day-to-day in busy hospitals like BZH, with intense involvement of the medical staff working around their schedule. Most of the members in the planning and implementing committee were not only just the staff of the respective units, but also departmental and unit heads. Managing time and bringing them together proved difficult; however development of the disaster response plan was successfully completed.

5.2. Involvement of Hospital Staff in Planning and Implementation was Effective

As mentioned earlier, active involvement of hospital staff, ranging from the top level Medical Superintendents to the lowest level maintenance technicians, proved very effective. All the members of the committees were made well aware of hospital disaster preparedness planning and their

involvement, particularly of the members of the planning committee, in the preparation of the plan has also developed a sense of ownership of the plan. Involvement of the staff from maintenance units in implementation of non-structural mitigation measures was also a good opportunity for the transfer of knowledge and technology.

5.3. Integration with Other Programs was Cost Effective

Integrating some of the activities of the disaster preparedness plan with other programs was cost effective, though coordination in terms of time management was challenging. For example, incorporating construction of a ramp in the program of DUDBC made the program more cost effective whilst achieving a more accessible route for people with disabilities and other vulnerable groups, thus making the plan more functional

5.4. Application of New Concept is Challenging and Requires Patience

Earthquake safe construction technology following the National Building Code is not practiced in many parts of Nepal. Nepalgunj Municipality is not an exception. Incorporation of earthquake resistant elements in the construction of generator and pump housing was difficult as the contractor and masons were hesitant, initially refusing to apply the new concepts. Similarly, implementation of non-structural mitigation measures in various departments and units were not initially welcomed. It was difficult to convince those involved that simple things, with little cost implication, also matter in ensuring the safety of non-structural elements.

5.5. Regular Practice of Triage is Important

Applying triage, prioritizing victims according to severity of their injuries, was not very effective in the drill. The terminology of triage itself was new to many staff. Triage is not a onetime business. It must be practiced regularly. The most effective application is therefore in the emergency department, where it can be practiced on a regular basis. Moreover, there may arise a situation in which the hospital receives disaster patients who have already been triaged in the field and sent to the hospital for further treatment, as in the drill. The security forces (Nepal Army, Nepal Police, and Nepal Armed Police Force) who generally reach the incident site first for rescue have started doing field triage before sending them to hospitals. Many courses like Medical First Responder (MFR) and Collapsed Structure Search and Rescue (CSSR) have recently been introduced for those forces able to build their capacities of on-site medical support and rescue of victims. Medical staff must also be aware of this process.

5.6. Continuous Training for the Staff Needed

Just knowing the plan is not enough to act during a disaster. Almost all the staff had attended the orientation training on the hospital disaster response plan; however aspects of the drill still did not go as anticipated. Understanding the importance of disaster management and hospital functionality is essential. Managing the disaster situation is not additional work for hospital staff; rather it is a part of their hospital duty. Hence every staff member must be aware at least of his or her role and responsibility once a state of disaster as been declared in the hospital. This requires rigorous training in regular intervals. In addition, top-level hospital staff should be trained further in courses such as HOPE.

5.7. Linkage of Disaster Store with Emergency Store Necessary

A separate disaster store was established to house medical and logistic supplies to be used in the wake of the disaster as part of the disaster preparedness plan, a critical factor in effective mass casualty management. However, this practice risks the necessary medicines reaching their expiration date and not being available when the disaster eventually hits. This also risks the possibility of medical equipment not being sterilized in due time. The disaster store must be regularly stock piled and re-

stocked with necessary medical and logistic supplies. This risk can be avoided if the medicines and equipment for more common emergencies are taken from disaster store, maintaining its minimum stock and re-stocking immediately. Linking the emergency store with the disaster store ensures the medicines and equipment are regularly rotated.

5.8. Mass Casualty Management is Not All Technical

It is generally thought that in the midst of injuries and demand of medical facilities, it is solely a medical and technical matter. However, it was realized that managing a mass casualty incident is not all technical. Every minute detail plays a significant role in making disaster response effective. For example, if the key of a gate designed to control and guide the influx of people is not available, or the gate keeper closes or opens the wrong gate, the scenario would change drastically. Management is a key factor. Effective response comes down to a thorough understanding of each individual's job and working in a team.

5.9. Drill as a Learning Experience for Nursing Students

The drill provided a learning opportunity for nursing students. Entering into the medical profession, they were able to see the gaps and challenges that they will soon face and identify areas for improvement. They each shared appreciation for the unique opportunity.

5.10. Drill to be conducted on Regular Basis

The drill in BZH was a first of its kind in the history of the hospital. Though it was a good learning experience for most of the staff, the single practice session is not adequate. There were still many things to be improved. The drills provide an opportunity for on-site practice of possible scenarios whilst strengthening the mass casualty management system. The drills must therefore be continued at regular intervals, to update the response accordingly.

6. CONCLUSION

Developing and implementing an emergency response plan that ensures complete functionality of a hospital through a disaster is a new phenomenon in Nepal. Developing the hospital disaster response plan for BZH involved a variety of novel activities, from the decision making process to plan development to implementation and eventual testing. Being a pilot project, several approaches and methodologies were adopted. Reviewing the whole process, it was found to be a rewarding learning experience for all; however, several concepts and key elements in the plan were still new to the hospital personnel and were not able to be sufficiently familiarized and internalized within the constraints of the program, leaving definite space for improvements.

As gleaned from the works of BZH and the lessons learnt, all approaches and methodologies were found to be highly effective and can be replicated, with project-specific alterations, in other health institutions in Nepal in future. Sensitization, interactive dialogue, and wide participation in planning and decision-making, were the key elements of the project's success. However, some approaches were quite challenging, including the involving the personnel of an operational hospital through the whole planning processes and in implementation, convincing those implicated of the importance and need of non-structural mitigation, and coordinating different stakeholders for the integration of programs. Learning and improving is a continuous process. The BZH program has highlighted areas requiring further intervention, largely in developing a more effective disaster management system in hospitals. Hospital management should immediately begin regular practice of triage, periodic seismic training for all hospital staff, and updating and maintaining the medicinal and logistic disaster stock-pile, as they were not up to the satisfactory level. With everyday pressures to provide for a high flow of patients, management often does not prioritize the need for regular drills and they are often postponed or canceled. It is therefore essential that the additional workload involved be formally inbuilt into the

hospital's quarterly and yearly programs, with monitoring and reporting mechanisms developed for higher authorities.

The BZH experience has established two distinct feasible interventions. Non-Structural Mitigation is important and can be applied without disturbing the day-to-day operations of hospitals like BZH. Emergency Response Plans are extremely important, especially in cases of weak buildings. The September 18, 2011 Himalayan Earthquake proved that time is running out for the type of work conducted at BZH to be applied in other hospitals. GON and other stakeholders should pay due attention, that they are losing precious time.

PHOTOGRAPHS

Glimpses of activities of BZH: Orientation on disaster preparedness, Earthquake resistant construction technology process and Non-structural mitigation measure in hospital.



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