EL NINO AND ITS HEALTH IMPACTS

Over recent years there has been growing interest in links between El Nino (and other extreme weather events) and human health. A number of studies have demonstrated that pronounced changes in the incidence of diseases can occur in parallel with the extreme weather conditions associated with the El Nino cycle.

What is El Nino? "El Nino" is the familiar term given to the Christchild in Latin America. It is also used to describe an anomaly in the flow of ocean waters along the west coast of South America, which can occur around Christmas time. This anomaly is the result of the nutrient-rich cold water of the coastal Humboldt Current being replaced by eastward-flowing warm ocean water (which is nutrient poor) from the equatorial Pacific. El Nino events have occurred every three to five years, on average, since weather records began in 1877, and they are associated with catastrophic declines in fisheries along the Pacific coast of South America.

The Southern Oscillation (SO) is a large-scale atmospheric "see-saw" centred over the equatorial Pacific Ocean. The variation in pressure is accompanied in surrounding areas by fluctuations in wind strengths, ocean currents, sea surface temperatures and precipitation. The SO and the warm waters of the El Nino are part of the same climate phenomenon referred to as ENSO (El Nino/Southern Oscillation). ENSO influences climate in distant regions: droughts in south-east Asia, parts of Australia, and parts of Africa, and heavy rainfall and flooding in arid areas of South America, have been observed during El Nino years, while the Indian summer monsoon sometimes weakens and winters in western Canada and parts of the northern USA become milder. Overall, disasters triggered by drought are twice as frequent worldwide during El Nino years.

Ability to predict El Nino: Forecasting techniques to predict and measure El Nino events have improved dramatically in recent years. According to one of these techniques (the multivariate ENSO index), there were three such extreme events during the 1950-1980 period, since 1984, there have already been four major El Ninos. The longest single El Nino period on record occurred from 1990-1995. Whether or not this apparent increase is related to global warming has not yet been established.

El Nino's (and other weather phenomena's) link to health: An increasing array of studies demonstrate important associations between the ENSO cycle, climate phenomena and human health. El Nino and similar weather disturbances affect human health mainly through natural disasters and related outbreaks of infectious diseases. It is impossible to estimate, however, how many human deaths and illnesses are directly linked to El Nino, as the health effects result from a complex interaction of abnormal weather events with factors such as population, overcrowding, health status, sanitation infrastructure, etc.

Natural Disasters: El Nino can cause dramatically increased or decreased rainfall, which can lead directly to natural disasters such as floods or droughts. In addition, high wind events such as tornadoes may increase in frequency or intensity. These effects can occur at long distances from the ENSO phenomenon and tend to be more dramatic in particular areas. These disasters may cause direct injuries and deaths, destroy crops and property, lead to famine and interrupt development. They make already-vulnerable populations more vulnerable. Research has shown that the numbers of people affected by natural disasters worldwide are greater during the first El Nino year and the following year than in the pre-El Nino year.

The 1997 El Nino has already been associated with drought-related forest fires originating in Indonesia, which have, in turn, resulted in a dramatic increase in respiratory disease visits in Kuala Lumpur General Hospital and in the State of Sarawak (both in Malaysia). These fires have mainly been used by human activity but the lack of seasonal rains has led to their spread over wide areas and the fires are now affecting virgin rain forest. Similar fires are being witnessed in the Amazon rain forest and pose a major ecological threat to both farming and traditional indigenous communities. At the time of publication of this Fact Sheet, drought-related famine is threatening countries such as Sudan and the Philippines. In 1997-1998, El Nino has also been associated with very destructive flooding in South America. Ecuador and Peru have been particularly affected.

Infectious Diseases: In addition, strong evidence exists of linkages between these weather variations and increases in the incidence of infectious diseases, such as insect vector-borne disease (e.g. malaria, Rift Valley fever) and epidemic diarrhoeal diseases (e.g. cholera and shigellosis).

Climatic factors, such as changes in temperature and humidity, are known to be capable of facilitating or interrupting the capacity of insect vectors to transmit disease to humans. Malaria and Rift Valley Fever (RVF) are two diseases for which substantial documentation in this area exists. Less well documented, but of increasing interest, are the effects of ENSO on

dengue. This largely urban disease, present in tropical regions around the world, is spread by mosquitoes that breed in artificial containers. Thus, in addition to climatic factors, changes in domestic water storage practices, brought about by disruption of regular supplies, will also influence patterns of transmission.

Malaria: El Nino events have an impact on malaria control in many parts of the world because the associated weather disturbances influence vector breeding sites, and hence the transmission potential of the disease. It has been recognised that many areas experience a dramatic increase in the incidence of malaria during extreme weather events corelated to El Nino. Moreover, outbreaks may not be larger, but more severe, as populations affected may not have high levels of immunity. Quantitative leaps in malaria incidence coincident with ENSO events have been recorded around the world: such epidemics have been documented in Bolivia, Columbia, Ecuador, Peru and Venezuela in South America, in Rwanda in Africa, and in Pakistan and Sri Lanka in Asia. Historically, the Punjab region of north-east Pakistan, the risk of malaria epidemic increases five-fold during the year following a major El Nino, and in Sri Lanka, the risk of a malaria epidemic increases four-fold during an El Nino year. These increased risks are associated with above-average levels of precipitation in the Punjab and below-average levels of precipitation in Sri Lanka. In South America and Rwanda, heavy rainfall has contributed to major epidemics of malaria. To be able to forecast the impact of El Nino in different endemic areas, control programmes need to develop a thorough understanding of how local vector species respond to climate variability, and how a population's immunity and nutritional status fluctuate over time. To mount a timely and effective epidemic response, malaria control programmes need to incorporate surveillance and epidemic control in their everyday activities.

