Use of the damage and loss assessment **methodology** to **estimate** the **effects** of the coronavirus disease (COVID-19) **pandemic**

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Abstract

Given the human, social and economic impacts of the coronavirus disease (COVID-19) across the world and in Latin American and Caribbean countries, the Economic Commission for Latin America and the Caribbean (ECLAC) has, since the onset of the pandemic, focused its work agenda on the pandemic. To contribute to these efforts, this paper presents the Methodology for the Assessment of Disasters (known as Damage and Loss Assessment – DaLa) developed by ECLAC, and its applicability in the national assessments of the effects of COVID-19. ECLAC is therefore making this tool and the technical support for its implementation available to the countries. In the current context, it is important to have a consistent methodology with which to examine the sectoral effects of the event.

Introduction

On 11 March 2020, the World Health Organization (WHO) declared that coronavirus disease (COVID-19) was a pandemic. At that time there were 114 countries affected by the disease, 118,00 cases had been confirmed and 4,291 people had died. Four months after this declaration, confirmed cases of the first pandemic caused by a coronavirus numbered 11.8 million and 544,000 deaths had been reported. On 3 March 2022, after various waves and variants of the virus had emerged, those figures were 441.1 million and 5.98 million respectively.

Given the human, social and economic impacts of COVID-19 on the world, and in the Latin American and Caribbean countries in particular, the Economic Commission for Latin America and the Caribbean (ECLAC) focused its work agenda for 2020 and 2021 towards offering support and assistance in this area to the region. One of the first actions taken was the establishment of the COVID-19 Observatory in Latin America and the Caribbean, a platform that compiled the measures countries had taken to respond to the disaster, study its potential effects and make policy proposals.[1] The achievements and recommendations of ECLAC were reflected in the over 30 special reports on COVID-19 that have been issued to date, as well as in the interventions made by the senior officials of the Commission in the major regional and global forums.

With the objective of contributing to these efforts, this report presents the Damage and Loss Assessment Method (DaLa) developed by ECLAC,[2] and its applicability to the national assessments of the effects of COVID-19. ECLAC is thus making this tool available to countries and providing technical support for its implementation.

The latest edition of the Handbook for Disaster Assessment (ECLAC, 2014) included a special chapter on the assessment of epidemics. Given the magnitude of the COVID-19 pandemic, this report expands on what is presented in the manual. In a situation like this, it is important to have available a

[1] See [online] https://www.cepal.org/es/temas/covid-19.

[2] ECLAC was the first institution that dedicated resources to disaster assessments and it designed and disseminated a methodology for this purpose. The first disaster assessed was the Managua earthquake of 1972 and the latest was the disaster caused by Hurricane Dorian in the Bahamas, which took place between 1 and 2 September 2019. During this period, ECLAC led the assessment of over 100 disasters in more than 28 countries and territories of Latin America and the Caribbean.

coherent methodology that will allow the exploration of the sectoral effects of the pandemic. The reflections presented here were the basis for the following reports and, in turn, were enriched by them: the assessment of the effects and impacts of COVID-19 on the Bahamas (Bello and Espiga, 2022); the assessment of the effects and impacts of COVID-19 on the tourism sector in Latin America and the Caribbean (ECLAC, 2021); the assessment of the effects and impacts of COVID-19 on the tourism and trade sectors in Panama (ECLAC/Office of the United Nations Resident Coordinator in Panama, 2022) and the assessments of the impact of Hurricanes Eta and Iota in Guatemala and Honduras (ECLAC/IDB, 2021; Bello and Peralta, 2021). The latter posed the challenge of evaluating a disaster and the devastation caused by hurricanes, compounded by another disaster, the effects of COVID-19.

Prior to the COVID-19 pandemic, epidemics have caused major disasters in the region. According to the International Disasters Database (EM-DAT), compiled by the Centre for Research on the Epidemiology of Disasters of the Catholic University of Louvain, between 1970 and 2019 there were 150 epidemics in the region, which caused 24,800 deaths and affected 4,155,001 persons.

The deadliest epidemics in Latin America and the Caribbean have been bacteriological in origin – mainly cholera – which have caused 89% of deaths. The epidemics that have affected the population most widely in the region have been viral in origin – dengue above all – which are responsible for 70.3% of the total number of persons affected by epidemics. It should be noted that the EM-DAT database does not contain any information on the cost of epidemics, due to the fact that it only records damage, and such events do not produce the destruction of infrastructure.

Considering the threats that epidemics represent and their potential to cause a disaster, since 2009 ECLAC and the Pan American Health Organization (PAHO) have conducted assessments for the Influenza A (H1N1) pandemic in Mexico (ECLAC/PAHO, 2010) and an outbreak of dengue fever in the Plurinational State of Bolivia (ECLAC, 2010). Those analyses highlighted the differences between the disasters studied and those involving destruction of capital, and allowed the methodology to be adapted to take a different approach to epidemics. Because this type of disaster does not involve the destruction of the stock of physical resources, estimates of their effects consider only additional costs and losses (see box 1).

Box 1
Effects of a disaster

Damage

Monetary value of the physical assets partially or totally destroyed. In the specific case of an earthquake, the damage is produced at the time the event occurs and to mitigate it, an attempt is made to value what existed previously. For example, if a hospital built ten years earlier is destroyed, in estimating the damage the depreciation of the construction materials must be considered. The damages are not the cost of reconstruction, since this includes disaster risk reduction measures, the possible relocation of infrastructure and technological improvements. Note that the reconstruction process implies taking policy decisions on each of these three elements.

Loss

Monetary value of the property that has stopped producing and of the services that are no longer being provided as a result of the disaster. Losses are counted from the moment when the disaster occurs until the area affected returns to the situation before the event, and are estimated as gross income, not earnings which agents are no longer receiving.

Additional costs

Public and private expenditures which are made for the purpose of providing goods and services temporarily after a disaster. Additional costs shall mean those costs which exceed the budget previously established and are aimed at responding to the emergency and recovery.

The sum of the damage, losses and additional costs as a whole provides an estimate of the cost of an event.

Source: Economic Commission for Latin America and the Caribbean (ECLAC) *Handbook for Disaster Assessment* (LC/L.3691), Santiago, 2014.

ECLAC and PAHO studies give examples of the two types of epidemics that it is possible to encounter when conducting an assessment: (i) those which do not involve quarantine or other physical distancing measures, as was the case with dengue, and (ii) those whose control does include this type of measure, as occurred with the Influenza A (H1N1) epidemic. In the first case, the assessment focuses on the increase in demand for services in the health sector —which assumes additional costs owing to the emergency— and on losses in this sector associated with all the services that are usually provided and that must be postponed in order to confront the crisis created by the epidemic. In the second case, along with the additional costs, the potential losses associated with isolation measures in the production and services sectors which require greater contact and interaction, such as tourism, transport, industry, trade and education, must be evaluated. The two types of epidemics have consequences for people's lives, but when isolation and physical distancing measures are taken, more people experience secondary effects, which can include job losses because of the related decline in economic activity.

The first section of this report gives a brief explanation of the damage and loss assessment methodology and the refinements in the methodology which have been made as a result of the experience gained by ECLAC since 1972. The second section presents a definition of an epidemic and the reasons why this phenomenon is considered a disaster. The third part illustrates with data the extent of epidemics in Latin America and the Caribbean. The fourth section describes the experience of ECLAC in the assessment of epidemics, while the fifth and sixth sections include the steps to be taken to conduct the assessment of the COVID-19 pandemic in the health sector and in other sectors, respectively. Lastly, the conclusions of the report are presented.

I. Disaster assessment

The economic, social and environmental assessment of a disaster consists in making an estimate, in monetary terms, of the effects and impacts of the event that can serve as a guide in the recovery and reconstruction processes, with the objective of returning the population of the affected area to the situation they were in before the disaster occurred. According to ECLAC (2014) the effects are the damages, losses and additional costs caused by the disaster (see box 1). On the other hand, the impacts are the consequences of the effects on different social and economic variables, such as family income, unemployment, growth of gross domestic product (GDP) and balance of payments.

In addition to monetary estimates, the damage and loss assessment methodology allows the inclusion and analysis of the effects and impacts on the population. This is of the greatest relevance in the case of an epidemic, since its impacts are reflected in the population and some of them are difficult to quantify in monetary terms. This analysis precedes the monetary estimate and focuses on the different effects on the population of women, the elderly, youth and children, as well as migrants and informal workers.

The categories mentioned —monetary estimates of the effects and impacts on the population— are estimated based on sectoral and local information. With respect to the former, the methodology divides the economy into social, infrastructure and production sectors.[3] Furthermore, given that a disaster is a local phenomenon, it is important for those categories to have a political and administrative expression.

The latest edition of the *Handbook for Disaster Assessment* (ECLAC, 2014) included various innovations, including (a) a special chapter on the assessment of epidemics; (b) inclusion of the concept of additional costs; (c) an in-depth analysis of how to measure losses in the health and education sectors; and (d) a calculation of the effect on livelihoods based on social accounting.

[3] The social sectors include health, education, housing, culture and cultural heritage; infrastructure includes transport, water and sanitation, power and telecommunications; production includes agriculture, industry, trade and tourism, and any other relevant activity in the affected zone.

II. Epidemics

The natural threats that contribute to the origins of a disaster, according to the Centre for Research on the Epidemiology of Disasters, are classified in the following groups: biological, geophysical, hydrological and meteorological. Biological threats refer to the exposure to living organisms and their corresponding toxic substances (for example, venom or mold) or to diseases transmitted by vectors. Some examples of this are venomous animals or insects, poisonous plants and mosquitos that carry disease-causing agents such as parasites, bacteria or viruses (for example, the mosquito that carries the parasite causing malaria). There are three types of biological threats: epidemics, infection by insects,[4] and accidents with animals.[5]

This report centers on the assessment of the COVID-19 pandemic and, to put the discussion into context, it is worth reviewing some concepts of epidemiology.[6] The Pan American Health Organization (PAHO) defines a communicable disease as one caused by a specific infectious agent or its toxic products, which is manifested by the transmission of this agent or its products from a reservoir to a susceptible host, whether directly from an infected person or animal, or indirectly by means of an intermediate host, either vegetable or animal, from an inanimate vector or environment (PAHO, 2011a).

In the past, communicable diseases represented the main cause of death in the world. However, social and economic progress that brought with it improved nutrition and sanitation, as well as the development of antibiotics and vaccines and the establishment of systems for epidemiological surveillance, led to relative control of such diseases.

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[4] General and developing swarms of insects or parasites that affect humans, animals, crops and property.

[5] Human encounters with dangerous or exotic animals in urban and rural settlements.

[6] Epidemiology is the study of the frequency and distribution of health events and their determinants in human populations, and the application of this study to the prevention and control of health problems (WHO, 2011a). The epidemiological characterization of diseases allows their nature and behavior to be known and to decide on the type of response needed for their control.

Relative control of communicable diseases was followed by an increase in morbidity and mortality from noncommunicable diseases, mainly chronic conditions. In developed countries, this brought about a major change in the profile of mortality over the past 100 years. Currently, the main causes of death are cardiovascular diseases and cancerous malignancies, while communicable diseases such as pneumonia or influenza are responsible for a reduced proportion of deaths (WHO, 2011a). On the contrary, in developing countries communicable diseases such as dengue and cholera still persist, and there has been a simultaneous increase in mortality from noncommunicable diseases. Communicable diseases tend to be acute, of short duration, like dengue and COVID-19, and usually have shorter periods of latency than noncommunicable diseases. For example, the source of a cholera outbreak can be looked for in the days prior to its appearance. Usually, the study of epidemics focuses on communicable diseases.

An epidemic is defined as the appearance of an unusual number of cases of a disease, which can exist earlier in a region —for example, the case of dengue in many zones of Latin America and the Caribbean— or be previously non-existent, like COVID-19 (PAHO, 2011a). The term is used in public health to refer to the fact that a disease has a level of incidence higher than what is considered normal. The International Disasters Database (EM-DAT) classifies three types of epidemics: viral, bacteriological and parasitic.

In this way, epidemics turn into natural threats that can cause disasters, which occur because of the combination of a natural threat with a vulnerability. In the case of an epidemic, various vulnerabilities can turn it into a disaster: lack of coverage and resources for the health system which limits its capacity to respond, overcrowding and existing social practices relating to labor and public transport, among others. Epidemics that are addressed through isolation measures tend to expose systemic vulnerabilities, such as lack of diversification in the production sector, informal and precarious employment and violence against certain groups, such as women, children and migrants.

Epidemics and droughts are the disasters that last the longest. An earthquake lasts seconds; a hurricane, days; a flood, weeks. On the contrary, an epidemic can last years. Epidemics basically occur in cities, since a concentration of human beings is a necessary condition for a disease to become a disaster. Neighborhood markets and mass transport systems are elements of urban life that can facilitate the spread of a virus due to the large groups of people they attract. Moreover, given that an epidemic can last for years, it is likely that various waves will be produced during that period.[7]

When an epidemic is sustained in the same zone for a prolonged period of time it becomes endemic, as is the case with malaria in several countries. When the epidemic spreads throughout the entire world or in a wide area, crossing borders of different countries and affecting a large number of persons, it transforms into a pandemic (Last, Spassoff and Harris, 2001). In accordance with its etymology, this word means "sickness of all the people" and, as with COVID-19, pandemics are usually produced by the appearance of a new virus from which there is no immunity.

Given that climate is one of the determining factors in insect or water-borne diseases, it is likely that the current context of climate change will give rise to more epidemics, since this phenomenon increases the probability that the seasons for transmission of diseases will be prolonged, along with changes in their geographical distribution (WHO, 2014).

[7] There is no general rule in terms of the intensity of waves. In the case of the pandemics of the past century, the 1918 epidemic appeared light at the beginning, but the second wave, six months later, took a much more lethal form. The 1957 pandemic was not very serious at the beginning, but appeared in a more serious form during the second wave, although much less devastating than was the case in the 1918 pandemic. The 1968 pandemic was also relatively light at the beginning, with some sporadic cases before the first wave, and continued to be light during the second wave in most countries, although not in all.

III. Epidemics in Latin America and the Caribbean

The database used in this study is EM-DAT, from the Centre for Research on the Epidemiology of Disasters; in it, epidemics are identified by type of disaster, subtype of the disease, name, region in which they occur and the time period in which they occur. For example, in the case of the dengue epidemic that ECLAC assessed in the Plurinational State of Bolivia, its classification in the database is as follows: biological threat, bacteriological disease, dengue, Santa Cruz (Plurinational State of Bolivia), November 2010–December 2011.

Disasters[8] caused by epidemics are not unknown in Latin America and the Caribbean. According to the EM-DAT database, between 1970 and 2019, 150 epidemics occurred: 23 in the Caribbean, 49 in Central America and Mexico and 78 in South America. These epidemics caused 24,800 deaths and affected 4,235,601 persons[9] (see table 1).

The deadliest epidemics in Latin America and the Caribbean have been bacteriological in origin, causing 89% of deaths (see table 1). Furthermore, between 1970 and 2019, 2 of the 15 most deadly disasters in Latin America and the Caribbean were epidemics (see table 2). Di Cesare (2011) indicates that, although the mortality rate for communicable diseases tended to stabilize (but not to disappear), the region presented widely varied results during the period covering 1995–2006. Countries like Bolivia (Plurinational State of), Guatemala, Haiti and Peru reported mortality rates (adjusted for age) higher than 200 deaths per 100,000 population, while countries like Chile, Costa Rica, Cuba, Guadalupe,

[8] According to the EM-DAT database, for a disaster to be recorded in the database it must have some of the following consequences: 10 or more persons declared dead, 100 or more persons declared affected, declaration of a state of emergency, and international assistance requested.

[9] During this period, Africa was the continent most affected by epidemics: there have been 919 since 1970, causing 183,965 deaths and affecting 16,446,384 persons. In 2019 the world's deadliest disaster was the measles epidemic in the Congo, leading to 5,400 deaths and affecting 250,00 persons. In 2014, there was an Ebola epidemic in three West African countries: Guinea, Liberia and Sierra Leone. It is estimated that the short-term impact —in the year of the outbreak— amounted to a loss of US$ 359 million distributed as follows: Guinea - US$ 130 million (2.1% of GDP), Liberia-US$ 66 million (3.4% of GDP), and Sierra Leone-US$ 163 million (3.3% of GDP). The neighboring countries to these three nations closed their borders and suffered considerable indirect impacts, above all in the tourism sector (World Bank, 2014).

