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# WHO Report on Global Surveillance of Epidemic-prone Infectious Diseases

World Health Organization

Department of Communicable Disease Surveillance and Response

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# Acknowledgements

We would like to acknowledge all the WHO country and regional offices who are the mainstay of WHO global surveillance systems. We would also like to thank the UNAIDS/WHO Working Group on HIV/AIDS and STI Surveillance for their contributions to Chapter 9.

This report is dedicated to the late Karin Ljungars Esteves, our former colleague at WHO, who made an enormous contribution to communicable disease surveillance activities over many years.

# Contents

This report was prepared by:

*M. Anker*

*D. Schaaf*

With contributions from WHO, Geneva

*R. Arthur*

*J. Barkway*

*M. Birmingham*

*A. Burton*

*C-L. Chaignat*

*P. Creese*

*P. Desjeux*

*P. Gavinio*

*J. Jannin*

*L. Kuppens*

*D. Lavanchy*

*S. Lazzari*

*P. Lucas*

*E. Netto*

*B. Piot*

*C. Roth*

*M. Ryan*

*E. Tikhomirov*

*R. Winkelmann*

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# CHAPTER 1
# INTRODUCTION

## Background

This report focuses on the analysis and interpretation of data collected by WHO on the surveillance of infectious epidemic diseases, the strengths and weaknesses of the data, and how the data can be used and interpreted. There are several aspects of this report that are worth noting. First, time series data for approximately half a century are reported for many of these diseases. Such data allow recent changes to be interpreted in a long-term perspective. Indeed, part of the motivation for including particular diseases in this report is to make these data available to the public, to health professionals and to scholars. One of the surveillance systems discussed in this report, the surveillance system for leishmania/HIV co-infection, is very new. Already this system is indicating that co-infection is a problem in some parts of Europe. For HIV/AIDS, there is a unique set of data from the beginning of the pandemic until the present time.

Second, this volume uses a multiple disease approach, and examines not only the surveillance of (nine) different diseases, but also contrasts and compares their global surveillance systems.

Surveillance has been defined as the continuing scrutiny of all aspects of the occurrence and spread of a disease that are pertinent to effective control.[1] For this, systematic collection, analysis, interpretation and dissemination of health data are essential. This includes collecting information about clinical diagnoses, laboratory diagnoses and mortality, as well as other relevant information needed to detect and track diseases in terms of person, place and time. Surveillance systems must detect new communicable diseases as well as recognize and track diseases that currently are, or have the potential to become, of major public health importance.

## Why infectious diseases are still a problem and surveillance is still required

In the 1970s many experts thought that the fight against infectious diseases was over. In fact, in 1970, the Surgeon-General of the United States of America indicated that it was “time to close the book on infectious diseases, declare the war against pestilence won, and shift national resources to such chronic problems as cancer and heart disease”.

Indeed, complacency about the threat of communicable diseases in the 1970s led to less priority for communicable disease surveillance systems. Partly as a result, these systems were not maintained in large parts of the developing world, and this retarded recognition of the magnitude of problems posed by new and re-emerging communicable diseases, and therefore effective action to control them.

During the last two decades, this opinion has been reversed, and there is now a renewed appreciation of the importance of communicable disease. The spread of new diseases such as HIV/AIDS, hepatitis C, and dengue haemorrhagic fever, and the resurgence of diseases long since considered under control such as malaria, cholera, and sleeping sickness, have drawn considerable attention. Infectious diseases cause 63% of all childhood deaths and 48% of premature deaths. Many of these deaths are caused by epidemic infectious diseases such as cholera, meningococcal disease, and measles. There are continuing threats of large epidemics with widespread mortality like the ‘Spanish flu’ epidemic in 1918-1919 which killed an estimated 40 million people worldwide, or the HIV/AIDS epidemic which has caused widespread morbidity and mortality, and reversed hard-won gains in life expectancy in Africa.

In light of this, it is clear that effective public health surveillance is critical for the early detection and prevention of epidemics. There is a clear and urgent need for surveillance of (i) known existing

[1] Last, JM. *A Dictionary of Epidemiology*. Oxford University Press, 1995.

communicable diseases, especially those with high epidemic potential, (ii) early recognition of new infections (over 20 new pathogens have been discovered since the mid-1970s), and (iii) monitoring the growing resistance to antimicrobial drugs.

## Global epidemic surveillance

In the modern world, with increased globalization, and rapid air travel, there is a need for international coordination and collaboration. Everyone has a stake in preventing epidemics.

WHO has the mandate to lead and coordinate global surveillance. This includes setting international epidemic surveillance standards, providing technical assistance to Member States in surveillance activities, training in field epidemiology, strengthening laboratory capacity and laboratory networks. WHO also maintains international collaborating networks like the WHO Network of Collaborating Centres for Influenza Surveillance which monitors strains of influenza, the cholera task force which coordinates preparedness and response to cholera outbreaks, and the International Coordinating Group (ICG) on Vaccine Provision for Epidemic Meningitis Control.

In addition, WHO ensures international coordination of epidemic response, particularly for diseases of international public health importance or when countries lack the capacity to respond to an epidemic themselves. Responses can vary from investigating the cause of an epidemic, to verifying and disseminating information, and to providing needed equipment and laboratory supplies.

## The scope of this report

This report concentrates on the surveillance of nine infectious epidemic diseases that are either new or volatile or pose an important public health threat. All have high epidemic potential and most are increasing in incidence. They include:

Yellow fever

Plague

Cholera

Meningococcal disease

Dengue fever and dengue haemorrhagic fever

Influenza

African trypanosomiasis

HIV/AIDS

Leishmaniasis and leishmania/HIV co-infection

These diseases are difficult to track because of their complicated epidemic patterns, their ability to develop new strains, and their tendency to spread quickly to new locations. Most of these diseases have high case fatality rates and severe symptoms increasing the urgency of fast identification of new occurrences to prevent further transmission.

These nine diseases have several different transmission patterns. Yellow fever, plague, dengue/dengue haemorrhagic fever, African trypanosomiasis, and leishmaniasis are all vector-borne diseases transmitted by the bite of infected insects; influenza and meningococcal disease have airborne transmission routes; while cholera is transmitted by contaminated food and water, and HIV is transmitted primarily through sexual contact. HIV and HIV-leishmania co-infection, and African trypanosomiasis can also be transmitted through contact with infected blood either from blood transfusions, contaminated needles or use of contaminated blood products. Vertical transmission from mother to child occurs in both HIV and African trypanosomiasis.

The remainder of this chapter presents a description of the types of data used in the surveillance of the nine diseases presented. This provides insight into the different types of activities that make up disease surveillance systems, and includes a discussion of the uses and limitations of surveillance data. Next, there are observations about how the modern world is impacting on infectious diseases, using examples from the nine diseases covered in the report. Finally some conclusions are drawn.

## Types of surveillance

Table 1.1 presents the types of surveillance data available for the nine diseases covered in this report. This includes the information collected, years covered, type of surveillance, frequency of reporting, and the strengths and weaknesses of the surveillance system.

### *Reporting cases and deaths*

One of the mainstays of communicable disease surveillance is the reporting and confirmation of cases seen in health facilities. This is known as passive reporting (in contrast to active case-finding methods where cases are actively looked for). For passive reporting to be successful, primary health care providers must be able to recognize the clinical manifestations of reportable diseases. This involves having clear, uniform case definitions available at the peripheral level. In addition, laboratories need adequate resources to make the required laboratory diagnoses.

Passive surveillance has many weaknesses. First, in many parts of the world there is very little access to health care facilities, and many people fall ill or die at home without ever visiting a health facility. Thus many cases are not reported. Second, there are problems of under-recognition of diseases, particularly those that are new to an area or those with non-specific symptoms. Third, in many parts of the world the level of laboratory support is inadequate. Fourth, there are common logistical problems in reporting in many parts of the world, over-worked and underpaid staff, lack of motivation for reporting when no feedback is provided, and a need for further training. Overall, there is considerable variation in the quality of reporting systems from country to country, reflecting economic, social, cultural and epidemiological differences.

There are several typical reporting practices used, depending on the control measures needed, and the specific regulations in the country.

Three diseases are currently subject to the International Health Regulations:[2] yellow fever, plague, and cholera. The regulations, which were first adopted by the World Health Assembly in 1951 and then revised slightly in 1969, are a mechanism to provide security against the international spread of epidemic diseases with a minimum interference with world traffic. These are the only binding international legislation for public health and they require that:

> Each national health administration should inform WHO within the first 24 hours of being informed of the first suspected case on its territory of a disease subject to the Regulations. This includes both indigenous and imported cases. All subsequent cases and deaths should be reported to WHO.

For these diseases the report from the health professional to the next higher administrative level is done by a rapid method such as phone, e-mail, fax or telex.

Although all cases and deaths from yellow fever, plague and cholera should theoretically be reported to WHO, this does not always happen in practice. In many instances, countries are unwilling to notify WHO because of the fear of economic and political consequences, such as the loss of tourism and trade, and the imposition of travel restrictions. This causes underreporting and reporting delays.

[2] The International Health Regulations are currently undergoing substantive revision.

Therefore reported data for the diseases covered by the International Health Regulations need to be interpreted with caution.

For diseases not subject to the International Health Regulations, national reporting practices and laws vary across countries. For infectious diseases with potentially high case fatality rates which can spread rapidly (such as meningococcal disease), most countries require rapid reports of the first occurrences of suspect cases. For other diseases, such as pneumonia or AIDS, weekly, monthly, or quarterly case reports are done. Not all infectious diseases are routinely reported, as reporting every infectious disease would place an undue burden on health services.

Some countries have sentinel sites that report more frequently and sometimes on more diseases than the routine reporting system. If these sites are well chosen, they can provide a wealth of information in a timely way – something that would be impossible to expect of all primary health care centres. The disadvantage of relying on sentinel sites alone is that they may not necessarily be representative of the country as a whole.

With the exception of the International Health Regulations which are determined internationally, reporting requirements for infectious diseases are nationally or sub-nationally determined. For example, a disease like leishmaniasis is notifiable in some high risk countries but not in all. Even within countries there may be important differences. For example, reporting of HIV is required in some states in the United States of America but not in others.

As a result there are differences from country to country, and even within countries in how the reporting of each disease is carried out. This makes sense because each country faces a different set of disease related circumstances. However, it does introduce an element of non-comparability into global disease surveillance systems, since information on the same disease is collected in a somewhat different way depending on the country. This must be kept in mind in the analysis of global surveillance data.

Six of the nine diseases in this report depend heavily on reported numbers of cases and/or reported numbers of deaths to track the disease in terms of person, place and time. These include cholera, plague, yellow fever, meningococcal disease, dengue, and leishmaniasis (including leishmaniasis/HIV co-infection).

WHO headquarters maintains disease specific global data bases including the reported numbers of cases and deaths for each country by year. During analysis and interpretation, these data are often supplemented by additional information, and scientific studies. For example, in many instances scientific studies indicate that disease transmission has taken place in a particular country, even though there have been no reported cases. In general, WHO data are adequate to present a broad reflection of disease and mortality trends as is done in this report. More disaggregated data are usually needed for more in-depth analyses.

### *Surveillance of disease strains*

Detection and reporting of disease strains is very important for all infectious diseases, since new strains have the potential to cause new epidemics and pandemics. For some diseases, such as influenza, new strains occur frequently. For influenza a major component of surveillance is to track circulating virus strains, which is key for the development of appropriate influenza vaccines each year. Dengue is another disease where particular importance is given to keeping track of circulating virus strains to assess the potential for outbreaks of dengue haemorrhagic fever.

Surveillance of strains relies on laboratory reports both for the confirmation of clinical diagnoses, and for the assessment of antimicrobial resistance. Good surveillance requires strong laboratory facilities, appropriate resources both human and financial, access to necessary reagents, and strong quality control. Currently, laboratories in many developing countries, particularly in Africa, are not functioning well enough to meet surveillance needs. WHO is making considerable strides in rebuilding infectious disease laboratory capacity in developing countries. In addition, WHO Collaborating Centres and reference

laboratories provide international support for such tasks as identifying outbreaks, and identifying problem specimens.

### *Population screening*

Screening the population for communicable diseases is not often done because it is expensive and potentially invasive of privacy. Sleeping sickness (in particular, gambiense sleeping sickness) is one of the few diseases that uses systematic population screening to find cases. All those who screen positive are referred to treatment centres, where they are re-tested and treated if infected. The certain fatality of untreated sleeping sickness, and the impracticality of other methods of surveillance and control, makes systematic screening of populations living in high-risk areas imperative.

### *Surveillance of HIV/AIDS*

HIV/AIDS surveillance differs from surveillance of other diseases in many ways reflecting transmission patterns, the long latency period, the lack of affordable treatment and cure, high case fatality rates, and the social stigma associated with HIV infection. HIV/AIDS surveillance can be carried out in different and complementary ways. The first surveillance data collected were reported AIDS cases. This was the easiest data to collect, and had the advantage of raising awareness of countries about the disease. In developed countries, AIDS cases were also used for calculating the past prevalence of HIV infection. These data can be detailed enough to provide breakdowns by age, sex and probable mode of transmission. However, because of the long latency period, during which HIV infection is basically asymptomatic, reported AIDS cases reflect infection that occurred many years ago and are not appropriate for tracking current infections. HIV/AIDS surveillance also poses a number of special ethical problems arising mainly from the stigma and discrimination attached to AIDS, and the lack of access of most infected people to treatment. Therefore, unique methods for estimating current prevalence rates have been developed, which involve unlinked anonymous testing. Finally, HIV/AIDS surveillance includes behavioural surveillance, in order to understand trends in behavioural risk factors for HIV.

## Modern times, rapid change – how this impacts on infectious diseases

Rapid change is one of the hallmarks of current times. This includes rapidly changing environments for microbes as well as humans. For example, there has been unprecedented population growth, accompanied by rapid, unplanned urbanization. This has resulted in large increases in urban slums without adequate water and waste management. In addition many of the people living in slums are migrants from rural areas, with little immunity to urban diseases. These changes create an excellent environment for communicable diseases to flourish. For example, rapid urbanization combined with lack of vector control (or in the case of South America the cessation of vector control), has lead to increased spread of *Aedes aegypti* mosquitos and consequently increased risk of both dengue and yellow fever epidemics.

The aeroplane is another hallmark of modern times. Air travel has become common place, and fast. The result is increased potential for rapid dispersion of infectious diseases to new environments. Other factors of the modern age that have increased the threat from communicable diseases include changes in land use and agriculture, and increased encroachment of people on forest and woodlands areas.

Civil unrest and war contribute to the spread of infectious disease. During wars, troops and equipment as well as displaced persons are constantly moving from one place to another, carrying with them infectious disease organisms and vectors. This is coupled with destruction of the physical and often economic infrastructure of the area. For example, dengue increased in South-East Asia during the Second World War and the immediate post-war period, due to the spread of mosquitos and different virus strains throughout the region. Wars have also been very important in the spread of plague. The deforestation associated with the Viet Nam War in the 1970s, coupled with the collapse of the local

infrastructure, is considered to be the cause of a large epidemic of plague during the 1970s and early 1980s.

Wars also spur widespread mass migrations. Migrants may have no immunity to diseases endemic in the new area; in addition, they may bring with them diseases that are common in their former home but which are not endemic in the new area. Migrants are stressed, often physically and emotionally. This combination of conditions especially in crowded makeshift refugee camps may lead to disease epidemics, such as the cholera epidemic in Goma, Democratic Republic of the Congo, which killed thousands of people in a short period of time during 1994.

Natural disasters, such as earthquakes and flooding often create conditions that are favourable to outbreaks of communicable disease. For example, in 1997, heavy rain and floods in the Horn of Africa were followed by outbreaks of cholera. In 1998 in Central America, unusual weather patterns, including hurricane Mitch were followed by a resurgence of cholera. The 1994 outbreak of plague in Surat, India was preceded by flooding.

On the positive side, there have been tremendous strides in the control and elimination of some communicable diseases especially for vaccine preventable diseases. Smallpox has been eradicated from the world, and major efforts are being made towards the eradication of polio. In many countries, living conditions have improved substantially with associated health benefits. There have also been considerable gains in life expectancy, especially in under-five mortality rates. Scientific knowledge about the disease process has advanced markedly in recent years, especially in areas such as molecular biology.

## Contents of disease specific chapters

Each of the following chapters discuses the global surveillance of a particular epidemic infectious disease. It begins with a background of the disease, providing a brief history of the disease, a short description of the transmission process, clinical features, and other characteristics of the disease that are important for surveillance. The available surveillance data are then described, as well as the strengths and weaknesses of the surveillance system. This discussion is followed by a summary of disease trends based on the available surveillance data and a concluding section. A list of references and detailed data tables are provided at the end of each chapter.

## Conclusions

1. WHO has long-term data on many epidemic infectious diseases. WHO also has the mandate to lead and coordinate the international effort in global surveillance and response.
2. The data collected serve many purposes. First, the data are used to alert health officials when there is an epidemic of infectious disease. For diseases that spread rapidly, and that have high case fatality rates if left untreated, timeliness is of utmost important. Since the data are collected over a long period of time, they can also be used to provide a general picture of long-term trends in incidence and case fatality rates.
3. The data have many weaknesses. Countries are hesitant to report diseases covered by the International Health Regulations, in part for fear of economic consequences, and its effects on tourism and trade. In addition, for many diseases there is gross underreporting, under diagnosis, and delayed reporting. The quality of reporting varies considerably from country to country. Finally, international data are not completely comparable as reporting systems, case definitions, and the quality and availability of laboratory facilities vary from country to country.
4. Despite these caveats, WHO data can provide a global picture of trends in epidemic infectious disease and case fatality rates over a relatively long period of time.

**Table 1.1 Types of surveillance and their strengths and weaknesses for nine epidemic infectious diseases**

| Disease | Years covered | | Type of surveillance | Reporting frequency | Strengths and weaknesses of reporting system |
|---|---|---|---|---|---|
| Yellow fever | 1950 | 1998 | Passive reporting[1] of cases and deaths<br><br>Immunization coverage surveys or administrative data | As soon as possible for first suspected case[2]<br><br>Annual reports of immunization coverage | Yellow fever is subject to the International Health Regulations. As with other such diseases, there is reluctance to report outbreaks because of a feared loss in tourism and trade or travel restrictions<br><br>There are often long delays in detection of yellow fever outbreaks, due to such factors as lack of access to health services, difficulty in clinical diagnosis, inadequate laboratory facilities and access to reagents<br><br>Despite the underreporting of cases, it is unlikely that major epidemics of yellow fever have been missed completely<br><br>Data on routine yellow fever childhood immunization is weak |
| Plague | 1954 | 1998 | Passive reporting of cases and deaths | As soon as possible for first suspected case[2] | Plague is subject to the International Health Regulations. As with other such diseases, there is reluctance to report outbreaks because of a feared loss of tourism, and trade or travel restrictions<br><br>There are differences from country to country in reporting practices. Some countries report all suspected cases while other countries report confirmed cases only<br><br>Despite these differences, and despite underreporting of cases, a general description of the distribution of plague and global trends can be obtained from WHO data |

**Table 1.1 Types of surveillance and their strengths and weaknesses for nine epidemic infectious diseases**

| Disease | Years covered | | Type of surveillance | Reporting frequency | Strengths and weaknesses of reporting system |
|---|---|---|---|---|---|
| Cholera | 1970 | 1998 | Passive reporting of cases and deaths | As soon as possible for first suspected case[2] | Cholera is subject to the International Health Regulations, as with other such diseases, there is reluctance to report outbreaks because of a feared loss of tourism, and trade or travel restrictions<br>Often cholera is reported to WHO as acute watery diarrhoea in order to avoid the perceived negative consequences of reporting cholera |
| African trypanosomiasis | 1902 | 1998 | Active case-finding by systematic population screening in high risk areas | Continually | Currently only three to four million of the 60 million people at risk of sleeping sickness are under surveillance (either under active population screening programmes or living within the catchment areas of treatment services). This means that the reported number of cases is far below the actual number of cases |
| Meningococcal disease | 1966 | 1999 | Passive reporting of cases and deaths | As soon as possible for first suspected case | Because of the long epidemic cycles of meningitis, it is important to have a relatively long time series to be able to monitor major trends. WHO has national data for over 30 years, which is adequate for monitoring broad trends<br>Weekly reporting of cases during the meningitis season in African meningitis belt countries has been put in place to facilitate the procurement and distribution of adequate supplies of vaccines. This has been working well, providing much more detailed and more comparable data than previously available for these countries |

**Table 1.1 Types of surveillance and their strengths and weaknesses for nine epidemic infectious diseases**

| Disease | Years covered | | Type of surveillance | Reporting frequency | Strengths and weaknesses of reporting system |
|---|---|---|---|---|---|
| Dengue | 1955 | 1998 | Passive reporting of cases and deaths | Routine reporting | Dengue surveillance is difficult to set up and maintain. Dengue fever (DF) is difficult to recognize clinically because it has non-specific symptoms<br>Diagnosis of DF cannot be done on clinical judgement alone. There is a lack of adequate laboratory infrastructure for dengue surveillance<br>Data from Africa are missing from the global database<br>A web-based system of reporting is under development that would allow the collection of more complete data |
| Influenza | 1947 | 2000 | Reporting of strains of influenza from isolates | Weekly | The surveillance system for influenza is a long-running, well-functioning, laboratory-based system, used as the basis for the composition of influenza vaccine<br>It has been expanding in recent years, and there are now separate recommendations for composition of the northern and southern hemisphere vaccines. Further expansion is necessary, especially in parts of Asia and Africa where there is little or no coverage by the WHO network of national influenza centres<br>A web-based reporting system known as 'FluNet' has been established, which has greatly facilitated the reporting of outbreaks and isolates |

**Table 1.1 Types of surveillance and their strengths and weaknesses for nine epidemic infectious diseases**

| Disease | Years covered | | Type of surveillance | Reporting frequency | Strengths and weaknesses of reporting system |
|---|---|---|---|---|---|
| HIV/AIDS | 1981 | 1999 | Passive reporting of AIDS cases<br>Reports of sero-positivity for HIV from unlinked anonymous testing of women in antenatal clinics and other population subgroups<br>Behavioural surveillance | Annually<br>Annually<br>Ad hoc reports | The spread of HIV and the development of the AIDS pandemic are being closely monitored worldwide. For most purposes precise data are not needed, as long as the general trends and the range or order of magnitude of the existing infection can be measured |
| Leishmaniasis<br>Leishmania/ HIV coinfection | 1997 | 1999 | Passive reporting of cases | Annually | Global surveillance of leishmaniasis is very weak. Data are not systematically reported to WHO<br>There is a new surveillance system for monitoring leishmaniasis/HIV co-infection. This system is expanding, although currently most of the centres are in southern Europe<br>The surveillance system is beginning to document the extent of the co-infection problem in the catchment areas of network centres |

[1]Passive reporting is the reporting of cases that come to health services for treatment.

