

If you have numerical information in an external file (in dBase, INFO, or comma- or tab- delimited ASCII format) that is related to the elements displayed in your view, it can be added to your ArcView project like any other table. These files generally contain additional information on the elements displayed in a view. It is also possible to create a table in ArcView to enter information interactively.

We have given basic information about ArcView operation and document handling. For a more detailed explanation of the programme's functions and operations, see the User's Manual for ArcView 3.0.

### THE ROLE OF ARCVIEW IN SPATIAL ANALYSIS

As mentioned previously, ArcView© is a display and querying tool that can carry out many tasks included in the spatial analysis of ARC/INFO© geographical databases. ArcView can be used with more than one coverage or database. Since display and query are essential for interpreting the results of spatial analyses, ArcView complements the spatial analysis carried out in ARC/INFO©, by making it possible to investigate the results and new spatial relationships derived from analytical procedures and models previously made with ARC/INFO©.

## II. HOUSING AND HUMAN SETTLEMENTS

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### A. INTRODUCTION

#### 1. General comments

This chapter of the handbook refers to all buildings used as dwellings, urban infrastructure and equipment. It does not deal with sectors involved in the production and marketing of construction materials or directly engaged in construction, as these industries are discussed in the chapter on productive sectors.

The interrelations with other economic activities and social segments must be taken into account when analyzing this sector since the deterioration or destruction of housing has broader effects on the living conditions and economic performance of the affected country or region. When housing is hit by a major disaster, the micro, small and medium-sized businesses located in those homes are similarly affected, as are household incomes. Many of these enterprises are owned and operated by women. Spending on the construction (and reconstruction) of housing contributes to the gross formation of fixed capital in the economy. Any change in housing construction rates –such as would occur after a major disaster– has significant implications for employment and for industries related to the construction sector. Thus, any negative effect on housing has ramifications for other sectors that must be identified and taken into account both in assessing the overall impact of the disaster and especially in defining reconstruction strategies and plans.

Pre-disaster conditions should be considered in impact assessment and when drafting reconstruction plans, since a disaster often aggravates pre-existing housing deficits. Actions in the field of housing are a primary aspect of national social development policies through which governments try to satisfy the population's housing needs. Responsibility for designing and implementing such initiatives falls not only on central government authorities, but also increasingly on regional and local governments or agencies, and even on non-governmental organizations.

When assessing damage or drawing up reconstruction plans, one should provide some idea of the effect that both have on employment, as well as on the installed capacity of the industrial and commercial sectors that provide the necessary inputs.

## 2. Assessment procedure

The housing and human settlements sector specialist –like the other specialists on the assessment team– usually has from one to three weeks' notice prior to visiting the affected country or region and from one to two weeks for field work. Before embarking on the mission, the specialist must collect all relevant information on the housing sector in the affected area or country and prepare a list of the institutions and people to be contacted during the field visit.

- 62 The specialist must keep in mind that at the end of the mission, he/she will be expected to develop a summarized table of damage to the sector. It should specify the amount of direct damage and indirect losses, broken down by property type (private and public), and indicate how they are distributed between the geopolitical units previously agreed upon among members of the assessment team. Table 1 provides an example of the type of table that the housing and human settlements specialist is expected to produce.

Table 1  
DAMAGES TO HOUSING AND HUMAN SETTLEMENTS  
(Millions of dollars)

Item	Damage			Sector		Cost of reconstruction	Imported component
	Total	Direct	Indirect	Private	Public		
<b>Total</b>							
Public schools							
National University							
Private schools							
Sports centers							
Cultural heritage							
Houses of culture							
Town halls							
Houses in historic centers							

The housing and human settlements specialist will also have to ascertain the sector's effects on the main macroeconomic variables –the external sector, public finances, etc.– and provide it to the team's macroeconomic specialist. Likewise, he/she will have to work with the employment specialist to determine the impact on jobs for both the disaster and reconstruction phases. He/she must also work in close cooperation with the gender specialist in order to determine the differential impact on women, as well as the possible implications of these gender differentials for reconstruction plans and projects.

The following is a guide to the normal sequence of procedures the specialist should follow:

- Definition of the geographical area in which the sector was affected using the standard methodology described in the previous chapter;
- Assessment of the pre-disaster situation based on information provided from on-site sources;
- Identification of direct damage or effects;
- Quantification of direct damage or effects;
- Valuation of direct damage or effects;
- Identification of indirect losses;
- Quantification of indirect losses;
- Valuation of indirect losses;
- Development of a typology of affected housing according to size, prevailing construction materials and type of ownership;
- Determination of the geographic or spatial distribution of total damage and losses;
- Assessment of corresponding social effects;
- Assessment of macroeconomic effects;
- Assessment of the impact on employment;
- Assessment of the impact on women;
- Collection of available information on reconstruction strategies, plans and projects, as well as on their execution timetable and possible budgets;
- Identification of issues or areas within the sector that need priority support or attention during reconstruction; and
- Helping the relevant authorities formulate definitive reconstruction strategies, plans and projects.

### 3. Information requirements

Information on the situation prevailing in the housing and human settlements sector before the disaster in the affected area or country is essential for establishing the baseline for the assessment. Minimum information requirements include:

- Number of dwellings in the affected area, specifying for each whether they are rural or urban, single- or multi-family, owned by men or women, privately or publicly - owned;
- Quality of existing dwellings, broken down either by permanent versus temporary units, the type of construction materials used (reinforced concrete, brick, wood, adobe, cardboard, etc.), the degree of conservation (good, regular, poor, etc.) or the type of dwelling (house, mobile home, shack, etc.);
- Average dwelling size by type, taking into account the average number of inhabitants per unit and the average area in square meters.
- The main construction techniques and materials used in the affected area;
- Typical furniture and equipment in the affected area, by dwelling type; and
- Costs of construction, furnishings and equipment.

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Costs must be specified at current market prices with the later application of depreciation coefficients to estimate the current value of lost or damaged assets, as described in the section on direct costs. Costs must be obtained in the local currency of the affected country, and later converted into dollars based on a single official exchange rate for the date of the disaster, which the assessment team should determine in conjunction with the country's financial authorities.

### 4. Sources of information

Basic information on the housing and human settlements sector can be obtained from both national and international sources.

The following national sources should be consulted:

- Periodic censuses and surveys, including population and housing censuses, statistics bulletins and yearbooks, land registries, periodic housing-sector surveys, construction permits and licenses and consumer price lists;
- National statistics institutes or agencies, housing and urban development ministries or institutes, planning ministries or institutes, construction industry chambers, pertinent trade associations (colleges, associations or federations of engineers and architects), banks or agencies that help finance social housing and academic or research institutions related to the sector;
- Women-focused institutes or bodies that can provide up-to-date statistics;
- Related companies such as construction firms and the producers and sellers of building materials;
- Trade and industry associations;
- Classified advertisements in local newspapers;
- Property and real estate brokers; and
- Insurance companies.

The following international sources can be consulted:

- United Nations statistical yearbooks or compendiums, such as the Statistical Yearbook for Latin America and the Caribbean (ECLAC), the Compendium of Human Settlements Statistics (New York), the Construction Statistics Yearbook (New York) and the United Nations Development Programme's Human Development Report (UNDP) and
- International organizations such as the Latin American and Caribbean Demographic Center (CELADE), the headquarters and subregional headquarters of the Economic Commission for Latin America and the Caribbean (ECLAC), the Women in Development Unit of ECLAC, the United Nations Programme for Human Settlements (Habitat/Kenya), the United Nations Statistics Division (New York) and the Organization of American States (OAS/Washington).

## B. QUANTIFICATION OF DAMAGE AND LOSSES

### 1. Direct damage

#### a) General comments

As we noted in the previous chapter, direct damage refers to losses of assets and property. Essentially, it includes damage to, or the destruction of, housing, domestic furniture and equipment, and public buildings and urban infrastructure.

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Damage depends on both the type of disaster and the type of construction. Earthquakes normally damage structural elements (beams, joists, panels, load-bearing walls, etc.) and non-structural elements (partition walls, non-structural roofs, furniture, installations, equipment, etc.) because of the additional strains or loads to which such elements are subjected. Permanent deformations of the land such as settling or landslides can also do damage.




The intense winds of tropical storms and hurricanes exert extraordinary pressure on buildings; they can damage structural and non-structural elements even when foundations and other elements located below ground are not affected. Other phenomena –such as volcanic eruptions, mudslides, and floods– also put added stress on buildings and can destroy or damage their components, deform the land on which they are built or render it useless. Water or wind can bury the area in mud, ash or waste.

The most severe damage is generally structural in nature and may be so extensive as to require demolition. Non-structural damage may be more visible but also more susceptible to repair, possibly only requiring the replacement of certain elements that do not affect the building as a whole. Land failure might require either abandonment of a building or soil stabilization efforts.

## b) Classification of dwellings

In light of the relatively limited time available for assessment, the housing and human settlements specialist may not be able to obtain a detailed inventory of all affected or destroyed units. In lieu of a statistically representative sample, the specialist may have to settle for extrapolating from what inspections he/she is able to conduct.

The specialist should classify dwellings and public buildings into the three following categories:

	Completely destroyed buildings or those beyond repair;
	Partially destroyed buildings with a possibility of repair; and
	Unaffected buildings or those with only minor damage.

A similar categorization can be made of the destruction or damage to household furniture and equipment.

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By locating on a map all dwellings and buildings affected in accordance with the categories noted above, it is easy to visualize the areas hardest hit and thus requiring priority attention from authorities in producing more detailed studies and defining demolition and debris removal requirements.

In addition, the housing and human settlements specialist must use the following criteria to classify dwellings and buildings according to their pre-disaster state:

- Geographic location (urban or rural);
- Materials used in construction;
- Number of rooms per dwelling, and
- Ownership (individual or collective; leased or self-owned; public or private).

The information must be grouped by the following categories:

- Houses;
- Apartments;
- Precarious housing; and
- Other types of dwellings.

The housing and human settlements specialist will have to clearly describe each of these categories to facilitate reader comprehension of the assessment document.

Differences should be noted between permanent or durable and precarious construction materials. Such distinctions can be useful when teams in the field detect rural settlements built from local materials that are not employed in urban construction. Likewise, dwellings must be classed by number of rooms, thus allowing for a calculation of the average number of rooms for each type of housing unit.

Information on affected dwellings available after a disaster is normally broken down into simple categories such as destroyed or damaged and rural or urban, rather than the classifications used in the population and housing census. In such cases a comparison cannot be made between the census and disaster-impact information. The pre-disaster information obtainable through REDATAM will only be useful for defining the universe of dwellings prior to the event. Comparisons will show that a disaster does not affect all construction equally; rather, "precarious" dwellings tend to be the hardest hit, while the resistance of specific types of construction materials varies depending on the type of disaster. Field surveys along with comparisons of pre- and post-disaster housing data are needed for the specialist to carry out realistic estimates of damage by type and location of dwellings.

Once the typology of the affected housing has been determined –albeit roughly– their pre-disaster values must be estimated based on a uniform measure, such as square meter of construction or per housing unit. Significant national variations make it impossible to define in advance standard housing price ranges for all of Latin America and the Caribbean. These estimates must be made for each case based on local information from construction industry chambers, housing funds, NGOs involved in the sector, housing cooperatives, classified advertisements, etc.

In Central America, the United Nations Programme for Human Settlements employs an evaluation formula comparing one square meter of construction of affordable housing to the prevailing minimum wage. The cost of land and basic services must be added to this calculation. This formula allows for rough estimates, but it is limited by potential variations in the relationship between labor and construction-material costs.

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### c) Damage - prone dwelling and building components

It is possible to identify ahead of time the basic components of dwellings and buildings that are subject to disaster damage, thus expediting the later assessment process. These components and the types of damage they are prone to suffer are described below.

#### i) Buildings. Possible damage to structural and non-structural elements:

- **Structural elements:** beams, joists, panels, load-bearing walls, foundations, etc.  
**Potentially repairable damage:**  
Types of damage: fissures, deformities, and partial destruction.  
Actions: repair the element and possibly reinforce it.  
**Irreparable damage:**  
Types of damage: fissures, deformities, total destruction.  
Actions: replace the element, reinforce it or condemn and replace the building.
- **Non-structural elements:** partition walls, internal installations, windows, non-structural roofing, floors, etc.  
**Potentially repairable damage:**  
Types of damage: fissures and cracks, deformities, partial destruction.

Actions: repair the element and possibly reinforce it.

**Irreparable damage:**

Type of damage: cracks, deformities, total destruction.

