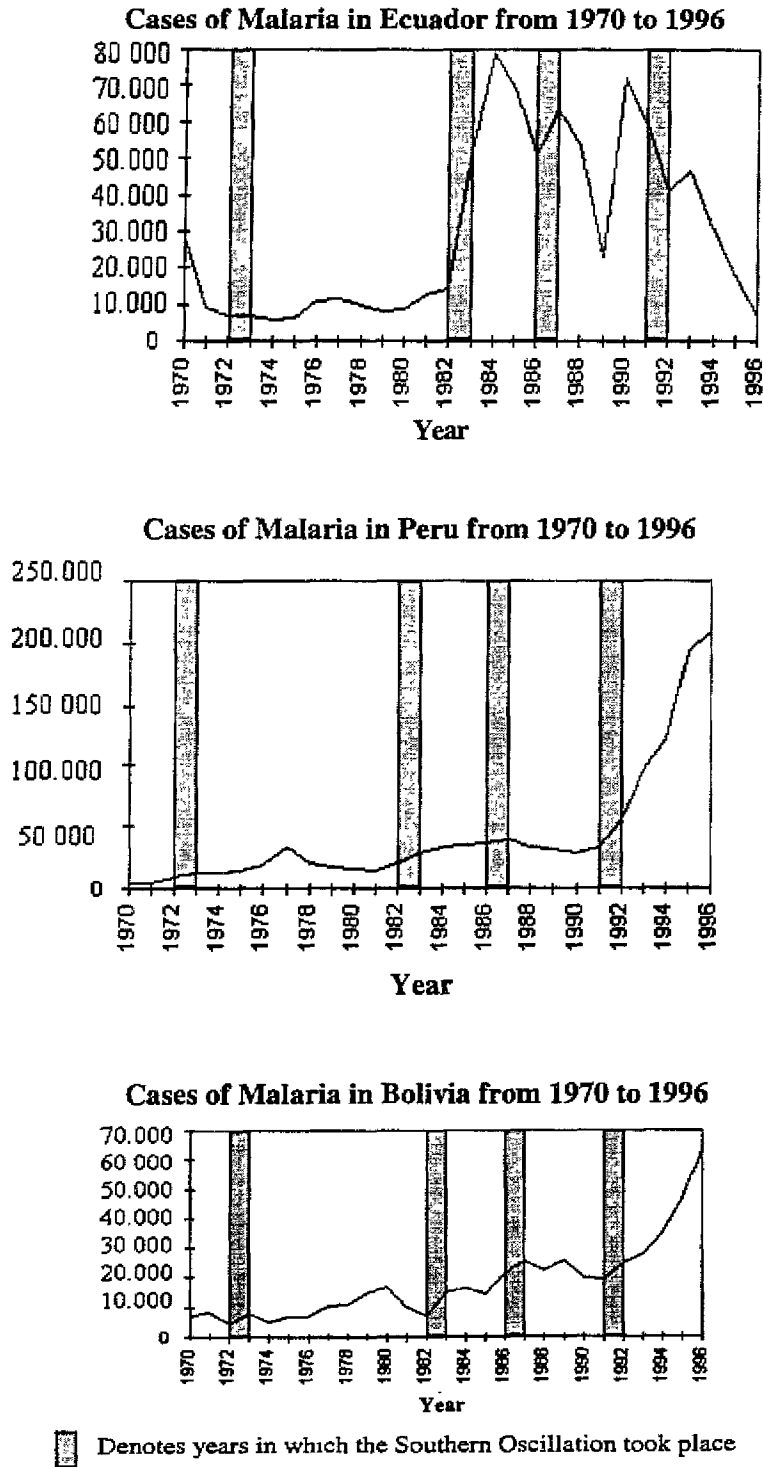


Figure 2



It appears that human or environmental factors confound any scientific analysis that could directly link El Niño or climate changes with malaria incidences. If El Niño events do contribute to changes in malaria incidences, it is extremely difficult to separate their effect from that of other factors that impact malaria transmission.

5.2 Dengue and Other Diseases Caused by Arboviruses

As with malaria, it is difficult to prove scientifically that changes in the distribution of dengue are the result of El Niño events (8). In a preliminary study to correlate dengue with increased rainfall, no positive correlation between the two factors was found. In fact, peaks in dengue did not occur in El Niño years.