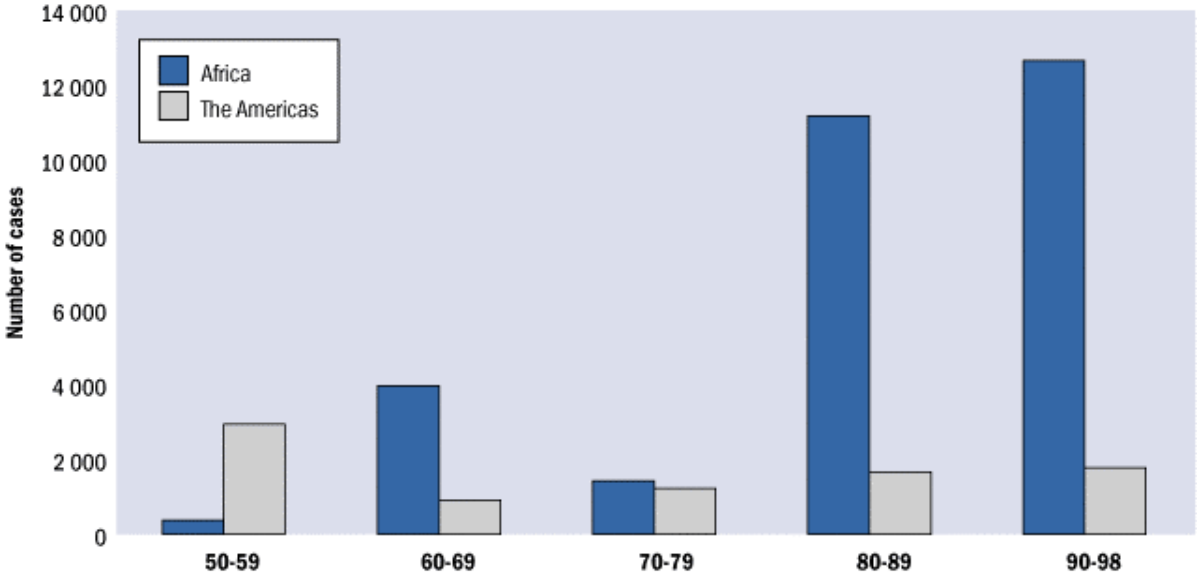
[2]Yellow fever, plague and cholera are subject to the International Health Regulations.

# CHAPTER 2
# YELLOW FEVER

## Background of the disease

Yellow fever is a viral disease transmitted by infected mosquitos that has caused large epidemics in Africa and the Americas. It can be recognized from historic texts stretching back 400 years. Infection causes a wide spectrum of disease, from mild symptoms to severe illness and death. The "yellow" in the name is explained by the jaundice that affects some patients. The number of epidemics, and the number of people infected with yellow fever have increased over the last two decades, and yellow fever is now a serious public health problem again (Fig. 2.1). Case fatality rates for reported cases are in the order of 15 to 50%.

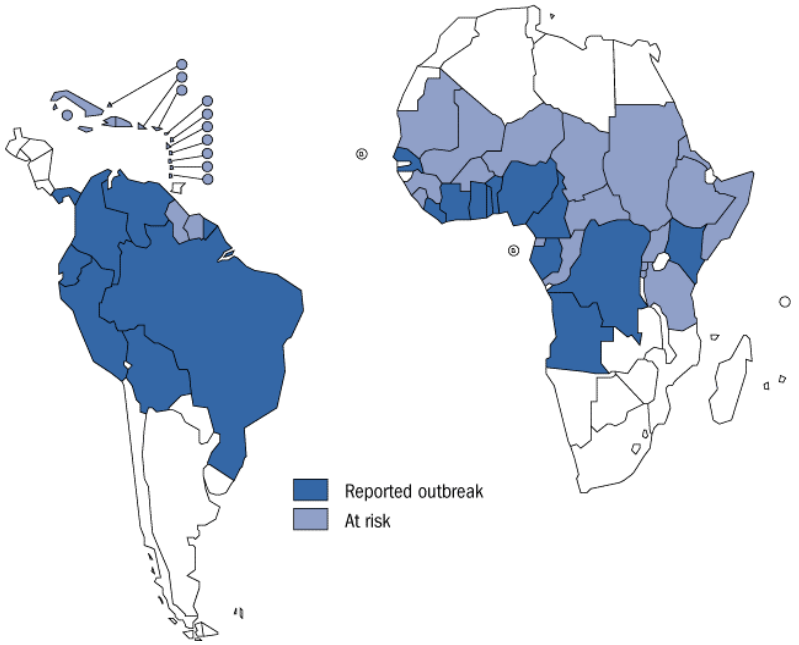
**Fig. 2.1 Number of reported cases of yellow fever per decade, 1950-1998**




An important reason for the re-emergence of yellow fever is the lapse of yellow fever immunization programmes in areas where they had been implemented in the past. Although a safe and effective vaccine has been available for 60 years, there are now large susceptible populations living in high-risk areas. Other factors contributing to the spread of yellow fever include increased urbanization, because mosquitos in urban areas increase the potential for explosive large urban outbreaks, increase in the distribution and density of mosquitos that transmit yellow fever and increased intrusion of people into forested areas.

The yellow fever virus is constantly present in mosquitos and non-human primates in some tropical areas of Africa and the Americas. Certain species of mosquitos are the reservoir of yellow fever virus; thus eradication of yellow fever is not feasible. This viral presence sometimes amplifies into regular epidemics. At present, 33 countries, with a combined population of 468 million, are at risk in Africa. These lie within a band ranging from 15°N to 10°S of the equator. In the Americas, yellow fever is endemic in ten South American countries and in several Caribbean islands. Bolivia, Brazil, Colombia, Ecuador and Peru are considered at greatest risk (see Map 2.1).

**Map 2.1 Countries at risk of yellow fever and countries that have reported at least one outbreak of yellow fever, 1985-1999**




## *Transmission*

Several different species of the *Aedes* and *Haemogogus* (South America only) mosquitos transmit the yellow fever virus. These mosquitos are either domestic (i.e. they breed around houses), wild (they breed in the jungle) or semi-domestic species (they display a mixture of habits). Any region populated with these mosquitos can potentially harbour the disease. There are three types of transmission cycles for yellow fever: sylvatic, intermediate and urban. All three cycles exist in Africa, but in South America, only sylvatic and urban yellow fever occur.

*Sylvatic (or jungle) yellow fever*: In tropical rainforests, yellow fever occurs in monkeys that are infected by wild mosquitos. The infected monkeys can then pass the virus onto other mosquitos that feed on them. These infected mosquitos bite humans entering the forest resulting in sporadic cases of yellow fever. The majority of cases are young men working in the forest (logging, etc.). On occasion, the virus spreads beyond the affected individual.

*Intermediate yellow fever*: In humid or semi-humid savannahs of Africa, small-scale epidemics occur. These behave differently from urban epidemics; many separate villages in an area suffer cases simultaneously, but fewer people are infected. Semi-domestic mosquitos infect both monkey and human hosts. This area is often called the "zone of emergence", where increased contact between man and infected mosquitos leads to disease. This is the most common type of outbreak seen in recent decades in Africa. It can shift to a more severe urban-type epidemic if the infection is carried into a suitable environment (with the presence of domestic mosquitos and unvaccinated humans).

*Urban yellow fever*: Large epidemics can occur when migrants introduce the virus into areas with high human population density. Domestic mosquitos (of one species, *Aedes aegypti*) carry the virus from person to person; no monkeys are involved in transmission. These outbreaks tend to spread outwards from one source to cover a wide area.

The potential for large-scale urban epidemics exists in many parts of the world. The density and habitats of *Aedes aegypti*, one of the mosquitos that transmits yellow fever, have expanded in both urban and rural areas. This mosquito is infesting regions where it was previously eradicated. Therefore,

although yellow fever has never been reported from Asia, this region is at risk because the appropriate mosquitos and primates are present. In addition, in the past, yellow fever outbreaks also occurred in Europe, the Caribbean islands and Central and North America - they must still be considered at risk for yellow fever epidemics even though the virus is not felt to be present in these areas now.

### *Prevention*

Immunization is the single most important measure for preventing yellow fever. In populations where vaccination coverage is low, vigilant surveillance is critical for prompt recognition and rapid control of outbreaks. Mosquito control measures can be used to prevent virus transmission until vaccination has taken effect.

Yellow fever vaccine is safe and highly effective. The protective effect (immunity) occurs within one week in 95% of people vaccinated. A single dose of vaccine provides protection for 10 years and probably for life. Immunization with yellow fever vaccine can and should be part of the routine immunization system (administered during the same visit as measles vaccine). In addition, preventive immunization can be done in mass "catch-up" campaigns to increase immunization coverage in areas where it is low. This is often done on an emergency basis after the beginning of an outbreak. WHO strongly recommends routine childhood vaccination, which includes yellow fever. This is more cost effective and prevents more cases (and deaths) than emergency immunization campaigns to control an epidemic. Mosquito control measures can also play a role in reducing the risk of yellow fever, but are not as effective as immunization.

## Description of the data

Yellow fever is one of the diseases reportable under the International Health Regulations (IHR). As such, countries are required to report cases and deaths to WHO within 24 hours of being notified of a case of yellow fever on their territory. Reporting of yellow fever cases and deaths to WHO began in 1948. Table 2.2 presents the total number of yellow fever cases and deaths reported to WHO from Africa and the Americas since 1950. WHO also collects data on immunization coverage, which is presented in Table 2.1 and Fig. 2.2.

## Strengths and weaknesses of the data

As with other diseases under the International Health Regulations, only a small fraction of cases are reported to WHO. However, it is unlikely that major epidemics of yellow fever have been missed completely.[1]

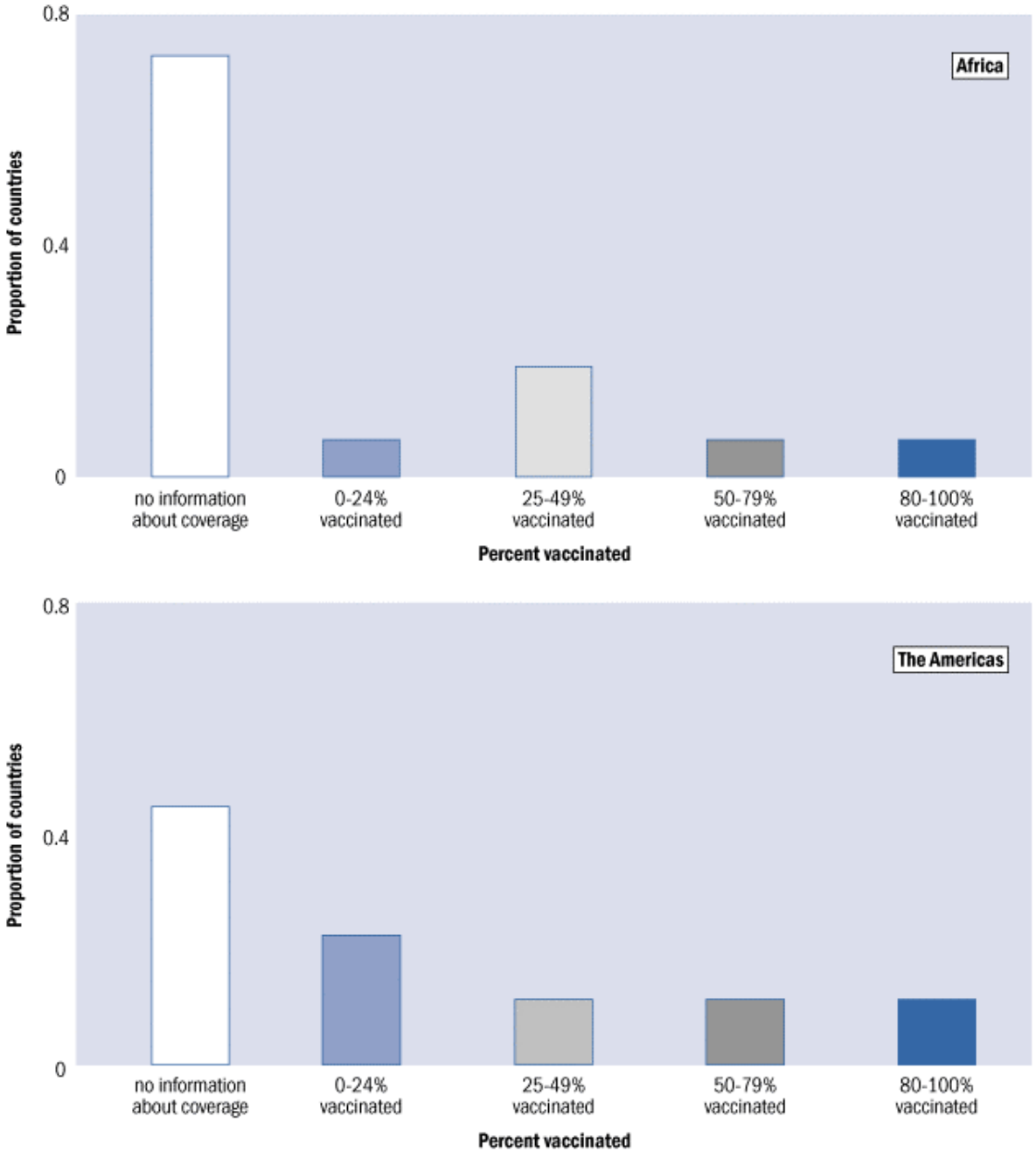
There are often long delays in detection of yellow fever outbreaks. This is due to a number of reasons including the often remote epidemic sites, lack of diagnostic facilities, difficulties in clinical recognition of the disease by peripheral health workers (yellow fever shares its symptoms with many other diseases that are common in the tropics), delays in recognition of the epidemic, and sparse communication of reports to the central level. These cause delays in the implementation of control measures, such as mass vaccination and vector control.

Logistical capacity to collect specimens and ready access to laboratory testing is essential for the confirmation of suspect cases but it is not always available (particularly in Africa). Accurate laboratory analysis depends upon trained laboratory staff, appropriate equipment and supplies, the provision of reagents, and proficiency testing. WHO has recently recommended that every at-risk country has at least one national laboratory where basic yellow fever blood tests can be performed,[2] and is actively assisting countries to upgrade the capacity for laboratory testing.

[1] A recent literature search for all available reports of yellow fever outbreaks indicated that when epidemics were known about, they had been reported to WHO – although often fewer cases were reported than had occurred.
[2] *District guidelines for yellow fever surveillance*, World Health Organization, 1998, WHO/EPI/GEN/98.09.

Data on routine yellow fever childhood immunization is weak. Not many countries are reporting routine childhood yellow fever immunization coverage to WHO.Of those countries that did report, coverage usually failed to reach even a rate of 50% of eligible children[3] (Fig. 2.2).

**Fig. 2.2 Yellow fever childhood immunization coverage, 1996-1998**




[3] *EPI information system: global summary*, World Health Organization, 1998, WHO/EPI/GEN/98.10.

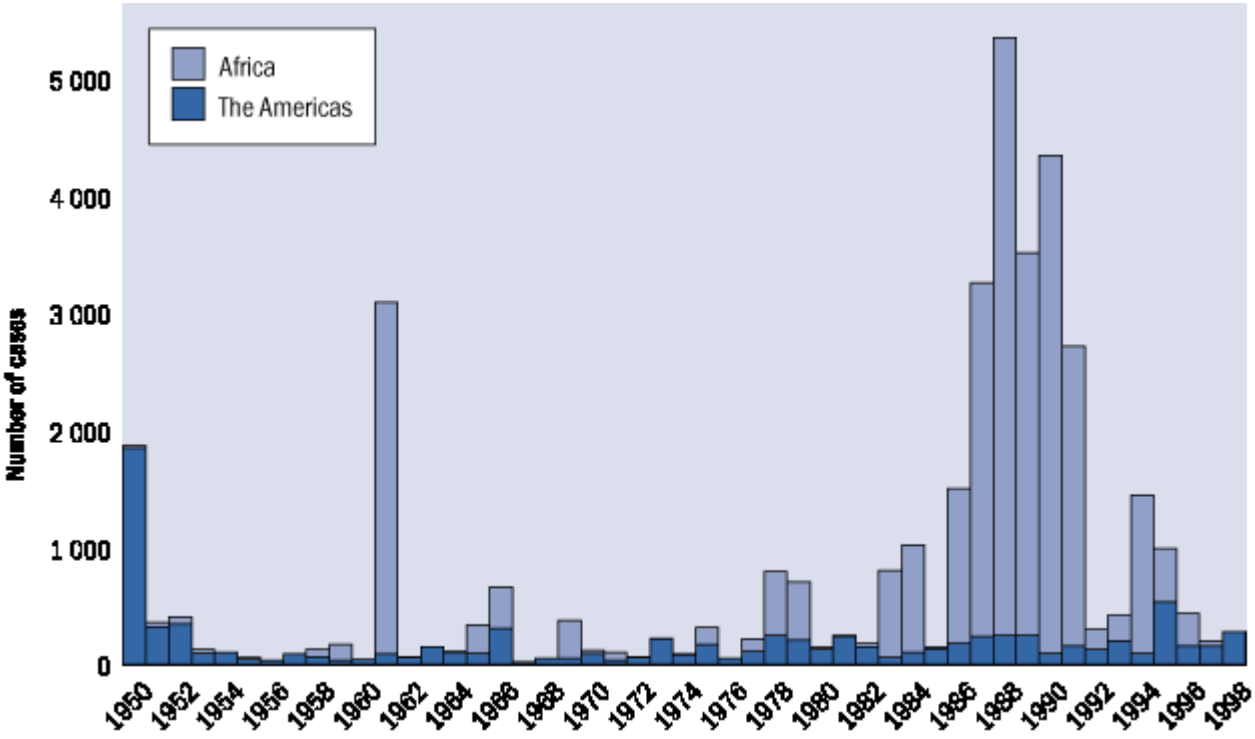
## Trends

- The six-year period from 1986 to 1992 represents a remarkably active period for yellow fever and represents the greatest amount of yellow fever reported to WHO for any such period since 1950. The reported number of cases of yellow fever has declined since 1994, although the number of countries reporting yellow fever has not (Fig. 2.3 and Table 2.2).
- Reported case fatality rates for reported cases of yellow fever are high, often greater than 50% of all cases reported.