Actions: replace the element, reinforce it or condemn and replace the building.

ii) **Furnishings.** For the purposes of the assessment, furnishings are understood as furniture proper (beds, tables, chairs, etc.), kitchen utensils, all clothing, domestic appliances and equipment (stoves, washing machines, radios, etc.) and other items such as decorations, books and games. When possible, it is useful to define typical furnishings (and their value) for each type of urban and rural dwelling that can be identified during the assessment.

Furnishings do not include the machinery or equipment of home-based micro, small, and medium-sized enterprises. Since such ventures are often run by women and are a source of supplemental income, related damages should be estimated separately, in cooperation with gender and industry specialists.

In cases of widespread destruction, time constraints may make it impossible for the housing and human settlements specialist to define with great precision the extent of damage to furnishings and the potential for repair at each site. Therefore, we suggest that the sectoral specialist use field inspections to define two or three basic ranges of damage (e.g., 100%, 50%, 25%) to furnishings in standard dwellings.

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iii) **Equipment.** In addition to the usual in-house installations such as sanitary and electrical devices, some buildings have air-conditioning or heaters, small electricity generators, potable and waste water pumps, incinerators or other devices for solid waste disposal, elevators, security equipment, recreation (swimming pools and gymnasiums) and irrigation equipment.

Some of this equipment is very uncommon in the region and mostly confined to limited applications in specific climate zones (for example, air-conditioning in tropical areas or heaters in cooler areas). Therefore, the housing and human settlements specialist may wish to adopt one of the following criteria:

- Define and describe "typical equipment" for all affected dwellings;
- Define and describe "typical equipment" for specific types of affected dwellings (this is the most frequently chosen alternative);
- Define for each segment (stand-alone units or apartments, urban or rural, etc.) an average value for furnishings as a percentage of the total value of each housing unit.

Similarly, a detailed inventory of damaged or destroyed equipment may be out of the question. In that case, the housing and human settlements specialist should define two or three damage categories (e.g., equipment needing total replacement, major repairs or only minor repairs) to a dwelling's typical equipment or to individual equipment units considered worth valuing.



iv) **Public buildings.** Government buildings and their furniture and equipment are affected by disasters in the same way as dwellings. While more limited in number than housing units, their complexity and cost is usually much greater; they therefore demand a more detailed application of the procedures described above.

Damage assessment for buildings of historical value should be dealt with separately. Detailed procedures for this purpose are given under the chapter on Education and Culture.

v) **Other direct damages.** It is necessary to record other damages demanding replacement or repair to their pre-disaster state. This includes household connections to public utilities such as water and sanitation services, electricity and –in some countries– gas lines.

The housing and human settlements specialist must also estimate damage to public areas including green zones and public parks or squares.

#### d) Quantification of damages

It is necessary to determine the replacement cost of restoring destroyed or damaged buildings to their pre-disaster state; in the case of precarious or informal dwellings, qualitative improvements must be introduced that expand unit replacement costs.

Definitive reconstruction costs, including any improvements for disaster prevention and mitigation, must be determined immediately thereafter.

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i) **Buildings, furniture and equipment.** One should begin by estimating replacement costs for instances of total destruction before calculating partial damage costs. Many years of experience have shown that the fastest approach is to determine the number of dwellings affected in each typological category and apply average per square meter construction costs to this figure.

A replacement value should be adopted for informal dwellings that is equal to the cost of the most basic units in any government housing programmes currently under execution.

Damage to partially affected dwellings is estimated by adopting coefficients related to their total replacement cost.

Damage to, or the destruction of, furnishings and equipment in buildings should be estimated based on special surveys to ascertain their average value for each category of affected dwellings.

Where damaged housing and other buildings are determined to have been located in hazardous areas, it is necessary to estimate the cost of the land and ancillary services and deeds needed to rebuild safe places. However, this additional cost should be considered as indirect damages.

ii) **Public buildings.** Since this heading will normally cover a small number of units compared to dwellings, damage to public buildings should be estimated building by building. As in the case of dwellings, replacement cost should be estimated based on the surface area of construction and the corresponding cost of construction per square meter.

In coordination with officials, a specific case-by-case estimate must be made of furnishings and equipment, which undoubtedly will be much greater than in the case of dwellings.

Detailed estimates are needed even when only repairs are called for. One alternative would be to assign a fraction or percentage of the replacement cost.

iii) **Cost of reconnecting public services.** An estimate should be made of the cost of replacing or repairing basic service connections (domestic water, sewer, power, telephone, etc.). The calculation should be based on the number of units totally destroyed or partially damaged. Unit replacement or repair costs will have to be applied later as officials make them available.

iv) **Public areas.** Damage to green areas and public squares or parks should be estimated based on their size in square meters and their unit repair or replacement cost. Estimates for public parks or squares should include the number and repair or replacement cost of benches, lampposts and lamps.

**70** Public areas may be classified according to the following categories:

- Parks with a regional or national relevance for the environment (including forest reserves);
- Large parks in an urban setting with relatively important infrastructure and support services and with relevance for the environment;
- Intermediate-sized parks within a local community (or communities), with only minor relevance for the natural environment; and
- Small parks located in small neighborhoods and with little or no relevance for the environment.

v) **The differential impact on women.** As we explain in greater detail in Volume Four, information must be obtained for ascertaining the differential impact on women in each sector.

With this in mind, the housing and human settlements specialist must uncover information on the percentage or number of homes where a woman is the head of household and/or owner of the dwelling or building. Those numbers are needed to determine the extent of women's losses in housing, equipment and furnishings. Losses to home production are taken into account as indirect damage, as described in Volume Four.

## 2. Indirect losses

### a) General comments

In addition to direct asset losses, it is necessary to estimate indirect losses under the following headings:

- The cost of reconstruction-related demolition and debris removal (cleaning costs are dealt with as part of the humanitarian assistance or emergency stage);
- The cost of reducing the vulnerability of housing and human settlements including works to stabilize soil, protect dwellings or reinforce structures;
- The cost of purchasing land to relocate dwellings away from vulnerable places and to install basic services; and
- Temporary housing costs for the period in which new units are under construction or damaged ones are under repair.

Temporary income losses suffered during the reconstruction period by home-based micro and small businesses are addressed in Section Four on productive sectors and as part of the evaluation of the differential impact of the disaster on women since most of those enterprises are owned and operated by women.

### b) Estimating indirect losses

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**i) Demolition and removal of debris.** To repair or rebuild a dwelling or building, it must often be partially or totally demolished and the resulting debris removed. These indirect costs may represent significant portions of total damage, depending on the type of disaster damage.

These costs are different from the considerably lower emergency-related costs incurred during the emergency stage, when certain components of buildings must be demolished or some debris removed in order to locate, rescue and assist victims.

Demolition costs are highly variable, depending on the type of materials used in the construction of damaged dwellings and their location. To facilitate estimates, specialists often use overall unit cost estimates by type of dwelling, multiplied by the number of units affected. The costs of removing debris are often estimated based on the volume to be removed, the unit cost of removing and disposing of debris and the number of each type of affected dwelling units.

**ii) Housing and human settlement vulnerability reduction.** After a major disaster occurs, a decision may be taken to protect dwellings and other buildings against the possible occurrence of similar phenomena in the future. The cost of land stabilization, flood protection and structural reinforcement should be estimated under indirect damages. Given the wide range of possible endeavors, it is not possible to adopt a single estimate procedure. However, we recommend determining the main work required for each type of dwelling and estimating a unit cost per dwelling. Alternatively, one may estimate the costs for a group of housing units included within one single vulnerability reduction project.

iii) **Relocation of dwellings.** Estimates must be made of all costs for temporarily or definitively relocating human settlements to less vulnerable areas if such relocation is likely. This calculation should not include the cost of evacuation incurred during the emergency stage.

The costs that must be included under this heading include the following:

- The value of the land where new dwellings are to be located;
- The cost for the provision of water, sanitation, power, telecommunications and related basic services;
- The cost of title deeds; and
- The cost of transporting furniture and equipment to their new location.

All these costs can be obtained per square meter of construction or as an overall total per housing unit, and then multiplied by the number of dwellings to be relocated.

iv) **Temporary housing.** The cost of temporary dwellings that must be provided while definitive housing solutions are being prepared is an indirect cost that must also be estimated. The number of temporary solutions must coincide with the number of families who have lost their homes, and not necessarily with the number of dwellings destroyed (which may have housed more than one family per unit), as temporary solutions generally do not allow more than one family to be housed per unit.

72 These alternatives may consist of temporary shelters in buildings normally used for other purposes or ad hoc constructions. When existing facilities such as schools, churches or sports venues are pressed into use, one must estimate the cost of repairing any resulting damage once the facility has been returned to normal use, as well as the cost of not carrying out the activities for which the buildings are normally intended. This cost must be registered under the corresponding sector (such as schools under education) rather than under housing and human settlements.

When temporary camps or shelters are built, it will be necessary to estimate the cost of construction and related services, such as the provision of water, latrines and electric power. These costs are normally estimated on the basis of the number of square meters and the unit cost of construction of each temporary housing solution, combined with the number of dwellings or homes involved. Temporary solutions in this case do not refer to shelters used to provide humanitarian assistance during the emergency stage, but to ones of a longer duration such as when the decision is taken to postpone reconstruction until after the rainy season ends. In the case of ad hoc housing, the unit value will depend on its technical characteristics.

While officials in the disaster area may have to choose among a wide range of alternatives, we generally recommend using construction materials that can later be used to build or rebuild permanent housing.

### 3. Sources of information on direct and indirect damage and losses

The basic information required to estimate direct damages and indirect losses must be obtained from reports produced by national and local authorities and other non-governmental organizations that normally operate in the areas affected by the disaster and that participated in the emergency and humanitarian assistance stage. It must be complemented with information obtained by the housing and human settlements specialist during his/her field visit. Media reports can also be useful to the specialist, when duly weighed against field observations.

Information on unit prices can normally be obtained from various sources, such as bulletins issued by the construction sector, documentation of recent bidding on housing projects, material and equipment suppliers' price lists, indexes of changes in prices and wages in commercial, industrial and construction associations, and the printed media. Interviews with construction companies and associations of engineers and architects in the area may prove very useful.

### 4. Macroeconomic effects

Direct damage and indirect losses in the housing and human settlements sector have an impact on the living conditions of the population and on economic performance. These effects include the following:

- The loss of the contribution to the national economy of income generated directly or indirectly by housing leases (actually paid in or implied) with the corresponding effect on gross domestic product (GDP);
- An increase in construction sector activity;
- Effects on the external sector;
- Effects on the public sector;
- Effects on prices and inflation; and
- Effects on employment and income.

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Each of the aforementioned macroeconomic effects is described in the following sections.

**i) Loss of the contribution of housing leases to the economy.** Gross domestic product takes into account rents and leases in a country's entire housing sector. This is estimated by multiplying the number of existing dwellings by the lease paid plus the implied lease on dwellings inhabited by their owners. When a disaster causes the destruction of, or significant damage to, the national housing stock, there is a corresponding effect on GDP.

The housing and human settlements sector specialist must cooperate with the macroeconomics specialist to carry out the corresponding estimates for this heading. The loss will be estimated by multiplying the number of dwellings totally destroyed by the average value of their actual or implied leases.

ii) **Increase in construction activity.** After a disaster occurs, activities in the construction sector are stepped up as rehabilitation and reconstruction programmes begin. In the case of major disasters, this may contribute to reactivating the economy or offsetting the fall in growth of other productive activities that might have been negatively affected by the same disaster.

The housing and human settlements specialist and the macroeconomist must jointly analyze the impact of housing sector rehabilitation on the construction sector. This must be based on a realistic analysis of reconstruction programmes and projects, available financing and the construction industry's execution capacity. The housing and human settlements specialist must obtain the rehabilitation and reconstruction plans for the sector from the relevant authorities, revise them and adjust them in accordance with an objective vision of actual domestic execution capacities; then he/she must prepare a realistic execution timetable. This schedule should be shared with the macroeconomics specialist for his/her GDP estimates.

iii) **Effects on the external sector.** Whenever a major disaster occurs, damage to the housing and human settlements sector can have negative repercussions or effects on the external sector of the affected country or region, as the need for additional materials, equipment and machinery will require that they be imported or diverted from the country's normal export flows.

74 If there is no local production of reconstruction materials, equipment and machinery, they will have to be imported from abroad, thus pressuring the country's balance of payments. The housing and human settlements specialist will have to determine, in close cooperation with local authorities, which components of buildings and equipment are not produced by the domestic industry so as to estimate the "imported component" of direct damages. This estimate will be used by the macroeconomics specialist for his/her external sector forecasts.