Martinique and Uruguay had rates below 50 per 100,000. Similarly, PAHO (2017) indicated that the mortality rates for communicable diseases in the Americas (adjusted for age) declined by 9.9% from the period 2002–2005 to the period 2010–2013, which reflected an epidemiological transition process.

Table 1
Latin America and the Caribbean: disasters caused by epidemics, 1970–2019

Type of disease	Number	Number of deaths	Persons affected
Bacterial	52	22 072	1 045 483
Parasitic	3	3	112 280
Viral	93	2 421	2 978 480
No information	2	304	99 358
Total	150	24 800	4 235 601

Source: Centre for Research on the Epidemiology of Disasters, International Disasters Database (EM-DAT).

Table 2
Latin America and the Caribbean: deadliest disasters 1949–2019

Year	Country	Type of disaster	Number of deaths
2010	Haiti	Earthquake	222 570
1970	Peru	Earthquake	66 794
1949	Guatemala	Flood	40 000
1999	Venezuela (Bolivarian Republic of)	Flood	30 000
1976	Guatemala	Earthquake	23 000
1985	Colombia	Volcanic eruption	21 800
1998	Honduras	Storm	14 600
1972	Nicaragua	Earthquake	10 000
1985	Mexico	Earthquake	9 500
1974	Honduras	Storm	8 000
1991	Peru	Epidemic	8 000
2010	Haiti	Epidemic	6 908
1960	Chile	Earthquake	6 000
1963	Haiti	Storm	5 000
1987	Ecuador	Earthquake	5 000

Source: Centre for Research on the Epidemiology of Disasters, International Disaster Database (EM-DAT).

Cholera epidemics caused the most deaths in the region: 20,201 persons, equivalent to 81.5% of the total, and eight of the ten deadliest epidemics were of this disease (see table 3). The countries experiencing the most cholera epidemics were Peru (six) and Haiti (five). This disease is transmitted in conditions of overcrowding and poor sanitation, above all through contaminated water. Apart from our region, this disease affects mainly Africa and Southeast Asia. The most lethal event of the past decade was the cholera epidemic that occurred in Haiti between October 2010 and December 2011. In should be noted that it took place under conditions of overcrowding as a consequence of the destruction caused by the Puerto Principe earthquake of 12 January 2010, and was transmitted by contaminated water. This is an example of a situation where, after a disaster causing major destruction of infrastructure, another disaster, an epidemic, occurred. Likewise, PAHO (2017) indicted that, after the case of Haiti in 2010 and 2016, cases of cholera were also reported in Cuba (469 cases and 3 fatalities), Mexico (203 cases and 1 fatality) and the Dominican Republic (32,778 cases and 488 fatalities). In 2018, 3,896 cases of cholera were reported in Latin America and the Caribbean, mainly concentrated in Haiti (PAHO, 2019).

Table 3
Latin America and the Caribbean: deadliest epidemics, 1970–2019

Year	Country	Type of epidemic	Subtype of epidemic	Number of deaths
1991	Peru	Bacterial	Cholera	8 000
2010	Haiti	Bacterial	Cholera	6 908
1991	Peru	Bacterial	Cholera	1 726
1974	Brazil	Bacterial	Cholera	1 500
1992	Peru	Bacterial	Cholera	690
1991	Colombia	Bacterial	Cholera	350
1991	Ecuador	Bacterial	Cholera	343
1991	Bolivia (Plurinational State of)	Bacterial	Cholera	329
2003	El Salvador	No information	Pneumonia	304
1984	Brazil	Bacterial	Gastroenteritis	300

Source: Centre for Research on the Epidemiology of Disasters, International Disaster Database (EM-DAT).

The epidemics that have affected the greatest number of persons in the region are those that are viral in origin, representing 70.3% of the total, and dengue is the disease of this type that most persons have suffered (2,814,383, equivalent to 66.5%). The countries which have had the most dengue epidemics were Brazil, El Salvador and Paraguay (seven each). Of the ten events affecting the most persons, seven were from dengue and among them, six took place in Brazil (see table 4). Note that none of the epidemics mentioned in tables 3 and 4 were national in character nor involved quarantines or isolation measures. PAHO (2019) reported 8,207,797 cumulative cases of dengue between 2011 and 2015 in the region of the Americas, which represented a 58% increase over the period covering 2006–2010 and resulted in 5,028 fatalities. Cases of dengue were concentrated in Brazil (265,934), Central America and the Andes, and in the latter two areas, Nicaragua and Colombia were the countries reporting the most cases (58,746 and 44,825 respectively).

Table 4
Latin America and the Caribbean: epidemics affecting the most persons, 1970–2019

Year	Country	Type of epidemic	Subtype of epidemic	Persons affected
2010	Brazil	Viral	Dengue	942 153
2010	Haiti	Bacterial	Cholera	513 997
2002	Brazil	Viral	Dengue	317 730
1991	Peru	Bacterial	Cholera	283 353
1998	Brazil	Viral	Dengue	213 932
2008	Brazil	Viral	Dengue	162 701
2009	Brazil	Viral	Dengue	126 139
1995	Brazil	Viral	Dengue	112 939
2006	Paraguay	Viral	Dengue	100 000
2000	Ecuador	Parasitic	No information	100 000

Source: Centre for Research on the Epidemiology of Disasters, International Disaster Database (EM-DAT).

Between 2013 and 2016, the region also suffered other viral epidemics, such as chikungunya, zika and yellow fever. In 2016 there were 157,288 confirmed cases of chikungunya out of a total of 361,312 suspected cases. In the same way, between May 2015 and December 2016, 712,167 indigenous cases of zika were reported and 2,525 cases of the congenital syndrome associated with the infection. Meanwhile, of the 14 countries where yellow fever is endemic, only

Bolivia (Plurinational State of), Brazil, Colombia, Ecuador and Peru reported cases during this period. In 2018, the major outbreak of yellow fever occurred in Brazil. It began at the end of 2016 and 1,376 cases were reported (PAHO, 2017 and 2019).

Regional events have also taken place in Latin America and the Caribbean. The most widely known was Influenza A (H1N1), which affected Mexico and later spread to the United States and Canada. The most relevant elements of the assessment conducted by ECLAC in that regard are presented in Section IV. Furthermore, the most recent event was the outbreak of dengue which occurred in 2019 in Costa Rica, El Salvador, Guatemala and Nicaragua.

Given the COVID-19 situation, it is worth reviewing the history of pandemics with high mortality (Jorda, Singh and Taylor, 2020) (see table 5). The following are some stylized facts:

- Since the fourteenth century, four pandemics have lasted two years or less, all in the twentieth century, in contrast with the longer duration of those which occurred in earlier centuries. Advances in hygiene and nutrition, as well as technological progress, have contributed to this result.
- Ten of the fifteen pandemics presented in the table were viral and associated with respiratory diseases.
- The most pandemics occurred in the nineteenth and twentieth centuries; there were nine.
- In absolute terms, the Spanish flu was the deadliest, while in relative terms, it was the Black Plague.

Table 5
Pandemics with at least 100,000 deaths, 1347–2009

Event	Beginning	End	Number of deaths
Black plague	1347	1352	75 000 000
Italian plague	1623	1632	280 000
Great Plague of Seville	1647	1652	2 000 000
Great Plague of London	1665	1666	100 000
Great Plague of Marseille	1720	1722	100 000
First cholera pandemic in Asia and Europe	1816	1826	100 000
Second cholera pandemic in Asia and Europe	1829	1851	100 000
Cholera pandemic (Russia)	1852	1860	1 000 000
Global flu pandemic	1889	1890	1 000 000
Sixth cholera pandemic	1899	1923	850 000
Lethargic encephalitis	1915	1926	1 500 000
Spanish flu	1918	1920	100 000 000
Asian flu	1957	1958	2 000 000
Hong Kong flu	1968	1969	1 000 000
Influenza A pandemic (H1N1)	2009	2009	203 000

Source: O. Jorda, S. Singh and A. Taylor, "Longer-run economic consequence of pandemics", *Working Paper Series,* No. 2020–09, Federal Reserve Bank of San Francisco, 2020.

In analyzing the COVID-19 pandemic from the perspective of those events, according to the projections of Fergusson and others (2020), it is expected to be the deadliest biological disaster since the Spanish Flu, which is the event on which the most studies have been conducted. In Correia, Luck and Verner (2020), cities in the United States which adopted quarantines and physical distancing measures such as early closure of schools and some types of businesses were compared to others who did so later. The conclusion is that those measures directly reduced economic activity by preventing people in some sectors from going to work, but increased it indirectly by avoiding large-scale fatalities, which in itself would have a negative effect. According to those authors, the cities that took such measures early grew more quickly than those which did not.

In addition, it is important to consider the possible timeline of the pandemic, both to estimate the resources necessary to address the emergency and to decide on the measures in support of vulnerable populations, not only because of the possible effects on their health but also their livelihoods. For example, the tourism sector predicts that the level of visitors prior to COVID-19 will not be reached for two years. Taking into account the weight of this sector in employment and its contribution to local economies, it is important, in the response strategy during the pandemic and in the recovery period after, to consider support to the populations and sectors most affected.

IV. Examples of assessments of epidemics prior to COVID-19

Social vulnerability and environmental degradation are the main underlying causes of disasters assessed by ECLAC to date. In addition to producing considerable destruction of the capital stock, epidemics bring to light the inequalities existing in the places where they occur, as is evident in the assessment of Influenza A (H1N1) in Mexico[10] and a dengue outbreak in the Plurinational State of Bolivia.

In Mexico, the Influenza A (H1N1) pandemic caused 146 deaths, 17,416 confirmed cases and 80,600 suspected cases. The dengue outbreak in the Plurnational State of Bolivia caused 6,895 confirmed cases and 60,252 suspected cases. Although the mortality rate in Mexico was 0.18% and no deaths were reported in the Plurinational State of Bolivia, both disasters had major socioeconomic effects, which demonstrates that epidemics put pressure on health systems and at the same time reveal vulnerabilities in labor and production.

A. Cost of the effects

Most of the cost of both disasters fell on the people and the private sector. Although the public sector incurred costs for medical care and sanitation relating to the emergency, the majority of the losses were due to the decrease in production and sales of goods and services and to absenteeism in the workforce, both as a result of isolation measures.

In Mexico, 96% of the effects of the disaster were absorbed by workers and by the private sector, while the remaining 4% corresponded to public sector activities carried out to address the emergency. The greater part of the losses in the private sector were due to closures of businesses because of the need for physical distancing (65%) and the impact on the international image of Mexico as a tourist destination (31%).

[10] Assessment conducted with the information available up to 30 June 2009.

In the Plurinational State of Bolivia, the effects of the pandemic analyzed also fell mainly on the population (some 63%), while the percentage for the public sector was 37%. The main source of losses was worker absenteeism (58%) which affected business productivity and employment. Some 25% represented medical care, both what was provided by the State and sought by individuals in the private sector. Lastly, around 17% of the losses were produced by costs incurred from fumigation, information and communications activities.

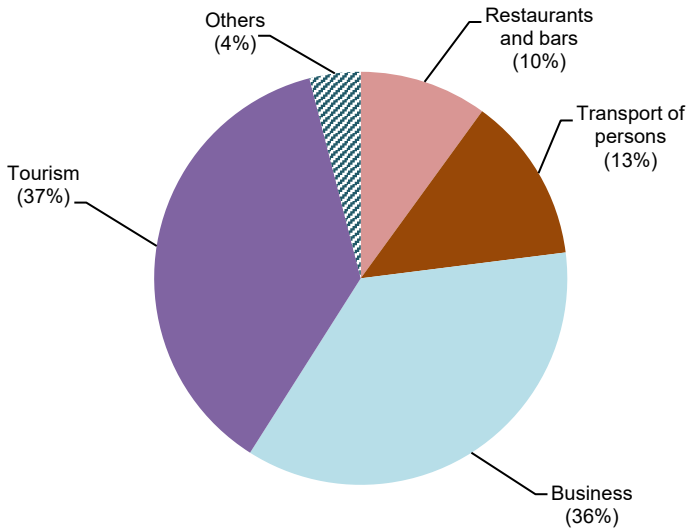
B. Sectors and gaps

Both disasters highlighted the socioeconomic vulnerability existing in those countries, whether because of high levels of informal work or low levels of diversification of production. Likewise, gaps within the countries were observed, demonstrating the persistent deficit still remaining in local and rural development in Latin America.

In Mexico, the sectors most greatly affected were tourism —mainly in Quintana Roo, where 37% of losses were concentrated, and business— above all in Mexico City, with a total of 36% in this sector. However, Quintana Roo represented only 12% of total losses, while Mexico City represented 49%, which shows its concentration of population and business.

Physical distancing measures caused the major effects on business because of the closure of businesses ordered in Mexico City. Moreover, while in Quintana Roo no cases were discovered nor closures ordered, the tourism industry was seriously affected from the damage to the country's image as a destination. This demonstrates the vulnerability of the tourism industry to external shocks. What is more, while the disaster produced a 1% reduction in the national gross domestic product (GDP) in 2009 as compared with 2008, it was estimated that the negative impact on growth in Quintana Roo represented some 49% of the GDP of the state. Dependence on tourism also contributed to the fact that the next most affected sectors were transport of persons (13%) and restaurants and bars (10%) (see figure 1).

Figure 1
Mexico: sectors affected by the Influenza A (H1N1) pandemic, 2009
(Percentages)



Source: Economic Commission for Latin America and the Caribbean (ECLAC), Pan American Health Organization (PAHO), *Preliminary assessment of the impact in Mexico of Influenza A H1N1* (LC/MEX/L.958), Mexico City, subregional headquarters of ECLAC in Mexico, 2010.

In the Plurinational State of Bolivia it was estimated that, in 2010, around 66% of workers were informal. This is relevant because companies in the formal sector provide paid leave to their workers, so that medical leave does not necessarily result in a drop in income, while in the informal sector it involves an interruption in income for workers and their families. Likewise, it was found that the main factors that could contribute to the appearance of an outbreak were solid waste management and a change in levels of precipitation. That is to say, worker vulnerability is added to health and environmental vulnerabilities.

C. Employment and wellbeing

The main source of losses in the case of both disasters had to do with employment and production: closures of businesses in Mexico and worker absenteeism in the Plurinational State of Bolivia. Economic losses because of the reduction in sales and production indicate the vulnerability of workers and their lack of resilience to cope with this type of event.

In Mexico, 59% of the persons hospitalized were between ages 15 and 44, while in the Plurinational State of Bolivia, 60% were between ages 11 and 40 (and 34% between 20 and 40 years old). These were persons of working age, and the effects on them were amplified by their unstable employment.

D. Response

The public response in both countries focused on medical care for the persons affected and in developing information campaigns in order to avoid further spread of the illness. Some central themes that should be considered in managing an epidemic are the following:

- Social communication: providing timely information is crucial in promoting good health practices, offering confidence in and transparency of public actions and avoiding the spread of disinformation.
- Testing: it is important to have infrastructure for reporting and analysis of samples, including the use of laboratories in other countries. Filters can be applied to analyze strategic populations (as was done with women and children in the Plurinational State of Bolivia and pupils in Mexico).
- Campaigns of control and sanitation.
- Development of response protocols and interinstitutional coordination.

E. Recovery

In accordance with the analysis conducted, both epidemics highlighted the unstable employment of many workers and its effect on their access to health care. Therefore, the main recommendations for recovery are focused on three themes:

(i) Employment and livelihoods of workers.

(ii) Support to micro-enterprises and small and medium businesses (in this case, tourism).

(iii) Improvement in health infrastructure, including patient registration and laboratory capacity.

V. Assessment of the effects of COVID-19

As mentioned earlier, an epidemic does not imply the destruction of the capital stock of an economy, because there would not be that kind of damage. On the other hand, the structure of the report on an assessment of the effects and impacts of the COVID-19 pandemic in a certain country is similar to any report referring to disasters. The report will be divided into three parts: (i) description of the event and the population affected; (ii) estimate of the effects of the disaster, a section describing the effects in the social, infrastructure and production sectors, as well as the estimate of the macroeconomic and social impacts, and (iii) conclusions for a resilient recovery.

One particular characteristic of the assessment of an epidemic in comparison to other disasters to which the damage and loss assessment methodology has generally been applied, such as earthquakes and hurricanes, is the emphasis placed on the health sector. During an epidemic, major demand arises for health services, which results in an increase in additional costs. In addition, there are losses in this sector due to all the usual procedures that are postponed in order to deal with the epidemic. Furthermore, as a consequence of the epidemic, physical distancing measures may be ordered, which generate losses in all other sectors, depending on the duration of the measures, their geographical extent and whether or not they cause businesses to disappear.