### *Immunization coverage*

- To prevent epidemics, it is estimated that at least 80% of the population should have acquired immunity to yellow fever. At present, only two countries have reported achieving 50% coverage - namely C⊥te d0Ivoire and the Gambia.
- In terms of childhood immunization, two very small countries, Trinidad and Tobago and the Seychelles, have reported over 90% coverage, and Venezuela, Senegal and C⊥te d0Ivoire have reported over 50% coverage. Other countries have either not reported during the last three years or have lower coverage rates.

**Fig 2.3 Reported number of cases of yellow fever, 1950-1998**



## Conclusions

1. Yellow fever is an important public health threat, which needs more attention. Currently it is endemic in Africa and South America, but other continents, particularly Asia, with mosquitos that are known to transmit yellow fever virus must be considered potentially at risk.
2. The efficacy of immunization has been well documented historically, and immunization of at-risk populations is the most important action to take for the prevention of epidemics. Yellow fever control programmes have lapsed in many countries, and current levels of immunization are well below their targets.
3. In the absence of adequate immunization levels, surveillance for yellow fever cases is essential to rapidly control disease outbreaks. Physicians must promptly report suspected cases, and health officials in at-risk countries should have laboratory capacity to perform diagnostic tests for yellow fever. Monitoring and surveillance of yellow fever incident cases and immunization coverage need strengthening to assess risk and detect outbreaks.

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*District guidelines for yellow fever surveillance, World Health Organization, 1998, WHO/EPI/GEN/98.09.*

*Yellow fever – Technical Consensus Meeting, Geneva, 2-3 March 1998*, World Health Organization, 1998, WHO/EPI/GEN/98.08.

*Module 8: Yellow fever, The Immunological Basis for Immunization Series,* World Health Organization, 1993,WHO/EPI/GEN/93.18.

### *Web pages*

WHO yellow fever web pages:
http://www.who.int/vaccines-diseases/diseases/Yellow_fever.htm
http://www.who.int/emc/diseases/Yellow_fever

**Table 2.1 Reported childhood immunization coverage, 1990-1998**

| Country | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|
| Angola | | 35 | 22 | 32 | 34 | | | | 36 |
| Burkina Faso | 65 | 78 | 41 | 42 | 45 | 55 | | 27 | |
| Central African Republic | | 60 | 35 | | 36 | 52 | | | 36 |
| Chad | | | 24 | 16 | 28 | | | | 25 |
| Cote d'Ivoire | | 44 | 35 | 37 | 38 | 43 | 53 | 59 | 57 |
| Dem. Rep. of the Congo | | | 8 | | | | | | |
| Gabon | | 23 | | | | | 35 | | |
| Gambia | | 87 | 87 | 50 | 68 | | | 91 | |
| Ghana | | | 3 | 33 | 22 | 24 | 28 | | |
| Kenya | | | 27 | 27 | 7 | 11 | 0 | | |
| Mali | | | 9 | 0 | 3 | | 0 | | 10 |
| Mauritania | 32 | | | | | | | | |
| Niger | | 18 | 22 | 19 | 17 | 27 | | | |
| Nigeria | | | | 1 | | | | | |
| Sao Tome & Principe | | | 2 | 1 | 2 | | | | |
| Senegal | | 59 | 41 | 46 | 46 | | | | 50 |
| Seychelles | | | | | | | | | 96 |
| Togo | | | 37 | 14 | | | | | |
| Zambia | | 8 | | | | | | | |
| **Africa:** Total number of countries reporting | 2 | 9 | 14 | 13 | 12 | 6 | 5 | 3 | 7 |
| Brazil | | | | | | | | | 38 |
| Guyana | | | | | | | | | 7 |
| Panama | | | | | | | | | 10 |
| Trinidad & Tobago | | | | | | | | | 91 |
| Venezuela | | | | | | | | | 79 |
| **America:** Total number of countries reporting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |

Source: *EPI information system: global summary*, World Health Organization, 1998, WHO/EPI/GEN/98.10.

## Table 2.2 Yellow fever, number of cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Africa | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | | | | | | | | | | | | | | | | | |
| Benin | | | | | | | | | | | | | | | | | |
| Burkina Faso | | | | | | | | | | | | | | | | | |
| Cameroon | | | | | | | | | | | | | | | | | |
| Central African Republic | | | | | | 1 | | | | | | | | | | | |
| Congo | 2 | 1 | 5 | 8 | 1 | 3 | 4 | 3 | 60 | 11 | 7 | 4 | | | | | |
| Cote d'Ivoire | | | | | | | | | | | | | | | | | |
| Dem. Rep. of the Congo | | | | | | | | | | | | | | | | | |
| Equatorial Guinea | | | | | | | | | | | | | | | | | |
| Ethiopia | | | | | | | | | | | | >3,000 | 10 | | | | 350 |
| Gabon | | | | | | | | | | | | | | | | | |
| Gambia | | | | | | | | | | | | | | | | | |
| Ghana | 13 | 25 | 6 | | 2 | 7 | | | | 2 | | | | 3 | | | |
| Guinea | | | 1 | | | | | | | | | | | | | | |
| Guinea Bissau | | | | | | | | | | | | | | | 6 | | |
| Kenya | | | | | | | | | | | | | | | | | |
| Liberia | | | | | | | | | | | | | | | | | |
| Mali | | | | | | | | | | | | | | | | | |
| Mauritania | | | | | | | | | | | | | | | | | |
| Niger | | | | | | | | | | | | | | | | | |
| Nigeria | 1 | 13 | 42 | 18 | | 1 | | 2 | | | | | | | | | |
| Senegal | | | | 2 | | | | | | | | | | | | 243 | |
| Sierra Leone | 1 | | | 1 | 3 | 2 | | | | | | | | | | | |
| Sudan | | | | | | | | | | 120 | | | | | | | |
| Togo | | | | | | | | | | | | | | | | | |
| Uganda | | | 1 | | | | | | | | | | | | 1 | | |
| Total no. of cases | 17 | 39 | 55 | 29 | 6 | 14 | 4 | 5 | 60 | 133 | 7 | >3,000 | 10 | 3 | 7 | 243 | 350 |
| Total no. of deaths | 9 | 24 | 21 | 18 | 3 | 12 | 4 | 4 | 23 | 98 | 7 | 3,000 | 6 | 3 | 7 | 216 | 0 |
| No. of countries reporting | 5 | 3 | 5 | 4 | 3 | 5 | 1 | 2 | 1 | 3 | 1 | 2 | 1 | 1 | 2 | 1 | 1 |

## Table 2.2 Yellow fever, number of cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Africa | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | | | | | 65 | | | | | | | | | | | | |
| Benin | | | | | | | | | | | | | | | | | |
| Burkina Faso | | | 87 | | | | | | | | | | | | | | 356 |
| Cameroon | | | | 1 | | 2 | 1 | 1 | 2 | 1 | | | | 7 | | | |
| Central African Republic | | | | | | | | | | | | | | | | | |
| Congo | | | | | | | | | | | | | | | | | |
| Cote d'Ivoire | | | | | | | | | | | | | | | | 25 | |
| Dem. Rep. of the Congo | | | | | 2 | | | | | | | | | | | | |
| Equatorial Guinea | | | | 4 | | | | | | | | | | | | | |
| Ethiopia | | | | | | | | | | | | | | | | | |
| Gabon | | | | | | | | | | | | | | | | | |
| Gambia | | | | | | | | | | | | 270 | | | | | |
| Ghana | | | 5 | 12 | 3 | 5 | 5 | 1 | 2 | 2 | 110 | 219 | 494 | 9 | 4 | 6 | 372 |
| Guinea | | | | | | | | | | | | | | | | | |
| Guinea Bissau | | | | | | | | | | | | | | | | | |
| Kenya | | | | | | | | | | | | | | | | | |
| Liberia | 5 | | | | | | | | | | | | | | | | |
| Mali | | | 21 | | | | | | | | | | | | | | |
| Mauritania | | | | | | | | | | | | | | | | | |
| Niger | | | | | | | | | | | | | | | | | |
| Nigeria | | | 208 | 4 | | | 3 | 7 | | | | 60 | | 8 | | | 15 |
| Senegal | | | | | | | | | | | | | 1 | | 3 | | |
| Sierra Leone | | | | | | | | | 134 | | | | | | | | |
| Sudan | | | | | | | | | | | | | | | | | |
| Togo | | | 1 | 2 | | | | | | | | | | | | | |
| Uganda | | | | | | | | | | | | | | | | | |
| Total no. of cases | 5 | | 322 | 23 | 70 | 7 | 9 | 9 | 138 | 3 | 110 | 549 | 495 | 24 | 7 | 31 | 743 |
| Total no. of deaths | 3 | | 119 | 12 | 44 | 6 | 5 | 2 | 44 | 2 | 33 | 103 | 120 | 9 | 2 | 29 | 488 |
| No. of countries reporting | 1 | 0 | 5 | 5 | 3 | 2 | 3 | 3 | 3 | 2 | 1 | 3 | 2 | 3 | 2 | 2 | 3 |

## Table 2.2 Yellow fever, number of cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Africa | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | | | | | 37 | | | | | | | | | | |
| Benin | | | | | | | | | | | | | 120 | 18 | 6 |
| Burkina Faso | 17 | 7 | | | | | | | | | | | | | 2 |
| Cameroon | 1 | | | | | | 173 | | | | 10 | | | | |
| Central African Republic | | | | | | | | | | | | | | | |
| Congo | | | | | | | | | | | | | | | |
| Cote d'Ivoire | | | | | | | | | | | | | | 11 | |
| Dem. Rep. of the Congo | | | | | | | | | | | | | | | |
| Equatorial Guinea | | | | | | | | | | | | | | | |
| Ethiopia | | | | | | | | | | | | | | | |
| Gabon | | | | | | | | | | | 28 | 16 | | | |
| Gambia | | | | | | | | | | | | | | | |
| Ghana | | | | | | | | | | 39 | 79 | | 27 | 6 | |
| Guinea | | | | 5 | | | | | | | | | | | |
| Guinea Bissau | | | | | | | | | | | | | | | |
| Kenya | | | | | | | | | 27 | 27 | 7 | 3 | | | |
| Liberia | | | | | | | | | | | | 360 | | 3 | 25 |
| Mali | | | | 305 | | | | | | | | | | | |
| Mauritania | | | | 21 | | | | | | | | | | | |
| Niger | | | | | | | | | | | | | | | |
| Nigeria | 898 | 6 | 1,318 | 2,676 | 5,067 | 3,270 | 4,075 | 2,561 | 149 | 152 | 1,227 | | | 7 | |
| Senegal | | | | | | | | | | | | 79 | 128 | | |
| Sierra Leone | | | | | | | | | | | | 1 | 4 | | |
| Sudan | | | | | | | | | | | | | | | |
| Togo | 1 | | | 5 | | | | | | | | | | | |
| Uganda | | | | | | | | | | | | | | | |
| Total no. of cases | 917 | 13 | 1,318 | 3,012 | 5,104 | 3,270 | 4,248 | 2,561 | 176 | 218 | 1,351 | 459 | 279 | 45 | 33 |
| Total no. of deaths | 21 | 3 | 424 | 1,014 | 1,516 | 618 | 341 | 661 | 21 | 38 | 452 | 34 | 141 | 9 | 10 |
| No. of countries reporting | 4 | 2 | 1 | 5 | 2 | 1 | 2 | 1 | 2 | 3 | 5 | 5 | 4 | 5 | 3 |

## Table 2.2 Yellow fever, number of cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| The Americas | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | | | | | | | | | | | | | | | | 2 | 51 |
| Bolivia | 1,806 | 3 | 1 | 18 | | 4 | 6 | 19 | 2 | 1 | 14 | 2 | | 81 | 13 | 19 | 69 |
| Brazil | 4 | 50 | 221 | 39 | 9 | 8 | 2 | 10 | 26 | 4 | 1 | 2 | 1 | | 13 | 14 | 167 |
| Colombia | 12 | 26 | 16 | 11 | 12 | 22 | 16 | 35 | 21 | 21 | 11 | 9 | 30 | 10 | 10 | 2 | 3 |
| Costa Rica | | 180 | 93 | 5 | | | | | | | | | | | | | |
| Ecuador | | 42 | | | | | | | | | | | | | | | |
| French Guiana | | | | | | | | | | | | | | | | | |
| Guatemala | | | | | | | | 3 | | | | | | | | | |
| Guyana | | | | | | | | | | | | 2 | | | | | |
| Honduras | | | | | 1 | | | | | | | | | | | | |
| Nicaragua | | | 7 | 8 | | | | | | | | | | | | | |
| Panama | 2 | 3 | 1 | | | | 1 | 4 | | | | | | | | | |
| Paraguay | | | | | | | | | | | | | | | | | |
| Peru | 16 | 4 | 1 | | 26 | | | 3 | 6 | 1 | 6 | 53 | 20 | 49 | 60 | 45 | 9 |
| Suriname | | | | | | | | | | | | | | | | | |
| Trinidad and Tobago | | | | | 18 | | | | | 2 | | | | | | | |
| Venezuela | 3 | 4 | 1 | 8 | 29 | 5 | 3 | 6 | 6 | 1 | 2 | 14 | 1 | 1 | 2 | 5 | 5 |
| United States of America | | | | | | | | | | | | | | | | | |
| Total no. of cases | 1,843 | 312 | 341 | 89 | 95 | 39 | 28 | 80 | 61 | 30 | 34 | 82 | 52 | 141 | 98 | 87 | 304 |
| Total no. of deaths | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| No. of countries reporting | 6 | 8 | 8 | 7 | 6 | 4 | 5 | 7 | 5 | 6 | 5 | 6 | 4 | 4 | 5 | 6 | 6 |

## Table 2.2 Yellow fever, number of cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| The Americas | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | 1 | | | | | | | | | | | | | | | | |
| Bolivia | | 27 | 8 | 2 | 8 | 9 | 86 | 12 | 151 | 18 | 2 | 11 | 10 | 46 | 102 | 95 | 11 |
| Brazil | 2 | 2 | 4 | 2 | 11 | 12 | 70 | 13 | 1 | 1 | 9 | 27 | 12 | 27 | 22 | 24 | 6 |
| Colombia | 5 | 11 | 7 | 7 | 9 | 3 | 16 | 36 | 12 | 23 | 9 | 105 | 51 | 11 | 7 | 2 | 1 |
| Costa Rica | | | | | | | | | | | | | | | | | |
| Ecuador | 1 | | | | | | | | 3 | 1 | | 1 | 14 | 2 | 2 | | 5 |
| French Guiana | | | | | | | | | | | | | | | | | |
| Guatemala | | | | | | | | | | | | | | | | | |
| Guyana | | 1 | | | | | | | | | | | | | | | |
| Honduras | | | | | | | | | | | | | | | | | |
| Nicaragua | | | | | | | | | | | | | | | | | |
| Panama | | | | | | | | 4 | | | | | | | | | |
| Paraguay | | | | | | | | 9 | | | | | | | | | |
| Peru | 3 | 5 | 28 | 75 | | 7 | 33 | 2 | 1 | 1 | 82 | 93 | 97 | 30 | 98 | 19 | 27 |
| Suriname | | 1 | 1 | | | 2 | | | | | | | | | | | |
| Trinidad and Tobago | | | | | | | | | | | | | 18 | | | | |
| Venezuela | | | | | | 22 | 7 | | | | | 3 | 3 | 4 | | | |
| United States of America | | | | | | | | | | | | | | | | | |
| Total no. of cases | 12 | 47 | 48 | 86 | 28 | 55 | 212 | 76 | 168 | 44 | 102 | 240 | 205 | 120 | 231 | 140 | 50 |
| Total no. of deaths | 0 | 0 | 0 | 64 | 21 | 41 | 148 | 45 | 95 | 35 | 82 | 91 | 161 | 104 | 104 | 77 | 43 |
| No. of countries reporting | 5 | 6 | 5 | 4 | 3 | 6 | 5 | 6 | 5 | 5 | 4 | 6 | 7 | 6 | 5 | 4 | 5 |

## Table 2.2 Yellow fever, number of cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| The Americas | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | | | | | | | | | | | | | | | |
| Bolivia | 5 | 54 | 30 | 23 | 12 | 107 | 50 | 91 | 22 | 18 | 7 | 15 | 30 | 63 | 57 |
| Brazil | 45 | 7 | 9 | 16 | 26 | 9 | 2 | 15 | 12 | 83 | 19 | 4 | 15 | 3 | 34 |
| Colombia | 16 | 5 | 6 | 17 | 7 | 1 | 7 | 4 | 2 | 1 | 2 | 3 | 8 | 6 | 0 |
| Costa Rica | | | | | | | | | | | | | | | |
| Ecuador | 1 | 1 | 12 | | | | 12 | 14 | 16 | 1 | | 1 | 8 | 31 | 3 |
| French Guiana | | | | | | | | | | | | | | | 1 |
| Guatemala | | | | | | | | | | | | | | | |
| Guyana | | | | | | | | | | | | | | | |
| Honduras | | | | | | | | | | | | | | | |
| Nicaragua | | | | | | | | | | | | | | | |
| Panama | | | | | | | | | | | | | | | |
| Paraguay | | | | | | | | | | | | | | | |
| Peru | 28 | 59 | 118 | 179 | 195 | 120 | 17 | 27 | 67 | 89 | 61 | 499 | 86 | 44 | 160 |
| Suriname | | | | | | | | | | | | | | | |
| Trinidad and Tobago | | | | | | | | | | | | | | | |
| Venezuela | | | | | | | | | | | | | | | 14 |
| United States of America | | | | | | | | | | | | | 1 | | |
| Total no. of cases | 95 | 126 | 175 | 235 | 240 | 237 | 88 | 151 | 119 | 192 | 89 | 522 | 148 | 147 | 269 |
| Total no. of deaths | 67 | 91 | 131 | 211 | 199 | 191 | 69 | 90 | 81 | 81 | 40 | 213 | 81 | 80 | 109 |
| No. of countries reporting | 5 | 5 | 5 | 4 | 4 | 4 | 5 | 5 | 5 | 5 | 4 | 5 | 6 | 5 | 7 |

# CHAPTER 3
# PLAGUE

## Background of the disease

Plague is primarily a disease of rodents and their fleas, which can infect humans. It is transmitted between rodents by rodent fleas, and can be transmitted to people when infected rodent fleas bite them. As with many primarily zoonotic diseases, plague is a very severe disease in people, with case fatality rates of 50-60% if left untreated.

Plague has been responsible for widespread pandemics with high mortality. It was known as the "Black Death" during the fourteenth century, causing an estimated 50 million deaths, approximately half of them in Asia and Africa and the other half in Europe, where a quarter of the population succumbed.

There are three main forms of plague in humans, namely bubonic, septicaemic and pneumonic. Bubonic plague is the result of an insect bite in which the plague bacillus travels through the lymphatic system to the nearest lymph node where it forms a swelling. The most usual place for this swelling is the groin, but it also occurs in the armpits and the neck. These swellings are known as buboes (derived from the Greek word for groin). The septicaemic form of plague occurs when the insect deposits the bacillus directly into the bloodstream. This form is almost always fatal. Pneumonic plague is an infection of the lungs with the plague bacillus. Pneumonic plague can be transmitted directly from person to person via infected air droplets or through infected clothing and other contaminated articles.

Plague has declined dramatically since the early part of the twentieth century, when outbreaks could cause tens of millions of deaths. This is due primarily to improvements in living standards and health services. However, a substantial number of countries continue to be affected by plague, case fatality rates remain high and antimicrobial resistance has begun. Therefore, continued vigilance is required, particularly in human populations living near natural plague foci. Plague foci are not fixed, and can change in response to shifts in factors such as climate, landscape, and rodent population migration. Natural foci of plague are situated in all continents except Australia, within a broad belt in tropical, subtropical and warmer temperate climates, between the parallels 55° N and 40° S. These foci are presented in Map 3.1.

