

# THE ROLE OF LABORATORIES AND BLOOD BANKS IN DISASTER SITUATIONS

*Rubén Boroschek Krauskopf, Ph. D.  
PAHO/WHO Collaborating Center  
Disaster Mitigation in Health Facilities  
Faculty of Physical Sciences and Mathematics, University of Chile*

## **INTRODUCTION**

### **(Slide 1)**

Recent disasters affecting large areas of a country, such as Hurricanes Mitch and Georges and the El Salvador and Peru earthquakes of 2001, have underscored the urgency of protecting laboratory and blood-bank systems in the region.

Such protection should be comprehensive, taking into account not only the safety of the relevant infrastructure but also the continuity of operations at the local, regional and national level and their coordination with sectoral health plans and other governmental and community disaster-reduction and response plans.

This presentation provides an overview of preparedness, response and recovery strategies. It is based on, and complements, the booklet *The Role of Laboratories and Blood Banks in Disaster Situations*, produced by the Pan American Health Organization's Program on Emergency Preparedness and Disaster Relief and the Program for Essential Drugs and Technology of the Division of Health Systems and Services Development.

The presentation will be in four parts:

### **(Slide 2)**

- Operational objectives for laboratories and blood banks
- Vulnerability and mitigation aspects common to both laboratories and blood banks
- Laboratories: Preparedness, response and post-emergency activities
- Blood banks: Preparedness, response and post-emergency activities

## ***Operational objectives for laboratories and blood banks***

In order to assess the functional and response capacity of a national laboratory and blood bank system, a comprehensive approach must be taken, starting from the local level up. Local laboratories and blood banks must be part of a national

system that, in the event of a disaster, should at the very least continue to fulfill adequately the following three functions:

**(Slide 3)**

- Ensuring early diagnosis of tracer diseases with high mortality rates;
- Ensuring the provision of safe blood to respond to immediate demand.
- Ensuring the delivery of clinical laboratory services for basic and essential tests;

For every likely type of disaster—an event or phenomenon that surpasses and disrupts local capacity—an operational and response plan is needed. It should be based on the assumption that the operations of laboratories and blood banks may be disrupted unless preventive measures are taken.

**(Slides 4 and 5)**

In a disaster, some or all of the following scenarios may materialize:

- Damage to health facilities at a time of increased demand for their services.
- Damage and partial or total loss of basic services (transport, communications, water, electricity).
- Human displacement leading to radically increased or decreased population density, affecting food supply and hygiene and precipitating the outbreak of communicable diseases.
- Environmental degradation leading to the proliferation of vectors and other sanitation problems.
- Disruption of social networks and the operations of health care and support entities.

Only a comprehensive strategy comprising vulnerability assessment, mitigation, and closely-knit organization at the local, regional and national level will ensure an adequate response in disaster situations and guarantee the timely and cost-effective recovery and reconstruction of the affected facilities.

**(Slide 6)**

## ***VULNERABILITY AND MITIGATION ASPECTS COMMON TO LABORATORIES AND BLOOD BANKS***

### **Objectives and strategy**

**(Slide 7)**

Given their highly specific functions and lack of redundancy at all levels, laboratories and blood banks need to enjoy low vulnerability to disasters. This means the probability of the system being significantly damaged should be as low as possible. Even if damage does occur, it should not disrupt the operational capacity required to provide assistance after a disaster. Moreover, whatever

damage occurs should be such that recovery can take place in a reasonable amount of time at reasonable expense.

**(Slide 8)**

Protecting laboratory or blood bank infrastructure alone does not ensure that the system will meet its operational objectives after a disaster. A robust system calls for integrating every laboratory and every blood bank into a national and regional system with clear goals and policies and low vulnerability.

## **Preparedness**

**(Slide 9)**

The first step, when considering a strategy for operational continuity, must be to have a clear idea of the hazards that threaten any given laboratory or blood bank, as well as the network or system as a whole. Hazards may be natural or technological, and they must be assessed by means of scientific studies that take into account those adverse events that have affected the system or region in the past.

In addition, the objectives each unit should meet in the event of various types of disaster, of differing intensity, should be clearly formulated.

**(Slide 10)**

At the very least, laboratory and blood-bank vulnerability assessments should consider the structural and non-structural components of the relevant local infrastructure and, at the supra-local level, the vulnerability of basic services and lifelines. Attention must also be paid to the organization, at the local and sub-national level, not only of the laboratory and blood bank system but also of the health sector as a whole. Other institutions that play a role in disaster response (public, private and military hospitals, universities, ministries, the Social Security Administration, customs, and so on) should also be taken into account.

Any strategy chosen must incorporate the integral management of adverse events. Appropriate response is only possible if there is a sufficient degree of preparedness. This can only happen if the roles and mechanisms for coordination and response have been defined in advance, based on a realistic estimate of the impact of any given type and intensity of event. Such a strategy must be continually perfected and tested by means of regular, institutionalized simulations and drills.

## **Vulnerability and mitigation**

**(Slide 11)**

Vulnerability assessment and mitigation is a comprehensive, ongoing process that must be incorporated permanently into the development and operations of the system.