When the country is an exporter of these types of components, the execution of the reconstruction programme may greatly diminish or eliminate such shipments abroad, thus pressuring external accounts in the form of diminished export revenues.

Housing and other buildings are often insured against different risks, and local insurance companies have reinsurance with foreign companies. Should this be the case, when reinsurance payments are made, they generate a net foreign currency inflow that must be taken into consideration. The housing and human settlements specialist must determine the possible amount of such reinsurance flows and transmits the information to the macroeconomics specialist so that this information may be included in the foreign sector analysis

iv) **Effects on the public sector.** Public finances may be significantly pressured when central or local governments undertake demolition, debris removal and reconstruction work in the housing and human settlements sector.

The most significant expenses in rehabilitation and reconstruction tasks for the sector can be projected based on the estimated cost of the respective projects. An estimate can be made of the shortfall in tax receipts expected as the destruction of housing and other buildings pares tax collection. This can be estimated based on implied rent that will not be received.

The housing and human settlements specialist once again must cooperate closely with the macroeconomics specialist to carry out these estimates.

v) **Effects on prices and inflation.** During the visit to the affected country or region, the housing and human settlements specialist will not normally have enough time to estimate the effect of the disaster on prices of reconstruction inputs. However, speculation and a possible shortage of construction materials and equipment may result in price increases. The specialist must at least obtain qualitative information on the behavior of the supply and prices of these inputs by comparing current prices during his/her visit with those prevailing before the disaster, and on this basis provide a learned opinion as to their possible future evolution.

As in other cases, close cooperation between the housing and human settlements specialist and the macroeconomist will be essential.

vi) **Effects on employment and income.** A disaster may affect the employment and income of the people that work in the sector. Indeed, there can be temporary paralysis of normal construction work during the humanitarian assistance stage, including the indefinite suspension of development projects in the sector. Later, as reconstruction gets underway, construction sector employment is likely to expand and wages may rise in the event of a shortage of labor.

The paralysis that may accompany the emergency phase is generally very short lived, so the field visit may determine its effect to be insignificant. Experience suggests that it is very rare for development projects in this sector to be entirely abandoned in the face of reconstruction work; in fact, reconstruction and development projects are frequently combined. Therefore, the task of determining the impact on employment is normally limited to estimating the number of new jobs that will be required during reconstruction.

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This increase in employment can be estimated based on the annual amount of investment in reconstruction, using factors that relate annual investment to the number of jobs. In this regard, the housing and human settlements specialist must cooperate with national or local authorities to determine these relationships for the special case under consideration, after a reconstruction timetable has been defined.

## 5. The reconstruction programme

The housing and human settlements sector specialist is often also involved in drafting or recommending changes to reconstruction strategies, plans and programmes, including prevention and mitigation measures.

She or he must identify and describe the characteristics and conditions of housing and its environs that might have determined the form and scale of the damage they sustained. This will make it possible to make general recommendations for reconstruction work.

This will require the description of the most common types of construction of the houses in the affected area and their disaster-related structural or non-structural failure. Equally essential are descriptions of the most commonly used construction materials in the affected area, their quality and behavior during the disaster and their suitability for the most common building typologies. In addition, the location of the houses and the physical characteristics of the environment -such as soil type, geology, topography, etc.- that might have had an influence on the degree of resistance of housing to the natural phenomenon will also have to be described. Such details will make it possible to prepare recommendations on the following relevant aspects of the reconstruction process:

- Technical characteristics of the repair and reconstruction of houses, processes to be applied and the types of locally available or imported materials to be used;
- The location or relocation of houses in accordance with the environment's characteristics, including reference to the need for upgrades when it is not possible to relocate houses away from vulnerable areas;
- Economic and supply issues for reconstruction inputs; and
- Administrative and institutional matters for the execution of reconstruction works such as community participation, available technical support, personnel training, inter-institutional coordination and the like.

**76** It will also be necessary to identify and briefly describe those technical cooperation projects –international or national– that might be required to fully develop the items described above in order to support reconstruction.

Any available information on rehabilitation and reconstruction project lists must then be collected, clearly indicating the amounts of required investments and possible sources of financing (international or through internal resources, public or private).

The housing and human settlements specialist must develop a timetable of reconstruction works and their corresponding financial requirements to be able to prepare one or more hypotheses on the amounts and periods in which reconstruction can be carried out, estimating the possible effects on public finances and the institutional capacity to carry them out. To do this, the following aspects must be taken into account:

- The availability of financial resources for reconstruction and the time periods required for their negotiation, allocation and disbursement;
- The institutional and organizational capacity of institutions that will be responsible for leading and executing reconstruction, taking into account the role the public and private sectors and civil society will play therein;
- The capacity of the construction sector to face the challenge of reconstruction, taking into account the scale of disaster damage –to housing and other affected sectors– as well as the volume and value of the sector's output (during the five preceding years, for example), while bearing in mind that reconstruction will generally demand an additional effort on top of normal construction activities;
- The supply of inputs for reconstruction –in terms of human resources, materials and equipment– including any imports that might be required;



- The time periods required for the design, planning and organization activities for reconstruction; and
- Aspects related to climatic conditions and to the return to normalcy after the disaster. For example, the onset and duration of the rainy season or the time required for floodwaters to recede might prevent or hinder reconstruction work.

The housing and human settlements specialist will have to obtain all information possible on the above-mentioned items from public and private - sector organizations, and add his/her own observations derived from the field visits undertaken during the assessment mission. This will make it possible to prepare a timetable of the number of dwellings and the amount of investments that will be possible in each succeeding year; this schedule can be used for analyzing both reconstruction and its macroeconomic impact.

### III. EDUCATION AND CULTURE

#### A. INTRODUCTION

##### 1. General comments

This chapter describes how to assess disaster damage and losses to the education and culture sector's infrastructure, equipment and general functioning. The infrastructure considered here includes all premises used for school or adult education (classrooms, laboratories, workshops, etc.) and their auxiliary installations, such as sanitary services, general services and administration, storerooms, sports areas and installations and libraries. Culture includes all buildings considered to form part of cultural and historical heritage, including assets formally declared to be part of heritage, museums, archaeological sites, archives, libraries, churches, houses located within historic centers and houses of culture. We do not include under this heading buildings that form an integral part of other productive or social sectors, such as libraries and training classrooms located in hospitals or in manufacturing industry.

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In Latin America and the Caribbean, both public and private sectors attend to these sectors, with the relative weight of one and the other varying from one country to another. In many rural or low-income urban areas, schools also discharge other functions by serving as centers for community and cultural activities. In other cases, the relationship is inverted, and churches, community centers and so forth are used for educational activities.

Schools are often used to temporarily house disaster victims, which can cause both a temporary interruption of the school cycle and damage from the use of the installations in overcrowded conditions.

Undoubtedly, the reconstruction of the education and culture sectors after a disaster will not be so significant when compared to –for example– the housing or transportation sectors. Nevertheless, delays in restoring normal operations in the education and culture sector after a disaster can have very important repercussions and even psychological effects on affected families.

2. Assessment procedure

The procedure to be followed to assess damage to education and culture is very similar to the one just described for the housing and human settlements sector. Indeed, the specialist in education and culture must work closely with the housing and human settlements specialist to ensure there is no duplication of estimates, especially in regard to houses and buildings of historic value.

The education and culture specialist must produce a summarized table of the damage and losses sustained in his/her area. The table should indicate the amount of direct and indirect effects, break them down by type of property (private and public) and educational level (primary, secondary and university) and show their spatial distribution within the geopolitical unit previously agreed on with other members of the assessment team. The following table shows the type of result the sector specialist must produce at the end of the assessment.

Table 2  
DAMAGES ON EDUCATION AND CULTURE  
(Millions of dollars)

Item	Damage			Sector		Cost of reconstruction	Imported component
	Total	Direct	Indirect	Private	Public		
<b>Total</b>							
Public schools							
National University							
Private schools							
Sports centers							
Cultural heritage							
Houses of culture							
Town halls							
Houses in historic centers							

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Likewise, the specialist in education and culture must estimate the effects of his/her area on the main macroeconomic variables -the external sector, public finances, etc.- to assist the macroeconomics specialist. He/she will also have to interact with the employment specialist to jointly determine the impact of the disaster on education and culture. Likewise, he/she will have to work in close cooperation with the gender specialist to estimate the differential impact of the disaster in the sector on women, including -among other factors- the increase in women’s reproductive work when school activities are suspended.

A usual procedure to carry out the required work would include and follow the sequence of actions described below:

- Definition of the affected area for the sector, based on the standard procedure described in the first chapter in this section of the Handbook;
- Determination of the spatial distribution of total damage and losses;
- Assessment of the conditions prevailing before the disaster occurred;
- Identification of direct effects;
- Quantification of direct damage;

- Valuation of direct damage;
- Identification of indirect losses;
- Estimation of indirect losses;
- Valuation of indirect losses;
- Determination of the geographic or spatial distribution of total damage and losses;
- Assessment of macroeconomic effects;
- Assessment of the impact on employment;
- Assessment of the differential impact on women;
- Collection of information that the sector's authorities might already have available on reconstruction strategy, plans and projects as well as their execution timetable and possible budgets;
- Identification of items or areas within the sector that might need priority support or attention during reconstruction and their possible financial requirements; and
- Support in the formulation of the final reconstruction strategy, plans and projects, as an input for the affected government.

### 3. Information requirements

The specialist in education and culture must gather information that will enable him/her to develop a baseline for the sector in order to assess the impact of the disaster. The information listed below is the minimum that should be obtained.

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Educational premises:

- Number of educational premises existing in the affected area, classified into urban and rural, publicly and privately owned and educational level (primary, secondary or middle, technical and vocational, university).
- Number of classrooms and students –total or, for example, per morning, afternoon and evening shift– for each educational premise;
- Quality of the building of the premises, based on –for example– the type of construction materials used (adobe, wood, brick, concrete, etc.), the average age of the construction and its degree of maintenance;
- Furnishings and equipment typical of educational centers in accordance with previously defined categories; and
- Unit building, furniture and equipment costs.

Cultural heritage buildings:

- Number and characteristics of public historic heritage assets –in other words, historic assets declared to be State property– broken down into the categories of world heritage, heritage buildings, museums, archaeological sites, movable goods, archives or documentary collections;
- Number and characteristics of private historical heritage assets –whether individually or institutionally owned– broken down into heritage churches, houses located in historic centers, libraries and collections located in foundations, libraries and churches;

- Non-heritage public cultural infrastructure –in other words, non-historical assets that are State owned and under official cultural programmes– broken down into cultural spaces, libraries, recreational parks, cultural centers in indigenous communities and artisans communities;
- Quality of construction of the above premises, based on –for example– the type of construction materials used (adobe, wood, brick, concrete, etc.), the age of the construction and its degree of maintenance;
- Furnishings and equipment typical of heritage centers in accordance with previously defined categories; and
- Unit costs of building, furniture and equipment.

As in the case of housing and human settlements, construction, furniture and equipment unit costs must be determined at current market prices with the later application of depreciation coefficients to estimate the current value of the lost or damaged assets, as described in the section on direct costs in Section One of this Handbook. Costs must be obtained in the local currency of the affected country, and later converted into dollars based on an official exchange rate defined in cooperation with the country's financial authorities, for the time of the disaster.

#### 4. Sources of information

As in other cases, local, national and international information sources in the education and culture sector must be used.

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The normal local and national sources include:

- Ministries of education and culture;
- Public - sector institutions entrusted with building and maintaining educational and cultural premises;
- Public institutions that are entrusted with coordination of university and adult education;
- Religious bodies and private foundations that manage and operate educational and cultural centers;
- Insurance companies, especially for the case of museums, libraries and archives; and
- Censuses of the educational and cultural sector.

The main international sources for the sector are the United Nations Education, Science and Culture Organization (UNESCO) and the Organization of American States (OAS). Both maintain records and issue periodic publications on the development of the education and cultural heritage of the Latin America and Caribbean countries. The Economic Commission for Latin America and the Caribbean (ECLAC) also publishes information on the sector, most notably in its Social Panorama.

## B. QUANTIFICATION OF DAMAGE AND LOSSES

### 1. Direct damage

#### a) General comments

As mentioned in Section One of this Handbook, direct damage refers exclusively to losses of capital or assets. In the education and culture sector, direct damage refers to the destruction of, or damage to, buildings, furniture and equipment, and materials, works or volumes of a cultural nature stored in heritage buildings that may have been affected by a disaster.