**Map 3.1 Natural plague foci (in rodent populations)**

### *Transmission*

Plague is transmitted between rodents and other animals primarily via wild rodent fleas. *Wild plague* exists in natural foci independent of human populations and their activity. *Domestic plague* is intimately associated with rodents living with humans and can produce epidemics in both human and animal populations.

Humans are extremely susceptible to plague and may be infected either directly or indirectly. Indirect transmission through the bite of a flea is the most common route of transmission between plague-infected rodents and humans. Human infection can occur within the natural foci of plague but this is rare. Infection occurs more frequently in human settlements when domestic rodents become infected. This can happen when the domestic rodents come into contact with infected wild rodents living in the surrounding areas. Infected fleas leave the bodies of rodents killed by plague seeking a blood meal from another host and may bite human beings. Humans who contract the disease may subsequently become infective to other people via the respiratory route.[1]

### *History*

Cases of human plague have been known from time immemorial.[2] The first record of plague was an outbreak among the Philistines in 1320 BC, described in the Bible (I Samuel, V and VI). In the last two millennia, plague has become widespread, affecting a large number of countries on most continents during several pandemics.

The first pandemic that we are certain of, known as Justinian=s plague, occurred between 542 AD and 546 AD, causing epidemics in Asia, Africa and Europe. It is estimated to have claimed nearly 100 million victims.

The second plague pandemic is the well-known "Black Death" of the fourteenth century (1347–1350). This pandemic was the beginning of a number of outbreaks of plague, which ravaged Europe and Africa in subsequent centuries.

The third pandemic began in Canton and Hong Kong in 1894 and spread rapidly throughout the world, by rats aboard the swifter steamships that replaced slow–moving sailing vessels in merchant fleets. Within 10 years (1894–1903) plague entered 77 ports on five continents. Plague became widespread in a number of countries. In India, there were over 6 million deaths from 1898 to 1908.[3]

### *Prevention and control*

Many natural foci of plague have been identified, and prevention and control measures have been developed which make it possible to prevent plague outbreaks. Effective treatment methods enable almost all plague patients to be cured if diagnosed in time. The use of these measures has led to a sharp reduction in the epidemicity of plague throughout the world. Today the distribution of plague coincides with the geographical distribution of its natural foci.

## Description of the data

WHO has data on the number of cases and deaths due to human plague notified to WHO under the International Health Regulations over the past 44 years (Table 3.1).

[1] Plague that can be transmitted via the respiratory route is known as pneumonic plague.

[2] Pollitzer R. *Plague*. Geneva, World Health Organization, 1954 (Monograph series).

[3] Datta KK. *Plague epidemiology, prevention and control*. National Institute of Communicable Diseases, Delhi, India, 1994.

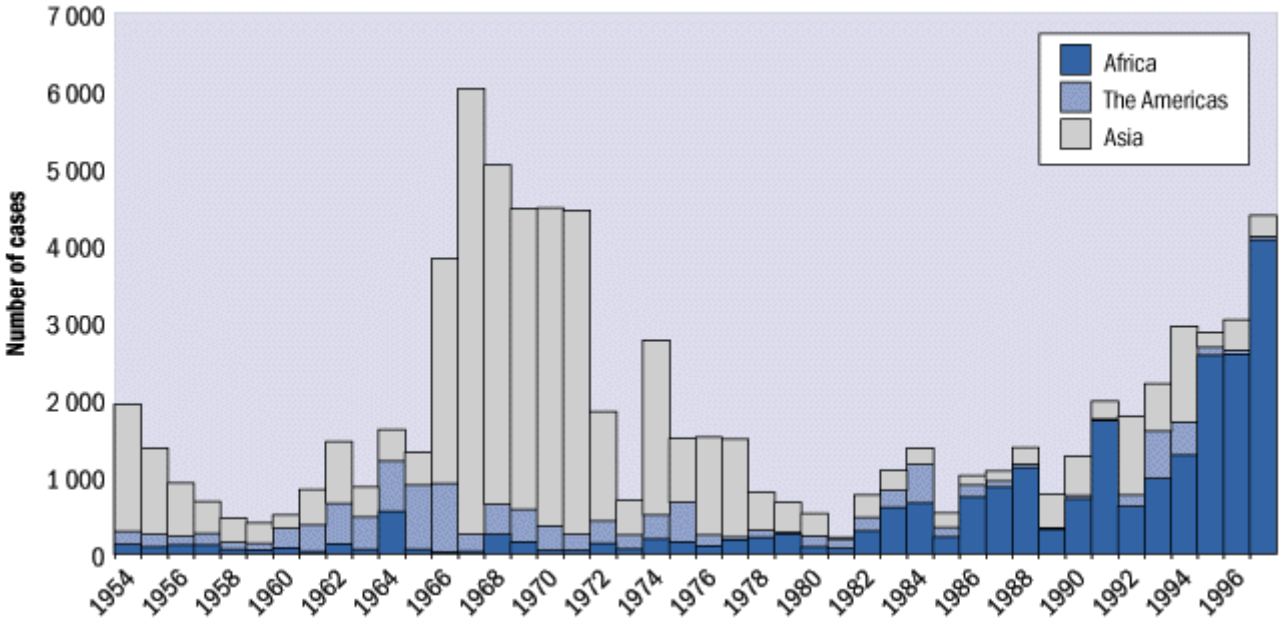
## Strengths and weaknesses of the data

Plague is one of the diseases under the International Health Regulations, and countries are required to report cases of plague to WHO within 24 hours of being notified. However, as with other diseases under the International Health Regulations, officially reported data on plague do not adequately reflect the incidence of plague. They represent only a portion of the actual number of cases and may not even represent all of the known, active enzootic foci in the world. Global statistics on plague are incomplete because of the reluctance to officially notify plague cases as well as inadequate surveillance and reporting. In addition systems of reporting differ considerably in countries, and underreporting of plague due to lack of laboratory facilities for diagnostic confirmation is common. In most countries only bacteriologically or serologically confirmed cases are reported. It is estimated that laboratory confirmation of cases is obtained in only approximately one–third of suspected cases, making the actual epidemiological situation or disease incidence difficult to assess. However, a general description of the distribution of plague and global trends can be obtained from WHO data.

## Trends

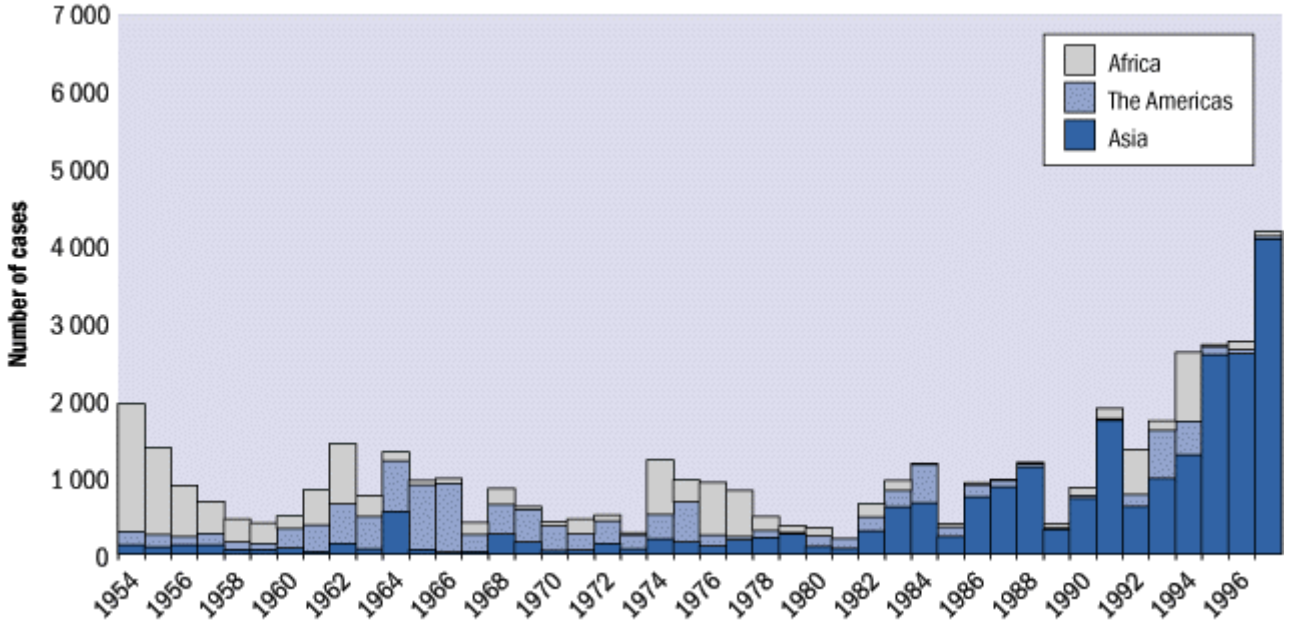
- Reports of plague were received from 38 countries during the period 1954-1997. These reports included notification of 80 613 cases and 6587 deaths. The maximum number of reported plague cases (6004) occurred in 1967 and the minimum (200) occurred in 1981.
- There are seven countries, namely Brazil, Democratic Republic of the Congo, Madagascar, Myanmar, Peru, United States of America, and Viet Nam which have been affected by plague virtually every year during the last 44 years.
- Over the past 44 years there have been three periods of increased plague activity. The first was during the mid-1960s, the second between 1973 and 1978, and the third was from the mid-1980s to the present. The rise in reported plague morbidity has continued worldwide in the 1990s (Fig. 3.1) particularly in Africa.

**Fig. 3.1 Number of cases of plague reported to WHO, 1954-1997**



- There has been a clear shift in the geographical distribution of plague over the last half-century. In the 1950s plague was primarily a problem of Asia, with some plague also occurring in the Americas. During the early 1960s there was an increased plague activity in the Americas, and the beginning of plague activity in Africa as well. During the last half of the 1960s and early 1970s there was a large plague epidemic in Viet Nam, which accounted for most of the plague activity in Asia, and plague became a more regular occurrence in Africa. During the last 20 years, reported cases of plague have increased dramatically Africa, a trend that is still continuing.
- A plague epidemic in Viet Nam from 1966 to 1972 was largely responsible for the increased plague activity during the mid-sixties. This epidemic is considered to have been largely a result of the defoliation of vast areas during military operations, as well as the disruption of the economy, ecosystem and infrastructure as a result of prolonged armed conflict. If an epidemic in Viet Nam had not taken place the global trends shown in Fig. 3.1 would appear quite different. Fig. 3.2 presents the number of reported cases of plague with data from Viet Nam excluded, and it shows that during the last half century, there has been a shift in the main focus of plague, from Asia to the Americas to Africa.

**Fig. 3.2 Number of cases of plague reported to WHO 1954-1997-Viet Nam excluded**




## *Africa*

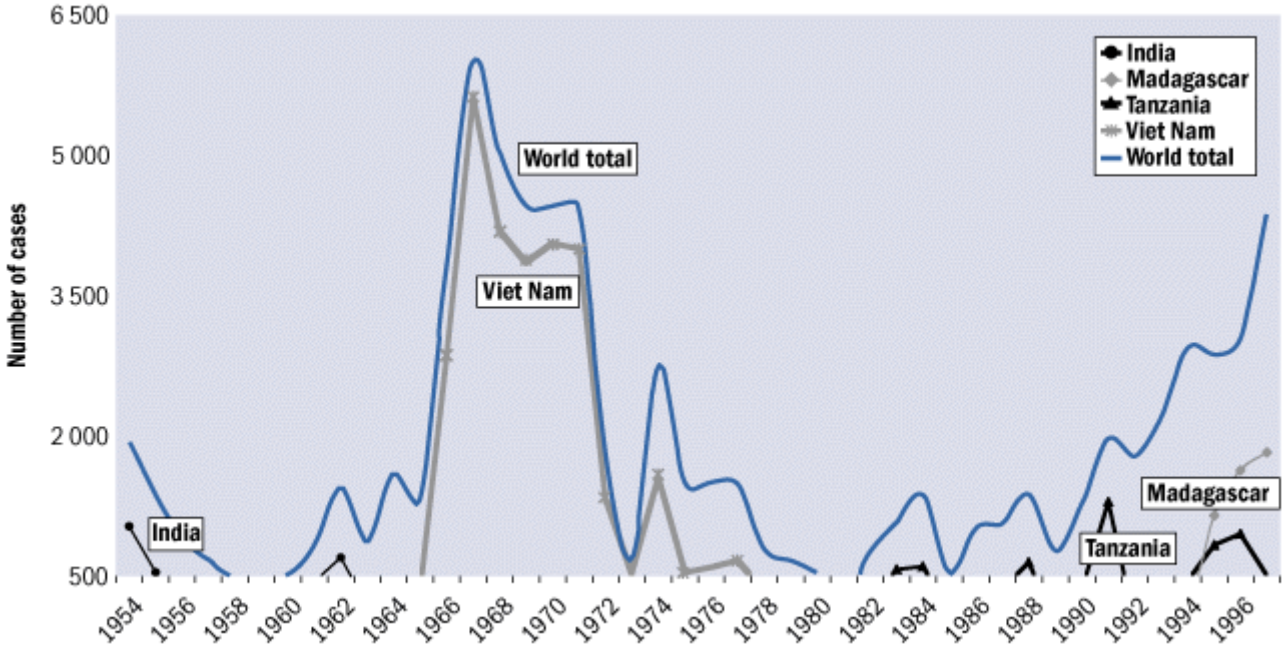
- Beginning in the 1980s, there has been a steep upward trend in the number of plague cases in Africa.
- There were a total of 19 349 cases and 1781 deaths in Africa from 1980 to 1997, comprising 66.8% and 75.8% of the world's total with an average case fatality rate of 9.2%.
- From 1980-1997, human plague was reported from 13 countries in Africa (Angola, Botswana, Democratic Republic of the Congo, Kenya, Libya, Madagascar, Malawi, Mozambique, South Africa, Uganda, United Republic of Tanzania, Zambia, Zimbabwe). Two of these countries, namely the Democratic Republic of the Congo and Madagascar have notified cases of human plague virtually every year, and Madagascar[4] and the United Republic of Tanzania have accounted for 62.5% of the total plague cases reported in Africa during the last 15 years.

[4] Madagascar reports all suspected cases of plague, including those that are not confirmed in laboratories. For example in 1997, there were 2863 cases of human plague reported, 1858 of which were bacteriologically negative.

## *Asia*

- From 1954 to the early 1980s, most cases of plague worldwide were reported from Asia.
- Myanmar and Viet Nam have reported cases of human plague virtually every year since 1954.
- From 1980 to 1997, human plague was reported from seven countries in Asia (China, India, Kazakhstan, Lao People's Democratic Republic, Mongolia, Myanmar, and Viet Nam).
- The large plague epidemic in Viet Nam dominated the global picture from 1966 to 1972. Other large epidemics, such as the one in India in the 1950s and those in Tanzania and Madagascar in the 1990s have a strong effect on the world totals (Fig. 3.3).

**Fig. 3.3 Plague in selected countries 1954 to 1997**



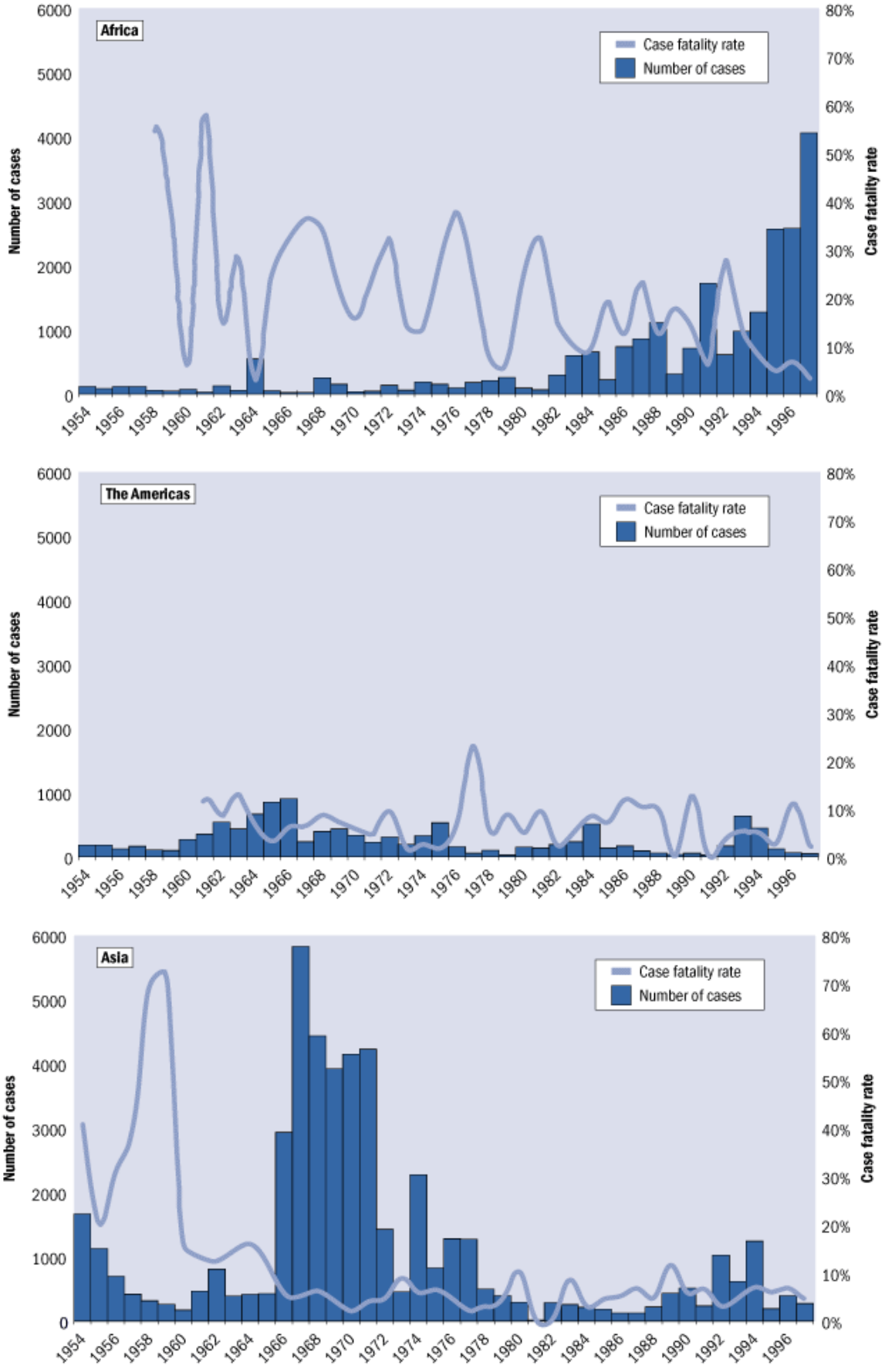

- In India, large plague outbreaks occurred during the first half of the twentieth century. There were also outbreaks in 1954, 1963, and then again 30 years later in 1994. Although the exact circumstances are unknown, factors contributing to the re-emergence of plague in India in 1994, are thought to include ecological changes created by the earthquake in September 1993 that disturbed the equilibrium density of domestic rodents and their fleas.[5] Rainfall and flooding that occurred several weeks before the outbreak, as well as a large holiday that brought crowds of people together are also thought to have facilitated the spread of human plague.

## *The Americas*

- Human plague was reported from five countries (Bolivia, Brazil, Ecuador, Peru and the United States of America). Three of these countries have notified some cases of human plague every year (Brazil, Peru, and the United States of America). Brazil and Peru accounted for 82% of the total cases reported in the Americas during the last 15 years. Totals for the period from 1980-1997 were 3137 cases with 194 deaths. The mean case fatality rate was 6.2% during the period.

5 *Report on an Interregional Meeting on Prevention and Control of Plague, New Delhi.* Geneva, World Health Organization, 1995 (unpublished document WHO/CDS/BVI/95.4).

**Fig. 3.4 Reported number of plague cases and case fatality rates per continent, 1954-1997**



### *Mortality*

- For the last 45 years the mean perennial plague case fatality for the world (i.e. the average over the past 45 years of the annual reported number of plague deaths divided by the annual reported number of plague cases) has been 11.8%. There is wide variation in reported case fatality rates by continent and by year (Fig 3.4). There is also considerable variation from country to country and from epidemic to epidemic.
- Despite the availability of a number of highly effective therapeutic agents, mortality due to plague in many countries was high during the period 1954–1997.