In order to assess the COVID-19 pandemic it is necessary to make assumptions, in consensus with the country's authorities, on the duration and extent of public health measures to control the pandemic and prevent the appearance of new episodes. Likewise, there must be information on the activities and types of care provided in the health services to address the emergency and prepare for possible future emergencies.

The COVID-19 pandemic has lasted several years, during which there have been several waves, and there is still uncertainty about when it will end. This section describes the steps that should be taken to conduct an assessment of this pandemic, which can be applied to any other. First, what should be highlighted in the description and characterization of the event is presented; next, the population affected and lastly, estimates of the effects, which include additional costs and losses in the health sector and other sectors.

A. Description of the event

In the case of an epidemic, the description of the event should include background such as the prior condition of the population, the evolution of the disease on prior occasions and the description of what happened in the event being studied. In the case of a pandemic caused by a new virus, like COVID-19, the background should refer to the demographic and socioeconomic characteristics of the country's population, since there are no references as to how the disease evolved. Thus, the demographic and socioeconomic characterization will offer a baseline to identify the vulnerabilities that may be exacerbated or limit the capacity to respond to the emergency caused by the pandemic.

1. Situation before the epidemic

The baselines are an overview of the conditions before the disaster and can have two functions: (i) to serve as a reference for estimating the effects after the disaster, and (ii) to constitute an input for the elaboration of public policies intended to prevent and reduce risks. That is to say, when an emergency has not taken place, the baselines show unresolved vulnerabilities, which can become basic inputs for decision making.

In the case of a known disease, compiling information on its behavior in the years preceding the epidemic is recommended.[11] For each previous outbreak it is important to indicate the following parameters:

(i) Duration

(ii) When it occurred (dates)

(iii) Number of waves of the disease in a year[12]

(iv) Maximum number of cases

(v) Number of deaths

(vi) Number of patients admitted to an intensive care unit (ICU)

(vii) Geographic location

(viii) Profile of the patients and deceased persons (age, gender and common pre-existing conditions, among other factors)

(ix) Secondary or long-term effects of the disease

What is sought is to understand the usual behavior of the disease in terms of number of cases, deaths and persons admitted to the ICU. In the case of diseases recurring in a country or which have been studied in detail, based on a model, data can be obtained for the year of the epidemic on the dynamics of the disease in relation to the variables mentioned. It is assumed that the budget of the health sector will be designed to cover the expected number of cases.

A way to summarize the behavior of previous occurrences of the disease is to estimate their endemic corridor, the expected behavior of this disease in a calendar year (PAHO, 2011b). The endemic corridor is determined by:

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[11] Whether it is a new disease or a known disease, it is important also to find out the characteristics of related diseases. For example, in the case of the COVID-19 pandemic, comorbidities are a relevant theme, and therefore it is essential to have information on associated illness. Ashktorab and others (2021) reported that the most common comorbidities detected in positive patients in Argentina, Bolivia (Plurinational State of) Brazil, Colombia, Ecuador, Mexico, Peru and Venezuela (Bolivarian Republic of) between 1 March and 30 July 2020 were obesity, hypertension and diabetes.

[12] It should be noted that the COVID-19 pandemic took place in waves, which could appear at an interval of months.

- The lower limit, which represents the minimum expected frequency of cases in each unit of time of the calendar year and.
- The upper limit, or epidemic threshold which represents the maximum expected frequency of cases in each unit of time of the calendar year.

The central tendency of the endemic corridor is the endemic level, the average expected frequency of cases in each unit of time of the calendar year. It is necessary to know the epidemiological profile of the population, since this allows the principal characteristics defining mortality, morbidity (number of persons suffering a disease in a period of time) and risk factors for individuals to be determined. This information has special relevance not only for its variability among separate population groups, but also because of its close relationship to other socio-demographic characteristics of the population. Knowing the epidemiological profile helps to identify vulnerabilities that can give rise to complications in the future when interacting with the disease being studied.

Furthermore, it is suggested that information should be obtained on public health interventions carried out in order to reduce the vulnerability of the population to specific diseases, for example in the case of a disease which can be prevented by a vaccine, on the vaccination coverage of the population at the national level and in the zone where the outbreak occurred. When it is a matter of a new disease, all the cases in the first wave of the epidemic will be considered excessive; the baseline for cases is zero.

All this should be complemented with information on the resources available to treat patients in accordance with the specific requirements of the disease in question, disaggregated by each health care facility in the affected region. The data which should be available refer to the availability of the following:

- Health care personnel (medical and paramedical)
- Hospital beds
- Intensive care beds
- Mechanical ventilators and dialysis units (and other life support equipment)
- Capacity to conduct diagnostic examinations to detect the disease (as well as other examinations intended for follow-up with the patients)
- Other medical supplies

It is also necessary to have information on availability of medical supplies and medicines to treat the disease, and when there is one, the quantity of vaccines available. The time required under normal conditions to replenish those supplies must also be known, as well as which supplies are imported and which are produced domestically. In both cases, the production and distribution chain must be understood, in order to determine the stages at which timely access to those goods might be compromised.

In the same way, information on the availability and capacity of health-related services, such as toilets, laundry, ambulances and food, and burial services, is essential. An increase in the number of hospitalizations also results in higher demand for those services (which may be due to greater frequency of use). Lack of capacity of these services to respond in a timely manner to the new health dynamics can cause friction that limits the quality of care offered to patients.

Knowing how the supply chain operates along with the related services on which the health sector depends is just as important as having information on the available resources to meet the specific requirements of the disease from which the epidemic originated.

2. The epidemic

The second step in the description of the COVID-19 pandemic consists in establishing quantitative details for the purpose of having a full picture of each wave. To that end, it is suggested that the following daily information be compiled:

- Record of confirmed and suspected cases
- Type of diagnostic testing available (laboratory and imaging, among others) and number of tests conducted
- Number of deaths[13]
- Number of hospital admissions (conventional hospitalization and to intensive care units)
- Number of outpatient cases (doctor visits and emergency room care)
- Number of mild cases treated by telemedicine
- Main symptoms[14]
- Most common complications among hospitalized patients[15]
- Number of persons recovered
- Number and average length of medical leave granted
- Number of persons with aftereffects or disability caused by the disease[16]

It is recommended that all these series of data should be disaggregated by gender, age, principal occupation and vulnerable populations (such as pregnant women, persons with disabilities and indigenous groups[17]). Lastly, given what has happened recently in the context of the COVID-19 pandemic, information should be presented in disaggregated form on the health care personnel affected,[18] especially since 72.8% of persons employed in this sector are women (ECLAC, 2020c).

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[13] This refers to the definition in use in the country where the assessment is being made, as there is no absolute definition. Given that this can vary from one country to another, in the case of a pandemic, care must be taken in comparing them.

[14] Ashktorab and others (2021) indicate that COVID-19 had different manifestations in the eight countries of Latin America that were evaluated, which should be taken into account because it may influence the strategies for management, treatment and prevention of the disease. The authors indicate that the most common symptoms were dry cough, fatigue, sore throat and fever. In turn, although gastrointestinal symptoms (diarrhea, nausea, vomiting and abdominal pain) were not associated with higher mortality, they noted that diarrhea was more common in Mexico and Peru. They also mentioned that some studies reported that a considerable proportion of those who had tested negative by a naso-pharyngal test had a positive stool test.

[15] For example, Claure-Del Granado and others (2020) emphasized the need to understand the epidemiology of the acute kidney damage associated with patients hospitalized with COVID-19 and to measure the resources needed for its treatment (infrastructure, medical staff and equipment), since its incidence is widespread. In that regard, reports from Italy and China place it between 0.5% and 29%, and in New York the incidence is 37%, with a mortality rate of 35%. Furthermore, 96.8% of patients who required renal replacement therapy had been on ventilators. In Latin America similar trends had been observed. In Mexico, some preliminary data reveal that acute kidney damage occurred earlier (within the first 72 hours from admission) and is more common in patients between age 50 and 55 with obesity and hypertension.

[16] Cutler and Summers (2020) state that at least a third of survivors of COVID-19 infections who were hospitalized or required intensive care had some long-term clinical problems. Ahmed and others (2020) noted the conditions they had observed: respiratory dysfunction, reduced exercise capacity, psychological problems (post-traumatic stress, depression and anxiety) and deteriorating quality of life.

[17] Meneses-Navarro and others (2020) state that 80% of indigenous communities in the region are located in the Plurinational State of Bolivia, Guatemala, Mexico and Peru, which highlights the need for those Governments to take action specifically aimed at addressing these populations that traditionally have been marginalized by the health services. They highlight information campaigns in their own languages, based on scientific facts but framed by their cultural values. In turn, they underline the relevance of parallel measures of empowerment, like access to drinking water.

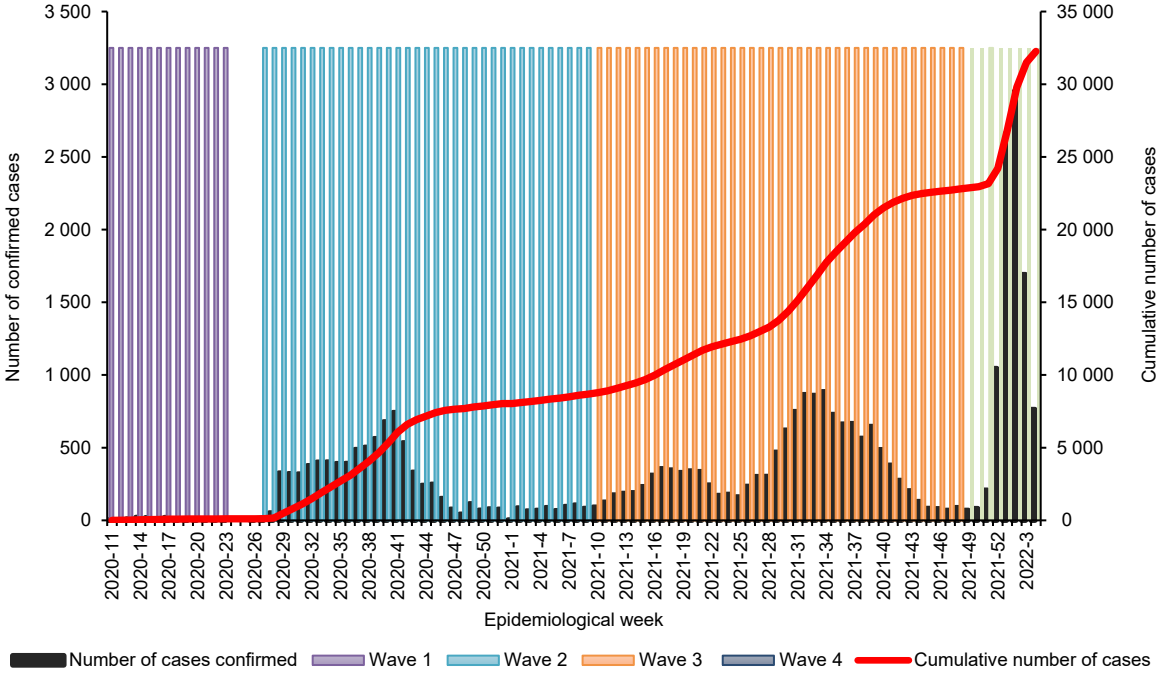
[18] This point will be analyzed in greater detail when addressing the estimate of additional costs in the health sector.

All this data should be presented in relation to the population of the country, and the information on the provinces and regions most affected should be displayed as a portion of its total population. The statistical information should also be complemented by in-depth interviews with officials responsible for its control, reporting and compilation. The purpose of these interviews is to understand the data collection process and document it.

One of the simplest and most useful ways to describe a disease is to build an epidemic curve (using sources of official statistics) that consists in a graphic representation of the daily, weekly or monthly frequency of the disease in a coordinated system, with the horizontal axis representing time and the vertical axis usually the frequency of confirmed cases (PAHO, 2011b).

Figure 2 presents the epidemic curve of COVID-19 in the Bahamas, based on the number of new cases confirmed —through the method of reaction in the polymerase chain with retro-transcription (RT-PCR) or the rapid antigen test (RAT)— compiled by week. In turn, the figure shows the periods corresponding to each wave of the pandemic that the country experienced.[19] Up to January 2022, the Bahamas experienced four waves of COVID-19: the first of 13 weeks, the second of 35, and the third of 39 (the fourth wave is still under way).

Figure 2
Bahamas: confirmed cases of COVID-19, by epidemiological week
(Number of cases)



Source: Ministry of Health and Wellness of the Bahamas.

Each observation of the epidemic curve in figure 2 is the moving five-day average, which is calculated by averaging the numbers for that day with the numbers for the two previous days and the two days after it, which helps to prevent major events (such as a change in the methods of presenting the reports) from producing bias in the data. This analysis allows both the number of new cases and the rate of change to be observed (Bello and Espiga, 2022).

[19] The Ministry of Health and Wellness of the Bahamas used the following report to make estimates that allowed it to identify the beginning and end of each wave: "Methods to determine the end of an infectious disease epidemic: a short review: (see Nishiura, 2016).

The epidemic curve is usually asymmetrical and displays the following elements:

- The rising curve, which represents the growth phase of the epidemic and whose gradient indicates the speed of its spread.
- The maximum point or plateau, which can be reached naturally or be truncated by early intervention.
- The falling curve, which represents the phase when the epidemic is exhausted.

An epidemic occurs when there are excessive cases, or a difference between those reported at the outbreak of the epidemic and those considered normal. It is assumed that the health sector budget allows financing for the resources to provide care for a normal number of cases, when it is a case of a known disease.

Lastly, interviewing the officials who led the response and medical care is recommended. These interviews should include representatives of the authorities of the ministry of health, social security institutions and private institutions providing health services. Sectoral representatives can provide valuable information that helps to understand the dynamic of the management of the emergency from different points of view, depending on the role each one played, and which reflect dimensions not captured by the numbers. They can also contribute by pointing out critical areas of coordination that will require future adjustments and vulnerabilities in the response. The qualitative information obtained through in-depth interviews with both help to better understand the actions and processes undertaken and contribute to detecting and documenting areas for improvement.

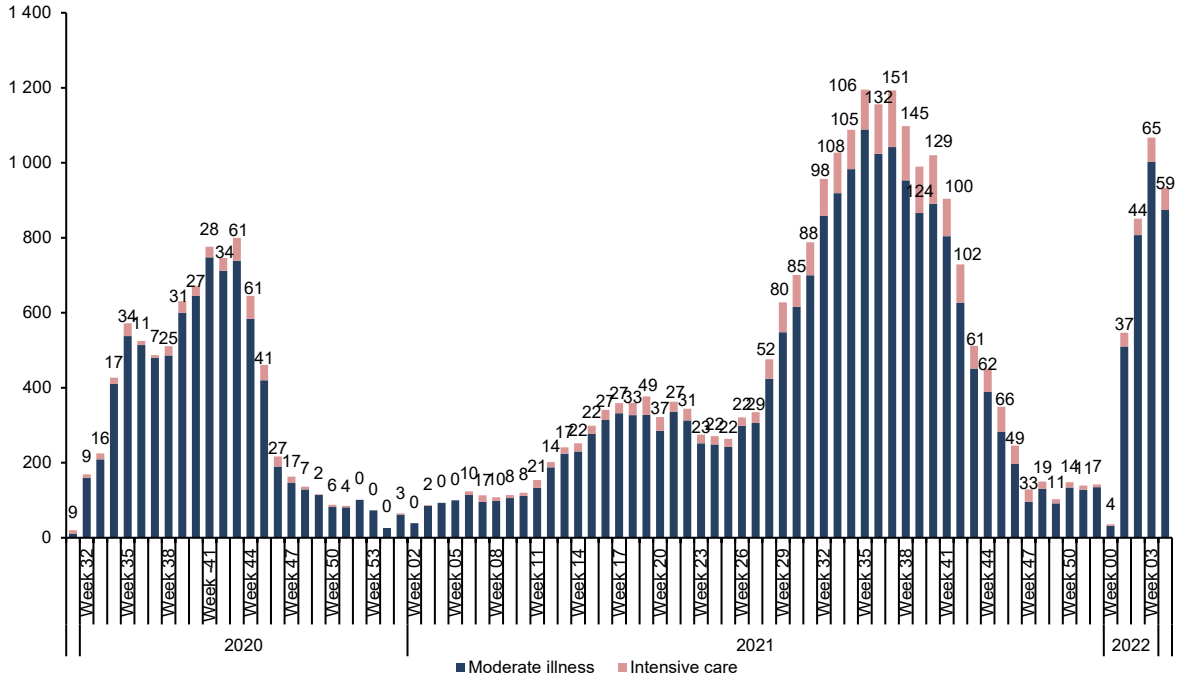
B. The affected population

The type of repercussions of disaster on an affected population are known as primary, secondary or tertiary. The primary affected population is made up of person who suffer the direct consequences of the disaster: (a) victims killed; (b) persons injured and incapacitated (primary trauma victims); (c) persons in shelters, and (d) the displaced population. In the case of an epidemic, the primary affected population are those who contract confirmed cases of the disease, among which will be those who died, those who were in intensive care units and those who recovered. Note that in the case of an epidemic, part of the description of the event in itself is an estimate of the primary affected population.