There has been a tremendous increase in the movement of people and goods, with a significant increase in international travel and trade. *Aedes aegypti* and *A. albopictus* have invaded new geographical regions due to the international trade in used tires and to road construction into rural areas. The movement of asymptomatic dengue carriers and vectors into nonendemic areas seems to be considerably more important for the spread of dengue than are El Niño events or climate change.

5.3 Viral Encephalitides

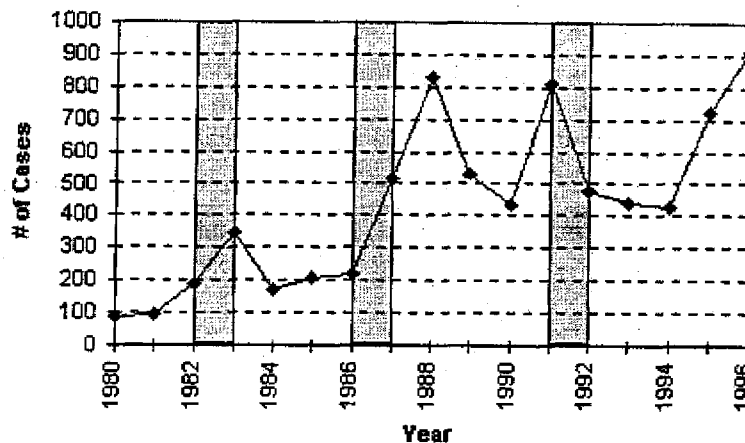
Arboviruses like Japanese, Eastern, and Murray Valley encephalitis are known to cause severe epidemics after periods of heavy rains. El Niño events have been suggested as the cause of recent outbreaks of Murray Valley encephalitis in Australia, and La Niña events as the cause of an epidemic of Japanese encephalitis in India (11). Riesen showed in a series of studies that an increase in temperature would decrease mosquito survival but increase growth rate in extrinsic incubation of the virus and extend the time frame when virus transmission would occur. However, there is still an absence of scientific data on viral encephalitides, and a correlation of El Niño or La Niña with outbreaks of arboviruses cannot be supported by current data.

5.4 Waterborne Diseases

It is extremely difficult to quantify the relationship between human health, climate change, and waterborne disease (16). In Brazil, *Sp. leptospirosis* is more likely to occur during periods of high precipitation (9). It is well known that El Niño in southern Brazil causes an increase in rainfall (Figure 1). However, when cases of leptospirosis are compared with those of El Niño years, there seems to be no correlation (Figure 3), and it appears that sudden, heavy rainfall is the key factor that triggers an increase in leptospirosis. For example, during the epidemic of leptospirosis in Nicaragua in 1995, a year in which the phenomenon did not occur, the rainfall in the municipalities affected by this epidemic was the highest recorded in the last 35 years (>3,500 mm). This suggests

that historical rainfall data needs to be taken into account when measuring the parameters that cause outbreaks of leptospirosis and other waterborne diseases. Such measurements should be taken in areas where flooding occurs, where wastewater mixes with drinking water, and where people come into contact with contaminated water or rodents.

Figure 3. Cases of Leptospirosis in São Paulo, Brazil from 1980 to 1996



Source: Instituto Adolfo Lutz. Shaded areas denote El Niño years.

Recently, it has been proposed that higher than normal temperatures in 1997 caused by El Niño increased the number of diarrhea cases in Lima, Peru (15). Unfortunately, no data on diarrhea during any other El Niño phenomenon was presented for comparison.

Cholera outbreaks have been associated with precipitation extremes—both droughts and floods (15). More recently it was discovered that *Vibrio cholerae* is associated with a large range of marine life located on the surface of the water (5). *V. cholerae* enters a non-active state in these organisms; when nitrogen, phosphorus, and warming conditions are favorable, *V. cholerae* reverts to a cultivable and infectious state. It has been suggested that the 1991 El Niño event, which warmed the ocean along the coast of Ecuador and Peru, accelerated the outbreak of cholera in this region (5). However, the quality of the water/sanitation system as a possible cause of the outbreak, and its eventual spread has not been adequately investigated. The possible interplay between the marine environment and sanitation systems in fostering the spread of cholera should also be considered.