## Conclusions

1. Although there has been a general decline in the incidence of plague worldwide, the number of countries affected by plague remains substantial.
2. There has been an obvious change in the distribution of plague morbidity by continent. Whereas in the 1970s plague cases were reported predominately from Asia, in the 1980s and the 1990s a small number of African countries with well-known natural plague foci reported the highest number of cases.
3. Despite the availability of a number of highly effective therapeutic agents, mortality due to plague remains unacceptably high.

## References

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*Plague manual: Epidemiology, distribution, surveillance and control*, World Health Organization, WHO/CDS/CSR/EDC/99.2.

Human Plague in 1997, *Weekly Epidemiological Record*, Vol. 74, 41, 1999.

Human Plague in 1996, *Weekly Epidemiological Record*, Vol. 73, 47, 1998.

Human Plague in 1995, *Weekly Epidemiological Record*, Vol. 72, 46, 1997.

## Table 3.1 Plague, cases and total number of deaths reported to WHO, and number of countries reporting, 1954-1998

| Africa | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | | | | | | | | | | | | | | | | | |
| Botswana | | | | | | | | | | | | | | | | | |
| Burkina Faso | | | | | | | | | | | | | 1 | | | | |
| Cameroon | | | | | | | | 1 | | | | | | | | | |
| Dem. Rep. of the Congo | 42 | 25 | 22 | 35 | 8 | 12 | 26 | 6 | 1 | 4 | 4 | 16 | 8 | 7 | 104 | 68 | 16 |
| Guinea | | | | | | | | | | | | | | | | 49 | 3 |
| Kenya | 9 | 27 | 8 | 6 | 19 | 14 | 36 | 3 | 2 | 3 | 1 | | | 1 | | | |
| Lesotho | 8 | 2 | | | | | | | | | | | | 3 | 108 | 2 | |
| Libyan Arab Jamahiriya | | | | | | | | | | | | | | | | | |
| Madagascar [1] | 17 | 17 | 20 | 57 | 21 | 5 | 6 | 4 | 28 | 9 | 6 | 32 | 9 | 10 | 28 | 26 | 13 |
| Malawi | | | | | | | | | | 30 | | | | | | | |
| Mozambique | | | | | | | | | | | | | | | | | |
| Namibia | | | | | | | | 9 | 80 | 3 | | | | | | | |
| South Africa | 4 | 8 | 3 | 5 | | 10 | 1 | 1 | 7 | 4 | 17 | | | 1 | 2 | | |
| Uganda | 18 | | | | 2 | 2 | | | | | | | | | | | |
| United Rep. of Tanzania [1] | | | 5 | 5 | | | | | 2 | | 513 | 1 | | | 6 | 2 | |
| Zambia | | | | | | | | | | | | | | | | | |
| Zimbabwe | 12 | | 49 | | | | | | | | | | 1 | | | | |
| Total no. of cases | 110 | 79 | 107 | 108 | 50 | 43 | 69 | 24 | 120 | 53 | 541 | 49 | 19 | 22 | 248 | 147 | 32 |
| Total no. of deaths | | | | | 27 | 16 | 4 | 14 | 18 | 15 | 14 | 12 | 6 | 8 | 84 | 32 | 5 |
| No. of countries reporting | 7 | 5 | 6 | 5 | 4 | 5 | 4 | 6 | 6 | 6 | 5 | 3 | 4 | 5 | 5 | 5 | 3 |

[1] Includes suspected cases.

## Table 3.1 Plague, cases and total number of deaths reported to WHO, and number of countries reporting, 1954-1998

| The Americas | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | | | | | 1 | | | | | | | | | | | | |
| Bolivia | 9 | 45 | 3 | | | | 12 | 20 | | 53 | 49 | 149 | 3 | 3 | 30 | 95 | 54 |
| Brazil | 6 | 27 | 4 | 37 | 25 | 16 | 28 | 106 | 36 | 39 | 285 | 115 | 48 | 157 | 285 | 293 | 101 |
| Ecuador | 81 | 85 | 80 | 79 | 22 | 40 | 77 | 140 | 326 | 258 | 194 | 369 | 171 | 19 | 24 | 23 | 30 |
| El Salvador | | 6 | | | | | | | | | | | | | | | |
| Peru | 75 | 8 | 24 | 37 | 50 | 33 | 139 | 68 | 164 | 72 | 125 | 200 | 662 | 41 | 45 | 8 | 128 |
| United States of America | | | 1 | 1 | | 4 | 2 | 3 | 1 | 1 | | 8 | 5 | 3 | 3 | 5 | 13 |
| Venezuela | | | 3 | | | | | 6 | | 1 | | | | | | | |
| Total no. of cases | 171 | 171 | 115 | 154 | 98 | 93 | 258 | 343 | 527 | 424 | 653 | 841 | 889 | 223 | 387 | 424 | 326 |
| Total no. of deaths | | 91 | | | | | | 40 | 44 | 54 | 42 | 26 | 54 | 14 | 33 | 30 | 19 |
| No. of countries reporting | 4 | 5 | 6 | 4 | 4 | 4 | 5 | 6 | 4 | 6 | 4 | 5 | 5 | 5 | 5 | 5 | 5 |

| Asia | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| China | | | | | | | | | | | | | | | | | |
| Cambodia | 1 | 12 | 2 | 1 | | | | | | | | | | | | | |
| India | 1,031 | 542 | 262 | 162 | 206 | 214 | 122 | 402 | 697 | 205 | 109 | 14 | 11 | 6 | | | |
| Indonesia | 348 | 354 | 113 | 17 | | 18 | 5 | | | | | | | | 102 | 4 | 10 |
| Iran | | | | | 12 | | | 7 | | 26 | | | | | | | |
| Kazakhstan | | | | | | | | | | | | | | | | | |
| Lao People's Dem. Rep. | | | | | | | | | | | | | | | | | |
| Mongolia | | | | | | | | | | | | | | | | | |
| Myanmar | 265 | 203 | 273 | 227 | 76 | 21 | 22 | 39 | 68 | 34 | | 36 | 48 | 120 | 86 | 32 | 43 |
| Nepal | | | | | | | | | | | | | | 24 | 13 | | |
| Philippines | | | 2 | | | | | | | | | | | | | | |
| Viet Nam [1] | | 1 | 34 | 4 | 15 | | 14 | 8 | 29 | 115 | 297 | 368 | 2,844 | 5,619 | 4,193 | 3,850 | 4,056 |
| Total no. of cases | 1,645 | 1,112 | 686 | 411 | 309 | 253 | 163 | 456 | 794 | 380 | 406 | 418 | 2,903 | 5,769 | 4,394 | 3,886 | 4,109 |
| Total no. of deaths | 663 | 220 | 209 | 162 | 214 | 180 | 26 | 60 | 97 | 55 | 64 | 50 | 156 | 294 | 273 | 161 | 82 |
| No. of countries reporting | 4 | 5 | 6 | 5 | 4 | 3 | 4 | 4 | 3 | 4 | 2 | 3 | 3 | 4 | 4 | 3 | 3 |

[1] Includes suspected cases.

## Table 3.1 Plague, cases and total number of deaths reported to WHO, and number of countries reporting, 1954-1998

| Africa | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | | | | | 49 | | | | | 21 | 6 | | | | | |
| Botswana | | | | | | | | | | | | | | | | |
| Burkina Faso | | | | | | | | | | | | | | | | |
| Cameroon | | | | | | | | | | | | | | | | |
| Dem. Rep.of the Congo | 6 | 8 | 36 | 20 | 1 | 12 | 4 | | 1 | | | 1 | | | | |
| Guinea | | | | | | | | | | | | | | | | |
| Kenya | | | | | | | | 166 | 227 | 5 | | | | | | |
| Lesotho | | 8 | | | 8 | | | | | | | | | | | |
| Libyan Arab Jamahiriya | | 16 | | | | 19 | 11 | | | | | | | 8 | | |
| Madagascar [1] | 31 | 63 | 20 | 38 | 55 | 47 | 58 | 25 | 23 | 11 | 44 | 38 | 24 | 39 | 85 | 29 |
| Malawai | | | | | | | | | | | | | | | | |
| Mozambique | | | | | | 15 | 97 | 12 | | | | | | | | |
| Namibia | | | | 102 | | | | | | | | | | | | |
| South Africa | | 1 | | | | | | | | | | 19 | | | | |
| Uganda | | | | | | | | | | | | 153 | | | | 340 |
| United Rep. of Tanzania [1] | | 32 | | | | | 2 | | | 49 | 9 | 76 | 569 | 603 | 129 | 360 |
| Zambia | | | | | | | | | | | | | | | | |
| Zimbabwe | | | | 23 | 34 | | | | | | | 3 | 1 | | 1 | |
| Total no. of cases | 37 | 128 | 56 | 183 | 147 | 93 | 172 | 203 | 251 | 86 | 59 | 290 | 594 | 650 | 215 | 729 |
| Total no. of deaths | 9 | 41 | 8 | 25 | 41 | 35 | 41 | 15 | 15 | 22 | 19 | 43 | 59 | 59 | 41 | 90 |
| No. of countries reporting | 2 | 6 | 2 | 4 | 5 | 4 | 5 | 3 | 3 | 4 | 3 | 6 | 3 | 3 | 3 | 3 |

[1] Includes suspected cases.

## Table 3.1 Plague, cases and total number of deaths reported to WHO, and number of countries reporting, 1954-1998

| The Americas | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | | | | | | | | | | | | | | | | |
| Bolivia | 19 | | | 14 | 2 | 24 | 29 | 68 | 10 | 26 | 21 | 1 | 21 | 12 | | 94 |
| Brazil | 146 | 169 | 152 | 291 | 496 | 97 | 1 | 11 | | 98 | 59 | 151 | 82 | 37 | 64 | 58 |
| Ecuador | 27 | 9 | 1 | | | 8 | | | | | 8 | | 65 | 7 | 3 | |
| El Salvador | | | | | | | | | | | | | | | | |
| Peru | 22 | 118 | 30 | 8 | 3 | 1 | | 6 | | | 27 | 11 | 17 | 413 | 44 | |
| United States of America | 2 | 1 | 2 | 8 | 20 | 16 | 18 | 12 | 13 | 18 | 13 | 19 | 40 | 31 | 17 | 10 |
| Venezuela | | | | | | | | | | | | | | | | |
| Total no. of cases | 216 | 297 | 185 | 321 | 521 | 146 | 48 | 97 | 23 | 142 | 128 | 182 | 225 | 500 | 128 | 162 |
| Total no. of deaths | 10 | 28 | 3 | 8 | 9 | 9 | 11 | 5 | 2 | 7 | 12 | 4 | 12 | 42 | 9 | 19 |
| No. of countries reporting | 5 | 4 | 4 | 4 | 4 | 5 | 3 | 4 | 2 | 3 | 5 | 4 | 5 | 5 | 4 | 3 |

| Asia | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| China | | | | | | | | | 8 | 30 | 1 | | 25 | | 6 | 8 |
| Cambodia | | 5 | 1 | | | | | | | | | | | | | |
| India | | | | | | | | | | | | | | | | |
| Indonesia | | | | | | | | | | | | | | | | |
| Iran | | | | | | | | | | | | | | | | |
| Kazakhstan | | | | | | | | | | | | | | | | |
| Lao People's Dem. Rep. | | | | | | | | | | | | | | | | |
| Mongolia | | | | | | | | | | 2 | | | | | 1 | |
| Myanmar | 189 | 63 | 17 | 700 | 275 | 673 | 591 | 171 | 73 | 73 | 1 | 165 | 96 | 10 | 35 | 6 |
| Nepal | | | | | | | | | | | | | | | | |
| Philippines | | | | | | | | | | | | | | | | |
| Viet Nam [1] | 3,997 | 1,340 | 425 | 1,552 | 536 | 593 | 667 | 314 | 306 | 180 | 11 | 116 | 127 | 196 | 137 | 104 |
| Total no. of cases | 4,186 | 1,408 | 443 | 2,252 | 811 | 1,266 | 1,258 | 485 | 387 | 285 | 13 | 281 | 248 | 206 | 179 | 118 |
| Total no. of deaths | 165 | 66 | 39 | 130 | 52 | 60 | 26 | 14 | 16 | 29 | | 1 | 21 | 6 | 8 | 6 |
| No. of countries reporting | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 3 | 2 | 3 | 2 | 4 | 3 |

[1] Includes suspected cases.

## Table 3.1 Plague, cases and total number of deaths reported to WHO, and number of countries reporting, 1954-1998

| Africa | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | | | | | | | | | | | | |
| Botswana | | | 103 | 70 | | | | | | | | |
| Burkina Faso | | | | | | | | | | | | |
| Cameroon | | | | | | | | | | | | |
| Dem. Rep. of the Congo | 474 | 369 | 1 | | 289 | 390 | 636 | 82 | 582 | | | |
| Guinea | | | | | | | | | | | | |
| Kenya | | | | 44 | | | | | | | | |
| Lesotho | | | | | | | | | | | | |
| Libyan Arab Jamahiriya | | | | | | | | | | | | |
| Madagascar [1] | 23 | 93 | 170 | 226 | 137 | 198 | 147 | 126 | 1,147 | 1,629 | 2,863 | 677 |
| Malawi | | | | | | | | 9 | | | 582 | |
| Mozambique | | | | | | | | 216 | | | 825 | 430 |
| Namibia | | | | | | | | | | | | |
| South Africa | | | | | | | | | | | | |
| Uganda | | | | | | | 167 | | | | | 49 |
| United Rep. of Tanzania [1] | 356 | 647 | 31 | 364 | 1,293 | 16 | 18 | 444 | 831 | 947 | 504 | |
| Zambia | 1 | | | | | | | | | | 319 | |
| Zimbabwe | | | | | | | | 392 | | | 8 | 5 |
| Total no. of cases | 854 | 1,109 | 305 | 704 | 1,719 | 604 | 968 | 1,269 | 2,560 | 2,576 | 5,101 | 1,161 |
| Total no. of deaths | 198 | 138 | 54 | 98 | 118 | 168 | 130 | 106 | 123 | 173 | 261 | 61 |
| No. of countries reporting | 4 | 3 | 4 | 4 | 3 | 3 | 4 | 6 | 3 | 2 | 6 | 4 |

[1] Includes suspected cases.

## Table 3.1 Plague, cases and total number of deaths reported to WHO, and number of countries reporting, 1954-1998

| The Americas | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | | | | | | | | | | | | |
| Bolivia | 2 | 2 | | 10 | | | | | | 26 | 1 | |
| Brazil | 43 | 25 | 26 | 18 | 10 | 25 | | 4 | 9 | 1 | | |
| Ecuador | | | | | | | | | | | | 11 |
| El Salvador | | | | | | | | | | | | |
| Peru | 31 | 10 | | 18 | | 120 | 611 | 420 | 97 | 23 | 39 | 8 |
| United States of America | 12 | 15 | 4 | 2 | 11 | 13 | 10 | 14 | 9 | 5 | 4 | 8 |
| Venezuela | | | | | | | | | | | | |
| Total no. of cases | 88 | 52 | 30 | 48 | 21 | 158 | 621 | 438 | 115 | 55 | 44 | 27 |
| Total no. of deaths | 9 | 5 | | 6 | | 6 | 32 | 21 | 3 | 6 | 1 | 11 |
| No. of countries reporting | 4 | 4 | 2 | 4 | 2 | 3 | 2 | 3 | 3 | 4 | 3 | 3 |

| Asia | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| China | 7 | 6 | 10 | 75 | 29 | 35 | 13 | 7 | 8 | 98 | 43 | |
| Cambodia | | | | | | | | | | | | |
| India | | | | | | | | 876 | | | | |
| Indonesia | | | | | | | | | | | 6 | |
| Iran | | | | | | | | | | | | |
| Kazakhstan | | | 2 | 4 | 1 | | 3 | | | | 1 | |
| Lao People's Dem. Rep. | | | | | | | | | 7 | 3 | | |
| Mongolia | | | 5 | 15 | 3 | 12 | 21 | | 1 | 6 | 4 | 8 |
| Myanmar | 5 | 8 | 34 | 6 | 100 | 528 | 87 | 6 | | | | |
| Nepal | | | | | | | | | | | | |
| Philippines | | | | | | | | | | | | |
| Viet Nam [1] | 107 | 196 | 374 | 405 | 94 | 437 | 481 | 339 | 170 | 279 | 220 | |
| Total no. of cases | 119 | 210 | 425 | 505 | 227 | 1,012 | 605 | 1,228 | 186 | 386 | 274 | 8 |
| Total no. of deaths | 8 | 10 | 49 | 29 | 15 | 30 | 28 | 85 | 11 | 26 | 12 | 5 |
| No. of countries reporting | 3 | 3 | 5 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | 5 | 1 |

[1] Includes suspected cases.

# CHAPTER 4
# CHOLERA

## Background of the disease

Cholera is an acute bacterial infection of the intestine caused by ingestion of food or water containing *Vibrio cholerae*, serogroups O1 or O139. Symptoms include acute watery diarrhoea and vomiting which can result in severe dehydration or water loss. When left untreated, death can occur rapidly – sometimes within hours.

Cholera is transmitted through contaminated food or drinking-water, as well as by person-to-person contact through the faecal-oral route. Sanitary conditions in the environment play an important role since the *V. cholerae* bacterium survives and multiplies outside the human body and can spread rapidly where living conditions are crowded and water sources unprotected and where there is no safe disposal of faeces. These conditions are met in poor countries and in many refugee camps. For example, in 1994 in a refugee camp in Goma, Democratic Republic of the Congo, a major epidemic took place. An estimated 58 000–80 000 cases and 23 800 deaths occurred within one month.[1]

Epidemics of cholera-like diseases have been described by visitors to the Indian sub-continent as far back as the early sixteenth century and continuing through the nineteenth century. Beginning in 1817 cholera spread periodically to other parts of the world, in pandemic waves, retreating to its endemic area in South-East Asia between pandemics. The current seventh pandemic caused by the El Tor biotype of *V. cholerae* O1 began in 1961 in Sulawesi, Indonesia and spread rapidly to other countries in Asia, Europe and Africa and finally to Latin America in 1991, after almost a century without cholera. It spread very rapidly in Latin America causing nearly 400 000 reported cases and over 4000 reported deaths in 16 countries of the Americas that year.

During the 1990s a new epidemic strain, *V. cholerae* O139 Bengal was identified. It caused large outbreaks in India and Bangladesh beginning in 1992. Until then only *V. Cholerae* O1 was known to cause epidemic cholera. *V. cholerae* O139 Bengal is still restricted to Asia.

The seventh pandemic is still ongoing and shows signs of increasing further, rather than abating. Nearly 120 countries reported indigenous cases of cholera to WHO since 1991, and nearly half of those countries have reported cholera for at least five of the last eight years. This reflects the fact that cholera is a recurring problem in many areas, and it has become endemic in others.

Research has shown that the El Tor biotype is more likely to 'produce inapparent infections, persist longer in the environment, multiply more rapidly following inoculation into foods, and evoke less complete immunity'[2] than the classical biotype. This has important implications for the control of cholera, which will need to take into consideration both the potential of cholera to spread to new areas where there are susceptible populations causing large epidemics, as well as the need to control cholera in new areas of endemicity, such as parts of Africa and the Americas.

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[1] Goma Epidemiology Group. Public health impact of the Rwandan refugee crisis: What happened in Goma, Zaire in July 1994? *Lancet*, 1995, 345:359-361.

[2] Mintz ED, Tauxe RV, Levine MM. The global resurgence of cholera. In: Noah N and O'Mahony M, eds. *Communicable disease epidemiology and control.* Chichester, UK, John Wiley and Sons, 1998.

## Description of the data

Cholera was the first disease for which modern public health surveillance and reporting was carried out in an organized way. It is one of the three diseases currently reportable under the International Health Regulations (IHR) of 1969. According to those regulations, national health administrations should report the first cases of cholera on their territory to WHO within 24 hours of their being informed. This applies to both indigenous cases of cholera as well as imported cases. Cholera cases and deaths reported to WHO during the week are published in the *Weekly Epidemiological Record* (WER). In addition the WER provides annual summary tables of cholera cases and deaths as well as short notes on outbreaks of cholera. Reports of important outbreaks also appear on the WHO web pages under Disease Outbreak News as listed in the references. Data presented in this chapter, include reports of cholera dating back to 1949 for Asia when cases were first reported in that continent. For Africa the data began in 1970 with the acceptance of the International Health Regulations. This covers a relatively long period of time and allows recent trends in cholera incidence and mortality to be interpreted in light of past experience. The annual number of reported cases of cholera for each country is presented at the end of the chapter.