It is recommended that the data on the primary affected population should be disaggregated by gender, race, age range and region, for the purpose of detecting population groups that are most greatly affected, as well as their intersectionalities; for example, between race and gender. The COVID-19 pandemic revealed the importance of this type of disaggregation. For example, women tend to be over-represented in employment in the health and essential services sectors, and thus were more exposed to social interaction, and as a result the incidence of cases among them was higher. Having this type of information allows the development of targeted policies for intervention according to the needs of each group.

As at 24 January 2022, the Bahamas had counted 32,238 confirmed cases and 731 deaths. Within the country, almost 79% of total cases were concentrated on the island of New Providence, followed by Grand Bahama Island, where that figure was around 10%. The COVID-19 pandemic affected more women than men in the Bahamas, as women represented 53% of the total confirmed cases. Also, about 43% of cases reported were of persons between age 20 and 39. The figures for the total number of persons who required hospitalization for moderate symptoms or intensive care are not available. However, figure 3 presents the evolution in the number of patients hospitalized per epidemiological week. As can be observed, between epidemiological weeks 32 and 41 in 2021, the highest number of people in intensive care units in the Bahamas from March 2020 to January 2022 was reported. In fact, in week 37 of 2021 there were 151 persons in an ICU (ECLAC/IBD, 2022).

Figure 3
Bahamas: hospitalizations per epidemiological week, 2020–2022
(Number of persons)



Source: Ministry of Health and Wellness of the Bahamas.

The number of persons recovered can be estimated by finding the difference between the total number of confirmed cases and the total number of deaths caused by the disease. In the case of the Bahamas, as at 24 January 2022, 31,509 recoveries had been calculated. It is important to point out that this method does not allow the identification of persons who suffer long COVID-19 or other long-term effects associated with the disease. This data depends in turn on the criteria that the health authorities use to classify patients as recovered, for example, if they require the absence of symptoms or secondary effects or only that they have a negative result on a coronavirus test.

In the case of the COVID-19 pandemic, it is also desirable to measure the persons who could have been infected but were asymptomatic. However, this information would be subject to the following three factors: (i) government capacity for mass testing with antibody tests,[20] (ii) the ability of families to pay for available tests and willingness to do so, and (iii) the capacity of governments to design an appropriate mechanism for subsidies aimed at financing the tests.[21]

Antibody tests are blood tests whose purpose is to detect the existence of proteins produced by the body to attack the virus, in this case severe acute respiratory syndrome type 2 (SARS-CoV-2) causing COVID-19. It should be stressed that these tests indicate whether the person suffered the disease and

[20] The State of New York promoted antibody tests as a way to construct a baseline for the infection and thus to learn the degree to which the virus had spread (it did include persons who were asymptomatic or with mild symptoms who did not see a doctor). Another of the reasons to promote this initiative was the desire to assist researchers in developing vaccines or other treatments for the virus. This test is recommended for persons who have not been ill or tested positive for COVID-19 in the past two weeks.

[21] Trudeau, Alicea-Planas and Vasquez (2020) state that voluntary participation in testing depends on the willingness of families to pay for the results. On the basis of inquiries conducted in 16 countries of the region, it is possible to conclude that the cost of the test and household income are the main factors determining the willingness for testing. This has resulted in undercounting of cases in published data.

produced antibodies, which does not necessarily imply immunity. Given that the production of antibodies can be delayed by days or weeks, this test is not very informative in cases of persons in the earliest stages of the infection. Because of this, and given the budgetary restrictions that countries can face, it is understandable that priority might be given to tests that indicate whether or not a person is infectious, as they are the most useful in preventing the spread of a disease.

The secondary affected population are the persons within the affected area that suffer other consequences of the epidemic associated with physical distancing. The following are some examples of that population:

(i) Workers who lose their jobs or whose salary is diminished because of cuts in production or closure of the business where they work.

(ii) Merchants who experience a loss of income due to the decline in activity or bankruptcy of businesses.

(iii) Girls, boys and adolescents who do not go to school.

(iv) Persons who lose family members and friends.

(v) Victims of domestic violence during the quarantine period.

(vi) Patients who must postpone some medical care because health services are overwhelmed.

Given the differences in the effects suffered, they should be separated and analyzed individually. In the case of an epidemic where prolonged isolation measures have been adopted, the reduction in total payroll and earnings will occur because of cuts in business activity for businesses that continue to operate or the failure of others. The part of the secondary population affected who lose their jobs will be calculated when estimating the impact of the epidemic on levels of employment, and the results should be presented in that section. On the other hand, the reduction in income will be analyzed in the section on the corresponding production sectors in section VI.A.

The loss of class hours is included in the section on the education sector. It should present an estimate of the number of students who stopped attending classes and the amount of time for which classes were suspended. During the COVID-19 pandemic, countries have utilized different tools to reduce the number of lost class hours. For example, they took advantage of university infrastructure for distance education, broadcast television programmes and sent work to students by email and messaging applications. Although these methods are no substitute for traditional teaching, they help to limit losses in education.

With respect to persons who lost family members,[22] this parameter could be calculated by multiplying the number of deaths by the average number of members of a household in the zone of the country where the deaths occurred.[23]

In order to estimate the number of victims of domestic violence, official sources can be used that record the cases reported during the period of the pandemic. A limiting factor on those statistics is that, although they contain several reports received, they are not always disaggregated, for example by the type of aggression, gender and age of the victim and the aggressor, and their relationship. It is also important to take into consideration that during quarantine victims could have fewer opportunities to report aggressors, and therefore alternative mechanisms of registering and reporting should be

[22] As mentioned in section C.3 of this chapter, many of those persons will require psychological assistance, which will generate additional costs.

[23] This is a base number because family members of persons who were admitted to intensive care units can also suffer psychological aftereffects arising from this experience.

considered that will make it possible for this population to become visible.[24] Just as in the case of the preceding variable, a way of estimating the potential number of persons affected is to multiply the number of reports by the average number of households where they originated.

The quantity of patients who had to postpone their medical treatment, such as surgeries and other types of treatment, can be determined by the average number of basic services of this type that the health facilities offered before the pandemic. It is also recommended to make contact with national and international medical associations to be up to date on private initiatives to learn of and measure these effects.[25]

Lastly, the tertiary population affected are the persons who suffer indirect consequences of the disaster, but do not live in the affected area. For example, if an epidemic occurs in a certain province of a country and a quarantine is ordered, it is expected that the production of certain goods will fall and consumers demanding them in other provinces will be affected. In the case of COVID-19, when the country as a whole is affected, this population is not relevant.

In the majority of disaster assessments, the primary affected population is the main objective (ECLAC, 2014). In the case of an epidemic where physical distancing measures have been taken, the secondary affected population is the target of the cash transfers and other measures because of the economic consequences in all sectors.

C. Estimates of additional costs in the health sector

Additional costs include all pubic and private expenditure for the purpose of offering goods and services provisionally after a disaster. In an epidemic it is expected that the additional costs will increase because of the activities implemented to address both the population that falls sick and that which can require preventive measures to avoid contagion and disease.

In order to estimate those costs in the health sector, consideration should be given to the fact that the expenditures to control the epidemic can be carried out by both national and local authorities (which can represent federal, district, regional, departmental, municipal or communal bodies, in accordance with how they are named in each country) and that the information should be disaggregated. The estimate of additional costs should be made separately for the public and private health sectors. These sectors can also be classified as public and non-public, including in the latter non-governmental organizations (NGOs), United Nations agencies, funds and programmes, professional societies and private entities, among others.

In the various classifications used in both sectors, that is, the public sector (national, regional and local) and the non-public sector (private sector and non-governmental organizations and international cooperation), it is also important to report the funding source.

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[24] Espinoza (2020) cites the example of how Ecuador attempted to address domestic violence during the beginning of quarantine by channeling reports through the 911 hotline. When considering the number of calls between 1 March and 30 April 2020, a drop of 33% of calls to report domestic violence compared to the same period in 2019 was observed. The author states that this result does not necessarily imply a reduction in cases, but reflects the lack of recognition by the Government of the violence suffered by women in their homes and the limitations on their ability to report cases during quarantine.

[25] Bernabe-Ramirez and others (2020) attempted to clarify how they were affected and way in which they had to adapt care for patients with cancer in Latin America during the COVID-19 pandemic. This initiative sought to include all the countries in the region through a survey conducted using the "snowball" method that reached around 1,000 oncologists in different specialties. In November 2020 this study had reached the data processing stage of the information gathered.

Additional costs that may arise are related to the following factors:

(i) Medical treatment for persons affected by the disease (above the ordinary budget for the sector), which will require the extraordinary provision of medicines and medical supplies, contracting of personnel, expanded hours of care and strengthening of services.

(ii) Information, education, and monitoring of health and prevention measures (above the ordinary budget in the sector).

(iii) Other public health activities, such as psychological support.

Each of these areas is discussed in detail below, along with the essential steps for their assessment.

1. Medical treatment

This includes medical office visits, telemedicine[26] and emergency care, conventional hospitalization and areas of critical care (pediatric, intermediate and intensive) and laboratory examinations and imaging. Treatment can involve outpatient care and hospitalization. Doctor visits should be disaggregated by medical specialty and type of care (external or as part of hospitalization); for example, number of nephrology visits for hospitalized patients. In the case of medical treatments, equipment and supplies, it is essential to capture information on the headings considered here requiring imports and the amounts.

As mentioned before, it is expected that in the case of an epidemic, medical treatment will increase. A series of additional costs and how to estimate them is presented below:

(a) Medications, vaccines and medical supplies

(i) Medications: identify the medications used to address the disease and its complications along with the quantities acquired and the price.

(ii) Vaccines: calculate the quantities acquired and the price, as well as the costs of storage, transport, administering (including health care staff and inputs), installation of vaccination sites and development of software to set up appointments and produce certificates of vaccination, among other things.

(iii) Cleaning and protection supplies: the acquisition of supplies of this type for the use of health care staff, such as face masks, visors, gloves and gowns in order to avoid transmission. For both types of supplies, a list of products, quantities and prices should be obtained. Cleaning supplies should include the acquisition and installation of sanitizer gel dispensers.

To the extent possible based on information, it will be necessary to note if any of the services (for example, storage of vaccines and medicines, or cleaning) have been outsourced or directly executed by the health care institutions.

(b) Reinforcement of existing hospitals and health care units. This category should include both equipment and modifications to the facility such as extra supplies and hiring of personnel. The following is a list of the elements that should be considered:

(i) Additional hospital beds: to estimate the monetary value of this item information is needed on the number of beds purchased and their unit cost. If expanding the available hospital beds in a hospital or health care unit involves modifications to the existing infrastructure, the cost of this work should be considered in the estimate.

[26] Costs for this modality should include software development, training and information campaigns to promote this modality of care. In some countries these services were offered free of charge or at low cost by insurance companies.

(ii) Additional intensive care beds: as with the item mentioned above, to estimate its monetary value information on the number of beds purchased and their unit cost is needed. This should also include the necessary equipment and the unit cost per bed. If expanding the number of available intensive care beds in a hospital requires making modifications to the existing infrastructure, the cost should be included in the estimates.

(iii) Mechanical ventilators (or other life support equipment): to calculate their monetary value, the quantities acquired, the price and the installation costs ae needed. If increasing the number of available mechanical ventilators in a hospital involves modifications to the existing infrastructure, the cost should be included in the estimate.[27]

(iv) Hiring of additional health care, medical and paramedical staff: to estimate the monetary value associated with this item information is required on the number of professionals hired by category, their average salary, the employee benefits (or liabilities) and the number of months their contracts will last. If medical personnel receive overtime pay, it is important to account for it based on the average number of hours and pay rate and include this (this can vary in accordance with the labor regulations of each country).

(v) Cooperation agreements: on some occasions, countries sign cooperation agreements that include sending medical personnel to the field, transfer of technology or technical assistance during an emergency. It is important to document the costs associated with the implementation of such agreements. For example, if it includes sending medical personnel, the additional costs incurred in the receiving country, housing and food for instance, should be quantified.

The cost of these items should be estimated for the public sector as a whole and not by hospital, because they are acquired for this sector as a group. It is important to differentiate between the various government agencies that make such acquisitions. In the case of the private sector, because this sector is not centralized, acquisitions are not global.

(c) Temporary hospitals and mobile units: expanding the services offered in the health sector can require the establishment of temporary hospitals. For each hospital of this type, information should be sought on the cost of acquisition and installation of the temporary structure, as well as the monthly cost of operation, which includes food, water, power and monitoring. To estimate staff costs, the procedure outlined in section C.1.b.iv of this chapter could be followed.

Temporary hospitals are sometimes set up in existing structures, such as event spaces or stadiums. In this case, the relevant information is the monthly rent. The other costs can be estimated as described in the paragraph above.

(d) Laboratories: during an epidemic it is essential to know the number of confirmed cases of the disease. This can require mass testing of examinations that can be processed in national laboratories, and therefore test kits and supplies to process them must be acquired. Suggested information to be gathered to account for this cost is the number of kits and their unit price, as well as the quantity of other supplies used and their unit price. It should also be considered whether it was necessary to hire additional staff or expand the capacity of the laboratories where the tests were processed. In the same way, it must be known whether the tests will be available to the population free of charge or if those affected must pay for them either in part or in full, whether through insurance or out of pocket.

[27] As an example, the Influenza A (H1N1) epidemic in Mexico should be cited, during which the capacity of some intensive care units in public hospitals was exceeded, and emergency beds and conventional hospital beds were reconfigured with ventilators and other life support equipment to provide care to seriously ill patients.

(e) Specialized laboratories: during an epidemic it is also important to study the genetic variations of the virus in order to identify mutations and predominant strains in each region or locality. Therefore, the additional costs incurred for these specialized analyses must be included, such as the purchase of additional supplies to process the tests or the costs to send them to international laboratories if the country does not have the capacity set up to process them.

(f) Emergency care in remote areas: this generates costs for transfer and travel of health personnel sent to such zones. The cost of fuel or transport fares should be accounted for; for the latter, information should be obtained on the cost per day, the number of days and the personnel participating in each mission. In the case of zones with indigenous populations, it is important to include the costs of interpreters, informational materials with medical instructions translated into the languages of those communities and any other adaptations required to accomplish the mission.

2. Information, education, health monitoring and prevention measures

It is necessary to know and place a value on the activities implemented during the emergency to prevent or mitigate the effects of the event on the health of the population living in the affected zone. Under each heading there should be an accounting for what is higher than the usual budget.

(a) Information and education

Because epidemics are long-lasting disasters, communications and education campaigns are key. The objective the former is to inform the people through social media and the communications media about the measures that are being taken to address the epidemic and on the best practices to prevent or delay new outbreaks.

This heading should also include the production and dissemination of educational materials intended for different audiences, which clearly explain what the disease is, its consequences and the individual and collective actions that should be taken to contain it. Both activities, in communications and education, help to prevent disinformation through timely and transparent communication. In placing a value on information and education campaigns, campaigns to combat false news should also be included.

(b) Health surveillance

This refers to all the tasks related to collection, analysis, interpretation and ongoing dissemination of data on health (PAHO, 2011b). During an epidemic this function can be overwhelmed because of the demands for assistance for the disease itself and because data on other communicable and non-communicable diseases must also continue to be compiled.