Because of the similarity to the housing and human settlements sectors, there is no need to repeat the methodology for damage assessment. The specialist in education and culture should refer to the corresponding chapter to obtain detailed information.

#### b) Classification of buildings

Unlike in the housing sector, a classification or typology of education and culture sector buildings is not a simple task. An exception might be public school-based education centers, especially those built in recent years under development programmes for the sector. Other educational establishments, especially cultural establishments, always have non-standard construction designs and qualities. Educational establishments are often converted residences or buildings originally intended for other uses that have been adapted as teaching premises. Heritage buildings in turn, are not only highly diverse, but in many cases were built many years ago, even as far back as the Colonial era.

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i) **Teaching premises.** Some typologies of school premises should be established in order to facilitate the education and culture specialist's work, on the basis of -for example- educational level, type of construction materials used, state of preservation or the age of the building. This implies that teaching premises of the same educational level have similar spaces as regards areas for teaching, other purposes and recreation. The type of materials used in the construction will enable an estimation of the buildings' unit costs of construction, whereas the degree of preservation and age of the building will assist in determining their depreciated value and in differentiating between damage caused by the disaster itself and damage sustained due to the lack of proper maintenance.

The space standards below are not always strictly enforced, depending on the educational level and location (urban or rural) of the educational establishment. As regards spaces and equipment used for adult and university education, the range is so broad that it is impossible to present average values that would have widespread application. Therefore, the education and culture specialist will have to carry out assessments on a case-by-case basis and define typologies on each occasion, based on his/her observations in the field. Notwithstanding, the standards presented here might provide a basis for the specialist's work in the field.

#### RANGE OF SPACE STANDARDS FOR SCHOOL PREMISES

Standards governing the construction and operation of school premises throughout the region of Latin America and the Caribbean vary widely. However, their ranges based on the type or use of educational premises can be given, as follows (figures indicate square meters per student):

##### Classrooms for primary and secondary education

Total surface area of construction	6.0 (Argentina) to 1.2 (Paraguay)
Surface area of individual classrooms	1.5 (Uruguay and Peru) to 0.9 (Guyana and Haiti)

##### Other school installations

Administrative buildings	0.85 (Argentina) to 0.05 (Bolivia)
Laboratories	3.80 (Ecuador) to 1.20 (Dominican Republic)
Technical and manual workshops	5.00 (Ecuador) to 1.20 (Uruguay)
Art workshops	6.00 (Paraguay) to 1.50 (Uruguay and Peru)
Industrial workshops	9.00 (Guyana) to 4.50 (Guatemala)
Libraries	4.32 (Brazil) to 0.15 (Bolivia)
Music rooms	2.70 (Paraguay) to 1.20 (Argentina).

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ii) **Cultural heritage buildings.** In this case, infrastructure and equipment follow no standards because the buildings vary widely in origin and construction. However, these buildings could be classified along the following typologies:

Public historic heritage buildings, including historic assets declared as such that are the property of the state:

- World heritage, world cultural assets registered in UNESCO's list of World Cultural and Natural Heritage;
- Heritage buildings or declared historic buildings, with their equipment and collections;
- Museums;
- Archaeological sites;
- Moveable goods, such as state-owned collections of historic value that might be located in buildings other than museums; and
- Archives and collections of documents.

Private historic heritage buildings, whether owned individually or by foundations:

- Churches registered as historical heritage through legislative decrees or executive orders;
- Dwellings located in historic centers, including buildings of historical value (used as dwellings or as dwellings and businesses) located within sections deemed historical heritage; and
- Libraries and collections, including private moveable goods located in foundations, libraries, churches, etc.

Non-heritage public cultural infrastructure, referring to State-owned non-historical goods operated under official cultural programmes:

- Cultural spaces, including houses of culture, public libraries and non-heritage theatres;
- Libraries and their equipment;
- Recreational parks, including zoos;
- Cultural centers in indigenous communities; and
- Artisan and crafts communities.

iii) **Sports facilities.** This is another instance in which there are no patterns, as each facility is unique in its characteristics, design and construction materials. Assets that may be damaged include gymnasiums, stadiums and other, smaller facilities.

#### c) Components of buildings that are prone to damage

Although the education and culture sector shares many similarities with the housing and human settlements sector, it has special characteristics that should be noted. In any case, the education and culture specialist should refer to the corresponding housing sector chapter in order to complement the assessment of damage to or destruction of his/her sector.

i) **Buildings, furnishings and equipment.** In the education and culture sector, "furnishings" is meant to include all instruments, utensils and equipment used in education and culture functions (for example laboratory and manual workshop equipment, sports gear, etc.), or that may be necessary to process or use works contained in the buildings (such as microfilm readers, computers, projectors, etc.) that are normally individually itemized in inventories.

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On the contrary, "equipment" refers to installations that are part of the building itself, such as elevators, security equipment, air conditioning, internal communication systems, and so forth.

ii) **Stocks, works and collections.** Buildings used for education normally have stocks of school materials (paper, books, chemicals, etc.) required for the undertaking of their respective activities. Their whose value can be sufficiently high to warrant individual assessment.

Inventories of works and collections deposited in a given institution must also be included under this heading. This must include books in libraries, religious and art works, samples or pieces in museum collections, the documentation in archives, and so forth.

Educational materials may be easily replaced; ascertaining their value is a straightforward matter. Works of a cultural, historic and religious nature found in libraries, museums, archives and churches must be identified almost individually. The latter can be difficult (or impossible) to repair or replace when they are unique or irreplaceable works. It is difficult to carry out valuations of objects whose value is subjective or that are not openly exchanged in the marketplace, as in the case of works of art or those that have a historical value.

#### d) Quantification of damage

Once again, reference must be made to the indications included in the housing and human settlements sector to quantify damage in the education and culture sector, because the valuation and quantification criteria contained therein are also applicable in this case. It is directly applicable to both educational - establishments and non-heritage cultural infrastructure. However, the cultural heritage subsector is a special case, and its particular headings are described below.

i) **Heritage buildings.** These will have to be treated individually because they are highly heterogeneous, and their direct repair or replacement cost will be estimated on an individual basis. When only repairs are needed, specialists in the field will have to be consulted to estimate restoration costs.

Valuating completely destroyed historical centers requires average bids made just prior to the disaster to purchase the dwellings and buildings, bearing in mind that there are land-use controls and that therefore no speculation would be involved. It is assumed that the bid price represents the cultural value and condition of the buildings within said historical centers.

Furnishings and equipment costs must be estimated following the same criteria as for the housing and human settlements sector, duly adapted for application to each cultural building.

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ii) **Movable goods, archives and other items.** The recovery costs of works of art, collections and objects of a historical value must be estimated in consultation with a specialist in the field, taking into consideration the type of good (paintings, sculptures, decorative objects, religious images, etc.), its origin and antiquity, and the degree of damage sustained. In the case of archives, a recovery alternative would be to estimate the cost of microfilming to at least keep the information available for public use.

Experts will have to be consulted in order to estimate the value of totally destroyed goods. Insurance companies can often provide the required information, since these goods are often insured.

## 2. Indirect damage

### a) General comments

Direct damage to assets of the education and culture sector cause indirect losses in the future, while the affected goods are being repaired or replaced. These losses include the following items:

- The costs of repair or rehabilitation of educational and sports premises that were used temporarily to house refugees;
- The costs of demolition and debris removal, after the emergency stage and before reconstruction;
- The costs of temporarily leasing premises to provide educational or cultural services that might be incurred during repair and reconstruction of infrastructure;



- The costs of reducing vulnerability in the sector's buildings;
- The costs of buying land and installing basic services to relocate buildings in less vulnerable or invulnerable areas;
- Income that will not be received as student fees while school premises are under repair or reconstruction;
- Income that will not be received from heritage establishments and from sports facilities during the repair or reconstruction period; and
- The increase in women's reproductive work because of the suspension of school activities. This figure should be included in the estimate of the differential impact of the disaster on women.

#### b) Estimation of indirect effects

**i) Damage due to the temporary use of educational, sports and cultural premises as shelters.** Schools, stadiums and churches are often used to temporarily house refugees during disasters. This leads to damage to their infrastructure, which is not designed for continuous use by a large number of people. Therefore, the cost to repair these installations must be estimated as indirect damage. Repairs are often needed to sanitary services, walls must be repainted and furniture and other similar items must be repaired.

**ii) Demolition and removal of debris.** To repair or rebuild any kind of building, its damaged or destroyed parts must be demolished, and the debris removed and disposed of. Depending on the type of construction involved, these costs may amount to significant proportions of the total cost of the building.

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These demolition and debris removal costs are different from costs incurred during the emergency stage to locate and rescue people trapped inside buildings. The latter are to be included under emergency stage expenditures.

In light of the variety of materials used and the diverse location of buildings in the education and culture sector, their demolition and debris removal costs are highly varied. Therefore, they are often estimated based on the volume of material to be removed and the unit cost of removal and transportation for each establishment in the sector. Another way of proceeding is to adopt a percentage of the total replacement cost of the affected good, which –as experience shows– may range from 10 to 25%.

**iii) Temporary leases.** Given the need to continue ensuring the provision of services –in educational, cultural, sporting and religious buildings that have been damaged or destroyed– it is usual to lease other premises while the original building is being repaired or rebuilt. Such costs must be estimated based on prevailing rents in the market at the time after the disaster and projected throughout the estimated repair or reconstruction period.

The cost of transporting all furniture and equipment required to provide the educational and cultural services to and from the leased premises must also be included under this heading.

iv) **Vulnerability reduction.** Costs to reinforce buildings in order to prevent further damage by similar future events must be taken into account under this heading. These may include reinforcement of structures, stabilization of soil that has been affected by mudslides or land settling and flood protection works. Likewise, protection systems might have to be established for moveable goods and objects of cultural value that may be located within the buildings, in addition to the establishment of early warning and evacuation systems in schools.

v) **Relocation of buildings.** Costs to relocate buildings exposed to the action of extreme natural phenomena into safer places must be estimated, provided there exists reasonable evidence that relocation will actually be undertaken.

The following costs should be included:

- The value of the land where the new building will be located;
- The cost of providing water, sanitation, power, telecommunications and other services when not available on the plot chosen; and
- The cost of transporting furnishings and cultural goods to the new location.

vi) **Loss of income.** Especially in the culture sector, but in education and sports as well, there will be losses of future income throughout the repair and reconstruction period resulting from damage to, or destruction of, infrastructure and goods. Likewise, commercial and tourism activities often cease due to damage to or the loss of heritage property, resulting in a reduction in or loss of income for the affected establishment or community.

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The education and culture specialist must estimate the income that will not be received, based on what used to be received before the disaster and the estimated rehabilitation or reconstruction period. In addition, the education and culture specialist must cooperate with the productive sector specialists to estimate –and not duplicate– reductions in commercial and tourism income (local or regional fairs, etc.) that may occur in the future due to the damage to or lack of cultural buildings and property.

vii) **The differential impact on women.** When educational establishments are temporarily used as shelters for refugees, classes are normally suspended and women must face an increased amount of reproductive work to look after children of school age at home. Although this item is not considered in national accounts –as mentioned in the appropriate chapter on the differential impact of disasters on women– the education and culture specialist must cooperate with the gender-related specialist to estimate this increase in women’s reproductive work, providing the estimated duration of the period for which the school year will be suspended.

In addition, the education and culture specialist must estimate, in cooperation with the gender and employment specialists, the temporary loss of employment and income for women in this sector, since it usually employs a relatively high proportion of women.

### 3. Macroeconomic effects

#### a) General comments

Damage to or the destruction of buildings in the education and culture sector caused by disasters will produce effects on macroeconomic performance and living conditions in the affected country or region. These effects will occur along a period of variable duration after the disaster.

A list of these macroeconomic effects is shown below:

- The loss of the sector's contribution to the development growth rate of the national or local economy;
- Effects on employment;
- Effects on the external sector;
- Effects on public finances; and
- Effects on prices and inflation.

#### b) Estimations of macroeconomic effects

The education and culture specialist must cooperate with the macroeconomics specialist to estimate the macroeconomic effects arising from the sector.

i) **Loss of contribution to development growth rate.** Institutions in the education and culture sector generate income that is calculated within the personal services sector in the national accounts system.

To estimate this loss, it is first necessary to estimate the "production" of such institutions while differentiating between private for-profit, private non-profit, and public - sector institutions. The production of for-profit entities can be estimated by using the same criteria applied to industrial sector companies, while that of non-profit entities can be carried out indirectly, by measuring loss as a function of inputs. The quantities or volumes of imports –both intermediary and primary– will have to be estimated and multiplied by their estimated average unit price and by the period of time the cessation of services is estimated to last.