## Strengths and weaknesses of the data

The data presented in this report have been obtained from official reports to WHO. As is the case with other diseases under the IHR, notification of cases is mandatory, but reporting is not complete. Countries are reluctant to report cholera for political and economic reasons. They fear loss of tourism and trade, and travel restrictions. This results in considerable delays in reporting, and in substantial underreporting of cases. For a few countries, there have been no cases of cholera reported for many years, despite references in the literature to many cholera cases in those countries. Often cholera is reported to WHO as acute watery diarrhoea, in order to avoid the perceived negative consequences of reporting cholera, while at the same time acknowledging a severe epidemic of diarrhoeal disease.

Poorly functioning surveillance systems in some parts of the world (particularly in Africa) contribute to the underreporting of cases. Thus, not only are there many more cases of cholera than the number reported, but also the completeness of the reporting varies considerably by country.

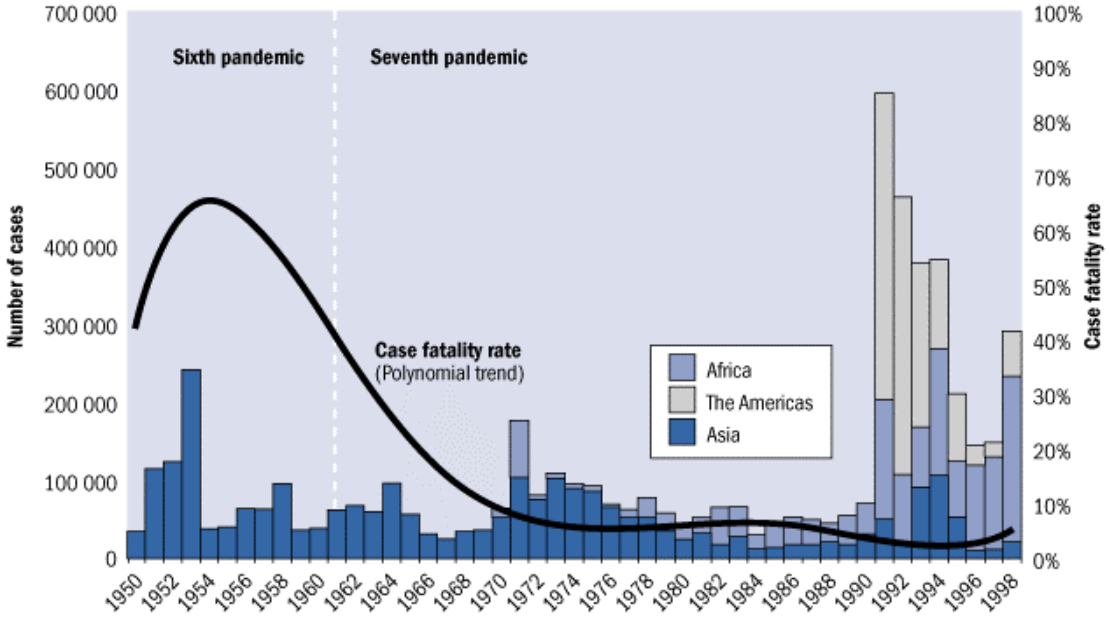
## Trends

### *Incidence*

- Cholera is a major public health problem that is becoming increasingly important as the number of countries affected continues to increase.
- New major outbreaks of cholera are continuing to occur, especially in the wake of climate changes.
- During 1998, there was a dramatic increase in the number of cholera cases worldwide compared to 1997, with the total number of cases almost doubling.
- Africa reported 211 748 cases in 1998, the highest number of cases ever reported and accounted for 72% of the global total. There had been a sudden increase of cholera at the end of 1997 in the Horn of Africa, and this continued throughout 1998 and spread to many other countries. During the year, major outbreaks occurred in the Democratic Republic of the Congo, Kenya, Mozambique, Uganda and the United Republic of Tanzania. There was a large increase in reported cholera cases in west Africa. Eleven countries reported outbreaks of cholera in September 1998.

- The Americas reported an upturn in cholera cases from 17 760 in 1997 to 57 106 in 1998. This reverses the downward trend in the region. The increase affected Peru primarily, as well as Ecuador, Guatemala and Nicaragua. This recrudescence is most probably related to the continuing effects of major disasters caused by El Nino and Hurricane Mitch.
- The number of cases reported in Asia continued the rise that began in 1997. There were more than twice as many cases in 1998 compared to 1997, with large increases in reported cases in Afghanistan, India, Cambodia, Malaysia, Nepal and Sri Lanka.

**Fig. 4.1 Cholera, reported number of cases and case fatality rates, 1950-1998**

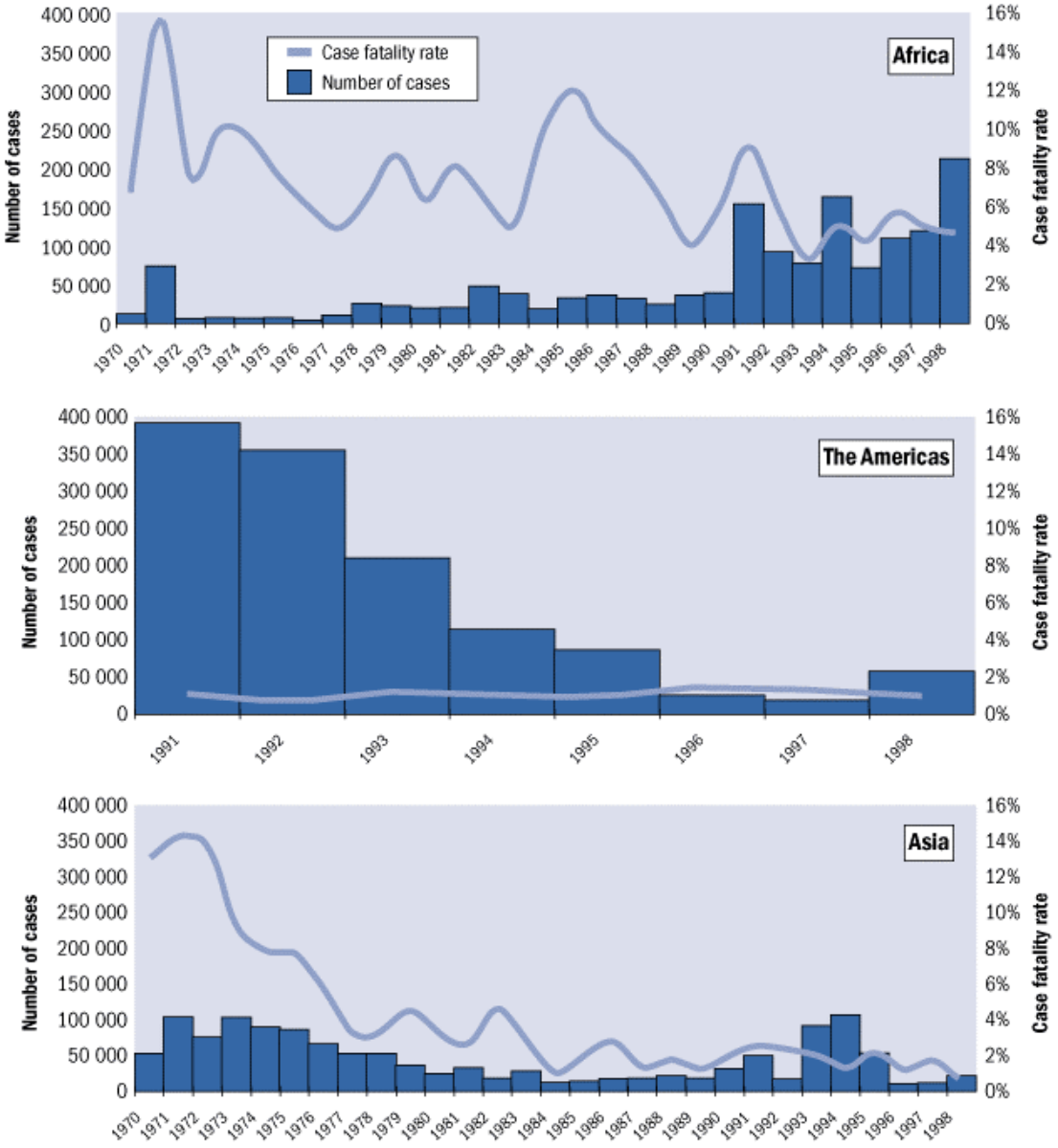



Deaths

- Figs. 4.1 and 4.2 present the annual number of reported cases of cholera from each continent since 1950 during the sixth pandemic. Case fatality rates were very high at that time and as many as 50-70% of cases died. With the replacement of classical cholera with El Tor, a less virulent strain, case fatality rates reduced dramatically during the 1960s. They have been further reduced, through better treatment and in particular more widely available oral rehydration therapy which was introduced during the early 1970s but which became widely available in many parts of the world during the 1980s.
- For the majority of cases, treatment with oral rehydration is sufficient. However, when either safe water or oral rehydration salts are not available, case fatality rates can be very high. A case fatality rate of 25-50% was estimated in refugee camps in Goma amongst those who were not treated. Where good treatment is readily accessible, the case fatality rate is less than 1%. Nowadays there are still large differences in case fatality rates from outbreak to outbreak. These differences are mainly due to differences in access to appropriate treatment and not because of alterations in virulence.
- In Africa, there has been a marked decline in case fatality rates since 1970, however Africa continues to have the highest reported case fatality rates (close to 5% in 1998) compared to the rest of the world.
- In Asia, reported case fatality rates have declined markedly since 1970, with a case fatality rate under 1% for 1998.
- Average case fatality rates for Europe and the Americas continue to hover around 1%.

- Since the case fatality rates are so different in different parts of the world, the global case fatality rates reflect only partly the trends in each region, as the global rates are also affected by the global distribution of cases.

**Fig. 4.2 Cholera, reported number of cases and case fatality rates, per continent**




## Conclusions

1. The seventh pandemic is still ongoing and the number of affected countries continues to increase especially in Africa.
2. We do not know whether epidemic strain *V. cholerae* O139 Bengal will continue to be restricted to its present geographical area, or spread further. The threat of a new pandemic caused by *V. cholerae* O139 Bengal cannot be ruled out.

3. An increasing number of geographic areas are becoming endemic for cholera reflecting a failure of effective epidemic control.
4. Case fatality rates in Africa remain unacceptably high.

## References

### *Publications and Documents*

*Cholera and other epidemic diarrhoeal diseases control – Technical cards on environmental sanitation,* World Health Organization, 1997. WHO/EMC/DIS/97.6.

*Epidemic diarrhoeal disease preparedness and response – Training and practice, 1998. Facilitator's guide,* World Health Organization, 1997, WHO/EMC/DIS/97.4 Rev.1.

*Epidemic diarrhoeal disease preparedness and response – Training and practice, Participant's manual,* World Health Organization, 1997, WHO/EMC/DIS/97.3.

*Guidelines for cholera control,* 1993, World Health Organization, Geneva.

*Management of the patient with cholera,* World Health Organization, 1992, WHO/CDD/SER/91.15 Rev1 (1992).

### *Web Pages*

Cholera fact sheet:
http://www.who.int/inf-fs/en/fact107.html

Epidemic dysentery fact sheet:
http://www.who.int/inf-fs/en/fact108.html

Cholera: basic facts for travellers:
http://www.who.int/emc/diseases/cholera/factstravellers.html

Cholera in Disease Outbreak News:
http://www.who.int/emc/outbreak_news/disease_indices/chol_index.html

WHO cholera web pages:
http://www.who.int/health-topics/cholera.html

Cholera cases reported to WHO, by country, 1998 (annual):
http://www.who.int/emc/diseases/cholera/choltbl1998.html

Cholera cases reported to WHO, by country, 1999 (annual):
http://www.who.int/emc/diseases/cholera/choltbl1999.html

Cholera cases reported to WHO, by country, 2000 (monthly):
http://www.who.int/emc/diseases/cholera/choltbl2000.html

### *Videos*

Cholera: the unnecessary disease. (31 mn)

A new time for cholera (*Vibrio cholerae* 0139). (24 mn)
http://www.who.int/emc/diseases/cholera/videos.html

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Africa | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Algeria | | 1,332 | 646 | 605 | 738 | 1,165 | 286 | 262 | 220 | 2,513 | 614 | | | 218 | 45 |
| Angola | | 1 | 268 | 263 | 934 | 88 | | 726 | | | | | | | |
| Benin | 175 | 2,133 | 250 | 3 | 73 | 45 | 146 | 2 | 27 | | 3 | 2 | 3 | 1 | 1 |
| Burkina Faso | 1 | 1,761 | 1 | 1,118 | 632 | 3 | | | 1 | | | | | | 2,191 |
| Burundi | | | | | | | | | 8,297 | 915 | 2,039 | 582 | 415 | 512 | 180 |
| Cameroon | | 2,167 | 362 | 206 | 83 | 3 | 135 | | 3 | 16 | 229 | 243 | 5 | 55 | 392 |
| Cape Verde | | | | | 303 | 20 | 219 | | | | | | | | |
| Central African Republic | | | | | | | | | | | | | | | |
| Chad | | 8,230 | 9 | | 338 | | | | | | | | | | |
| Comoros | | | | | | 2,675 | 5 | | | | | | | | |
| Congo | | | | | | | | | 51 | 5 | | | | | |
| Cote d'Ivoire | 868 | 668 | | | | | | | | 3 | | | 34 | | |
| Dem. Rep. of the Congo | | | | | | | | | 3,481 | 5,515 | 1,051 | 2,379 | 10,328 | 2,977 | 162 |
| Djibouti | 6 | 440 | 8 | | | | 2 | 2 | 3 | | | | | | |
| Equatorial Guinea | | | | | | | | | | | | | | | 404 |
| Ethiopia | 850 | 2,187 | | | | | | | | | | | | | |
| Gabon | | | | | | | | | | 5 | | 7 | | | |
| Gambia | | | | | | | | | | | | | | | |
| Ghana | 2,733 | 13,048 | 625 | 677 | 483 | 187 | 102 | 6,565 | 1,853 | 1,783 | 260 | 943 | 11,051 | 14,160 | 1,015 |
| Guinea | 2,000 | | | | | | | | | | | | | | |
| Guinea Bissau | | | | | | | | | | | | | | | |
| Kenya | | 239 | 51 | | 402 | 1,093 | 1,359 | 21 | 673 | 1,070 | 2,808 | 2,424 | 3,498 | 1,049 | 14 |
| Liberia | 168 | 606 | 947 | 1,336 | 512 | 704 | 646 | 512 | 422 | 438 | 2,690 | 1,582 | 670 | 183 | 492 |
| Libyan Arab Jamahiriya | 1,151 | | | | | | | | | | | | | | |
| Madagascar | | 2 | | | | | | | | | | | | | |
| Malawi | | | | 371 | | | 19 | 577 | 263 | | | 261 | | 487 | |
| Mali | 2,665 | 4,792 | 2 | 219 | 130 | | | | | | | | | | 1,795 |
| Mauritania | | 1,139 | 148 | 150 | | | | | | | | | | | 166 |
| Morocco | | 56 | 7 | | | | 2 | | | | | | | | |
| Mozambique | | | | 453 | 1,018 | 11 | 3 | 18 | | 4,564 | 1,212 | 1,753 | 2,301 | 10,745 | 521 |
| Niger | 16 | 9,265 | 51 | 121 | 286 | | | | | | | 7 | | | 3,788 |
| Nigeria | 15 | 22,931 | 1,363 | 157 | | 38 | 112 | 376 | 197 | 293 | 138 | 107 | 248 | 178 | 1,667 |
| Rwanda | | | | | | | | | 838 | 5 | 30 | 24 | 201 | 54 | 161 |
| Sao Tome and Principe | | | | | | | | | | | | | | | |
| Senegal | | 265 | 379 | | | | | | 315 | 103 | | 428 | | | 728 |
| Sierra Leone | 293 | 211 | | | | | | 12 | | | | | | | |

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Africa | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Somalia | 43 | 89 | | | | | | | | | | | | | |
| South Africa | | | | 1 | 37 | | | | | 2 | 859 | 4,180 | 11,968 | 4,715 | 1,182 |
| Sudan | | | | | | | | | | 845 | 17 | | | | |
| Swaziland | | | | | | | | | 2 | | | 238 | 538 | | |
| Togo | 75 | 335 | 16 | | 58 | | | 132 | 6 | | | | | | |
| Tunisia | 27 | | 4 | 656 | | | | | | | | | | | |
| Uganda | | 757 | | | | 3 | | | 1,120 | 940 | 1,539 | | 190 | | |
| United Republic of Tanzania | | | | | 10 | | | 297 | 6,608 | 2,559 | 5,196 | 4,241 | 4,071 | 1,816 | 2,600 |
| Zambia | | | | | | | | | 263 | 12 | 57 | 14 | 1,403 | 233 | |
| Zimbabwe | | | | 1 | 37 | 615 | 144 | | | | | | | | |
| Total no. of cases | 11,086 | 72,654 | 5,137 | 6,337 | 6,074 | 6,650 | 3,180 | 9,502 | 24,643 | 21,586 | 18,742 | 19,415 | 46,924 | 37,383 | 17,504 |
| Total no. of deaths | 747 | 11,427 | 386 | 636 | 582 | 504 | 194 | 462 | 1,591 | 1,869 | 1,185 | 1,581 | 2,988 | 1,903 | 1,711 |
| No. of countries reporting | 16 | 23 | 18 | 16 | 17 | 14 | 14 | 13 | 20 | 19 | 16 | 18 | 16 | 15 | 19 |

| Oceania [1] | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | | | 40 | | | | | 2 | 1 | 1 | 2 | 2 | 1 | 4 | 1 |
| Guam | | | | | 6 | | | 1 | | | | 4 | 2 | 1 | |
| Kiribati | | | | | | | | 1,307 | 494 | | | | | | |
| Northern Mariana Islands | | | | | | | | | | | | | | | |
| Micronesia (Federated States of) | | | | | | | | | | | | | | | |
| Nauru | | | | | | | | | 38 | 50 | | | | | |
| Papua New Guinea | | | | | | | | | | | | | | | |
| New Zealand | | | 3 | | | | | | | | | | | | |
| Samoa | | | | | | | | | | | 1 | | | | |
| Trust Territories of the Pacific [2] | | | | | | | | | | 13 | | | 2,214 | 321 | 19 |
| Tuvalu | | | | | | | | | | | | | | | |
| Total no. of cases | | | 43 | | 6 | | | 1,310 | 533 | 64 | 3 | 6 | 2,217 | 326 | 20 |
| Total no. of deaths | | | 1 | | 1 | | | 21 | 0 | 0 | 0 | 0 | 17 | 1 | 0 |
| No. of countries reporting | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 2 |

[1] In the 1960s the following countries reported cholera: Papua New Guinea: 1962: 1293 cases and 464 deaths and Australia: 1969: 1 case, no deaths.

[2] The Trust Territories of the Pacific consisted of the Federated States of Micronesia, Marshall Islands, Palau, and the Northern Mariana Islands.