**(Slide 12)**

From the point of view of infrastructure, attention must be paid to structural elements (e.g., foundations, beams, columns and load-bearing walls) as well as nonstructural elements. The latter include architectural features, emergency systems and building contents such as supplies, equipment, and furniture. The following table summarizes these various elements.

**Table 1: Nonstructural elements to take into account in assessing and mitigating vulnerability**

Architectural	Equipment and furniture	Basic installations
Dividers and partitions	Medical/laboratory	Medical/laboratory gases
Façades	Industrial	Industrial gases
False ceilings	Office	Vacuum
Coverings	Furniture	Steam
Cornices and terraces	Supplies	Air conditioning/heating
Chimneys		Basic electricity
Facings		Emergency power
Windows and glass surfaces		Telecommunications
Appendages (signs, antennas, marquees)		Drinking water
Lighting system		Industrial water
Railings and balustrades		Sewerage
Exit doors and routes		Fire extinguishing network
Expansion joint elements		Other pipes
		Human flow (elevators, stairs)

A presentation on seismic-risk vulnerability assessment and mitigation of structural and nonstructural elements is available on a CD-ROM from PAHO. It is titled *Disaster mitigation of health facilities*.

As already noted, however, safe infrastructure does not guarantee that the system will continue to function adequately. Organizational and administrative capacity must be such that increased demand can be met during both the emergency and recovery stages.

Also, since laboratories and blood banks do not operate independently of the rest of the health system, coordination is essential with other institutions. The other bodies on which the response of the laboratories and blood banks depends must have a clear idea of their vulnerabilities and operational capacity after a disaster has struck.

**(Slide 13)**

It is impossible to respond adequately to a disaster if severe structural damage has occurred. The first priority must be to safeguard the staff and facilities; only then should one consider the continuity of operations.

**(Slide 14)**

A safe structure contributes to the protection of the non-structural elements (and of the staff), but once that is achieved much remains to be done. Operational continuity can only be preserved if nonstructural elements suffer no more than minor damage. The level of protection of these elements should depend on the expected level of response by the specific laboratory or blood bank.

**(Slide 15)**

Moreover, infrastructural vulnerability is not limited to local conditions. Attention must be paid to the possible disruption of basic services and supply lines. Depending on the importance of the facilities within the overall system or network, a certain degree of redundancy must be incorporated, such as emergency water supplies or electrical generators.

The level of infrastructural protection should correlate meaningfully to the hazards to which the unit and system are exposed. It should be different for every hazard, and the role of each unit may also change. The same is true of vulnerability assessment and mitigation.

The vulnerability assessment of laboratories and blood banks should uncover at least the following information:

- Expected structural and non-structural behavior of the laboratory or blood bank facilities.
- Expected characteristics of the damage: location, causes, magnitude and consequences.
- Likely operational capacity after each type of disaster.
- Recovery time for full operational capacity.

The findings should be detailed enough to make the following actions possible:

- Improving disaster mitigation and response plans.
- Assessing the real capacity of the unit after the disaster.
- Designing and implementing evacuation plans if necessary.
- Designing strategies for handling increased demand during the emergency phase.
- Determining what mitigation measures make the most sense.
- Assigning priorities to the various mitigation measures based on urgency and pay-off.

From the practical point of view, structural mitigation should be the result of a specific project designed and implemented by specialists in the field.

Disaster mitigation of nonstructural elements, as well as the development of response plans, should be a joint effort involving both disaster reduction specialists and the laboratory or blood-bank staff.

**(Slide 16)**

Once the structural vulnerability of the system has been established, we can begin to mitigate the risks to the nonstructural elements. Once again, the protection required depends on the type of hazard. The slides in this presentation focus on seismic risk. Other approaches will be necessary in the event of hurricanes, floods, or technological disasters. The starting point of mitigation is to envision several likely disaster scenarios, including potential consequences and impact on the operational capacity required of the system. If, as in this example, we wish to ensure the continuing operations of a laboratory, it is necessary to protect the staff, the equipment and the work environment from the result of the various negative scenarios.

**(Slide 17)**

Architectural elements can be protected either by building support structures that secure them in place or by using elements that come with their own protective devices or have been otherwise designed to withstand damage and keep the staff safe.

**(Slide 18)**

Basic installations, such as gases or heating and air-conditioning, should be dealt with comprehensively, so that each component is rendered safe and secure based on its location and specific characteristics.

**(Slide 19)**

All the components of a system that perform a specific function, such as the cold chain, gases, water-supply pipes and electrical wires should be protected. Another consideration is the degree of independence that the facilities will enjoy from external lifelines in the event of a disaster, thanks to emergency backup systems, and the performance to be expected from such backup services.

**(Slides 19 and 20)**

The safety of all equipment, depending on each hazard, may be inherent in the equipment itself or provided by other structural or non-structural elements such as furniture, which in addition to being functional should increase the safety of those elements and equipment that it supports or contains.

**(Slide 21)**

Thus, all shelving should be secure and stable and provide enough protection for the objects it contains or supports.