Rift Valley Fever: Outbreaks of Rift Valley Fever (RVF), a vector-borne disease that principally infects livestock, have occurred in eastern Africa on almost every occasion that there has been excessive rainfall. Consequent on the 1997 El Nino, areas of north-eastern Kenya and southern Somalia experienced rainfall, which was 60-100 times heavier than normal and was the heaviest recorded since 1961. The rains, which began in October 1997 and continued through January 1998, caused RVF virus-infected eggs of floodwater *Aedes* mosquitoes to hatch. In the outbreak of Rift Valley Fever that followed livestock losses were considerable in the affected regions. Moreover, the estimated toll of human death due to RVF in the region was 200-250, while there were an estimated 89,000 human cases of RVF in north-eastern Kenya and southern Somalia. Other areas of Kenya, and the United Republic of Tanzania were also affected with widespread animal infections; however, their impact on the human population was not as great. Preliminary estimates of infections and deaths among animals and humans suggest this may be the largest outbreak of Rift Valley Fever ever reported.

Cholera and other epidemic diarrhoeal diseases: These are a major cause of morbidity and mortality in many countries. Outbreaks can be related either to floods or drought (floods, for example, contaminate water supply, while droughts both make hygiene more difficult an contaminate the water that remains).

There is a circumstantial evidence to indicate a close association between weather changes caused by El Nino and cholera. Since September/October 1997, there has been a deteriorating cholera situation in the Horn of Africa. After heavy rainfall and floods in the Horn of Africa, most of the countries in this region reported a dramatic upsurge in the numbers of cases of and deaths due to cholera. In 1997, a total of 40,249 cholera cases with 2,231 deaths were reported in Tanzania alone (this compares to 1,464 cases and 35 deaths in 1996). Kenya reported 17,200 cases and 555 deaths and Somalia 6,814 cases and 252 deaths due to cholera in 1997. With the floods continuing in this region and adding to already limited sanitation, poor hygiene and unsafe water, conditions are favouring the spread of cholera. At the end of 1997 other countries surrounding the Horn of Africa, such as Democratic Republic of Congo and Mozambique, were reporting increased numbers of cholera cases and deaths. Reported figures through the first three months of 1998 already showed 11,335 cases and 525 deaths in Uganda, and 10,108 cases and 507 deaths in Kenya.

In the Americas, the current cholera epidemic has been raging for seven years and, associated with a major El Nino, the number of cholera cases started to increase at the end of 1997. In 1998, Peru has been suffering from a major outbreak and has already reported,for the first three months of 1998, 16,705 cases and 146 deaths. Other countries which are reporting increasing numbers of cholera cases in 1998 are Bolivia, Honduras and Nicaragua.

A study examining the relationship between sea surface temperature and cholera case data in Bangladesh during 1994 documented a close association between those two variables.

Prediction and Prevention: Measures to predict and prevent disease outbreaks related to El Nino are increasing. In South - east Africa and the Horn of Africa, the regional WHO Cholera Surveillance Teams, warned by early forecasts of El Nino related extreme weather events in 1997, were able to help reduce the severity of the cholera outbreak in those regions by means of increased monitoring and heightened preparedness of healthcare institutions in the area.

The Southern Oscillation Index has been used to predict the probability of epidemics of vector-borne diseases (such as Murray Valley encephalitis in Australia). Satellite remote sensing, used to detect areas of abnormal precipitation via increases in vegetation, highlighted exactly those areas which were hit by the Rift Valley Fever outbreak in east Africa in late 1997 and early 1998. Mathematic modelling techniques to predict the spread of malaria into new areas in relation to climate changes are also being used (e.g. in Kenya).

WHO's role: WHO is a member of the "climate agenda", a United Nations interagency programme which integrates all major international climate-related activities. Within

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this mechanism, WHO plays a major role in linking the monitoring of health impacts with the monitoring of climate and other associated impacts, and in assisting Member States to use prediction and forecasting models to reduce the human impact on major climating events.

In December 1997, WHO, together with the United Nations Environment Programme (UNEP) and the UK Medical Research Council, held the first of a series of workshops on climate change and human health. At the workshop, the first steps towards drawing up an international research agenda were taken. WHO's long-term objective is to use improvements in predicting and monitoring unusual weather occurrences such as El Nino as an aid in taking pre-emptive measures to reduce the public health impact of such events.

Courtesy: World Health Organization Press Office
Fact Sheet No. 192, May 1998