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Africa | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Algeria | | | 1,507 | 699 | 393 | 1,293 | 1,991 | 69 | | 118 | | | | |
| Angola | | | 16,222 | 15,500 | 17,601 | 9,527 | 8,590 | 3,608 | | 3,443 | 3,295 | 1,306 | | |
| Benin | | 243 | | | | | 7,474 | 413 | 10 | 187 | 203 | 6,190 | 778 | 206 |
| Burkina Faso | 1,149 | | | | | | 537 | | | | 1,451 | 425 | | 1,036 |
| Burundi | 259 | | 523 | 571 | 94 | 82 | 3 | 479 | 78 | 562 | 2,297 | 418 | 1,959 | 1,067 |
| Cameroon | 1,158 | 165 | 94 | 4 | 4 | 16 | 4,026 | 1,268 | 648 | 527 | 615 | 5,796 | 1,709 | 4,603 |
| Cape Verde | | | | | | | | | | 128 | 12,913 | 426 | | 133 |
| Central African Republic | | | | | | | | | | | | | 443 | 4,095 |
| Chad | | | | | | | 13,915 | | | 1,094 | | 7,830 | 8,801 | 22 |
| Comoros | | | | | | | | | | | | | | 7,300 |
| Congo | | | | | | | | | | | | | 275 | 3,222 |
| Cote d'Ivoire | | | | | | | 604 | 37 | 724 | 1,108 | 4,993 | 1,345 | | |
| Dem. Rep. of the Congo | 740 | 1,059 | 1,150 | 295 | 99 | 468 | 4,066 | 1,949 | 986 | 58,057 | 553 | 7,888 | 2,421 | 34,899 |
| Djibouti | 115 | | | | | | | | 10,055 | 1,122 | | | 2,424 | 164 |
| Equatorial Guinea | 108 | | | | | | | | | | | | | |
| Ethiopia | | | | | | | | | | | | | | |
| Gabon | | | | | | | | | | | | | | |
| Gambia | 2 | | | | | | | | | 1 | 15 | 7 | | |
| Ghana | 60 | | | | | 2,937 | 13,172 | 228 | 1,448 | 2,267 | 4,698 | 1,665 | 379 | 3,426 |
| Guinea | | 286 | | | | | | | | 31,415 | 6,506 | 287 | | 881 |
| Guinea Bissau | | 200 | 2,443 | | | | | | | 15,296 | 119 | 8,397 | 20,555 | 126 |
| Kenya | 1,352 | 839 | 255 | | 918 | | | 3,388 | | 880 | 1,543 | 482 | 17,200 | 22,432 |
| Liberia | 355 | 59 | 33 | 68 | 28 | | 132 | | | 764 | 3,420 | 8,922 | 91 | 2,123 |
| Libyan Arab Jamahiriya | | | | | | | | | | | 22 | | | |
| Madagascar | | | | | | | | | | | | | | |
| Malawi | | | | 6 | 8,351 | 13,457 | 8,088 | 298 | 25,193 | 107 | 1 | 1 | 130 | 1,745 |
| Mali | 3,759 | 1,916 | 352 | | | | | | | | 2,048 | 5,723 | 6 | |
| Mauritania | 259 | 3,734 | 1,578 | 575 | 700 | | | | | | | 4,534 | 462 | |
| Morocco | | | | | | | | | | 6 | | | | |
| Mozambique | 3 | 1 | | | 371 | 4,152 | 7,847 | 30,802 | 19,803 | 692 | | | 8,739 | 42,672 |
| Niger | | | | | 166 | | 3,238 | | | 732 | 264 | 3,957 | 259 | |
| Nigeria | 30 | 91 | 1,290 | 137 | 1,078 | | 59,478 | 7,671 | 4,160 | 2,859 | 1,059 | 12,374 | 1,322 | 3,464 |
| Rwanda | 21 | 226 | 101 | 70 | 1 | | 679 | 530 | 568 | 10 | 3 | 106 | 274 | 3,220 |
| Sao Tome and Principe | | | | | 3,953 | 804 | 3 | | | | | | | |
| Senegal | 2,988 | 476 | 3,150 | 390 | | | | | | | 3,222 | 16,107 | 371 | |
| Sierra Leone | | 8,957 | 557 | | | | | | | 9,709 | 10,285 | | | 2,096 |

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Africa | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Somalia | 10,199 | 15,980 | | | | | | | | 27,904 | 9,255 | 10,274 | 6,814 | 4,404 |
| South Africa | 2,742 | 120 | 37 | | | | 10 | 11 | 78 | 4 | | | | 20 |
| Sudan | 4,457 | | | | | | | | | | | | | |
| Swaziland | | | | | | | | 2,281 | | | | 2 | | 7 |
| Togo | | | | 1 | | | 2,396 | 753 | 19 | 47 | 65 | 146 | 42 | 3,217 |
| Tunisia | | | | | | | | | | | | | | |
| Uganda | | | 140 | | | | 279 | 5,072 | | 704 | 538 | 291 | 2,610 | 49,514 |
| United Republic of Tanzania | 1,984 | 1,231 | 1,892 | 5,267 | 2,150 | 2,230 | 5,676 | 18,526 | 792 | 2,240 | 1,698 | 1,464 | 40,249 | 14,488 |
| Zambia | | | | | 44 | 3,717 | 13,154 | 11,659 | 6,766 | | | 2,172 | 36 | 171 |
| Zimbabwe | 144 | 2 | | | | | | 2,039 | 5,385 | | | | | 995 |
| Total no. of cases | 31,884 | 35,585 | 31,324 | 23,583 | 35,951 | 38,683 | 155,358 | 91,081 | 76,713 | 161,983 | 71,081 | 108,535 | 118,349 | 211,748 |
| Total no. of deaths | 3,837 | 3,490 | 2,658 | 1,500 | 1,445 | 2,288 | 13,998 | 5,291 | 2,532 | 8,128 | 3,024 | 6,216 | 5,853 | 9,856 |
| No. of countries reporting | 21 | 18 | 17 | 13 | 16 | 11 | 22 | 20 | 16 | 28 | 26 | 28 | 25 | 29 |

| Oceania | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | 2 | | 1 | 1 | | 2 | | 3 | 5 | 3 | 5 | 2 | 2 | 5 |
| Guam | 5 | 3 | 1 | | | 1 | | | | 1 | | 1 | | 2 |
| Kiribati | | | | | | | | | | | | | | |
| Northern Mariana Islands | | | | | | | | | | | | 1 | 3 | |
| Micronesia (Federated States of) | | | | | | 34 | | | | | | | | |
| Nauru | | | | | | | | | | | | | | |
| Papua New Guinea | | | | | | | | | | | | | | |
| New Zealand | | | | | | 3 | | | | 2 | 2 | | | 1 |
| Samoa | | | | | | | | | | | | | | |
| Trust Territories of the Pacific [2] | | | | | | | | | | | | | | |
| Tuvalu | | | | | | 27 | | 293 | | | | | | |
| Total no. of cases | 7 | 3 | 2 | 1 | | 67 | | 296 | 5 | 6 | 7 | 4 | 5 | 8 |
| Total no. of deaths | 0 | 0 | 0 | 0 | | 1 | | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| No. of countries reporting | 2 | 1 | 2 | 1 | 0 | 5 | 0 | 2 | 1 | 3 | 2 | 3 | 2 | 3 |

[1]In the 1960s the following countries reported cholera: Papua New Guinea: 1962: 1293 cases and 464 deaths and Australia: 1969: 1 case, no deaths.

[2]The Trust Territories of the Pacific consisted of the Federated States of Micronesia, Marshall Islands, Palau, and the Northern Mariana Islands.

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| The Americas | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|
| Argentina | | 553 | 2,080 | 889 | 188 | 474 | 637 | 12 |
| Belize | | 159 | 135 | 6 | 19 | 26 | 2 | 28 |
| Bolivia | 206 | 22,260 | 10,134 | 2,710 | 2,293 | 2,847 | 1,632 | 466 |
| Brazil | 1,567 | 30,309 | 59,212 | 49,455 | 15,915 | 4,634 | 2,881 | 2,571 |
| Canada | 2 | 4 | 6 | 2 | 7 | 2 | | 2 |
| Chile | 41 | 73 | 32 | 1 | | 1 | 4 | 24 |
| Colombia | 11,979 | 15,129 | 230 | 996 | 1,922 | 4,428 | 1,508 | 442 |
| Costa Rica | | 12 | 14 | 38 | 24 | 19 | 1 | |
| Ecuador | 46,320 | 31,870 | 6,833 | 1,785 | 2,160 | 1,059 | 65 | 3,724 |
| El Salvador | 947 | 8,106 | 6,573 | 11,739 | 2,923 | 182 | 0 | 8 |
| French Guiana | 1 | 16 | 2 | 2 | | | | |
| Guatemala | 3,674 | 15,395 | 30,604 | 5,282 | 7,970 | 1,568 | 1,263 | 5,970 |
| Guyana | | 576 | 66 | | | | | |
| Honduras | 11 | 384 | 4,007 | 4,965 | 4,717 | 708 | 90 | 306 |
| Mexico | 2,690 | 8,162 | 10,712 | 4,059 | 16,430 | 1,088 | 2,356 | 71 |
| Nicaragua | 1 | 3,067 | 6,631 | 7,821 | 8,825 | 2,813 | 1,283 | 1,437 |
| Panama | 1,178 | 2,416 | 42 | | | | | |
| Paraguay | | | 3 | | | 4 | | |
| Peru | 322,562 | 212,642 | 71,448 | 23,887 | 22,397 | 4,518 | 3,483 | 41,717 |
| Suriname | | 12 | | | | | | |
| United States of America | 26 | 102 | 19 | 47 | 19 | 3 | 4 | 15 |
| Venezuela | 15 | 2,842 | 409 | | | 269 | 2,551 | 313 |
| Total no. of cases | 391,220 | 354,089 | 209,192 | 113,684 | 85,809 | 24,643 | 17,760 | 57,106 |
| Total no. of deaths | 4,002 | 2,401 | 2,438 | 1,107 | 845 | 351 | 225 | 558 |
| No. of countries reporting | 16 | 21 | 21 | 17 | 15 | 18 | 16 | 16 |

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Asia | 1950-1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Afghanistan | 1,105 | | | | | | | | | | | | | | |
| Armenia | | | | | | | | | | | | | | | |
| Azerbaijan | | | | | | | | | | | | | | | |
| Bahrain | 1 | | | 74 | 37 | | | | | 906 | 39 | | | | |
| Bangladesh | 239,667 | 7,419 | 2,342 | 1,059 | 1,969 | 5,614 | 4,888 | 957 | 10,403 | 5,576 | 2,154 | | | | |
| Bhutan | | | | | | | | | | | | | | | |
| Brunei Darussalam | 199 | 24 | | | | | | | | | | | | 6 | |
| Cambodia | 427 | | | | 159 | 145 | 66 | | | | | | | | |
| China | 386 | | | | | | | | | | 85 | 88 | | | |
| Dem. People's Republic of Korea | | | | | | | | | | | | 170 | | | |
| Georgia | | | | | | | | | | | | | | | |
| Hong Kong SAR | 300 | | | | | | | 1 | | 2 | 4 | | 3 | 8 | |
| India | 946,794 | 15,067 | 71,386 | 20,435 | 41,611 | 30,903 | 22,049 | 14,946 | 8,376 | 10,585 | 5,073 | 8,344 | 4,681 | 4,656 | 8,542 |
| Indonesia | 4,738 | 5,997 | 23,555 | 44,383 | 52,042 | 41,474 | 48,387 | 41,264 | 17,112 | 10,683 | 18,817 | 5,541 | 18,354 | 10,391 | 13,832 |
| Iran (Islamic Republic of) | 5,977 | 19,663 | 344 | 322 | 55 | 304 | 2,966 | 2,100 | 10,836 | 264 | 1,856 | 1,599 | 6,034 | 427 | 270 |
| Iraq | 227 | | | | | | | | 133 | 96 | | | | | |
| Israel | | 185 | 1 | 11 | | | | | | | | | | 1 | |
| Japan | 26 | 5 | | | | | 3 | 6 | 52 | 34 | 11 | 23 | 19 | 16 | 35 |
| Jordan | | 3 | | | | | | 152 | 427 | | 141 | | 870 | | |
| Kazakhstan | | | | | | | | | | | | | | | |
| Kuwait | | 4 | | | | | 3 | 2 | 13 | 1 | 3 | | 8 | | |
| Kyrgyzstan | | | | | | | | | | | | | | | |
| Lao People's Dem. Republic | 479 | | | | | | | | | | | | | | |
| Lebanon | | 54 | | | | | | | 30 | | | | | | |
| Maldives | | | | | | | | | | 11,336 | | | | | |
| Macao SAR | 71 | | | | | | | | | 12 | | | | | |
| Malaysia | 968 | 106 | 53 | 864 | 369 | 349 | 110 | 246 | 444 | 1,635 | 502 | 97 | 469 | 516 | 2,195 |
| Mongolia | | | | | | | | | | | | | | | |
| Myanmar | 16,333 | 911 | 378 | 180 | 386 | 2,363 | 2,942 | 1,519 | | 3,551 | 874 | 1,018 | 28 | | 989 |
| Nepal | 3,695 | 391 | 4 | 1 | 7 | 8 | 260 | 185 | 428 | 1,662 | 22 | 1 | 24 | | |
| Oman | | | 9 | | | | | | | | | | | | |
| Pakistan | 11,740 | 2 | 1,185 | | | | | 144 | 12 | | | | 4 | | |
| Philippines | 59,180 | 1,095 | 3,585 | 5,601 | 2,840 | 1,730 | 680 | 1,258 | 1,363 | 1,408 | 1,268 | 836 | 864 | 930 | |
| Republic of Korea | 1,964 | 475 | | | | | | | | | | 145 | | | |
| Saudi Arabia | | 266 | | 303 | | | 91 | 50 | 18 | 30 | 23 | 2 | 13 | | |
| Singapore | 68 | | | 114 | 1 | 8 | 10 | | 11 | 83 | 10 | 18 | 34 | 31 | 14 |

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Asia | 1950-1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Syrian Arab Republic | | 49 | 5 | 505 | | | 67 | 795 | 2,362 | | 689 | | | | |
| Sri Lanka | | | | | 118 | 4,559 | 1,453 | 728 | 5 | 48 | 46 | 104 | 574 | 309 | 86 |
| Tajikistan | | | | | | | | | | | | | | | |
| Thailand | 19,739 | | | | 844 | 1,475 | 1,335 | 6 | 383 | 4,183 | 1,788 | 4,331 | 39 | 638 | 1,497 |
| Turkey | | 384 | | | | | | | 17 | | | | | | |
| Turkmenistan | | | | | | | | | | | | | | | |
| United Arab Emirates | | 8 | | 2 | | | | | | | | | | | |
| Uzbekistan | | | | | | | | | | | | | | | |
| Viet Nam | 41,663 | 82 | 270 | 146 | 1,495 | 139 | 5 | 1,068 | 32 | 2 | 365 | 978 | 157 | 57 | 392 |
| West Bank and Gaza Strip | | 239 | 1 | | | | | 42 | 3 | | 9 | | 168 | 5 | 25 |
| Yemen | | | 190 | 1,064 | 215 | 6 | 1 | | | 414 | 1,953 | 720 | | | |
| Total no. of cases | 1,355,747 | 52,429 | 103,308 | 75,064 | 102,148 | 89,077 | 85,316 | 65,469 | 52,460 | 52,511 | 35,732 | 24,015 | 32,343 | 17,991 | 27,877 |
| Total no. of deaths | 6,787 | 6,787 | 14,701 | 10,271 | 9,422 | 7,019 | 6,567 | 3,754 | 1,694 | 1,763 | 1,602 | 769 | 860 | 833 | 765 |
| No. of countries reporting | 23 | 22 | 15 | 16 | 15 | 14 | 18 | 19 | 21 | 21 | 22 | 17 | 18 | 14 | 11 |

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Asia | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Afghanistan | | | | | | | | | | 37,046 | 38,735 | 19,903 | | 4,170 | 10,000 |
| Armenia | | | | | | | | | | | | | | | 25 |
| Azerbaijan | | | | | | | | | | | 9 | | | | |
| Bahrain | | | | | | | | | | | | | | | |
| Bangladesh | | | | | | | | | | 12 | | | | | |
| Bhutan | | | | | | | | 422 | 494 | | | 25 | | | 19 |
| Brunei Darussalam | | | | | | | | | | | | | | | |
| Cambodia | | | | | | | | 770 | 1,229 | 2,252 | 3,085 | 4,190 | 740 | 155 | 1,197 |
| China | | | | | 7,865 | 6,158 | 639 | 205 | 580 | 11,717 | 34,821 | 10,344 | 312 | 1,163 | |
| Dem. People's Republic of Korea | | | | | | | | | | | | | | | |
| Georgia | | | | | | | | | | 8 | | | | | |
| Hong Kong SAR | 1 | 2 | 30 | 4 | 2 | 29 | 5 | 5 | 3 | 30 | 56 | 6 | 4 | 14 | 71 |
| India | 2,527 | 5,808 | 4,208 | 9,375 | 8,917 | 5,026 | 3,583 | 6,993 | 6,911 | 9,437 | 4,973 | 3,315 | 4,396 | 2,768 | 7,151 |
| Indonesia | 7,921 | 4,732 | 11,915 | 659 | 50 | 67 | 155 | 6,202 | 25 | 3,564 | 47 | | | 66 | |
| Iran (Islamic Republic of) | 531 | 1,208 | 20 | 295 | 486 | 5,222 | 178 | 1,880 | 97 | 1,347 | 15 | 2,177 | | 1,106 | 270 |
| Iraq | | | | | | | | 877 | 97 | 280 | 838 | 820 | | | 53 |
| Israel | | | | 2 | 1 | | | | | | | | | | |
| Japan | 55 | 36 | 26 | 35 | 38 | 99 | 73 | 90 | 46 | 89 | 91 | 321 | 39 | 89 | 60 |
| Jordan | | | | | | | 2 | | | | | | | | |
| Kazakhstan | | | | | | | | | | 74 | 3 | 8 | | 4 | |
| Kuwait | | 113 | 38 | | | 133 | | | | 1 | | | | 1 | |
| Kyrgyzstan | | | | | | | | | | | 4 | | | | |
| Lao People's Dem. Republic | | | | | | | | | | 5,521 | 9,640 | 1,365 | 720 | | |
| Lebanon | | | | | | | | | | 344 | 3 | | | | |
| Maldives | | | | | | | | | | | | | | | |
| Macao SAR | | | | | | 3 | 1 | | | | | | | | 8 |
| Malaysia | 67 | 52 | 55 | 584 | 753 | 350 | 2,071 | 506 | 474 | 995 | 534 | 2,209 | 1,486 | 389 | 1,304 |
| Mongolia | | | | | | | | | | | | | 177 | | |
| Myanmar | | | | | | 597 | 24 | 924 | 826 | 1,758 | 421 | 1,296 | | | |
| Nepal | | | | | | 141 | 23,888 | 30,648 | 764 | 31 | 32 | 157 | 274 | 245 | 1,745 |
| Oman | | | | | | | | | | | | | | | |
| Pakistan | | | | | | | | | | 12,092 | | | | | |
| Philippines | | 10 | | | | | | | 345 | 708 | 3,340 | 847 | 1,402 | 605 | 729 |
| Republic of Korea | | | | | | | | 113 | 6 | 5 | 34 | 74 | 7 | 10 | |
| Saudi Arabia | | | 74 | | | | | | | | | | | | |
| Singapore | 40 | 27 | 27 | 63 | 19 | 39 | 26 | 34 | 17 | 24 | 41 | 14 | 19 | 19 | 31 |

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Asia | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Syrian Arab Republic | | | | | | | | | | | | | | | |
| Sri Lanka | | | | | 154 | | | 70 | 121 | 1 | | | | 430 | 1,536 |
| Tajikistan | | | | | | | | | | 165 | 10 | | | | |
| Thailand | 645 | 899 | 213 | 6,353 | 2,248 | | | | | | 3,487 | | | | |
| Turkey | | | | | | | | | | | | | | | |
| Turkmenistan | | | | | | | | | | | 1 | | | 55 | |
| United Arab Emirates | | | | | | | | | | | | | | | |
| Uzbekistan | | | | | | | | | | | 1 | | | | |
| Viet Nam | 22 | 502 | 525 | 188 | 338 | 143 | 358 | 52 | 4,260 | 3,361 | 5,776 | 6,088 | 566 | 4 | 13 |
| West Bank and Gaza Strip | | | | | | | | | | | 103 | | | | |
| Yemen | | | | | | | | | 4 | | | | | | |
| Total no. of cases | 11,809 | 13,389 | 17,131 | 17,558 | 20,871 | 18,007 | 31,003 | 49,791 | 16,299 | 90,862 | 106,100 | 53,159 | 10,142 | 11,293 | 24,212 |
| Total no. of deaths | 119 | 276 | 477 | 238 | 378 | 224 | 628 | 1,286 | 372 | 1,809 | 1,393 | 1,158 | 122 | 196 | 172 |
| No. countries reporting | 9 | 11 | 11 | 10 | 12 | 13 | 13 | 16 | 18 | 25 | 26 | 18 | 13 | 18 | 16 |

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Europe | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Albania | | | | | | | | | | | | | | | |
| Andorra | | | | | | | | | | | | | | | |
| Austria | | | | | | | | | | | | 2 | | | |
| Belarus | | | | | | | | | | | | | | | |
| Belgium | | | | | | | | | | | 1 | | | 1 | 1 |
| Czechoslovakia [1] | 4 | | | | | | | | | | | | | | |
| Denmark | | | | | | | | | | | | | | | |
| Estonia | | | | | | | | | | | | | | | |
| Finland | | | | | | | | | | | | 1 | | | |
| France | 1 | 3 | | 4 | 5 | 9 | 5 | | | 8 | 1 | 20 | 18 | 3 | 1 |
| Germany | | 1 | 2 | 6 | 3 | 1 | 2 | 1 | | | 4 | 4 | 1 | | |
| Greece | | | | | | | | | | | | | | | |
| Hungary | | | | | | | | | | | | | | | |
| Italy | | | | 278 | | 1 | | 2 | | 8 | | | | | |
| Netherlands | | | | | | | 1 | 1 | 4 | 5 | | 2 | | 2 | |
| Norway | | | | | | | | | | | | | | | |
| Poland | | | | | | | | | | | | 1 | | | |
| Portugal | | 64 | | | 2,467 | 1,066 | | | | | | | | | |
| Republic of Moldova | | | | | | | | | | | | | | | |
| Romania | | | | | | | | | | | | | | | |
| Russian Federation | 720 | | | | | | 1 | 1 | | | | | | | |
| Spain | | 22 | | | 5 | 11 | 2 | | | 267 | 4 | | 2 | 2 | 4 |
| Sweden | | 4 | | 10 | 1 | | 1 | | | 1 | | | | | |
| Switzerland | | | | | | | | 1 | 1 | | | 2 | | | |
| United Kingdom of G.B and N.I. | 1 | 3 | 2 | 5 | 3 | 1 | 1 | 2 | | | 6 | 12 | 1 | 4 | 5 |
| Ukraine | | | | | | | | | | | | | | | |
| Yugoslavia | | | | | | | 3 | | | | | 2 | | | |
| Total no. of cases | 726 | 97 | 4 | 303 | 2,484 | 1,089 | 16 | 8 | 5 | 289 | 16 | 46 | 22 | 12 | 11 |
| Total no. of deaths | 1 | 4 | 0 | 23 | 48 | 8 | 2 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 |
| No. of countries reporting | 4 | 6 | 2 | 5 | 6 | 6 | 8 | 6 | 2 | 5 | 5 | 9 | 4 | 5 | 4 |

[1] Czechoslovakia dissolved on 31 December 1992.