The teams participating in surveillance should work together with those responsible for communications. The additional costs relating to monitoring are associated with hiring of extra staff to deal with the disaster. In order to estimate them, information on the number of persons hired, average salary and the number of months in the contract should be obtained. Another way of confronting the epidemic can be to contract for extra hours; if this is the case, they should be calculated based on the quantity contracted and their average value. For example, in the case of COVID-19, a strategy for containment of the disease can include contact tracing of persons who become infected. Some governments and private institutions have promoted the use of free applications for mobile phones or tablets that allow digital tracking of contacts, in which case the cost comes from the development of the platform and its maintenance. However, concerns about privacy and the use of the data collected, as well as technological restrictions (disparities in the use of smart phones among vulnerable populations) and the low level of acceptance of this mechanism by users (while this varies by the political

context of the country), have limited monitoring by digital means. For this reason, an alternative form of implementing this strategy is to hire tracers. In Chile it was estimated that 5,000 persons would be needed for this task in Santiago and 9,000 for the country as a whole.[28] The costs for a strategy like this would be associated with the acquisition of mobile phones, the establishment of a call center and hiring of staff (whose total cost would be the result of multiplying the number of persons hired by the average monthly salary by the number of months.)

(c) Containment programmes

Under this heading, other measures such as fumigation, cleaning of streets and buildings and distribution of protective equipment like masks and gloves to the population are included. To estimate the cost of these programmes, the procedure outlined in section V.C.1.a.iii of this report should be followed.

3. Other public health activities, including mental health

When an epidemic leads to a high number of confirmed cases, in addition to deaths and economic losses, it creates an elevated psycho-social risk, in a context of different vulnerabilities related to age, gender and socioeconomic status. Usually, in a disaster situation, the most vulnerable strata of the population are the ones with the least probability of recovering their livelihoods. An epidemic of major size, like any catastrophe, is a human tragedy with consequences for the mental health of the population, which are marked in the most economically vulnerable groups with limited access to education and health services.

During an epidemic, many individuals can face a crisis, a situation created by an external life event that exceeds the individual's emotional capacity to respond (PAHO, 2006). Faced with a situation of great emotional significance —like suffering a serious illness or the death of loved ones— some psychic manifestations are the understandable and transitional response to traumatic life experiences, but there can also be indications that they are becoming a pathological condition. Note that the experiences mentioned can be more traumatic in situations like the ones that arose during the COVID-19 pandemic, when patients were isolated and on occasion were not even able to say goodbye to their loved ones.

As in any other catastrophe where a large number of persons lose loved ones, those persons experience sadness, suffering and grief. The mourning period is when the individual assimilates the event, understands it, overcomes it and rebuilds his life. Mourning is lived through with a mixture of sadness, anguish, fear and anger and, at the most critical moment, reaches extremes of intense emotional pain and desperation. After that comes progressive relief, and mourning concludes with expressions of renewed confidence and hope. In major catastrophes, mourning assumes the need to deal with many other losses and has a broader and more communal meaning; it involves the breakdown of a life plan and has a dimension that is not only within the family, but is also social and economic (PAHO, 2006).

Faced with an event like this, support must also be offered to the population affected by the epidemic along with those who contract the disease, especially those who were in intensive care, and persons who lost a family member or close friend.[29]

Also, given the extent of the COVID-19 pandemic, the effects on the broader population experiencing secondary effects must be considered. Isolation measures created conditions of overcrowding that affected hygiene, privacy and coexistence. Likewise, the slowdown in economic

[28] See Diario Uchile (2022).

[29] This psychological support must also include the medical and paramedical staff who provided care during the epidemic on the front lines, because they were subjected to long hours of duty and stressful situations during the emergency.

activity and its effects in such sectors as manufacturing, construction, tourism and business had repercussions for a large number of micro-, small and medium-sized enterprises and independent workers. This creates anxiety and stress when faced with uncertainty about how to meet basic needs like food and paying rent and public services. The effects of the pandemic were also different by gender. As mentioned, 72.8% of the persons employed in the health sector are women, who tend to suffer more violence in their workplace, especially in situations of disinformation. Women also take on the tasks of caring for the home and the sick which are not always paid. Lastly, lockdown measures have increased domestic violence, and many countries have created communications channels to reach victims, mainly women and children.

Psychological and psychiatric support will result in additional costs relating to the hiring of staff. In order to quantify them, information is required on the number of professionals hired by category, their average salary and the number of months the contract will last. It should be mentioned that, in circumstances of prolonged physical isolation, which COVID-19 involved, that type of care can be provided through virtual platforms.[30]

4. Consolidation of additional costs

Total additional costs equal the sum of expenditures made in the following areas: medical treatment, information, education, health surveillance, containment programmes and others such as psychological support. As for the presentation of the results, from an institutional perspective, the public sector can be separated from the private sector. From a geographical point of view, the results should be expressed by region, department or state, in accordance with the political-territorial divisions of the country for which the estimates are being made. As for origin, the costs should be divided between those involving imports and those that include acquisition of domestic products.

D. Estimates of losses in the health sector

In the case of an epidemic, the demand for services in the health sector can increase over its baseline, that is, the number of normal cases. However, this increase represents care not usually provided, to the detriment of the routine care provided by the health system. For example, in the case of COVID-19, many hospitals in different Latin American cities were devoted entirely to care for patients with the disease and all other activities were suspended, and thus it is important to measure the services not provided.

The step-by-step procedure is explained below.

(1) Baseline[31]

(a) Information should be obtained on the number of treatments and the projected income of hospitals for the year in which the disaster occurred. Treatments would include outpatient visits, surgeries, laboratory exams and hospitalizations. If this information is not available, the data for the number of such services offered for the previous year can be used.

In the case of the Bahamas, ECLAC and IDB (2022) present background along those lines. In the period before the COVID-19 pandemic, from 2015–2019, data on hospital utilization reveals a nominal declining trend in all types of services, except emergency room visits and pediatric admissions. While

[30] The NGO *Duelo Contigo*, headquartered in Medellin, Colombia, is offering psychological support services to those going through a mourning process as a consequence of COVID-19. The organization was created for that purpose.

[31] A short summary explaining the functioning of the health sector in the country and its financing sources should be included. This is useful since, for example, knowing the size of the public health system will provide an idea of the capacity for emergency response. Also, knowing if access to health care is free and universal or with copays and by affiliates will shed light on the income that the listed services could generate.

general admissions were declining, the amount of the decline year over year was in no case greater than 0.04%. In 2020, during the pandemic, a decrease in hospital admissions and access to community and ambulatory services was observed. There was a major drop, which largely exceeded the numbers from before the COVID-19 pandemic. Specifically, in the 2019–2020 fiscal year, in comparison with the average of the four previous fiscal years before the pandemic, access to health services recorded a reduction of somewhere between 27% and 7%. The types of services that experienced the greatest interruption were intensive care, psychiatric care and internal medicine, with decreases of 17%, 22% and 22% respectively (see table 6). On the contrary, geriatric admissions increased by 3%.

Table 6
Bahamas: medical treatment by fiscal year, 2015–2020
(Number of treatments)

Medical service	2015/16	2016/17	2017/18	2018/19	Average 2015–2019	2019/20
Intensive care	812	798	689	675	744	544
Psychiatry	1 436	1 520	1 438	1 303	1 424	1 107
Internal medicine	4 224	3 923	3 896	3 599	3 911	3 057
Emergency room	1 061	1 178	993	1 152	1 096	892
Surgery	4 821	5 147	5 296	4 957	5 055	4 211
Obstetrics-Gynecology	1 924	1 832	1 828	1 918	1 876	1 629
Pediatrics	5 886	5 617	5 389	5 339	5 558	4 931
Infirmary	4 106	3 863	4 393	3 789	4 038	3 740
Geriatrics	38	47	30	35	38	39
Total	24 308	23 925	23 952	22 767	20 150	

Source: O. Bello and F. Espiga (coords.), *Assessment of the effects and impacts of the COVID-19 pandemic in the Bahamas* (LC/TS.2022/69), Inter-American Development Bank (IDB)/Economic Commission for Latin America and the Caribbean (ECLAC), 2022.

(b) It is necessary to place a value on this change in flows based on payroll and salaries when dealing with public health. Note that in this case the value added would be estimated directly. In the case of private health care, the income not being received could be used, for which a gross amount produced would be calculated (see ECLAC, 2014).

(2) Based on the information on postponement of services as a consequence of the COVID-19 pandemic, the value of the number of treatments that were not provided would be determined. The calculation is done from the baseline. If possible, this information can be disaggregated by type of service and medical specialty.

E. Exercise based on a hypothetical case

In order to illustrate the concepts developed in the previous sections, the following exercise based on a hypothetical case is proposed.

Epidemic in Pavonia

"It's true, there were two waves, but the first was a tsunami." Director of the University Hospital.

Pavonia is a country of 170,000 km² made up of three provinces, two continental provinces named Levante and Poniente, and a relatively isolated island province named Lejania. The population of Pavonia is approximately 15.8 million people, 49% male and 51% female. Pavonia has three major population centers, the same number as its provinces, and the country is highly urbanized. The most populated city,

Levante, has a population of 7.5 million; Poniente follows with 6.8 million, and the capital of the island province has almost a population of almost 300,000. The rest of the population is rural. The exchange rate for the national currency, called the monetary unit (MU) is 1 to 1 with the United States dollar.

At the beginning of 2020, cases of an atypical pneumonia were detected in a neighboring country to Pavonia. After conducting various tests, the existence of a new type of virus was determined, which the World Health Organization (WHO) called COVID-19. The virus spread rapidly to the neighboring countries, including Pavonia. On 1 February 2020, the first case was confirmed in Levante City.

At the time when the authorities reacted, there was already community spread and the epidemic was extensive. In Lejania, however, there were few cases and the epidemic was able to be controlled at the early phase. Taking advantage of its island status, a shutdown of air and maritime traffic was rapidly ordered, which made it easier to control the epidemic. On the other hand, the situation in the continental provinces was different.

At the end of March, it was clear that the epidemic was out of control: over 2,000 confirmed cases of the disease were reported daily and more than 800 persons had died. On 25 March, the Government ordered the quarantine of the continental population with the aim of reducing the spread and preventing the collapse of the health system. Classes and all non-essential activities were suspended, and meetings of more than ten persons were prohibited. The order included a freeze on firing and the Government offered to cover 80% of salaries of all businesses for the next three months.

Although some of the measures were relaxed during the quarantine period, it extended until 1 July. When quarantine ended, new cases per day were under 200 and over 80,000 cases had been confirmed; moreover, there had been over 10,000 deaths. In the month of July, a serological study was begun in order to estimate the degree of prevalence of the disease. This study had two phases and was elaborated based on visits to 12,000 households at two different times. Its total cost was 6 million monetary units (MU). The study was completed in the middle of August and it was determined that around 8% of the continental population of Pavonia had antibodies against the virus. For its part, the figures were practically insignificant in Lejania.

As soon as quarantine was lifted, the number of cases began to rise. Various hot spots appeared in different places both in Levante and Poniente, many of which were associated with nightlife and the crowds of summer. The second wave of infection was longer than the first, but less intense. Moreover, for the first time it was associated with younger people, who presented a higher number of asymptomatic cases. The peak of this second wave occurred at the beginning of October. In mid-August, the Parliament approved the use of tracking technology and allocated 2.5 million MU to launch its development, supplemented by 3 million MU intended for tracking staff. This new programme went into effect in mid-September.

The field work, which included conversations with various actors and official staff, obtained the following information:

- The total number of confirmed cases during the epidemic was 242,991, with 10,520 deaths. A total of 6,229,849 tests were performed. The daily numbers were available.
- A total of 35,833 patients were hospitalized for a total of 179,166 days. Of those patients, 7,166 required intensive care and 1,791 of those were put on ventilators. There were a total of 52,895 patient days of intensive care and 38,578 patient days on ventilators. There were 264,155 outpatient visits. The daily figures were available.
- Based on conversations with officials of the Ministry of Health, the following costs were obtained:

- Tests: 25 MU
- Hospital bed (including the bed and equipment): 5,000 MU
- ICU equipment: 10,000 MU
- Ventilator: 2,000 MU
- Outpatient visit per patient: 65 MU
- Hospital treatment per day per patient: 300 MU
- ICU treatment per day per patient: 600 MU
- Treatment of patients in ICU with ventilators, per day: 800 MU
- One dose of the vaccine: 35 MU
- Masks: 3 MU
- Anti-COVID-19 treatment: 45 MU per person infected

- Transport of persons and equipment amounted to 3.5 million monetary units (MU), which included the cost of 20 respirators sent from Lejania to support the continental provinces.
- Two facilities, one in Levante and one in Poniente, were adapted to serve as field hospitals. Each of them was equipped with 200 beds, of which 20 were for intensive care, all with respirators. The cost of adapting these facilities was 12.5 million MU, without including the cost of beds and equipment. All the equipment was imported.
- The Ministry of Health allocated 30 million MU for awareness and information campaigns.
- The Ministry of Health allocated 70 million MU for medical supplies.
- The Government estimated that, as a consequence of the epidemic, 1,200 MU per person was spent on psychological assistance. It was calculated that the group of persons receiving this type of care would represent 0.2% of the population quarantined by the pandemic.
- The baseline for the number of health interventions performed by the public sector in the previous year and their costs is shown in table 7.

Table 7
Pavonia: baseline of costs for health interventions, 2019
(Number and monetary units (MU))

Health intervention	Quantity	Cost (*in MU*)
Vaccination	1 200 000	50
Primary care	1 246 942	75
Emergencies	6 408 725	600
Hospitalizations	1 467 370	
Surgeries	1 179 447	
Appendectomy	50 000	5 400
Cataract surgery	90 000	4 350
Cholecystectomy	76 790	7 890
Hernia surgery	63 478	4 670
Prostatectomy	30 000	9 345
Neurosurgery	20 000	23 456
Heart surgery	43 980	18 569

Health intervention	Quantity	Cost (*in MU*)
Catheterization	73 560	3 900
Hip replacement	12 000	11 430
Knee replacement	6 500	12 360
Rhinoplasty	50 000	7 800
Other plastic surgery	125 000	11 980
Other surgeries	538 139	3 500
Transplants	1 820	
Kidney	1 141	10 500
Liver	409	12 000
Heart	100	18 000
Lung	140	21 000
Pancreas	26	11 400
Other	4	15 000
Obstetrics and gynecology	286 103	
Delivery	119 923	5 460
Cesarean section	31 180	8 940
Mastectomy	40 000	7 350
Breast biopsy	90 000	2 670
Hysterectomy	5 000	7 890
Physiotherapy and rehabilitation	360 000	85

Source: Prepared by the authors.

- The epidemic consumed the country's health resources, which had a negative effect on the provision of services. This was especially evident during the quarantine period.
- During the quarantine, all vaccination campaigns ceased.
- Primary care visits dropped by 50% during quarantine. Officials stated that this type of care was reduced by 5% for the rest of the pandemic period.
- Emergencies fell by 15% during quarantine.
- Surgical interventions dropped by 45%, except for plastic surgeries, none of which took place during the quarantine.
- Transplants dropped by 15%, and part of the decline was a result of the drop in donors during the quarantine.
- As for obstetrics and gynecology, mammograms, breast biopsies and mastectomies fell by 80% during the quarantine. There was no effect on the rest of those interventions.
- Physiotherapy and rehabilitation were totally suspended during quarantine.

Based on the information provided:

(i) Estimate the primary, secondary and tertiary populations affected in Pavonia during the first wave of COVID-19.

(ii) Estimate the baseline for treatment corresponding to the health sector in Pavonia.

(iii) Estimate the losses in the health sector caused by the COVID-19 epidemic in Pavonia.

(iv) Estimate the additional costs in the health sector associated with the COVID-19 epidemic in Pavonia.

Responses

(1) There are three types of affected populations: primary, secondary and tertiary. The primary affected population are those who contracted or were presumed to have contracted the disease. In Pavonia, throughout the pandemic, 242,991 cases were confirmed. Furthermore, through a serological study it was determined that around 8% of the continental population had antibodies against the disease. Thus, the primary affected population is estimated at 1,236,890 persons.

The secondary affected population are those who experienced direct consequences of the disease but did not contract it. In this case, it is the population that had to be quarantined, with the resulting effects on income and employment. In Pavonia, the entire continental population was quarantined; therefore, the secondary affected population is estimated at 15,461,126 persons.

Lastly, the tertiary affected population are those who suffered the indirect effects of the epidemic. In this case, the population of Lejania, which remained isolated from the rest of the country, was not quarantined, but it is understood that its economy suffered the consequence of isolation. The indirect effects of the epidemic were also experienced by the rest of the continental population of Pavonia; therefore, the tertiary affected population is the entire population of the country (see table 8).

Table 8
Pavonia: population affected by the COVID-19 epidemic, 2020
(Number of persons)

Affected population	Number of persons
Primary affected population	1 236 890
Confirmed cases	242 991
Probable cases	993 899
Secondary affected population	15 461 126
Levante	7 888 330
Poniente	7 572 796
Tertiary affected population	315 533
Lejania	315 533

Source: Prepared by the authors.