6. PAHO Technical Cooperation

The main activities and recommendations of the Pan American Health Organization have been directed toward the following actions:

- Training workshops in the health services network in the areas with the highest risk of disease transmission for the strengthening of entomological surveillance, vector control, and prevention activities. Support for the development of a project to introduce treated mosquito netting. As a complement, in-service training responsible for clinical and environmental management was carried out.
- Active surveillance in the areas at greatest risk.
- Upgrading of health personnel in aspects related to mental health in the most hard-hit subregions (prevention, assistance, and rehabilitation).
- Implementation of the Supply Management Project in the Aftermath of Disasters (SUMA) to strengthen the logistical information process at the national level and in the affected subregions, through workshops and follow-up for the ministries of health, nongovernmental organizations, and United Nations institutions.
- Provision of basic supplies for water storage and treatment.
- Local workshops to find solutions to environmental sanitation problems.
- Training of members of the organized community in the hardest-hit departments (the authorities, leaders, neighborhood representatives, school health monitors, health promoters) in aspects of preparedness for El Niño.
- Identification of shelter sites and requirements for their installation, and food control.
- Characterization of rodents and vectors of public health significance in disaster areas.
- Strengthening of laboratory diagnosis for leptospirosis and hantavirus.
- Vaccination of the affected population against whooping cough, tetanus, and diphtheria to guard against potential outbreaks.

As part of the response, the management of emergency supplies was organized, using SUMA as the methodology. An agreement to use this methodology at the national level was signed between the Government of Ecuador, PAHO, and the Red Cross; in Peru, SUMA was put in place and is currently being used by government agencies and nongovernmental organizations.

7. Conclusion

The impact of El Niño on the facilities where emergency preparedness and disaster mitigation efforts were carried out was far less serious than in those where no programs existed at all. It is therefore necessary to continue technical cooperation to reduce the vulnerability of health facilities to all types of disasters, improve structural and nonstructural safety, and encourage the health sector to incorporate mitigation measures in health facilities.

When an El Niño event is forecast, the following should be determined about the infrastructure of health facilities: (a) their condition during and after the event to determine whether they can continue to operate and the conditions and needs that must be met to guarantee their operation; (b) the capacity of the affected region or area to receive basic water, electricity, communications, and transportation services; and (c) the operating capacity available to deliver health services to the affected community and the ability of the community to access such services.

The results presented indicate that El Niño events do affect health through the deaths, injuries, and population displacement that they produce or their direct impact on the physical infrastructure of the health services.

In the specific macro analysis it has not been possible to show a direct association between El Niño and infectious diseases. However, with more systematic data collection and better quality data, it would perhaps be possible to revise what has been demonstrated up to now.

The projected impacts of El Niño on disease will vary with the manifestation of the phenomenon (flood, drought, temperature increase). Since El Niño serves to exacerbate conditions already present, the risk of communicable disease will increase in areas where the disease is already endemic, the health situation is deteriorating, and there is overcrowding and damage to basic services. In preparation, countries should draw up a checklist (Table 2) of regional risk factors, instituting effective disease surveillance that will make it possible to recognize changes in the incidence of endemic diseases associated with the El Niño phenomenon. The incorporation of climate forecasting into existing disease surveillance, emergency preparedness, and disaster prevention and

mitigation programs can help to lessen the health impacts of El Niño/Southern Oscillation and other extreme events.

Table 2. Example of a Disease Checklist

	Projected effects of El Niño on Disease		
	Flood	Drought	Temperature Increase
<i>Water borne disease</i>			
Cholera	++++	+	
Rotavirus	++++		
Diarrhea non specific	++++		
Viral hepatitis A	++	+	
Dinoflagellates	-	-	+++
<i>Vector borne diseases</i>			
Malana	+	-	+
Dengue	+	?	
Rabies	++	+	
<i>Physical and Chemical factors</i>			
Pesticides	++	-	-
Toxic Iron ores	++	-	-
<i>Respiratory diseases</i>			
	-	++	+
++++ = extreme impact, +++ = large impact, ++ = moderate impact, + = small impact			

Note: Each country should prepare its own checklist, taking the endemic levels of disease and regional risk factors into account.

El Niño is a singular phenomenon due to its ability to cause major flooding or severe drought. In either case, it has an indirect impact on disease because of its repercussions on agriculture, migration, and sanitation, and its effects are often exacerbated by pre-existing conditions such as poor soil management. The impact of El Niño on health and infrastructure, in turn, has repercussions for trade and tourism. The effects of El Niño cannot be considered in isolation but must be viewed in combination, as a link in a chain reaction.