The impact of private education losses on the GDP growth rate may be estimated by combining the non - received average fees and the time period over which classes were suspended, as indicated under the heading of indirect effects. The result must be adjusted by the ratio of value added over total value for the sector –which usually ranges from 50 to 75 per cent– in the national accounts for the affected country. As an alternative, use could be made of the ratio of value added to gross income, derived from school accounting.

The macroeconomic impact of losses in public education is usually non - existent or extremely low, as its contribution to GDP is measured through wages and salaries earned by teachers and other sector employees of the sector, who generally continue to work and be paid during disaster situations, even if at alternative locations.

In any case, care must be taken not to calculate temporary interruptions of service in normal working timetables when these are to be made up whether by extending the school year or implementing double shifts on the same premises – unless such measures imply greater disbursements for the year.

ii) **Effects on employment.** A disaster may lead to changes in the sector's employment rate by rendering personnel who work in the affected institutions unemployed for relatively long periods. However, in many public - sector cases, as previously indicated, personnel collect their wages continuously throughout the whole year, something the education and culture specialist must take into account when making his/her estimates. In any case, the number of employment positions lost temporarily is to be estimated, and the sector specialist must cooperate closely with the employment specialist.

iii) **Effects on the external sector.** The repair or reconstruction of education, sports and culture sector facilities can have an effect on the affected country's imports and exports. This could be due to the situations described below.

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- When construction materials, machinery and equipment are not produced domestically, they will have to be imported from abroad, with the subsequent effect on the balance of payments. Estimation of this item must be carried out in the same fashion as described in the housing and human settlements sector; that is, estimating the proportion of imported elements and costs in reconstruction.
- The affected country might export materials, machinery and equipment whose production might be redirected to reconstruction, thereby resulting in a shortfall in exports and a subsequent effect on the balance of payments. To estimate this item, the education and culture specialist must cooperate with the housing and human settlements specialist and jointly analyze the installed capacity of the construction sector.
- As a result of insurance for damage to or destruction of buildings and goods in the sector, that portion of the insured amount that is reinsured by companies abroad must be taken into account as an increase in foreign currency income and introduced in the balance of payments. This is especially important in the case of works of a high historic and cultural value. To estimate this item, the specialist must consult with local insurance companies.
- Financing for reconstruction programmes and projects normally involves foreign-currency income throughout the reconstruction period. The duration of said period and a tentative scheduling of reconstruction and its external financing must be defined with local authorities, and the effects on the balance of payments, estimated on that basis. The education and culture specialist must cooperate closely with the macroeconomics specialist in these estimates.

iv) **Effects on the public sector.** The destruction of, or damage to, the sector's facilities and their repair or reconstruction can significantly affect public finances, especially under the following two items.

- Lower revenue due to the reduction in tax collection or transfers in the sector's damaged or destroyed buildings, which can be estimated based on the reduction in the income of each private institution affected and its income-tax rate;
- Greater public sector spending and investment needed for rehabilitation and reconstruction, which are estimated based on project execution and financing schedules, as indicated in the heading on effects, above.

v) **Effects on prices and inflation.** If there is significant damage and destruction in the sector and shortages arise in materials, machinery and equipment for reconstruction, the prices of such inputs might rise. This is true for all sectors of the national economy.

The specialist in education and culture must cooperate closely with the housing and settlements and macroeconomics specialists to deal with this issue, and must at least provide inputs –even if only quantitative– so that the latter can carry out a complete analysis of the situation.

## APPENDIX V EXAMPLE OF CALCULATING DAMAGE TO THE EDUCATION AND CULTURE SECTOR

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The information available on the earthquakes that affected El Salvador in January and February 2001 is used to illustrate how to calculate the damage and effects caused by a disaster in the case of the education and culture sector.

### 1. Direct damage

Direct damage to the education and culture sector was estimated based on the field observations of mission specialists and prior surveys by the sector's local authorities.

#### a) Education

It was determined that the first earthquake damaged or destroyed a total of 1 367 educational centers, including various National University buildings, in addition to 34 private - sector premises. With the second earthquake, 219 buildings that had already been affected by the previous event were further damaged or destroyed, and an additional 150 public sector and 27 private - sector educational premises were affected, raising the total figure for educational premises affected to 1 516.

The average unit price for the repair or construction of each kind of building was determined, differentiating between buildings in the urban and rural sectors, and between educational level; that is, primary, secondary, technical and vocational, and university. These figures, taken together with the average surface areas of construction for each type of building, allowed total direct damage to education to be estimated at 63.9 million dollars.

In the case of sports facilities, it was determined that there was minor damage to the infrastructure of three public - sector stadiums administered by the National Sports Institute, as well as to some privately - owned stadiums. An estimate was made of the cost of repairing these structures, with the total amounting to 1.2 million dollars.

#### b) Culture

The earthquakes negatively affected the country's cultural heritage. There was damage to numerous public historic heritage installations: cultural goods, 22 heritage buildings, two museums, an archaeological site, furnishings and archives. Damage was also recorded in the case of private historic heritage (more than 100 churches, 5,120 dwellings located in historic centers, libraries and the collections of two foundations), in addition to cultural locations such as 145 urban culture centers, three libraries, various theatres, three recreational parks, 39 cultural centers in indigenous communities and 40 craft communities.

90 A detailed and individualized estimate of each heritage center had to be carried out in cooperation with government authorities to determine the cost of repair or reconstruction. For public historic heritage sites, an estimate was made of the costs of restoration and replacement of objects, collections, furnishings and equipment, as well as the repair and reinforcement of buildings. For private historic heritage, the costs of repairing and rebuilding churches had to be estimated, based on figures available in the country for certain rescue projects. The estimate of the costs of replacing dwellings located in historic centers was based on purchase bids available before the disaster in controlled-use sites, together with estimates of the value of the furnishings and equipment of the dwellings; when dwellings had been partially damaged, the costs of repair were estimated. As regards non-heritage cultural infrastructure, repair and reconstruction costs were estimated based on figures available for contemporary buildings of similar characteristics. In the case of craft communities, in addition to the cost of the repair or reconstruction of infrastructure, the value of stocks of goods stored by members, 75% of whom are women, had to be estimated. The cost of repairing damage to cultural centers located in indigenous communities was estimated based on the costs of recent construction in similar centers.

The total amount of direct damage to the culture subsector was estimated at 125.2 million dollars.

## 2. Indirect effects

#### a) Education

Few educational centers were used as temporary shelters for victims. Nevertheless, the start of the school year had to be postponed until premises were available, either after repairs were completed or when temporary or leased facilities could be made available. In addition, authorities decided to postpone the start of students' vacations to match the delay in the start of the school year, ensuring there would be no loss in the quality of education. The indirect damage estimated in this case was for the provision of temporary or provisional classrooms, amounting to 19.2 million dollars.

Because of the minor damage to certain public and private sports installations, certain events had to be suspended, causing a loss of income that also had to be estimated, worth 0.7 million dollars.

#### b) Culture

In the case of cultural heritage, income not received during the period needed to repair or reconstruct historic buildings, both public and private, was estimated, along with the temporary leasing of other premises to house some of their activities. In the case of dwellings located in affected historic centers, the estimated cost of leasing equivalent units was, calculated at 5% of direct cost. The total amount of indirect effects was estimated at 0.2 million dollars.

In addition, the reduction in the income of craft community centers during the period needed to rehabilitate and reconstruct infrastructure, as well as that of fairs that are carried out around historic or religious buildings that were damaged or destroyed, was estimated. However, these items were taken into account in the trade and services sectors to avoid duplication when determining the total amount of damage in the country.

#### 3. Summary of damage

The total amount of damage caused by the earthquakes of January and February 2001 in El Salvador in the education and culture sector was estimated at 57.3 million dollars: 40.9 million dollars in direct damage to heritage and 16.4 million dollars in indirect effects stemming from reduced income and increased spending to provide services. The analysis indicates that 51% of total damage was to the public sector (29.4 million dollars), while the remaining 49% (27.9 million dollars) belonged to the private sector.

## IV. THE HEALTH SECTOR

### A. INTRODUCTION

#### 1. General Comments

All disasters have an impact on the health sector, whether due to the need to protect the population's health during emergency situations and disasters, evacuate and rescue victims and modify health-care models or programmes in the medium and long term, or because of damages caused to the infrastructure of the health-care services network. This impact translates not only into immediate needs, but also into long-term effects.

Understanding and assessing these effects requires the availability of information that allows one to determine, in the time available for the assessment, the scope of damage to the sector's different components and functions. In the absence of such information, the assessment must proceed via spot studies or projections to measure the time and requirements for recovery. The collection and analysis of information and, more generally, the implementation of health information systems, is an essential component of disaster preparation. The availability and quality of the health information are very important, because they form the basis for understanding the fundamentals of health policy and thus provide the opportunity to undertake a review of the health-care services network, with an eye to rationalizing resources and modernizing the sector.

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Disasters can be considered a problem for public health for several reasons:

- They can cause an unexpected number of deaths, injuries or illnesses in the affected community, thereby exceeding the therapeutic capacity of the local health-care services and forcing authorities to reorganize the sector or to solicit outside help;
- They can destroy local health infrastructure such as hospitals, health-care centers, laboratories and the like, which will thus be unable to respond to the emergency. Disasters can also alter the provision of routine health-care services and preventative activities, with subsequent long-term consequences in terms of increased morbidity and mortality;
- Some disasters can have adverse effects on the environment and the population by increasing the potential risk of transmissible diseases and environmental dangers that increase morbidity and premature deaths and could lower the quality of life in the future;
- They can affect the mental health and the psychological and social behavior of the affected communities. Generalized panic, paralyzing trauma and antisocial behavior rarely occur after big disasters, and the survivors quickly recover from the initial shock. However, anxiety, neurosis and depression can arise following both sudden and slowly forming emergencies;
- Some disasters can cause food shortages, with severe nutritional consequences such as a specific deficit of micronutrients (vitamin deficiencies); and



- They can cause broad movements of the population –whether spontaneous or organized– often to areas where the health-care services cannot meet the new situation, with a consequent increase in morbidity and mortality. The displacement of large population groups can also increase the risk of outbreaks of transmissible diseases in the displaced and host communities, where the large groups of displaced persons may be housed in and share unhealthy conditions or contaminated water.

After the disaster, the sector must take on three essential tasks: the rescue, treatment and subsequent care of primary trauma victims who have suffered the direct effects of the disaster; the prevention of the appearance or propagation of effects that are harmful from the perspective of public health; and the speedy recovery of the affected health-care facilities. Any expense that corresponds to the rescue, treatment and subsequent care of primary trauma victims that has not been taken into account in the emergency stage or in the corresponding section of the affected population must be accounted for within the assessment of the corresponding effects on the health sector, as discussed in the present chapter.

Given that the health sector’s mission is to prevent the propagation of disaster-related effects that could endanger the public health, unfounded rumors and the speed with which massive international efforts in medical aid are mobilized to the most distant areas have contributed, in part, to the erroneous idea that disasters are almost inevitably accompanied by the outbreak of epidemics transmitted by contaminated water, vectors or direct contact. In fact, experience confirms that there is usually no immediate risk of epidemic outbreaks due to causes attributable to a disaster. After a period of time has passed, the implementation of normal surveillance methods for detecting epidemics or the application of a situation-specific protocol of surveillance makes it possible to identify and control the risk of transmissible diseases and prevent any potential epidemic outbreak. Experience gained with all kinds of disasters over the last ten years confirms that it is not necessary to undertake massive vaccination campaigns.

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Recent experience thus shows that the swift mobilization of communities, national resources and international aid facilitates the treatment of the wounded –including the most serious cases– within a short time, thereby reducing the disaster’s impact in terms of the length of the “crisis” in the health sector. Consequently, reconstruction issues will be addressed much more quickly and effectively.

## 2. Assessment procedure

Like the other specialists participating on the assessment mission, the one in charge of the health sector should be notified of his or her participation on the mission two or three weeks in advance. The field mission should last one to two weeks. It is therefore recommended that in the period leading up to the visit, the health specialist should collect all the available information on the sector, both at the national level and at the level of the affected region. Likewise, it is advisable for the specialist to prepare in advance a list of people and institutions with whom contact must be established in the field.

At the end of the assessment mission, the specialist will be expected to present a table summarizing the effects on the health sector. The information should be broken down not only by geographical area, in particular at the level of the country's administrative units (the same units used for all the sectors), but also by public and private sector and by the amount of direct and indirect damage (see Table 1, which presents a model of the kind of information to obtain).