(2) The baseline for health care interventions during a year as presented in table 9. A total of almost 10.7 million health interventions were provided for a total of 12.963 million MU. In order to place a value on these interventions, the unit costs established in the public sector are used.

Table 9
Pavonia: baseline of costs for health interventions, 2020
(Number and monetary units (MU))

Health intervention	Quantity	Unit cost (*in MU*)	Total value (*in MU*)
Vaccination	1 200 000	50	60 000 000
Primary care	1 246 942	75	93 520 650
Emergencies	6 408 725	600	3 845 235 000
Hospitalizations	1 467 370		

Health intervention	Quantity	Unit cost (*in MU*)	Total value (*in MU*)
Surgical interventions	1 179 447		
Appendectomy	50 000	5 400	270 000 000
Cataract surgery	90 000	4 350	391 500 000
Cholecystectomy	76 790	7 890	605 873 100
Hernia surgery	63 478	4 670	296 442 260
Prostatectomy	30 000	9 345	280 350 000
Neurosurgery	20 000	23 456	469 120 000
Heart surgery	43 980	18 569	816 664 620
Catheterization	73 560	3 900	286 884 000
Hip replacement	12 000	11 430	137 160 000
Knee replacement	6 500	12 360	80 340 000
Rhinoplasty	50 000	7 800	390 000 000
Other plastic surgery	125 000	11 980	1 497 500 000
Other surgeries	538 139	3 500	1 883 485 333
Transplants	1 820		
Kidney	1 141	10 500	11 980 500
Liver	409	12 000	4 908 000
Heart	100	18 000	1 800 000
Lung	140	21 000	2 940 000
Pancreas	26	11 400	296 400
Other	4	15 000	60 000
Obstetrics and gynecology	286 103		
Delivery	119 923	5 460	654 781 400
Cesarean section	31 180	8 940	278 749 200
Mastectomy	40 000	7 350	294 000 000
Breast biopsy	90 000	2 670	240 300 000
Hysterectomy	5 000	7 890	39 450 000
Physiotherapy and rehabilitation	360 000	85	30 600 000
Total	10 683 037		12 963 940 463

Source: Prepared by the authors.

(3) Losses in the health sector are all the health services that were not provided as a result of the epidemic, and are calculated from the baseline presented above. Table 10 summarizes the losses caused by the COVID-19 pandemic in Pavonia. In total, almost 1.1 million health interventions were not provided, with a value of 1.492 million monetary units. In order to calculate this decrease, the annual interventions from the baseline were turned into daily interventions and the drops reported during the quarantine and the rest of the year were used to obtain the number of interventions not provided.

Table 10
Pavonia: losses in the health sector, 2020
(Number of cases and monetary units (MU))

Health intervention	Losses	Unit Cost (*in MU*)	Value of services provided (*in MU*)
Vaccination	322 192	50	16 109 600
Primary care	214 201	75	16 065 075
Emergencies	258 105	600	154 863 000
Hospitalizations	197 418		
Surgical interventions	168 347		
Appendectomies	6 041	5 400	32 621 400
Cataract surgery	10 874	4 350	47 301 900
Cholecystectomy	9 278	7 890	73 203 420
Hernia surgery	7 670	4 670	35 818 900
Prostatectomy	3 625	9 345	33 875 625
Neurosurgery	2 416	23 456	56 669 696
Heart surgery	5 314	18 569	98 675 666
Catheterization	8 888	3 900	34 663 200
Hip replacement	1 450	11 430	16 573 500
Knee replacement	785	12 360	9 702 600
Rhinoplasty	13 425	7 800	104 715 000
Other plastic surgeries	33 562	11 980	402 072 760
Other surgeries	65 019	3 500	227 566 500
Transplants	73		
Kidney	46	10 500	483 000
Liver	16	12 000	192 000
Heart	4	18 000	72 000
Lung	6	21 000	126 000
Pancreas	1	11 400	11 400
Others	0	15 000	0
Obstetrics and gynecology	28 998		
Deliveries	0	5 460	0
Cesarean section	0	8 940	0
Mastectomy	8 592	7 350	63 151 200
Breast biopsy	19 332	2 670	51 616 440
Hysterectomy	1 074	7 890	8 473 860
Physiotherapy and rehabilitation	96 658	85	8 215 930
Total	1 088 574		1 492 839 672

Source: Prepared by the authors.

(4) The additional costs of the epidemic are all the expenditures incurred by the public and private sector to confront the emergency. Table 11 compiles the additional costs that originated with the COVID-19 epidemic which took place in Pavonia.

Table 11
Pavonia: additional costs from the COVID-19 epidemic, 2020
(Number and monetary units MU))

Item	Unit of measure	Price (*in MU*)	Quantity (*number*)	Cost (*in MU*)
Medical care			94 503 975	
Outpatient	Visits	65	264 155	17 170 075
Hospitalization	Days per patient	300	126 271	37 881 300
Intensive care units (ICU)	Days per patient	600	14 317	8 590 200
ICU and ventilator	Days per patient	800	38 578	30 862 400
Testing	Test	25	6 229 849	155 746 225
Serological study	One payment		6 000 000	
Establishment of field hospitals			14 980 000	
Adaptation of facilities			12 500 000	
Beds	Unit	5 000	400	2 000 000
ICU equipment	Unit	10 000	40	400 00
Ventilators	Unit	2 000	40	80 000
Purchase of protective medical supplies				70 000 000
Transport of staff and equipment				3 500 000
Communications campaigns				30 000 000
Tracing technology				2 500 000
Tracing staff				3 000 000
Psychological assistance	Persons affected	1 200	30 922	37 106 400
Burial or cremation	Deceased persons	1 500	10 520	15 780 000
Total				433 166 600

Source: Prepared by the authors.

The additional costs reached a total of 433.2 million MU. Within this total, the costs for medical care were 94 million MU, the majority of which represented hospitalizations. The cost of the over 6.2 million tests conducted were 156 million MU, and the serological study had a cost of 6 million MU.

The establishment of field hospitals, with beds and the rest of the equipment, cost almost 15 million MU. In addition, the cost of protective medical gear was 70 million MU. Those supplies were added to the costs and were not accounted for in the baseline cost of health interventions, as they were additional protective medical supplies arising from the epidemic. For transport of staff and equipment, 3.5 million MU were allocated, and 30 million for various communication and awareness campaigns. The tracing programme, which had a significant influence on containment of the second wave, created costs of 37.1 million MU; lastly, the costs of burial or cremation of deceased persons were 15.8 million MU.

VI. Assessment of the effects of the COVID-19 pandemic on sectors other than the health sector

A. Estimates of losses in various sectors

The COVID-19 pandemic, or a large-scale epidemic in a country or a region of a country, will have decisive consequences for its economy due to the physical distancing measures taken to avoid continuing spread of the disease, such as restrictions on mobility and suspension of activity in sectors that are considered non-essential.[32] These policies are applied in a context where a new virus is spreading rapidly because the population has no significant immunity to the disease. Therefore, it can produce a high mortality rate because vaccines and treatment are not yet available.[33]

The measures mentioned can be effective if they are strictly observed. In that respect, a quarantine is difficult to observe in countries where the rate of informal work is high, since many of the activities that are part of this sector of the economy cannot be performed using the telework modality, and the persons who work in that sector need to work because of their low levels of savings. The situation of these people is rather precarious because, by going out to work, they increase the possibility of catching the disease, and their incomes are lower because the economy is operating at a slower pace. In addition, they have very limited access to social security systems.

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[32] When referring to quarantines and other physical distancing measures, normally the costs to the economy are pointed out, but not the benefits in terms of a reduction in deaths. Thunstrom and others (2020) examined the net benefits of physical distancing to slow the spread of COVID-19 in the United States. They used epidemiological and economic predictions to conduct a rapid cost-benefit analysis on the control of the COVID-19 outbreak. According to those authors, the physical distancing measures substantially reduced deaths. Furthermore, they estimated the monetary value of the lives saved and that surpassed the economic costs of those measures by US$ 5.2 billion.

[33] Since the past decade, as a consequence of the H5N1 flu, there was talk of a possible catastrophic scenario. In September 2005, Dr. Lee Jong-Wook, former Director-General of WHO, warned of the high probability that a global pandemic would result from the avian flu, an event that would have incalculable health, social and economic consequences and would be even more serious if the ministries of health were not prepared and countries did not have a communications strategy to inform the public about the pandemic, its development and how to protect themselves.

From an economic point of view, in the short term, these containment policies are a negative supply-side shock[34] that brings about a temporary decline in economic activity and high unemployment (ECLAC, 2020a). From a social perspective, this results in an increase in poverty indicators (ECLAC, 2020b). The shock will be greater the longer the measures in question last.

In all other sectors, losses caused by the epidemic are estimated on the basis of the latest version of the *Handbook for the Assessment of Disasters* (ECLAC, 2014). This publication details for each of the sectors how the estimate of lost flows should be made. As in any disaster, it is necessary to make assumptions on the duration of the recovery; for example, in the case of a major hurricane or major earthquake, the recovery will depend on the speed with which destroyed assets are replaced.

It should be recalled that disasters result in increased sales of some products and services, which should be included in the assessment of losses. For example, during the COVID-19 pandemic, many businesses relied on electronic trade, including sales on social networks, which allowed them to maintain a certain level of business. Meanwhile, the massive transfer to remote work increased the use of broadband and products related to information and communications technologies (ICT). In addition, the search for entertainment during the lockdown raised the consumption of digital services for education, wellness, mental health and video games, together with free streaming services (over-the-top applications), among others.

Using as a reference an ECLAC publication (2014), a valuation of the losses in some of sectors most affected by the COVID-19 pandemic - education, water, power, and tourism - is presented below.

1. Education sector

Losses in this sector occurred as a consequence of quarantines or measures to close educational establishments, meaning that class hours were suspended or their quality declined. In the case of the COVID-19 pandemic the first closures throughout the region prevented classes from being given because the education sector was not prepared for such a situation. Once capacity for remote instruction was established or increased, class hours were still lost because the distance learning day is usually shorter than the normal day before the pandemic. Each set of lost hours - those representing the beginning of the pandemic and the hours lost during the period when there were remote classes – should be accounted for separately. Also, an adjustment should be made for quality, because the in-person class hours given before the pandemic are not equivalent to an hour of remote learning. There were extreme situations where the quality was even more seriously compromised. For example, in rural areas in some countries, where people had limited or no access to the Internet, instruction was done by providing reading materials and exercises that were taken from the school weekly, and in some cases, disseminated through radio and television programmes. The following week the work was handed in for correction and new reading and exercises were delivered, and so on. (ECLAC/IDB, 2021).

The procedure outlined below is suggested in calculating the losses in this sector.

Baseline (information before the pandemic).

(i) Number of students for each level of education.

(ii) Number of class hours in a typical school day.

(iii) School calendar.

[34] According to Guerrieri and others (2020), demand can react in an exaggerated manner to supply-side shocks, which can lead to a recession. The conditions that produce this result are low substitution capacity among the sectors and restriction of liquidity by consumers from incomplete markets.

With this information, the total number of hours received by the student body can be estimated by multiplying the number of class hours given to each student by the number of students at each educational level. It is recommended that this information should be obtained both from public schools and private schools and that the results of both types of education should be presented separately.[35]

(i) Number of teachers, administrative and other employees of each college or school.

(ii) Average cost of private education.

The information from points (iv) and (v) will be used in calculating the losses in public and private schools (ECLAC, 2014).

Estimate of losses (in a pandemic scenario):

(i) The first step is to seek information on the number of class hours given at each level after the suspension of in-person classes when quarantine was ordered. As in the baseline, the number of hours should be multiplied by the number of pupils at each educational level.

(ii) In order to estimate the number of hours lost as a consequence of the pandemic, the class hours from the baseline should be subtracted from the estimated hours from the previous point, for both public and private education. The hours lost at the start of the pandemic as a result of quarantines should be separated from those lost after remote classes began. It is important to present this figure because it shows the number of hours dedicated to students that the student body stopped receiving.

(iii) In order to express the losses in monetary terms, the total hours lost is divided by the number of hours in the average school day. In this way, the number of days lost is obtained, which can then be expressed in terms of months.

(iv) In the case of public education, for each school this number is multiplied by the average teacher salary and the number of teachers. A similar procedure is applied to the other employees of each educational establishment. Both amounts are added and the total value of losses is obtained. That is, the salaries paid but which, because of the pandemic, did not result in a product (hours of class given).

(v) In the case of private education, the figure obtained from point (iii) is multiplied by the monthly tuition cost.

For the Bahamas, using the procedure described above, ECLAC and IBD (2022) estimated that losses were 48.2 million Bahama dollars,[36] of which 63% were in the private sector and 37% in the public sector (see table 12). The calculation is that each student in the Bahamas, in the academic years 2019–2020, 2020–2021, and 2021–2022, lost an average of 358 class hours. Thus, at least 18.7 million class hours were lost, considering the total number of students reported as the baseline (52,306).

Table 12
Bahamas: losses in the education sector, 2019–2022
(Bahamas dollars at 2021 prices)

Type of loss	Private schools	Public schools	Total
Reduction in class days in the 2019–2020, 2020–2021 and 2021– 2022 academic years	6 637 991	18 087 785	24 725 775
Enrolment in private schools	23 513 880		26 685 640
Total	30 151 871	18 087 785	48 239 655

Source: O. Bello and F. Espiga (coords.), *Assessment of the effects and impacts of the COVID-19 pandemic in the Bahamas* (LC/TS.2022/69), Inter-American Development Bank (IDB)/Economic Commission for Latin America and the Caribbean (ECLAC), 2022.

[35] In our experience, information from private schools is more difficult to obtain.

[36] All the monetary figures in this report are expressed in Bahamian dollars and 2021 prices.

2. Water and sanitation sector

The shutdown of a large part of the economy because of the pandemic could have resulted in lower monthly billing of water supply companies. It should be taken into account that the decrees ordering the closure of various activities divided them into essential and non-essential. The first included public services, selling food and medicines, and production of food and medical supplies. Non-essential services were those that were not necessary in an emergency situation, such as tourism. Thus, the selective closures caused a decrease in monthly billing by water supply companies for non-residential consumption. On the other hand, residential water consumption could see increases because, as a consequence of quarantine, people spent more time in their homes. In order to place a value on the net effect of COVID-19 on this sector, both flows should be taken into account, as outlined below.

To estimate losses in this sector, the following procedure described below is suggested.

Baseline (or information prior to the pandemic)

(i) Number of residential and non-residential clients by geographical area, according to the country's territorial divisions.[37]

(ii) Rates for each type of client by geographical area.

(iii) Billing for each type of client, by geographical area, before the pandemic.

Estimation of losses (in a pandemic scenario):

(i) First, information should be sought on the rates for each type of client, by geographical areas (usually the same as the baseline).

(ii) Information is also needed on the consumption of each type of client by geographical area.

(iii) For both types of clients, information is needed on the amount of billing since the start of the pandemic.

Losses are estimated by subtracting the amounts billed after the pandemic began from the billing before it started. Given that the pandemic has lasted for several years, losses should be accounted for annually. Another fact to consider is that, in many countries of the region, measures were ordered that prevented cuts in public services. To analyze this, inquiries should be made about the duration of this policy, funds to pay for this benefit (in cases where clients were not exempt from payment) and the payment schedule. In turn, it is also necessary to investigate whether the government granted any type of subsidy to compensate delays in payments. Note that under these circumstances, this is not a loss, but a delayed payment, or rather, a debt.

3. Power sector

The case of power supply is very similar to water supply. Quarantines and shutdowns had a noticeable effect on power consumption.

To estimate losses in this sector, the procedure described below can be used.

Baseline (information prior to the pandemic):

(i) Number of residential and non-residential clients per geographical area, according to the country's territorial divisions.[38]

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[37] It should be stressed that in the majority of countries, the water supply company is not national, but there are various companies in each state, region or province (or island, in the case of some Caribbean countries). This introduces some complexity into the assessment of an event like the COVID-19 pandemic because the information must be requested from different bodies.

[38] Note that in the majority of countries the electrical supply company is not national, but there are various companies in each state, region or province. This introduces some complexity in the assessment of an event like the COVID-19 pandemic, since this information must be requested from different bodies.

(ii) Rates for each type of client by geographical area.

(iii) Consumption for each type of client, by geographical area, before the pandemic.

(iv) For each type of client, amount billed before the pandemic.