The Internet has facilitated information exchange on solutions that could be implemented to deal with the negative health impact of El Niño events. The ministries of health should move to promote and improve its use, taking advantage of this medium to increase preparedness at little cost and reduce the vulnerability of the health sector. An improvement in radio and cellular phone communication in the Region would give health authorities better access to the information generated at the site of El Niño events.

Many people in the Region are currently trained in the system for managing supplies in the aftermath of disasters; it is suggested that the countries strengthen their knowledge of the SUMA system to improve and facilitate the management of humanitarian assistance.

It is necessary to conduct scientific studies on the impact of extreme meteorological conditions such as El Niño events on human and animal health. Attention should focus on the vulnerability of ecosystems to El Niño events, the manner in which the incidence of disease responds to extreme climate conditions, and the need for the programs to adapt to climate-induced changes in morbidity and mortality.

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Annex



EXECUTIVE COMMITTEE OF
THE DIRECTING COUNCIL

PAN AMERICAN
HEALTH
ORGANIZATION

WORKING PARTY OF
THE REGIONAL COMMITTEE

WORLD
HEALTH
ORGANIZATION



RESOLUTION

CSP25/10 (Eng.)
Annex

CE122.R11

EL NIÑO AND ITS IMPACT ON HEALTH

THE 122nd SESSION OF THE EXECUTIVE COMMITTEE,

Having seen Document CE122/10 on El Niño and its impact on health, presented by the Director,

RESOLVES:

To recommend to the 25th Pan American Sanitary Conference the adoption of a resolution along the following lines:

THE 25th PAN AMERICAN SANITARY CONFERENCE,

Taking note of the grave impact of El Niño 1997-1998 on the health and economy of the entire Region of the Americas;

Having seen Document CSP25/10 on El Niño and its impact on health, presented by the Director;

Concerned about the vulnerability of the health sector to events resulting from this phenomenon;

Recognizing the importance of the measures adopted by several countries to strengthen their systems for epidemiological surveillance, basic sanitation, and communicable disease control;

Convinced that the damage to the infrastructure of the sector, including health facilities, water and sanitation systems, and other vital services, can be minimized for future catastrophic events and that greater efforts should therefore be made by the Member States in this regard;

Recalling Resolutions CD24.R10 (1976), CD26.R36 (1979), CD27.R40 (1980), CD32.R10 (1987), and CD40.R13 (1997) of the Directing Council, mandating that PAHO provide technical cooperation on disaster preparedness in matters related to health and, specifically, that it continue this cooperation designed to prepare the sector to deal with the disasters caused by El Niño; and

Taking into account Resolution AG/RES.1584, "Special Program of Support to Countries affected by El Nino," adopted by the XXVIII regular session of the General Assembly of the Organization of American States, urging the member states and the organs and agencies of the inter-American system (in particular the Inter-American Development Bank, the Inter-American Institute for Cooperation in Agriculture, and the Pan American Health Organization), as well as the nongovernmental organizations that are pursuing similar aims, to intensify, within the framework of the International Decade for Natural Disaster Reduction, their cooperation with efforts aimed at preventing, reducing, and repairing the effects of El Nino,

RESOLVES:

1. To invite the Member States to review and update their emergency health plans, using as a foundation the lessons learned from the disasters caused by El Niño 1997-1998.
2. To urge the Member States that had developed disaster preparedness and mitigation programs prior to the disasters caused by El Niño to strengthen these programs, maintaining a comprehensive vision that encompasses all types of risks.
3. To request the Member States that still have not done so to:
 - (a) develop disaster mitigation programs that, in keeping with the recommendations of the International Conference on Disaster Mitigation in Health Facilities held in Mexico in 1996, include aspects of design and structural and nonstructural reinforcement and maintenance of health facilities, water and sanitation systems, and other vital services;
 - (b) strengthen their programs for preparedness in any emergency, placing multidisciplinary emphasis on epidemiological surveillance, disease control, environmental quality, environmental sanitation, and vector control, as well as on disaster preparedness in hospitals and communities;
 - (c) support data collection and medium- and long-term research projects in order to determine with greater certainty the impact of El Niño on human health.

4. To request the Director to:
 - (a) strengthen technical cooperation with the Member States for the development of policies and programs geared toward upgrading the sanitary structure for the prevention and mitigation of damages caused by disasters;
 - (b) promote regional and country efforts to ensure the creation of an institutional memory with respect to El Niño 1997-1998, as well as epidemiological surveillance and research studies that lead to a better understanding of the impact of this phenomenon.

*(Adopted at the seventh meeting,
25 June 1998)*