The health specialist should also provide the macroeconomics specialist with any pieces of information that facilitate an estimation of the health sector's effects on the main macroeconomic variables, especially public finances. It is also important to work in close coordination with the specialists in the other sectors to assess the repercussions of the disaster, particularly on the employment sector. With regard to the issue of gender, the health specialist must take into account that the sector employs mostly women and that disasters have a greater impact on women's health.

Table 1  
THE IMPACT OF A DISASTER ON THE HEALTH SECTOR  
(Thousands of dollars)

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Component	Damage			Sector		Effect on the balance of payments*
	Total	Direct	Indirect	Public	Private	
<b>Infrastructure<sup>1</sup></b> Health ministry Social security Private						
<b>Equipment and furniture<sup>2</sup></b> Health ministry Social security Private						
<b>Medications</b> Health ministry Social security Private						
<b>Unforeseen expenses and income</b> Emergency treatment Income not received Treatment not given Increased costs Increased expenditures in medications Epidemiological surveillance Vector control Community education Psycho-social rehabilitation						
<b>TOTAL</b>						

1 Specify the name of the affected infrastructure, if relevant, and the severity of the damage.

2 Identify any equipment and furniture that require specific quantification due to their value.

Table 2

THE IMPACT OF A DISASTER ON THE HEALTH SECTOR, BY AFFECTED REGION  
(Thousands of dollars)

Component	Region			TOTAL
	1	2	3	
<b>Health ministry<sup>3</sup></b> Infrastructure Equipment and furniture Medications				
<b>Social security</b> Infrastructure Equipment and furniture Medications				
<b>Subtotal, public sector</b> <b>Private</b> Infrastructure Equipment and furniture Medications				
<b>Subtotal, private sector</b> <b>Unforeseen expenses and income</b> Emergency treatment Income not received Treatment not given Increased costs Increased expenditures in medications Epidemiological surveillance Vector control Community education Psycho-social rehabilitation				
<b>TOTAL</b>				

The assessment process might develop through the following stages:

- Determination of the geographical area affected by the disaster, as well as the disaster's main immediate effects;
- Analysis of the sector's operation and policy before the disaster, based on existing documents;

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<sup>3</sup> Specify the name of the affected infrastructure, if relevant, and the severity of the damage, as well as any lost equipment and inputs, so as to facilitate a specific quantification.

- Analysis of the political and socio-economic implications of the disaster's effects on the sector;
- Field assessment of direct damage and effects to validate or modify the information provided by the sector's authorities;
- Quantification of the direct effects;
- Estimation and valuation of the indirect effects;
- Assessment of the macroeconomic effects;
- Estimation of the effects induced on other sectors, in particular on employment and women;
- Gathering of any available information concerning the strategy, plans and projects that may be under consideration, as well as the support and reconstruction resources that are, or may be, made available to the sector; and
- Cooperation in formulating the strategies, plans and projects for the reconstruction and revitalizing of the sector.

### 3. Information requirements

To assess the disaster's impact and effects on the sector, it is important to analyze the available administrative, economic, social and epidemiological information for the period before the disaster in the affected region and/or country.

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This report should, at the very least, contain the following information:

- The socio-demographic situation and the status of the main epidemiological indicators, including the morbidity rate and incidence of different diseases that are relevant to the type of disaster in question;
- A description of the characteristics and location of existing health-care facilities;
- The existing human resources, equipment and medical supplies in the health sector and its facilities;
- The sector's management, the way in which it is financed and its financial resources;
- The health service coverage provided by each of the different institutions; and
- The cost of the services supplied, including the cost of a doctor's visit, daily hospital room charges and average wages, among others.

### 4. Sources of information

Sources of information vary widely in type and origin. No source should be ruled out when it comes to obtaining information that might help measure the impacts and assess the direct and indirect effects on the sector.

It is important to make use of existing information, including available publications, pertinent historical material and data on the situation prior to the emergency. It is also advantageous to talk with appropriate, well-informed individuals, including donors, personnel in humanitarian organizations and in national public administration, local specialists, community leaders of both sexes, the elderly, health-care workers, teachers, businesspeople and so forth. Group discussions with members of the affected population can provide useful information on practices and beliefs. Other sources of information include early warning systems and vulnerability assessments, as well as national and regional plans for preparing in case of disaster.

One of the main sources of information will necessarily be the government agencies in charge –in this case, the ministry of health and social security– as they can provide statistical and budgetary information on the sector’s resources and activities. Especially useful are annual or periodic budget documents, the inventories of relevant institutions (which contain details on their personnel and materials), periodic statistical publications, reports on health structures and bulletins on the epidemiological situation.

The different services of the health and social security ministry can similarly provide information on current programmes, international aid and any reform plans and projects being developed. Apart from the health ministry, the ministry in charge of coordinating foreign aid and cooperation in the country can supply useful information on the aid resources being channeled into the sector.

The pharmaceuticals industry and the government agency in charge of its regulation generally make available useful information on the medicinal drugs market.

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Information on the population and its main socio-demographic characteristics can be requested from the national institutes or agencies in charge of producing official statistics. More detailed or specific information can be obtained from decentralized agencies, municipalities and professional associations.

Private institutions are another important source of information, as they can supply a detailed inventory of the private sector’s infrastructure and human and financial resources, information on the costs of different services rendered, frequency rates for medical visits to private hospitals, private sector development forecasts and so on. Similarly, training bodies and professional medical and paramedical associations are important sources for verifying medical demographic information.

Information published by international agencies that provide specific support to the sector should generally be taken into consideration. Examples include the (regular) statistical publications of the PAHO/WHO, the report on “Health Conditions in America”, the UNICEF publications on children’s health and publications by the United Nations Population Fund (UNFPA). The International Red Cross and international NGOs that are involved in emergency assistance are equally important sources to consider. Multilateral and/or bilateral assistance agencies that finance specific reform-support programmes usually generate information that can help clarify current policies.

## B. QUANTIFICATION OF DAMAGE

### 1. Definitions

#### a) Direct damages

Direct damages are those caused to the health system infrastructure, as well as to the stock of medical equipment and inputs. The following components are usually the most affected:

- Hospitals, health centers, clinics, dispensaries and rural and urban health-care stations belonging to the national health or social security system;
- Health sector offices;
- Laboratories and blood banks;
- Rural and urban private sector hospitals and clinics;
- Medical and auxiliary equipment and medical and surgical instruments;
- Non-medical equipment and supplies used in the health sector;
- Furniture and basic material; and
- Stocks of medications and vaccines.

- 98** The magnitude of the damage to the health infrastructure and medical inputs/equipment will depend not only on the type of construction, but also on its location and the type and origin of the disaster.

#### b) Indirect losses

Indirect losses occur after the event that caused the disaster; they refer to the consequences for the economic flows of the sector. Indirect effects thus include the reduction in the level of normally available services, the additional cost of caring for victims, including the cost of relocating services and personnel into emergency services, the cost of maintaining idle human resources as a result of the impact on infrastructure, the reinforcement of epidemiological surveillance, the increased cost of medical treatment, lost income, activities associated with emergency care, delivery of medications and other inputs, vector control, vaccination, psychological care and so on.

The nature of indirect losses varies greatly. The following are some of the main types:

- The costs of monitoring and controlling the spread of infectious and contagious diseases and the harmful effects on health;
- The public and private cost of hospital and outpatient care;
- The cost of reinforcing primary care in rural areas and for vulnerable groups;
- The decline in the victim's well-being and living standards due to the general erosion of the standards of public hygiene;

- The general decline in activity in the formal and informal productive sectors resulting from the psychological trauma suffered by the affected population (this is usually measured in the estimates for the corresponding productive sector);
- The additional cost of treatment and health care for the affected population; and
- The additional cost incurred to reduce the vulnerability of the sector's buildings

## C. ASSESSMENT METHODOLOGY

### 1. Direct damages

Public and private health-sector authorities are the main sources of the information required for assessing direct damage. Information may also be requested from the decentralized government services that normally operate in the affected area.

Information on current prices in the construction sector can be obtained from authorized professional entities (engineers' or architects' associations, construction chambers).

Given that the disaster's consequences can also be analyzed as part of an operational review of the health-care services network and model of care –on the regional or country level, depending on the magnitude of damages– the health and social security ministry can provide indicators of activity that make it possible to judge the functionality of a given structure and decide whether it should be repaired or replaced. The disaster can thus provide an opportunity to lower the operating costs of structures that no longer ensure that the population will receive effective service.

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#### a) Damages to infrastructure

To assess direct damage to health sector infrastructure, the same general procedure described in the chapter on housing and human settlements should be followed. That discussion defines three broad types of damage to infrastructure:

i) **Structural damage:** beams, joists, structural flooring, load-bearing walls, foundations and so forth;

ii) **Non-structural damage:** partition walls, interior installations, doors, windows, non-structural roofing, floors and so on; and

iii) **Deformations to the land:** settling, shifting and so forth.

Starting with a list of health infrastructure in the area affected by the disaster, with the facilities organized by type of establishment, the specialist will proceed to diagnose the damage. As in the case of housing, it is advisable to classify the facilities into the following groups: buildings that were totally destroyed or that are beyond the possibility of repair; buildings that were partially destroyed or that can be repaired; and buildings that were not affected or that suffered minor damage.

In other words, after collecting reliable data on the number of damaged or destroyed hospitals, health-care centers and other infrastructure in the sector, the specialist should seek up-to-date information on the value per square meter of new construction or repair, as is relevant in each case.

Next, each facility must be specifically identified, with details on its location, category, the main materials used in its construction and the unit prices for its reconstruction, full replacement or repair, as required in each case. The cost estimate for repairs should be expressed as a percentage of the cost of full replacement, as estimated by the assessor responsible for determining whether the facility should be repaired or partially rebuilt (see Table 3).

To assess the effects on the service network, the specialist should also categorize the affected health sector facilities by i) geographical area, ii) level of care, iii) number of beds and iv) public versus private. The analysis should include a description of the post-disaster situation in each of these categories. As part of this analysis of the impact on the services network, the specialist should also assess the affected infrastructure as a percentage of the total (see Table 4).

#### b) Furniture and equipment

**100** The assessment of the damage to furniture and equipment can be based on the same three categories used for infrastructure: i) no possibility of repair (necessary replacement); ii) possibility of repair; iii) and minor damage.

To estimate the cost of repairing or replacing medical equipment and furnishings, depending on the level of the facility, either a coefficient can be allocated to each hospital bed to represent the value of the equipment and furnishings associated with it or an estimate can be made on the basis of existing price lists or price lists prepared for this purpose.

In the case of specialized equipment, however, it will be necessary to determine the current cost of replacement and whether the item must be imported.

The assessment must also take into account possible damages to non-medical equipment. This encompasses all non-medical equipment necessary for maintaining the sector's operations, from the air and water quality control system to personnel administration. Examples include air conditioning units, heaters, refrigerators for storing vaccines, office equipment, air purifiers, water filters and the like.

A table can be drawn up to summarize the estimated damage to infrastructure and equipment, with a breakdown by degree of damage and a detail of the associated costs, as follows



Table 3

DIRECT DAMAGE TO INFRASTRUCTURE AND EQUIPMENT

	Replacement		Repair		Minor damage	
	Units	Ave. cost (per sq. m)	Units	Ave. cost (per sq. m)	Units	Ave. cost (per sq. m)
Hospitals						
Clinics						
Health-care stations						
Pharmacies						
Laboratories						
Medical equipment						
Non-medical equipment						
Furniture						
Other						
Total						

Table 4

AFFECTED INFRASTRUCTURE AS A PERCENTAGE OF THE TOTAL

	Replacement		Repair		Minor damage	
	Units	% of the total	Units	% of the total	Units	% of the total
Hospitals						
Clinics						
Health-care stations						
Pharmacies						
Laboratories						
Total						

## 2. Indirect losses

### a) Demolition and clean-up costs

The costs of demolition, removal of debris and land improvement are considered indirect losses. This assessment should be carried out in close cooperation with the government officials responsible for the sector. Demolition costs vary widely in relation to the type of building materials involved. The specialist should thus consult with an engineer or architect on this point. The costs of removing debris are usually estimated based on the volume to be removed and the unit cost of removal and transport to the waste disposal location.

### b) Cost of disaster mitigation works

It is often necessary to adopt mitigation and prevention measures to avoid or reduce the impact of future disasters on the sector's infrastructure. The costs of such works or measures, as well as the costs of relocating facilities to less vulnerable sites, are considered an indirect effect of the disaster.