Estimation of losses (in a pandemic scenario). The following information is needed in this case:

(i) Rates for each type of client, by geographical area, since the pandemic began (usually the same as the baseline).

(ii) Consumption for each type of client, by geographical area, since the pandemic began.

(iii) For both types of clients, information on the amounts billed since the pandemic began.

Losses are estimated by subtracting the amounts billed since the pandemic began and the billing from before it happened. As mentioned in the previous point, in many countries of the region there were orders that prevented cuts in public services. The duration of such policies should be verified, the funds to pay for the benefit and the payment schedule. It should be emphasized that this does not constitute a loss, but an account to be paid. Given that the pandemic has lasted several years, losses should be accounted for annually. As there are several companies in a country, this information should be requested from each one, and a meeting held with the national regulatory agency.

Following the procedure indicated, a value was arrived at for the effects of COVID-19 on the power sector in the Bahamas (ECLAC/IBD, 2022). Losses were estimated at 25 million Bahama dollars, 90% of which were incurred between 2020 and 2021 (see table 13). As already mentioned, the measures taken to respond to the pandemic resulted in people spending more time at home and increased their electricity use, above the levels expected before the pandemic. As a result, the billing exceeded the baseline, and thus there were negative losses. On the contrary, closure of borders and other restrictions on mobility reduced the volume of business; therefore, non-residential consumption dropped. Losses in that area reached approximately 36 million Bahamas dollars, but the increase in household consumption partially compensated for them.

Table 13
Bahamas: losses in the power sector, 2020–2023
(Bahamas dollars at 2021 prices)

Year	Residential consumption	Non-residential consumption	Total
2020	-5 767 911	17 960 021	12 192 110
2021	-4 357 735	14 616 098	10 258 363
2022	-405 825	2 668 053	2 262 228
2023	-41 428	321 149	279 721

Source: O. Bello and F. Espiga (coords.), *Assessment of the effects and impacts of the COVID-19 pandemic in the Bahamas* (LC/TS.2022/69), Inter-American Development Bank (IDB)/Economic Commission for Latin America and the Caribbean (ECLAC), 2022.

4. Tourism sector

Due to the particular characteristics of tourism —it assumes travel by plane, ship or bus and promotes activities in large groups— this sector was among those most affected by the pandemic. Given its importance in the economy of Caribbean countries, we will present an example explaining the methodology for estimating losses.

Tourism sector in Pavonia

The tourism sector in Pavonia is one of the main engines of the economy. In the year before the pandemic, Pavonia received a total of 11.7 million visitors. Some 6.3 million of them stayed overnight in the country, and out of them, almost 2 million were residents of Pavonia, which shows that domestic tourism is a major part of total tourism. The rest of the visitors did not stay overnight, and of this group, 4.6 million were cruise passengers and the rest on day excursions.

There is some difference in tourism patterns among the regions. The island region of Lejania receives a bit more than 5 million visitors, of which around 3.3 million are cruise passengers. The favorable climate, natural attractions and infrastructure capable of handling a large number of tourists makes this sector the main engine of the economy of Lejania and also its major employer. In turn, the province of Levante received a total of 2.6 million visitors. As a Mediterranean region, Levanted does not receive cruises but it has a high number of overnight visits from neighboring countries. The province of Poniente received almost 3 million visitors, of which about two thirds were overnight visits, and the rest were cruise passengers and on day trips.

At the time the lockdown was ordered, all tourism activity was suspended. From April to July 2020, there were no types of visits to any of the regions. When the restrictions were lifted, the flow of overnight visitors slowly began to recover, but cruises remained suspended until 1 December. In total, the effects of the pandemic on the tourism sector were prolonged until June 2021.

As tourism was a highly relevant source of activity, the country made efforts to collect statistics on the sector. Pavonia has a satellite account for tourism in its national accounts, and constantly makes estimates to determine the amounts and spending patterns of tourists. The Pavonia Tourism Office (PTO) provides monthly figures on the number of visitors, disaggregated by category. It also offered figures on the average spending per visitor and the spending patterns during 2019. The level of prices in Pavonia is stable.

Based on the information above:

(i) Determine the baseline of visitors for Pavonia and each of its provinces, from January 2020 to June 2021.

(ii) Determine the baseline of income from tourism for Pavonia and each of its provinces, from January 2020 to July 2021.

(iii) Determine the losses in the tourism sector associated with the COVID-19 pandemic, for each of the provinces and the country as a whole.

In conversations with the Pavonia Hotel Association (PHA), the assessment team gathered the following information:

- When activity resumed, hotels were obliged to change their protocols to confront the new situation. Months beforehand, PHA paid a total of 500,000 monetary units (MU) to a distinguished consulting firm to determine the protocols that should be implemented in the industry during the pandemic.
- PHA estimates that adapting facilities, hiring staff, buying equipment and other costs would mean an investment of 10 million MU for the hotel sector.
- In the restaurant sector, the costs indicated in the previous point were estimated at 6 million MU. Only about 30% of those costs could be attributed to the tourism sector.

- According to PHA calculations, among the various levels of government and private enterprise, 5 million MU were spent to adapt various spaces and tourist attractions, which included the installation of sanitizer gel dispensers and protective dividers.
- PHA invested 2 million MU in campaigns to promote Pavonia as a tourist destination, as a result of the pandemic.

(iv) Determine the additional costs in the tourism sector due to the COVID-19 pandemic.

Responses

(i) Based on the time series provided on the number of travelers, econometric techniques were used to project each of the series of visitors. It was calculated that, between January 2020 and June 2021, Pavonia received a total of 17.2 million visitors. Of them, 7.2 million were cruise passengers and about 1 million, day trippers. Of the overnight visitors, 6.3 million were non-residents and 2.7 million were domestic tourists.

Table 14
Pavonia: number of visitors, January 2020–June 2021

Province	Overnight		Not overnight		Total
	Resident	Non-resident	Cruisers	Day trips	
Lejania	997 372	1 670 643	5 606 626	34 480	8 309 121
Levante	1 141 884	1 990 653	0	931 984	4 064 521
Poniente	582 947	2 658 420	1 574 693	28 142	4 844 202
Total	2 722 203	6 319 716	7 181 319	994 606	17 217 844

Source: Prepared by the authors.

The province of Lejania received the most visitors, a total of 8.3 million, and the majority of them were cruise passengers. In second place, the province of Poniente received 4.8 million visits, most of which were overnight visits by non-residents (2.7 million) and residents (0.6 million). Lastly, the province of Levante received 4.1 million visits between January 2020 and June 2021; the majority were non-residents with overnights.

(ii) Given that price levels in Pavonia are stable and that there are projections for the number of visitors of each type, the baseline for income in the tourism sector can be estimated.

The total projected income from tourism for Pavonia between January 2020 and June 2021 was 16.4 million MU. Of this figure, 13.7 million MU, or 83.7% of the total income, represented non-resident overnight visitors. Note that, although the number of this type of visitor is lower than the number of cruise passengers, their contribution is much more significant. This is due to the fact that the spending per overnight visitor is much greater than for a cruise passenger, a spending pattern that is fairly general in tourist destinations that receive both types of visitors. For its part, the spending under domestic tourism is 2.200 million MU, while total spending for visitors without an overnight is 500 million MU. Domestic tourism represents 13.2% of total tourism spending in Pavonia.

Table 15
Pavonia: income from tourism, January 2020–June 2021
(Monetary units)

Province	Overnight		Not overnight		Total
	Residents	Non-residents	Cruises	Day trips	
Lejania	698 160 400	3 508 370 300	336 397 560	1 206 800	4 544 115 060
Levante	970 601 400	4 379 436 600	0	46 599 200	5 396 637 200
Poniente	495 504 950	5 848 524 000	125 975 440	1 407 100	6 471 411 490
Total	2 164 266 750	13 736 310 900	462 373 000	49 213 100	16 412 163 750

Source: Prepared by the authors.

As for the projections by province, Poniente generated the most income from tourism, a total of 6.5 million MU. Around 5.8 billion MU came from non-resident overnight visitors. The province of Levante is in second place, with 5.4 billion MU, of which 4.4 billion correspond to non-resident overnight visits. Levante is the region that receives the most visits from resident tourists, which provide income of almost 1 billion MU in total. Lastly, the province last in income is Lejania. Tourism spending was a total of 4.5 billion MU, and about 3.5 billion MU of that is from non-residents with stays. This province records the most income from the arrival of cruise passengers.

(iii) Losses in the tourism sector are estimated by comparing the income actually received during the period with the baseline projections (see table 16). Pavonia lost a total of 8.9 billion MU, most of that in 2020 (7.7 billion MU). This is due to several factors. First, there were a higher number of months considered in this year since the pandemic began to affect the number of visitors beginning in March and continuing through the rest of the year. On the other hand, 2021 was affected only until June. Second, the effects on tourism flows were especially strong in 2020. During that year, there were months when the flow of tourists stopped completely. As the restrictions were relaxed, the flows began to recover. Lastly, cruise ship arrivals did not resume until December 2020; effectively, there were only three full months of that year when cruise passengers were received.

Table 16
Pavonia: losses in the tourism sector, 2020 and 2021
(Monetary units)

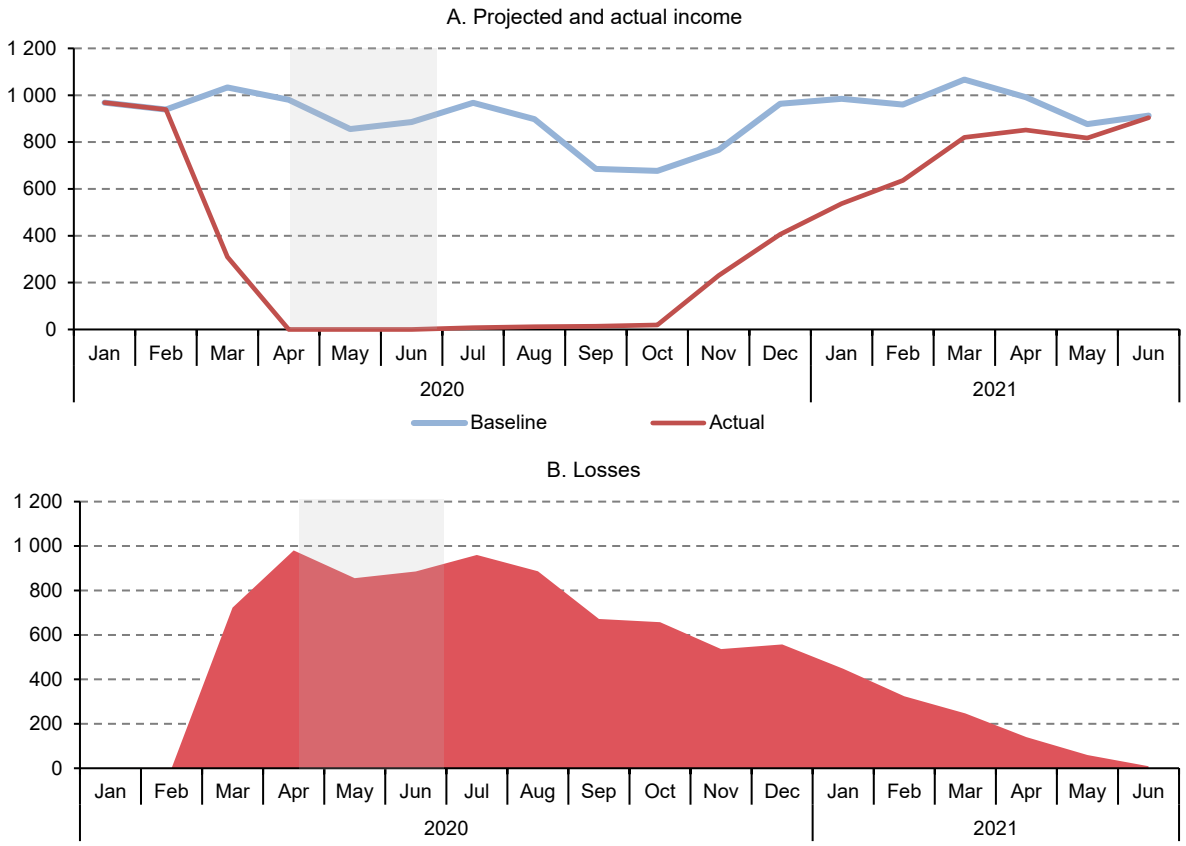
	Lejania	Levante	Poniente	Total for Pavonia
2020	2 225 775 740	2 510 611 650	2 976 719 170	7 713 106 560
2021	319 565 335	404 491 350	503 602 270	1 227 658 955
Total	2 545 341 075	2 915 103 000	3 480 321 440	8 940 765 515

Source: Prepared by the authors.

As for losses per province, Poniente experienced the greatest losses (3.480 million MU). In second place was Levante, with total losses of 2.915 million MU, and lastly, in Lejania, losses were 2.545 million.

To add to this information, the monthly losses in Pavonia from the pandemic are presented. From figure 4 it is possible to assess the total loss of income during the lockdown period, and later, the slow recovery beginning in October.

Figure 4
Pavonia: projected and actual income and losses, January 2020–June 2021
(Millions of monetary units)



Source: Prepared by the authors.

In order to apply this methodology to the tourism sector, it is suggested that readers consult chapter V of Bello and Espiga (2022) and ECLAC (2021). Also, to apply it to the estimate of losses in the business sector, ECLAC/Office of the United Nations Resident Coordinator in Panama (2022) may be consulted.

(iv) Additional costs of the pandemic are those additional expenditures that businesses and the public sector must make to offer tourism services during the pandemic. Table 17 shows that those costs were around 17 million MU in total, basically related to the costs of adapting facilities and procedures to be able to provide tourism services during the pandemic.

Table 17
Pavonia: additional costs in the tourism sector, July 2020–June 2021
(Monetary units)

Item	Amount
Consultant on new protocols	500 000
Adapting facilities and procedures in lodgings	10 000 000
Adapting facilities and procedures in restaurants	1 800 000
Adapting tourist areas	5 000 000
Total	17 300 000

Source: Prepared by authors.

5. Other considerations in estimating losses

In the specific case of the COVID-19 pandemic, the following aspects of the recovery process should be taken into account:

(i) The measures have different effects on sectors because two categories of activities were established: (i) essential, usually including the production and sale of food and beverages (supermarkets) and pharmaceutical products as well as certain public services; and (ii) non-essential, such as the operation of bars, restaurants, casinos, movie theaters and theaters; the concert industry, tourism, sales of clothing and shoes and automobiles, engineering and architecture offices, and some manufacturing sectors. The fall in activity among this second group may lead to the closure of some businesses, which in the medium term may make recovery more difficult because of restricted supply.

(ii) Recovery can also vary. For example, in the context of the COVID-19 pandemic, it is expected that international tourism will be the last sector to recover, given than this sector depends on the following factors: (a) measures adopted in different national jurisdictions; (b) increases in income levels, since tourism is a luxury good; (c) the return of confidence among the public in the protocols established in hotels, airplanes, airports, ports and cruise ships, among other places were large numbers of tourists go; and (d) price wars between destinations to attempt to attract tourists in a context of low demand.

(iii) Once isolation measures are lifted, recovery is not immediate, because of the uncertainty caused by lack of immunity. Furthermore, given that epidemics are phenomena that last for a long time, it is expected that they will produce various waves, and their intensity and spread is unknown. It can be assumed that, in the subsequent waves, there will be a better understanding of the disease, so that quarantines can be more targeted. Also, because both the society and the authorities have acquired knowledge of how the first wave developed, the protocols established can be followed more easily.

(iv) The recovery will also depend on the type of spending the government prioritizes, its amount and the time when public sector resources are provided to assist selected sectors.[39] The priority should be workers and businesses that provide non-essential activities —especially micro, small and medium businesses— which are two of the groups most affected by the measures taken to confront the epidemic.[40] This is information that should be considered in estimating the fall in economic activity.

(v) In the context of the COVID-19 pandemic, where some governments of the region made and are continuing to make major fiscal efforts in several areas (granting of subsidies to households and small and medium businesses, among others) the effects should be reported in the sectors where the spending takes place. For example, if a government provides cash transfers to workers who lost their jobs or persons who are in the lowest income quintiles, this will be reflected in an increase in activity in sales of food, and possibly in protective supplies like masks. It is worth mentioning that, in cases where aid is provided in the form of food boxes, the effect would be the same; the only difference is that it would result in an increase in wholesale sales in food and not retail sales.

[39] Using data from the United States, Faria-e-Castro (2020) make estimates of the effectiveness of certain fiscal policies to compensate the unemployed and affected businesses in this situation.