**(Slide 22)**

A clear notion of the expected level of structural and non-structural damage will help the institution to organize its response to an emergency and, if needed –

**(Slide 23)**

– evacuate the premises according to a carefully designed plan.

**(Slide 24)**

In emergency situations, we should not expect the system—and its staff—to respond above and beyond the criteria set out in the national or local disaster response plans. Overwork, or the use of unfamiliar techniques, are not feasible options.

**(Slide 25)****(Slide 26)**

## **LABORATORIES**

### **Preparedness**

**(Slide 27)**

The main operational objective of the laboratory network, both during and immediately after the emergency, should be establishing early diagnosis of tracer diseases with high mortality rates.

**(Slide 28)**

Each unit should have its own realistic preparedness strategy that is fully integrated into more wide-ranging plans at the local, regional and national level. This strategy should be based on the unit's organization, capacity, and vulnerability. When assigning roles to each of the facilities, these plans in turn should consider the vulnerability of the other "nodes" of the network, their geographic location, their capacity, and their links to the central reference laboratory and main supply lines.

It should be noted that the laboratory network in normal times may be different from the emergency network. After a disaster, temporary components such as portable laboratories may come into play. There may also be a need to coordinate efforts with external laboratories.

**(Slides 29 and 30)**

Each laboratory should design its own strategy based on its particular responsibilities and vulnerability.

### **Response**

**(Slide 31)**

After a disaster has struck, it is necessary to assess the state of each facility and the system as a whole in terms of infrastructure and operational capacity.

**(Slide 32)**

Services should begin to be provided as soon as possible, while constantly evaluating their effectiveness and identifying ways of improving them.

**(Slide 33)**

Fluent communications should be established and maintained with the central laboratory and the managers of emergency epidemiological programs to ensure that response is carried out in coordinated fashion.

**(Slide 34)**

At the local level, microscopic examination will be the essential tool for the rapid diagnosis of most infectious diseases.

**(Slide 35 and 36)**

It is particularly important to engage in the prompt clinical identification of diseases and report all positive cases to the central level and other relevant nodes as contemplated in the response plan.

**(Slides 37 and 38)**

This table shows the specimen, rapid diagnosis, reference technique, and timeframe for delivery of results by groups of diseases.

**Post-emergency stage**

**(Slide 39)**

Once demand for the services provided by the laboratory decreases, it is essential to recover normal operational capacity as soon as possible so as to continue monitoring those diseases that were under surveillance before the disaster.

The positive and negative experiences in implementing the plan should be duly recorded and evaluated in order to improve response in the future.

***BASIC LIST OF LABORATORY EQUIPMENT REQUIRING SPECIAL PROTECTION***

**(Slide 40)**

This is a basic list of the equipment that requires special protection so that it can be restored and rendered operational as soon as possible after a disaster has struck. Individual facilities may need to protect additional equipment.

## **CLINICAL LABORATORIES**

**(Slide 41 and 42)**

The first measure that must be taken is assessing the damage so as to rehabilitate, reactivate and, if necessary, reorganize the laboratories in the shortest time possible and ensure that they have the human resources, supplies and equipment needed to meet demand.

**(Slide 43)**

## **BLOOD BANKS**

### **Preparedness**

**(Slide 44)**

A national blood bank system—including a central reference facility—should be established for the handling of emergencies.

The system should take into account the capacity and vulnerability of each center, both from the point of view of infrastructure and the services it should provide in an emergency. The emergency network may not be identical to the network in normal times, since temporary emergency systems may be incorporated and alternative facilities may have to come online.

The organization and hierarchy of the blood bank network should be established in advance as part of the overall development and management of the system. An inventory of human and physical resources should be carried out, including the precise definition of roles and responsibilities.

**(Slide 45)**

Emergency communications should be carefully planned and tested in advance, including redundant channels and alternative modes.

Transportation of blood and other supplies and equipment to the affected areas should also be planned with care, including alternative routes in case roads have been blocked by landslides, debris or flooding.

Simulations and drills should be carried out in normal times to test the efficacy of the system.

**(Slide 46)**

At the level of each unit, emergency plans must also be devised to handle such matters as donor reception and orientation, screening tests, blood grouping, component separation, shipments, and administrative and logistical support.

## **Response**

**(Slide 47)**

Immediately after a disaster has struck, damage to each facility and to the system as a whole should be assessed from the point of view of both security and operational capacity. Then an assessment must be made of the need for blood, supplies, and other physical and human resources. If donations are required, one should ideally accept first of all people who have previously donated blood, and process the units of blood in accordance with national safety standards.

## **Post-emergency stage**

**(Slide 48)**

The system should be restored as soon as possible to its normal operational capacity, including the replenishment of key stocks such as reagents. A critical evaluation of the positive and negative aspects of the latest intervention should be carried out and reported to the relevant authorities in order to improve future response plans.

**(Slide 49)**

## ***ACKNOWLEDGMENTS***

Thanks are due to the staff of the Ministry of Health of Chile for their assistance in the development of this presentation, particularly engineer Agustín Gallardo, medical technologist Sonia Amaya, and the personnel of the blood banks at San Jose and San Juan de Dios hospitals.