102 The mitigation of disaster-induced losses via the adoption of preventative measures is a highly profitable endeavor in areas that experience recurrent events. Each dollar spent on adequate mitigation before a disaster hits represents enormous savings in losses that could have been avoided. Different mitigation measures have different implementation modes and costs. The simplest and most economical are those associated with non-structural and organizational-administrative aspects, whereas structural measures are more complex and expensive.

Phasing in an integrated hospital damage mitigation plan will facilitate a slower, more feasible application of resources. The practical experience gained in hospital damage mitigation works over the last ten years, together with current information on the building code, can serve as the basis for estimating these costs.

### c) Cost of treating victims

From a medical standpoint, the classification of the wounded and injured according to the severity of their wounds and their chances of rehabilitation is especially relevant. When a disaster causes a relatively large number of victims, it is not possible to attend to all of them at once. In such cases, medical or paramedical personnel should sort the victims by triage at the time of search and rescue operations. Triage is essential for optimizing existing curative resources, since it describes and sorts the victims while making it possible to estimate the cost of treating and rehabilitating both the seriously and slightly injured.

Health specialists may face two alternative situations. Under the first scenario, primary victims are few and relatively concentrated, and the normal relief and treatment services in isolated or remote regions are capable of dealing with all the cases without too great a delay. In this case, information will generally be centralized, and the health specialist should therefore have no difficulty in estimating the additional costs related to additional medical examinations, hospitalization costs, long-term treatments, the increased demand for medications and sedatives, overtime work by medical and paramedical personnel, transportation expenses for victims or for long-time patients who are deemed healthy enough to return home and so forth. The second scenario occurs when the number of primary victims exceeds the capacity of primary and hospital health-care services both inside and outside the devastated area. In view of the difficulty of estimating the cost of medical attention, the following standard is customarily accepted: no conjectural estimates are made to account for the wounded who are not registered in the national system or in the private health-care system, and the total cost incurred by the hospital system is estimated on the basis of the care given to the primary victims. In other words, the increase is determined as the total cost incurred by the system for search and rescue and the treatment and subsequent care of the trauma victims from isolated or remote areas. The accuracy of the estimate will depend essentially on the validity and reliability of the classification procedure and access to information.

If the number of existing entries in the registry is reliable, the health specialist should not have much difficulty estimating the costs. Otherwise, they may be able to estimate them based on the increased costs of the following interventions: i) the enlargement of the reception and treatment areas; ii) the length of stay of patients in the reception, treatment and hospitalization areas; iii) the treatment and recovery of hospitalized patients; iv) the treatment and recovery of outpatients, if justified by the availability of personnel; v) medical, paramedical and auxiliary personnel; vi) the evacuation of new and pre-existing patients; vii) transportation costs; viii) the treatment of patients sent home prematurely; ix) mobile units; and x) health inspections carried out in homes.

These cost components can be rearranged to suit the public or private hospital system unit responsible for receiving the primary victims of the disaster. If some facilities charge for medical services, the value of the benefits thus given are replaced by the procedure described above. Finally, monitoring and registration of the victims' records will probably be centralized by the health ministry or other governmental body.

#### d) Costs of public health and epidemiological interventions

This section analyzes public health interventions necessary for preventing or controlling the spread of harmful effects from the disaster on public health.

Health measures following a disaster are generally palliative in nature. Their primary objectives are to control water quality, prevent epidemic outbreaks and ensure that the disaster's impact does not trigger the spread of latent diseases. With regard to epidemic outbreaks, the health specialist must identify those that are caused exclusively by the disaster event before registering the costs.

The following kinds of interventions are rapid and are generally coordinated by the health ministry. It is important to request that the health ministry provide all the available information on these interventions (resources, operation, financing commitments, nature and amount of outside aid, etc.). The associated costs must be identified for each intervention, if it is implemented.

- Water. This category includes the cost of supplying the population with simple materials outlining instructions on i) the need to check water quality before using the water; ii) uses for sterilized water; iii) the danger of storing water in broken, dirty or uncovered containers; and iv) the importance of keeping wells, springs or other sources of raw or potable water free of contact with human and animal excrement, trash and industrial or domestic wast water.

Water quality must also be monitored (this is defined and estimated under the heading water and sanitation in the chapter on infrastructure). The process might include carrying out an analysis of water quality (residual chlorine or bacteriological quality), overseeing sterilization, monitoring the quality of water distributed via water tanks and so forth. Public health authorities will have the responsibility of ensuring that all shelters and affected population without access to water sources have appropriate, undamaged water storage containers, whose capacity is sufficient for the number of people in the shelter.

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If the shelters do not have water storage containers, some type of storage facility will have to be provided (PVC, fiberglass or asbestos-cement tanks). Water sterilization tablets may also be distributed to the affected population or shelters.

Another cost to take into account is the removal of the corpses and remains of buried or partially buried animals.

- Sanitation control. This item includes public health educational activities concerned with food handling and domestic hygiene, as well as health inspection of living quarters and temporary shelters for the victims or the primary affected population. Measures that might be carried out include mass public awareness campaigns, talks with affected groups, visits to shelters and so on. The wide-scale or selective distribution of protective products might also be undertaken, as in the case of masks for filtering ash in an effort to prevent respiratory problems following a volcanic eruption.

- Fight against vectors. This includes the cost of destroying and monitoring new foci of vector reproduction, as well as the fight against the vectors themselves. It includes the localized application of rodent controls and insecticides, the protection of domestic water supplies, the destruction of unnatural water collection areas, the detection and treatment of cases and prophylaxis, if necessary. This item should also include health education and the distribution of repellents or barriers to reduce contact between people and the vector.

- Vaccination campaigns. It may be necessary to carry out mass vaccinations (typhoid fever, cholera) or selective campaigns (for example, children and measles); such costs should be considered an indirect effect of the disaster. At the same time, efforts should be made to avoid interrupting the regular national vaccination programmes, which may require the following actions: i) immediately reinstate the vaccinations routinely given in national immunization programmes; ii) propose the temporary use of cold boxes (RCW42) to ensure the preservation of vaccines in affected areas and consider the possibility of mobilizing immunobiologics, provided ice is available; iii) resort to the use of photovoltaic refrigerators for storing vaccines and producing ice, given the availability of sufficient batteries; and iv) initiate the recovery of the cold chain (purchase of refrigerators, thermoses, thermometers and so on).

- Epidemiological surveillance Epidemiological surveillance after a disaster involves four fundamental steps: i) investigate rumors and reports of cases in the field; ii) approach laboratories to obtain definitive diagnoses and support for epidemiological investigations; iii) present epidemiological information to decision makers; and iv) ensure surveillance during and after the rehabilitation phase. It is necessary to determine the cost of the following items: epidemiological surveillance in health-care facilities and in the community (including field research, data processing and laboratory analysis); the quarantine, isolation and treatment of the first cases; and finally, the epidemiological surveillance of people housed in shelters.

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- Food safety. The health sector may contribute to the formulation of intersectoral post-disaster policies on food safety by providing information and orientation as needed. The health sector is also responsible for preserving the sanitary condition of food donated by humanitarian aid. It must also monitor the nutritional status of the affected population (for example, via surveys), given that the decreased availability of food could lead to malnutrition from a lack of protein or micronutrients, such as vitamin A, vitamin C or iron. All of these actions should be included in the cost assessment.

The main source of information will be the national emergency committee and the health ministry. In principle, all relevant epidemiological information should be included.

The health specialist will probably find that the relevant information has already been classified in some form. In any case, it is useful to verify the validity and reliability of the available information or to make one's own cost estimates.

Health specialists should give particular attention to the following items:

Cost of personnel. This item should include the cost of the additional personnel and regular staff overtime needed to tackle the post-disaster situation. Special attention should be given to the additional personnel recruited by the health system and assigned to disaster-related public health interventions, water quality control, epidemiological surveillance, vaccination campaigns, laboratories, environmental health and the fight against vectors. The cost of special brigades for health-related actions or epidemiological surveillance must also be accounted for. Other costs include the training or orientation of personnel for the implementation of disaster-related public health measures.

Cost of material and equipment. Here, the costs to be considered include the purchase, storage and distribution of equipment, medications, vaccines and pharmaceuticals used for preventative purposes (and curative, in the case of transmissible diseases) to counter the effects of the disaster. The logistical costs of vaccination campaigns are also included, as are the costs of equipment that had to be purchased for vector control and for sanitary control measures that form part of the disaster response. The cost of imported medications should be accounted for separately.

Cost of diffusing public information. The cost of diffusing public health information must be measured, whether it involves mass social awareness campaigns, educational programmes targeting the affected population or talks with vulnerable groups.

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To avoid double accounting, it is important to distinguish between the cost of personnel, material and equipment involved in the treatment of victims and those channeled into the aforementioned public health measures. The former should be taken into account under the first heading of indirect effects (the cost of treating the victims), whereas the latter should be analyzed and incorporated here.

The health specialist's first task is the identification of the costs associated with sanitation and epidemiological surveillance operations. The second, and more difficult, task is to determine which disaster-related effects can be considered aftereffects. This distinction should be taken into account especially for epidemiological surveillance activities such as the collection and interpretation of data to determine the risk (or presence) of outbreaks or foci of transmissible diseases. It is generally said that a disaster does not "produce" transmissible diseases, but merely modifies environmental conditions, thereby unleashing latent diseases. When changes in the incidence of disease are detected, the only way of knowing with any degree of certainty whether an increase can be ascribed to the disaster is to refer to the epidemiological records and the health organizations' reports.

Additional sources include sectoral programmes run by international organizations, which often maintain their own information systems. Health specialists can also draw on the following sources of information:

- Project presentation documents;
- Press reports; and
- Interviews with health personnel.

#### e) Increased cost of preferential health care for vulnerable groups

While there are many, complex causes of vulnerability, experience shows that the chief cause is poverty, especially in the case of single mothers, children under the age of five and the aged. Likewise, after a disaster, pregnant women and the undernourished are the population groups that are most exposed to risk, especially infectious and contagious diseases. Other highly susceptible groups include adolescents, unaccompanied minors and people with disabilities. Consequently, the protection of these groups after a disaster requires specific health interventions. Special health operations are also often carried out for other groups that have been particularly affected by the disaster, such as rural families and farmers whose land has been severely damaged by flood or prolonged drought. The cost increase resulting from these special interventions on behalf of vulnerable groups should be estimated and recorded as an indirect cost.

#### f) Additional indirect health service operating costs

The destruction or crippling of the public and private hospital, primary care and other health infrastructure, together with disaster-related deaths and injuries to medical and paramedical personnel, force the national and private health system to incur additional operating expenses. These are described below.

**Failure to meet income forecasts.** If there is a lack of qualified personnel or if the infrastructure is put out of service, this might lead to a reduction in income from the charged services of the national public health system and of private clinics and hospitals. The health specialist should determine the value of such a reduction in future expected income for outpatient and hospital services by referring to the applicable rates prior to the disaster.

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The calculations can be simplified by using earnings and cost indexes that have been previously established by the hospitals' planning departments. A more precise assessment can be made when there is a hospital information system that keeps records on the volume and relative cost of the assumed illnesses.

**Non-provided health-care services.** It is also necessary to estimate the cost of the services, whether free or subsidized, not provided by the public health system. Two types of calculations can be used to make a quick assessment. The number of non-performed outpatient examinations, surgical procedures and hospital treatments can be estimated and evaluated on the basis of established prices. When this information is unavailable (or when there has been considerable destruction or impairment of the infrastructure), it is preferable to use the "foregone income" of the medical, paramedical and auxiliary personnel while activities are stopped. The average individual salary of each of these categories should be multiplied by the total number of shifts not worked and by the number of members absent in each of the health officials' categories.

The valuation of this item should consider the possible reduction in costs owing to the total or partial non-operation of certain health-care facilities, with a corresponding decrease in the purchase of inputs and payment of basic services used in the operation of these facilities.

**Increased costs of providing services.** This item covers all additional costs incurred by the public and private health-care services to ensure that services are available, except i) those services provided to direct victims of the disaster and ii) the public health-care services mentioned above. In general, it encompasses the increase in the cost of services stemming from the disaster, the expense of replacement personnel (estimated in the same way as in the preceding paragraph), the relocation of outpatient services, the strengthening of the infrastructure, transport, public information costs, importation of medications and instruments and so on. It is essential to take into account that the use of resources to prevent the consequences of a disaster has a cost inasmuch as these resources are no longer used for their originally intended purposes. The health specialist thus has the choice of estimating these resources from the point of view of the benefits that they will have ceased to supply because they are being used for disaster-related needs and estimating them in accordance with the replacement value of the service supplied.