[40] See ECLAC (2020c).

B. Estimates of additional costs in other sectors

An epidemic will also produce additional costs in all other sectors of the economy. For purposes of this study, we will consider two types of sectors, those which continue to operate with isolation measures —the essential sectors— and those subject to physical distancing measures.

1. Essential sectors

Additional costs in these sectors are associated with:

(i) Personal hygiene supplies, such as those required for hand washing.

(ii) Cleaning supplies, such as detergents.

(iii) Personal protection items, such as masks, gloves, face shields and protective gowns; articles for protection of consumers, such as sanitizing gel, thermometers and mats.

These three costs can be estimated following the procedure outlined in section V.C.1.a.iii of this report.

(iv) Modifications to the workspace in order to minimize spread, either to comply with new legal requirements or at the initiative of the business. Any change that must be made to the workspace such as the installation of partitions and protective panels should be included here. For partitions, the calculation of the total cost can be made by multiplying the square metres of construction by the cost per square meter. For protective panels, the unit price and the quantity purchased is needed, along with the installation costs.

(v) Training for employees on biosafety measures.

(vi) Equipment for checking temperature and implementation of new procedures to avoid the risk of transmission.

(vii) Transport, which can be offered by businesses to their workers because, in quarantine situations, public transportation can be limited, or to diminish the possibility of transmission. Companies can also pay an additional voucher for this purpose. In the first case, the cost is estimated by multiplying the number of trips contracted per month by their average price. In the second situation, in order to calculate the cost, the number of workers receiving the voucher is multiplied by the number of months provided and its amount.

(viii) Other labor costs. During the pandemic there was discussion of hazard pay and bonuses. The possibility was also studied of providing insurance policies to frontline workers who did not have them, as well as expanding coverage of workplace health and accident policies for those who did have them. Such actions could be taken at the initiative of employers or by government mandate. A review is recommended of whether they were implemented across the board in each sector and for how long.

Below is a detailed example of the estimation of additional costs in the water and sanitation sector.

In this case, the additional costs are the outlays required to provide basic water and sanitation services during the pandemic, in accordance with the type of measures the governments put into practice within their territories. Thus, the proposed quantification will be developed according to the type of measures implemented and with applied examples, in keeping with the following hypothetical scenario:

- Total population of the country: 10 million people
- Number of persons per family: 3.6
- Population under the poverty line: 29%

- Coverage in aqueducts: 97%
- Cost of safe drinking water per cubic meter: US$ 0.30
- Cost of sewerage per cubic meter: US$ 0.75
- Cost of solid waste management per month: US$ 9
- Rate of water consumption per day: 120 litres per person per day

(a) Required water supply during the general quarantine

This measure means that the water and sanitation sector must supply a daily minimum amount of safe drinking water to all vulnerable households that are not connected to the supply network. The method utilized for this purpose is transport of water in tanker trucks.

The following data is needed to calculate this additional cost:

- Value of a cubic meter (or appropriate unit) of treated water
- Daily consumption per person or volume of water to be provided to the community, in the same unit that is charged
- Cost of the transport and distribution method of safe drinking water

The calculation is performed by multiplying the value of the cubic meter (or appropriate unit) by the average quantity of safe drinking water supplied per person per day by the number of persons benefiting by the number of days of supply. To the result obtained is added the cost per day of transporting the water, thus obtaining the total daily cost of supplying water to communities not connected to the drinking water supply. The calculations can be made per day or per month.

In the hypothetical scenario presented, in accordance with the coverage in the country, a total of 300,000 persons lack connections to the aqueduct by traditional means (piping), and they are the ones who should be supplied with water by alternative means during preventive and mandatory isolation. The method most often used for the distribution is tanker trucks.

The daily cost of renting a tanker truck with a capacity of 20 cubic metres is around US$ 470. While normal consumption should be approximately 125 litres per person per day, the distribution using alternative methods cannot be over 50, given the logistical limitations and the costs involved. Therefore, the volume of water with which the vulnerable population will be supplied can be calculated in this way:

- 300,000 persons x 50 litres/person/day = 15,000,000 litres per day.
- 15,000,000 litres per day = 15,000 cubic metres per day.

Transporting 15,000 cubic metres in a tanker truck with a capacity of 20 cubic metres assumes a total of 750 trips per day (15,000 cubic metres/20 cubic metres).

A tanker truck, according to the distance covered and the road conditions, can make between four and five daily trips; therefore, the number of tanker trucks needed per day is 150 (750 trips/ 5 trips per day).

Lastly, the cost of transport can be obtained from the daily cost of a tanker truck by the number of such vehicles required, as indicated below:

- Daily transport costs = 150 tanker trucks x 470 dollars (cost of a truck per day) = US$ 70,500.

It should be noted that road conditions affect the size of the vehicles that can travel over them; for example, tanker trucks with smaller capacity (1, 3, 5 or 10 cubic metres) or campers with vinyl polycholoride (PVC) tanks.

With respect to the cost of safe drinking water, the initial calculation corresponds to the amount of water required per day, data which is obtained from the number of persons to which water will be carried by alternative methods multiplied by the amount of water supplied per person.

In this example, a daily supply of 50 litres per person was determined, therefore, as explained earlier, 15,000 cubic metres of water must be purchased per day.

Then, the daily cost of drinking water to be supplied is obtained by multiplying the cost of a cubic meter by the amount of water required per day:

- Cost of purchasing water per day = US$ 0.30 x 15,000 cubic metres = US$ 4,500.

The additional cost of supplying water through alternative methods during the pandemic corresponds to the sum of the costs of transporting and buying drinking water, as indicated below:

- Additional cost per day = US$ 70,500 + US$ 4,500 = US$ 75,000.

Lastly, the additional cost per day should be multiplied by the number of days on which this measure was implemented:

- Total additional cost = US$ 75,000 x 30 days = US$ 2,250,000.

(b) Reconnection to the water system, immediately and at no cost, for all households disconnected for non-payment

Implementation of this measure assumes sending personnel to the household water supply connection to reconnect the water; that is, to remove the plugs installed during the disconnection.

The cost of applying this method is the cost of sending the staff, which can amount to US$ 8 per unit reconnected, multiplied by the number of reconnections, which, in the hypothetical case presented, would be 65,000 users. Thus, the additional cost would be as follows:

- Cost of reconnections = 75,000 reconnections x US$ 8 per reconnection = US$ 520,000.

The debt generated by disconnection is not assumed as loss, because an account is maintained and recorded and can be charged.

(c) Installation of water in field hospitals

In some municipalities where care for patients with COVID-19 went through critical periods, field hospitals were set up or facilities were refurbished as temporary hospitals.

Because these were temporary facilities, this sector was responsible for installing water connection points and collecting waste water and solid waste to make their operation possible. It should be mentioned that these hospitals were physical facilities dependent on the type of piping and networks existing in the zone, their distance from them and the type of access roads.

To calculate the cost of this task, the following factors should be estimated:

- Cost of staff to carry out the activities.
- Acquisition cost of the necessary elements (piping, connections and keys, among others).

(d) Disinfection and cleaning of public areas for mass use

In order to diminish the bacterial load in public places where the most people gather in urban areas, municipal administrations have taken measures to disinfect and clean public areas for mass use, such as the entries to mass transit stations, parks, entries to public buildings and the streets surrounding hospitals and health centers.

Under normal conditions, public areas are not disinfected; streets and parks are only swept. This activity is usually the responsibility of the entities or businesses that offer collection and processing of solid waste since they have the logistical capability to facilitate this new task. This condition means that, in the majority of cases, disinfection is delegated to the water and basic sanitation sector.

The following variables are used in the calculations:

- Total area disinfected
- Value of the supplies used for the task
- Cost of the operators who carry out the task (on the basis of output/return, number of persons per month)
- Rental cost of the vehicles used

(e) Increase in chemical supplies for a higher rate of water treatment

In municipalities where the industrial, tourism and business sectors are not highly developed, where the majority of users are households, there is a general increase in water consumption, which leads to greater volumes of water treatment.

At the same time, limitations on travel and closure of countries' borders have produced a hike in the cost of the chemical supplies used in treating drinking water.

The calculation of additional costs in this case involves the difference between the following items:

- Value of the supplies used monthly during the pandemic
- Average value of the supplies used monthly during the months with no emergency

(f) Increase in solid waste in households

In order to increase protection of all types of products during transport and distribution, in addition to facilitating disinfection, the use of single-use plastics has grown, which under normal conditions is related to over-packaging for transport of products.[41]

For the sector, over-packaging represents a setback for policies intended to reduce the use of single-use plastics, together with an increase in the work hours for operators for the separation of plastics for re-use and recycling. The additional cost, therefore, involves the following:

- Cost of the additional time for staff of recycling plants, expressed as the cost per hour of each operator
- Cost of new campaigns to discourage the use of single-use plastics

The higher volume of single-use plastics together with a reduction in business activities, leads to a decrease in the quantity of recyclable products, which has economic consequences for recyclers. This activity is not included in this exercise as it is not part of the sector being analyzed.

(g) Management of solid wastes coming from households with persons infected by COVID-19

Persons who have tested positive for COVID-19, whether asymptomatic or with mild symptoms, are quarantined in their homes in order to decrease the pressure on hospital care.

[41] To this is added an increase in traditional packaging due to the higher volume of electronic sales and home delivery services.

Quarantines produce an increase in the volume of the normal solid household waste because infected people must remain in their homes. Additional waste is also generated associated with the care of infected persons, such as protective gear, cleaning products and disinfectant, which should receive different treatment.

The additional costs are associated with the different handling of the waste relating to an infected person, which requires a system of special containers for transport, and, in the case of condominiums and apartment buildings, different containers for the storage of this type of waste.

Limitations on this exercise relate to effective source separation of waste in the household.

The additional cost in this case comes from the value of the storage containers and transport deployed as part of the garbage collection service. To this is added the value of the final handling of this waste, for example, incineration. Furthermore, the cost of biosanitary protection for the operations personnel responsible for the collection and transport of this waste is calculated in the next point.

(h) Strengthening of protection for operators

The water and sanitation sector is as essential as the health sector, which is the reason why it could not interrupt its operations despite any restrictions of mandatory isolation that may be applied. This means that the people who work in the basic water and sanitation sector must continue their daily work, especially the operations personnel, and therefore biosanitary protection measures must be put into place, such as the use of masks, gloves and sanitizing gel.

The operational personnel responsible for collecting, transporting and eliminating solid waste should have additional protections, for example, stronger gloves, masks and fluid-resistant clothing.

Industrial safety protocols were adjusted to the realities of the pandemic, and consideration was given to biosanitary protection in operational areas, repairs and maintenance, client service and development of new projects. This implies, in turn, that follow-up and control of compliance with the measures established will increase, which will involve the hiring of new staff for such duties.

Furthermore, at work sites, handwashing stations were installed and control of staff at entry points (with digital thermometers, for example) was performed, and in most cases a staff member was hired for the control and monitoring of biosanitary measures established in the field. Staff hired on a contract basis are different from those hired for general safety duties during COVID-19 as part of the operation of the sector.

The additional cost of greater protection for operators is calculated as the sum of the following items:

- Cost of supplies for washing and disinfection of personnel
- Cost of protective equipment
- Cost of personnel hired to implement protection measures
- Cost of labor to install handwashing stations at worksites, or the cost of renting them in cases where that option was considered
- Cost of acquiring items for monitoring of staff, like digital thermometers

(i) Adoption of digital tools and platforms

Physical distancing has meant that in all sectors virtual communications media have been installed or reinforced with users (for example, client services and payment of services) and staff who can perform their duties by telework.

With respect to operational activities, digital monitoring and automation of some processes moved forward, which diminished the exposure of operations personnel.

For the implementation of such measures, the fundamental requirement is the acquisition of technology that is compatible with virtual communications; the calculation of the cost is the sum of the following elements:

- Cost of hiring staff specialized in the use of digital tools and platforms
- Value of the computer equipment purchased, intended both for the headquarters offices and for telework, to meet the technological needs of virtual communication
- Cost of acquiring technology, such as computer programmes to automate processes and transmission of data, client service platforms and platforms for digital payment
- Value of equipment intended for automation
- Cost of support teams for information storage, management and protection
- Cost of training for employees

(j) Cost of additional staff due to the spread of COVID-19

In a pandemic situation like that caused by COVID-19, with ongoing exposure of operational personnel in the water and sanitation sector, there is a high possibility of infection.

Therefore, it was necessary to hire additional staff in the sector to replace infected staff, and in many cases, the entire crew that was in contact with the infected person who must be quarantined.

This cost corresponds to the value of the contract per person per day multiplied by the period of time during which they replace the operational staff who are in quarantine.

2. Non-essential sectors

When activity resumes, additional costs will be incurred related to the items indicated below:

(i) Items (i) to (vi) of section VI.B.1, which explain in detail the case of essential sectors, are also applicable to non-essential sectors.

(ii) In such sectors as transport and tourism,[42] publicity and information campaigns on the security and protocols establishing the conditions for those activities must be conducted. Also, for tourism, national and international campaigns are needed to disseminate all the measures and safety improvements that have been put into practice. Those costs would be included in additional costs.

(iii) There may have been businesses in some fields that reoriented their production due to the demand generated by the pandemic. For example, in the case of COVID-19, a business producing cosmetics might produce sanitizing gel, some clothing manufacturers might begin producing masks, or automobile manufacturers might produce respirators. Any cost incurred in this unusual production should be included as an additional cost of the respective business.

(iv) The expenditures made by businesses relating to telework, that is, acquiring platforms for online communication, platforms for employee monitoring, portable computers and tablets, as well as office furniture and supplies, will be included in additional costs.

In order to estimate these costs, the detailed guidelines in ECLAC (2014) should be followed for each sector.

[42] Estimation of additional costs in the tourism sector is shown in the example presented in the section on losses.

VII. Concluding remarks

The pandemic caused by COVID-19 is an event that is global in scope, which to date has already caused more deaths in Latin America and the Caribbean than all the disasters recorded in the region since 1970, and furthermore, it has had the highest costs. As initially mentioned, this event is different from the more common epidemics in the region, like cholera and dengue, which are confined to specific locations in certain countries and are diseases for which there are known treatments; physical distancing measures and quarantines are not ordered.[43]

Furthermore, the level of inequality in the region exacerbates the health effects of the pandemic, representing a crisis for a majority without access to social security systems, decent work and adequate housing.

The recovery of the health systems, as well as the economy as a whole, should be designed to be sustainable and resilient. With the purpose of achieving a recovery with these characteristics, and in accordance with the effects that have been produced to date, the following tasks are recommended:

- Provide health care personnel with appropriate working conditions and protection, especially taking into account future worker trends.
- Support job transition and the development of new skills in the case of persons who have had to move out of an economic sector when it has experienced massive job loss (for example, sectors with high levels of manual and routine tasks), and the reintroduction of women into the workforce.
- Promote the digital transformation of information systems and improve their convergence to make better use of a major stock of public data.

[43] The only experience that has any similarity with this is the influenza A (H1N1) pandemic in Mexico. At the beginning this was an unknown and highly contagious disease with a high mortality rate and its containment strategy included physical distancing measures.

- Support collaborative efforts to fight disease, such as the proposal by Costa Rica and WHO to establish an open repository of data, knowledge and intellectual property.
- Design information and education campaigns aimed at different audiences and platforms, which consider the risks of disinformation on social networks. Also, ensure respect for privacy and protection of the data on infected people and their contacts, especially given the ever-increasing use of digital applications.
- Consider the proper elimination of waste produced during the emergency, such as gloves, masks, face shields and other protective gear. A major contribution of face masks to marine contamination is predicted, and thus this topic should be included in education and information campaigns.

ECLAC will continue offering technical assistance and producing information to help countries to confront this disease and offers alternatives for a sustainable social, environmental and economic recovery. It also reaffirms its commitment to provide technical support in the assessment of the effects and impacts of the pandemic.

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Given the human, social and economic impacts of COVID-19 across the world and the Latin American and Caribbean region, since its onset the Economic Commission for Latin America and the Caribbean (ECLAC) has focused its work agenda on assessing the impact of the pandemic on the three dimensions of sustainable development. To contribute to these efforts, this paper presents the Methodology for the Assessment of Disasters (known as Damage and Loss Assessment – DaLa) developed by ECLAC, and its applicability in the national assessments of the effects of COVID-19. The Commission is therefore making this tool and the technical support for its implementation available to the countries. In the current context, it is important to have a consistent methodology with which to examine the sectoral effects of the pandemic on the countries of the region.

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