When calculating increases in health-care operating expenses, health specialists must include all expected future services, even though they might not yet have been supplied, because they represent a net loss for the beneficiary population.

**108 Interruption of aid programmes.** In many countries, the national health-care services are in charge of implementing and distributing some social aid programmes (distribution of milk, family assistance programmes, advance payments of health-care expenses, etc.). Such programmes are often interrupted when a disaster occurs. Since a good number of these programmes are only briefly interrupted, often without important consequences for the beneficiaries, the health specialist should use his/her judgment in estimating the corresponding costs. If beneficiaries suffer net losses during the time that such programmes are suspended, the cost of these losses must be calculated for the time that the services are expected to be suspended. The same goes for the additional costs that will probably have to be incurred to speed up the normal supply of these benefits.

#### **g) Increased public and private costs owing to higher sickness rates**

The increase in morbidity owing to causes attributable to the disaster, as confirmed by the people in charge of epidemiological surveillance services and by the health specialist, entails increased costs for both the national and private systems, as well as for the victims themselves. Health specialists who make a quick assessment of the damage may find that information is scarce. In these circumstances, the easiest thing to do is to record the additional public and private costs that will have to be incurred, using an estimate of the number of cases to arrive at the costs. When there are many cases spread over a wide area, the first task will be to verify the two categories of cost attributable to the disaster:

- The treatment of primary cases (quarantine, isolation, etc.); and
- The increased costs to the sector for the provision of additional services.

If either or both of these items incur costs, the health specialist should separate the additional costs that are attributable to the higher level of sickness from the additional costs that are attributable to other causes. This will ensure that the same costs are not counted twice and that only the increase stemming from the greater morbidity rate is measured.



Disaster-related morbidity forces individuals to incur expenses, lowers production and gives rise to medical or hospitalization costs. The health specialist should work in cooperation with the macroeconomic specialist to assess these related losses and add them to the costs incurred by organizations. There are two ways of calculating these sickness-related production losses. In the first, the average per capita production figure is calculated for a defined period using a process of prorating and extrapolation, and this is then subtracted from GDP. This method facilitates comparison, but it fails to show that the activities do not fall within a single segment of society and that sickness is not distributed evenly throughout the population. The second method is based as much as possible on the productive activity of the sick. It consists of defining the groups of different income levels that may be affected and then arriving at the amount of lost production by calculating the number of days not worked. Nevertheless, these costs do not include the “intangible effects” on the quality of life of the sick and their surroundings.

The difficulty here is to express the cost of the effects on morale and psychological suffering in monetary terms. In order to estimate the additional costs related to the increased morbidity, an average cost per sick person should be estimated. In the case of medical expenses and the cost of medications, this may be done either by referring to existing tables or by using all of the sickness-related costs of a sample of the sick. These figures (that is, lost production, medical expenses and medications) should be applied to the part of the population recognized as being sick from causes attributable to the disaster. If treatment costs differ appreciably according to the patients’ age, this will have to be taken into account by separating particular age groups.

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#### D. MACROECONOMIC EFFECTS

The health and macroeconomic specialists should work together to determine the macroeconomic effects originating in the health sector.

##### a) Diminished contribution to development growth rates

Losses should first be measured in terms of the health sector’s contribution to gross domestic product (GDP). Health is a service sector that creates multiple jobs and has many ramifications, including knowledge investment (scientific research), human capital investment (training and education) and material investments (buildings and materials).

National accounts can be used to measure the reduction in the sector’s output as a percentage of GDP. In the case of the private sector, this reduction may be assessed using the criteria of businesses in the industrial and commercial sector. For the public sector, one should first calculate average production and then apply the figure to the estimated period of suspended or reduced activity.

##### b) Effects on employment

The damage caused to infrastructure may lead to unemployment among sector personnel. In most cases, these employees will continue to receive their wages. The actual number of jobs lost in the relevant period will, however, have to be estimated.

#### c) Effects on the external sector

A disaster's effects can have an impact on imports and exports insofar as the raw materials and equipment needed for reconstruction are concerned.

- In some countries, the construction or repair of health infrastructure entails importing materials and equipment that are not produced locally. In this case, it is important for health specialists to work closely with the officials responsible for the sector on a national level to determine the quantities and costs of the products and materials to be bought overseas, and then to estimate the portion of imports that are destined for the reconstruction effort.

- If damaged or destroyed buildings and equipment are insured with a local insurance company that has reinsured that risk with a foreign company, an influx of foreign currency may result. The health specialist should obtain information about this by questioning the insurance companies.

#### d) Effects on public finances

The health specialist must determine the increase in public budgetary outlays needed to meet emergency, rehabilitation and reconstruction requirements. This estimate can be made by adding the amounts spent during the emergency stage to projections on rehabilitation and reconstruction projects.

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In addition, the government may experience a drop in normal income, since any reduction in the services provided by private health-care establishments translates into a corresponding decrease in the amount of taxes paid. When estimating such losses, the normal tax rate for these cases should be taken into consideration.

#### e) Effects on prices and inflation

The magnitude of the damages might be so great that the reconstruction needs for all sectors –not just health– leads to a scarcity of construction materials and equipment and causes prices to rise. The health specialist should search all available sources to obtain information about prevailing prices before and immediately after the disaster so as to make allowances for any increase and to project price movements. To do this, the health specialist must collaborate closely with the specialist in housing and human settlements.

#### f) The differential impact on women

As in other sectors, the disaster affects women differently than men. In the health sector –as in education and culture– women account for a higher percentage of workers than men, such that any loss in employment and income will affect them directly as a group. Furthermore, whenever overtime is required of health sector workers, women's overall work load will be increased beyond the compensation of the additional income they may receive, as they must still discharge their reproductive activities after returning home late.

To determine these differential effects on women, the health specialists must work in close cooperation with both the employment and gender specialists of the assessment team to ensure that these losses are properly estimated and that no double accounting occurs.

As in previous chapters, an example of the application of the methodology described above is provided in the following appendix, using information obtained during a recent disaster.

## APPENDIX VI

### ESTIMATE OF DAMAGES IN THE HEALTH SECTOR CAUSED BY THE 1999 MUDSLIDES IN VENEZUELA<sup>1</sup>

Torrential rains occurred in December 1999 along Venezuela's northern coastline after a low-pressure trough stalled over the Caribbean for nearly 20 days. The resulting mudslides and flooding had catastrophic effects on the population, urban infrastructure, basic services and productive infrastructure, as well as incalculable effects on the environment. The states of Vargas, Miranda and Falcón were the most severely affected.

#### 1. Health sector

The health sector was unable to respond fully to the extraordinary demand arising out of the catastrophe as a result of damage to physical infrastructure, access to facilities and the availability of personnel –areas that were already showing weaknesses and inequalities before the events of December.

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The physical plant of hospitals and outpatient centers sustained varying degrees of damage in the hardest-hit regions –especially in the state of Vargas– with some rendered non-operational as the tragedy unfolded. Even the medical facilities that could continue working were completely cut off, as many roads were washed out. The loss of furniture, equipment, materials and medications –exacerbated in some cases by looting– was another difficulty that had to be faced, as was the effective loss of personnel, a third of whom were themselves victims (in Vargas) while others were unable to reach work owing to difficult conditions on key roads, including the Caracas-La Guaira highway.<sup>2</sup>

Medical reinforcements were deployed from abroad during the initial relief effort, including more than 400 Cuban doctors, paramedics and nurses who worked in the most devastated areas. International shipments of equipment and medications also helped alleviate much of the immediate shortage.

Once the emergency phase –rescue, emergency medical care, finding the dead<sup>3</sup> and moving victims to temporary shelters– had passed, environmental and epidemiological surveillance efforts were stepped up so as to minimize risk factors. In an effort to involve the public at large in Vargas, health brigades were formed and given training in the handling of toxic solid waste, food preparation and conservation, water treatment and vector control.

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<sup>1</sup> ECLAC, *Los efectos socioeconómicos de las inundaciones y deslizamientos en Venezuela en 1999*, Mexico City, February 2000.

<sup>2</sup> Many health-care workers missed paydays because service had been suspended at the banks where their wages are normally deposited.

<sup>3</sup> The Attorney General's Office was entrusted with locating the corpses of victims.

Other emergency-phase priorities included repairing damaged health-care facilities. At the beginning of 2000, Venezuela had 182 hospitals, as well as 707 urban and 3 541 rural outpatient clinics.<sup>4</sup> Most of the damage was concentrated in the states of Vargas, Miranda, Falcón, Yaracuy and the Federal District, in which a total of 31 hospitals and 687 outpatient clinics are located. Of these, 9 hospitals (29%) and 251 outpatient clinics suffered damages, ranging from minor to total loss. The extent of the damage may not seem significant as a national percentage, but it is clearly quite high in the disaster areas, affecting health-care services for 360 000 disaster victims (see Table 1).

Table 1

## VENEZUELA: HEALTH-CARE FACILITIES DAMAGED IN THE MOST SEVERE DISASTERS AREAS

Federal Entity	Hospitals			Out-Patient Clinics		
	Total	Damaged	%	Total	Damaged	%
Total	31	9	29.0	687	251	36.5
Vargas	5	5	100.0	36	26	72.2
Federal District	6	1	16.7	76	-	-
Miranda	12	1	8.3	178	107	60.1
Falcon	3	1	33.3	308	97	31.5
Yaracuy	5	1	20.0	89	21	23.6

Source: Ministry of Health and Social Development and PAHO/WHO

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Most of the health-care facilities in Vargas were affected, to varying degrees. Five outpatient clinics and two hospitals were severely damaged.<sup>5</sup> The Macuto maternity hospital (Hospital Materno Infantil de Macuto) was completely covered by mud, destroying its 120 beds and other equipment, but apparently leaving the building itself in tact.

The state psychiatric hospital was similarly affected. The Venezuelan Social Security Institute's Hospital Vargas, which was not open to the public at the time of the disaster, was quickly cleaned up and pressed into service to cover spillover from other besieged medical facilities. The Pariata and La Sabana hospitals functioned at 70% of their normal capacity, while the Naiguatá hospital operated at 40%. Outpatient clinics proved to be the most vulnerable. The type III clinic, "Dr. Alfredo Machado" at Catia la Mar, a key medical facility in a heavily populated parish, was completely covered by mud, and it struggled to provide some services at a church next door. In Vargas alone, six outpatient clinics were deemed a total loss.

<sup>4</sup> See Censo de Establecimientos de Salud de las Direcciones Generales Regionales de Salud, 1998.

<sup>5</sup> The state of Vargas had three specialized hospitals (Hospital de Niños Excepcionales, Hospital Dermatológico "Martín Vegas" and the Hospital Materno Infantil de Macuto), two type III hospitals, 19 urban outpatient clinics (5 type III, 1 type II and 13 type I) and 17 rural outpatient clinics (all type I).

The Federal District's oncology hospital suffered extensive damage to its very costly equipment, but with some well-known exceptions, most facilities were easily restored following clean-up and the restoration of the water and drainage systems and roads.

Direct damage to physical plant at health-care facilities was estimated at 18 million dollars, plus 11 million dollars in lost equipment and furniture. Total direct cost to the sector thus reached 29 million dollars. The cost of fully rebuilding damaged facilities, incorporating modern materials and equipment, was estimated at around 55 million dollars.

Table 2

VENEZUELA: DAMAGE TO THE HEALTH SECTOR a/  
(Millions of dollars)

Item	Total	Direct	Indirect a/	Reconstruction Costs	Foreign component
Total	61.0	29.0	32.0	55.5	4.2
Total or partial destruction of healthcare infrastructure	18.0	18.0		32.4	2.3
Loss of equipment and furniture	11.0	11.0		23.1	2.0
Increased allotments for hospital and out-patient care b/	12.0		12.0		
Additional costs for sanitation, vaccinations and epidemiological control b/	8.0		8.0		
Retrieval and treatment of trauma victims	1.0		1.0		
Medical, psychological and food assistance at b/	8.0		8.0		
Cost attributed to the diminished capacity of healthcare services	3.0		3.0		

Source: ECLAC, based on data supplied by the Ministry of health and Social Development and PAHO

a/ Includes estimated costs affecting the public health system, as well as both for-profit and non-profit private health-care facilities.

b/ Includes cash and material aid from other nations.

Of even greater significance for the sector were the extraordinary outlays it made –with assistance from the international community, civil society and the local community itself– which were estimated at 32 million dollars. These emergency funds went primarily to special care for injured and displaced persons and to preventative health and vaccination campaigns. Total direct and indirect costs attributable to the health sector thus reached 61 million dollars.