## Table 4.1 Cholera, cases and total number of deaths reported to WHO, and number of countries reporting, 1950-1998

| Europe | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Albania | | | | | | | | | | 626 | | | | |
| Andorra | | | | | | | | | 1 | | | | | |
| Austria | | | | | | 2 | | | 1 | 1 | | | | 1 |
| Belarus | | | | | | | | | | 3 | 3 | | | |
| Belgium | 1 | | | | | | | 1 | 1 | 1 | | | | |
| Czechoslovakia | | | | | | | | | | | | | | |
| Denmark | | | | | | 1 | | | 2 | 2 | 3 | | | |
| Estonia | | | | | | | | | 2 | | | | | 1 |
| Finland | | | | | | | | | | 2 | 1 | | | |
| France | | 37 | 7 | | 1 | 6 | | | 5 | 4 | 5 | 6 | 3 | 2 |
| Germany | | 2 | | 2 | 1 | 1 | 7 | 1 | 1 | 5 | 1 | | 2 | 5 |
| Greece | | 1 | | | | | | | 1 | | | | | |
| Hungary | | | | | | | | | | | | | 1 | |
| Italy | | | | | | | | | | 12 | 1 | | | 2 |
| Netherlands | | | | 1 | | 3 | | | 2 | 1 | 9 | 3 | 2 | 4 |
| Norway | | | 1 | | 1 | | | | | | 1 | | | 2 |
| Poland | | | | | | | | | | 1 | | | | |
| Portugal | | | | | | | | | | 1 | 1 | | | |
| Republic of Moldova | | | | | | | | | 1 | 8 | 240 | | | |
| Romania | | | | | | 270 | 226 | 3 | 15 | 80 | 118 | | | |
| Russian Federation | | | | | | | 3 | 6 | 23 | 1,048 | 9 | 1 | 4 | 10 |
| Spain | | | 3 | | 3 | 11 | 1 | | 3 | 1 | 6 | 1 | | |
| Sweden | | 1 | 1 | | | | | 1 | | 1 | 2 | 1 | | |
| Switzerland | 1 | | | 1 | | | | 1 | 2 | | 2 | | | 2 |
| United Kingdom of G.B and N.I. | 4 | 11 | 2 | 10 | 1 | 6 | 8 | 5 | 13 | 18 | 10 | 13 | 6 | 18 |
| Ukraine | | | | | | 49 | 75 | | | 813 | 525 | | | |
| Yugoslavia | | | | | 4 | | | | | 2 | | | | |
| Total no. of cases | 6 | 52 | 14 | 14 | 11 | 349 | 320 | 18 | 73 | 2,630 | 937 | 25 | 18 | 47 |
| Total no. of deaths | 1 | 0 | 0 | 0 | 0 | 2 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| No. of countries reporting | 3 | 5 | 5 | 4 | 6 | 9 | 6 | 7 | 15 | 20 | 17 | 6 | 6 | 10 |

[1] Czechoslovakia dissolved on 31 December 1992

# CHAPTER 5
# MENINGOCOCCAL DISEASE

## Background of the disease

Meningococcal disease is a contagious bacterial disease caused by the meningococcus (*Neisseria meningitidis)* with high case fatality rates. It is spread by person-to-person contact through respiratory droplets of infected people.

*N. meningitidis* is a common inhabitant of the mucosal membranes of the nose and throat, where it usually causes no harm. Up to 5-10% of a population may be asymptomatic carriers. These carriers are crucial to the spread of the disease; most cases are acquired through exposure to asymptomatic carriers. A small minority of the persons who contract the disease will develop an acute inflammation of the meninges, the membranes covering the brain and the spinal cord. The disease is mainly affecting young children, but is also common in older children and young adults.

There are two clinical forms of meningococcal disease. Meningococcal meningitis is the more common entity, especially during epidemics, and the less common entity is meningococcal septicaemia. Meningococcal meningitis is the only form of bacterial meningitis which causes epidemics. The data presented in this report refer to both clinical forms of meningococcal disease.

Meningococcal disease occurs as both an endemic and epidemic disease, and both forms cause substantial illness, and death, as well as persistent neurological defects, particularly deafness. Other consequences of the disease are loss of limbs, mental retardation and paralysis. Because of the severe consequences of meningococcal disease, access to treatment with antimicrobials as early as possible is very important. In the case of epidemics, mass vaccination campaigns are used to control epidemics.

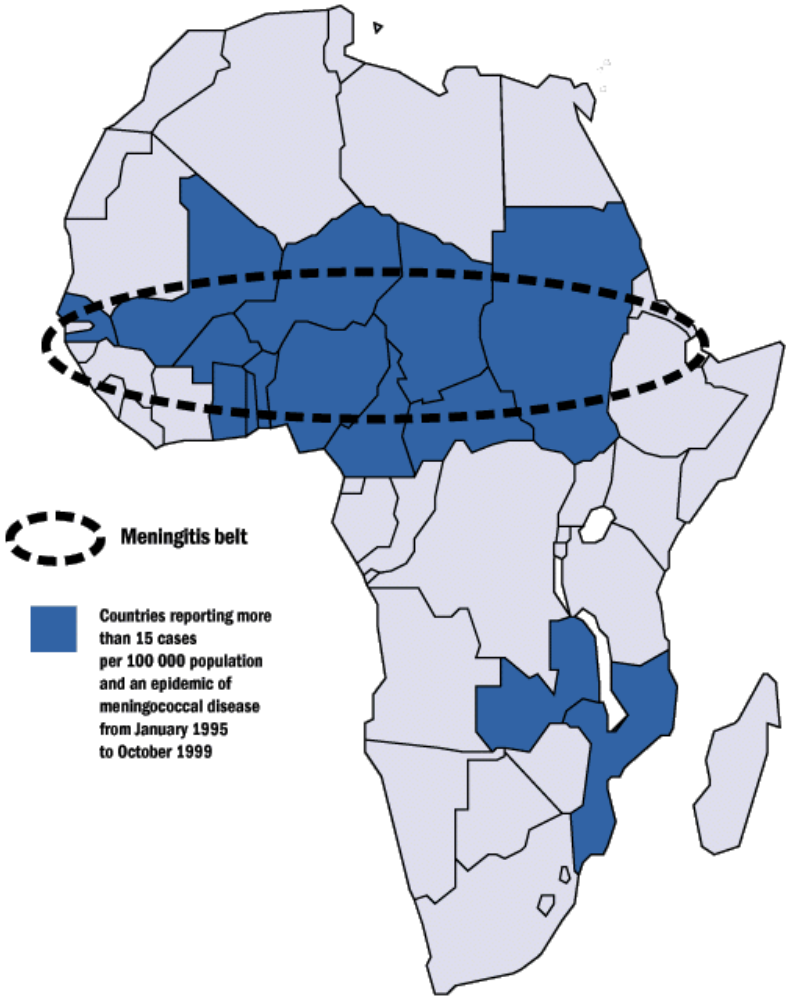
Three serogroups, A, B and C, account for up to 90% of all disease. All three serogroups may cause epidemics, however the risk of epidemic meningococcal meningitis differs between serogroups. Serogroup A meningococcus has historically been the main cause of epidemic meningococcal disease and still dominates in Africa during both endemic and epidemic periods.

The highest number of cases and the highest burden of disease occur in sub-Saharan Africa in an area that is referred to as the meningitis belt. This is the area between Senegal and Ethiopia (Map 5.1). Epidemics occur in seasonal cycles between the end of November and the end of June, depending on the location and climate of the country, and decline rapidly with the arrival of the rainy season. Within the meningitis belt, meningococcal disease occurs in epidemic cycles which last between 8 to 15 years. The mechanisms that cause these cycles are not well understood, but are thought to be related to variations in herd immunity.

Although the highest burden of disease is currently in Africa, epidemics can occur in any part of the world. Asia has had some major epidemics of meningococcal disease in the last 30 years (China 1979 and 1980, Viet Nam 1977, Mongolia 1973-1974 and 1994-1995, Saudi Arabia 1987, Yemen 1988). There have also been epidemics in Europe and in the Americas during the last 30 years, but they have not reached the very high incidence levels of epidemics in other parts of the world.

In January 1997, the International Coordinating Group on Vaccine Provision for Epidemic Meningitis Control (ICG) was developed to regulate and coordinate the procurement of meningococcal disease vaccine, after large epidemics in sub-Saharan Africa in 1995-1996 largely exhausted global vaccine stocks. In order for the ICG to function properly, timely information on meningococcal disease from each country is required. This has accelerated improvements in the surveillance system in African countries – which now have an increased incentive to report cases.

**Map 5.1 Meningococcal disease in Africa, 1995-1999**




## Description of the data

There are three types of data collected on meningococcal disease namely national data on the number of cases and deaths each year, weekly data on the number of cases and deaths in meningitis belt countries, and data on specific epidemics.

### *Annual national level data*

The main function of this global database is to keep track of major epidemics of meningitis and major geographical trends over time. This database includes the number of cases per year per country, (both endemic and epidemic cases) and dates back to 1966. The database contains officially reported data as well as other published reports from countries when available. Twice a year, letters are sent to regional offices asking for data from countries to maintain this database.

### *Weekly national level data for meningitis belt countries*

Since the end of 1997, WHO has been receiving weekly reports of the number of cases and deaths per country in the African meningitis belt during the meningitis season. Outside the meningitis season reporting is once every two weeks. This includes zero reporting.[1]

[1] Zero reporting means that if there are no cases during a particular period, instead of sending no report, a report is sent indicating that zero cases were identified.

### *Local level data on specific epidemics*

Since 1992, WHO country offices, Médecins Sans Frontières, the United Nations Children's Fund, International Federation of Red Cross and Red Crescent Societies, and other non-governmental Organizations have been sending data to WHO on local outbreaks of meningococcal disease mainly to justify appeals for vaccination supplies. This data is often on district or county level, and sometimes includes age and sex breakdowns. Population data for calculating rates is sometimes available, especially for requests to the ICG. Supplementary information on specific outbreaks is available at WHO, but is not presented in this chapter.

## Strengths and weaknesses of the data

### *Annual national level data*

Since meningococcal disease is an epidemic disease with long cycles between epidemics, it is important to have data over a long period of time to be able to monitor major trends. The data presented here on the annual number of cases and deaths for each country has been collected for over 30 years and is an adequate time period for broadly monitoring major changes in epidemic patterns. Despite some incompleteness, the fact that the data were supplemented by official publications makes it unlikely that major outbreaks have been completely unreported. The data are relatively complete for the African and Eastern Mediterranean regions, but there are other parts of the world where data reporting is less complete. One reason for this is that in many countries meningococcal disease is relatively rare and not notifiable. Other reasons for non-reporting include a reluctance to report for economic reasons.

### *Weekly national level data for meningitis belt countries*

These data provide more detailed information about the timing of the epidemics than the annual data; however, the data have only been collected for two years – so they provide a very short time series.

### *Case definitions*

There are differences in the case definitions used for reporting; some countries report cases comprising both viral and bacterial meningitis, others report bacterial meningitis only; some countries only report laboratory confirmed cases whilst others also report suspected cases. These differences in reporting make it difficult to compare countries.

There are a number of aspects for surveillance which are missing from the data set. For example, it is difficult to trace the spread of different strains of meningococcal diseases because data on strains is not collected systematically. Likewise the data set is not comprehensive enough to study the effects of factors such as mass migration, climate, herd immunity, antimicrobial resistance and vaccination.

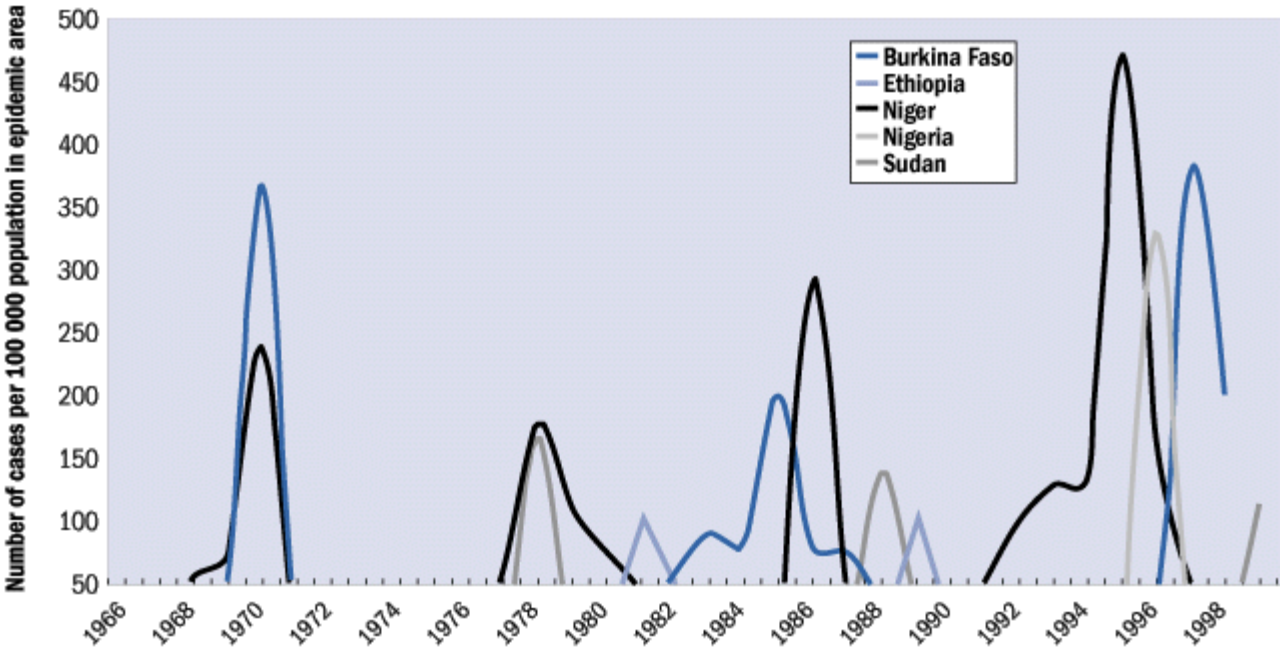
The weekly national level reporting for the meningitis belt in Africa, which has been going on for the last two years is a very promising development. The reporting system is more timely, and provides more detailed and more comparable data than previously available. It makes it possible to follow the control of an epidemic. This system needs to be continued, and further strengthened.

# Trends

## *Incidence*

- China and Nigeria (Table 5.1) reported the highest number of cases between 1966 and 1998. Almost all major epidemics in terms of numbers of cases in this period occurred in the meningitis belt. Poland (27 569 cases in 1972), India, the Russian Federation and China (over 100 000 cases in 1979 and 1980), are among the countries that had high numbers of cases and are located outside the meningitis belt.
- The length of the epidemic cycles are not the same for all countries in the meningitis belt (Fig. 5.1), Niger and Nigeria: 8-9 years, Burkina Faso: 10-15 years, Sudan: 10 years.
- The last two epidemics in Ethiopia were proceeded within two to three years by an epidemic in Sudan (Fig. 5.1). It is expected that Ethiopia will soon have an outbreak of meningococcal disease, given the outbreak of Sudan in 1999.

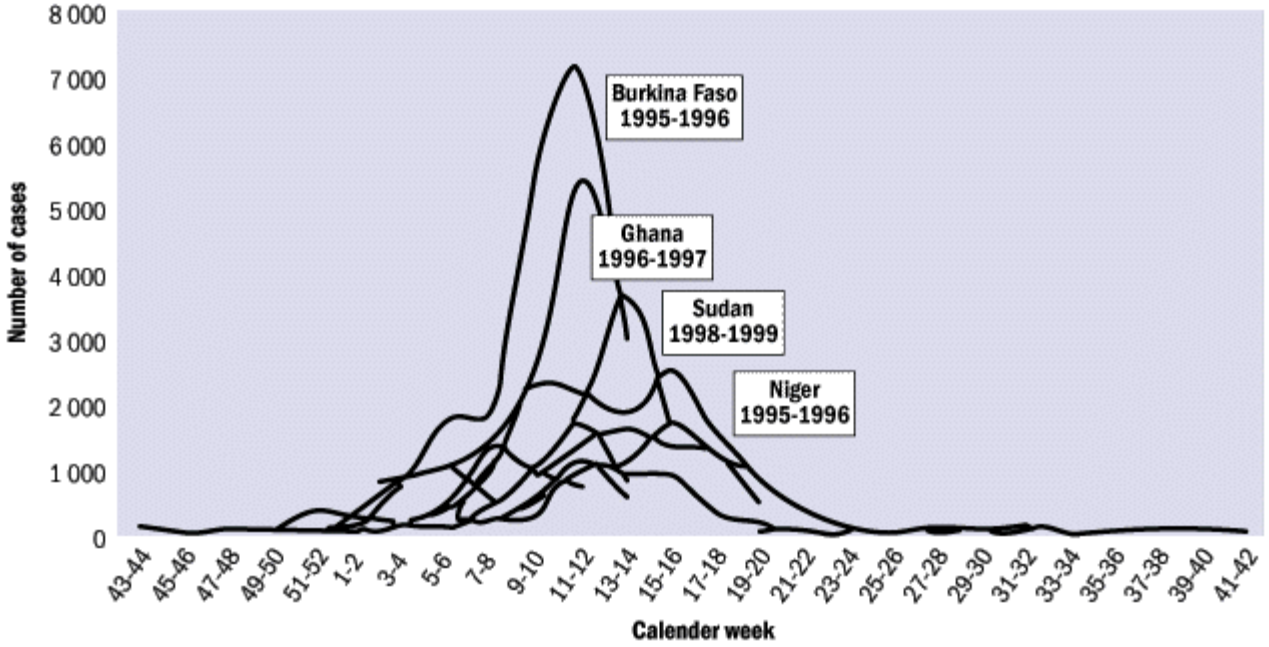
**Fig. 5.1 Epidemic cycles, meningococcal disease for selected African countries,1996-1999**




## *Epidemics*

- The number of cases in the years immediately proceeding and following large epidemics are often elevated and sometimes reach epidemic levels. An example of this is Burkina Faso in the 1980s (Table 5.1 and Fig. 5.1).
- Some reports arrive late, when there are already a considerable number of cases. For example, Burkina Faso started reporting to WHO when there were already 383 cases (1996). An efficient early warning system would detect an elevated number of cases in the early stage of an epidemic (Fig. 5.2).

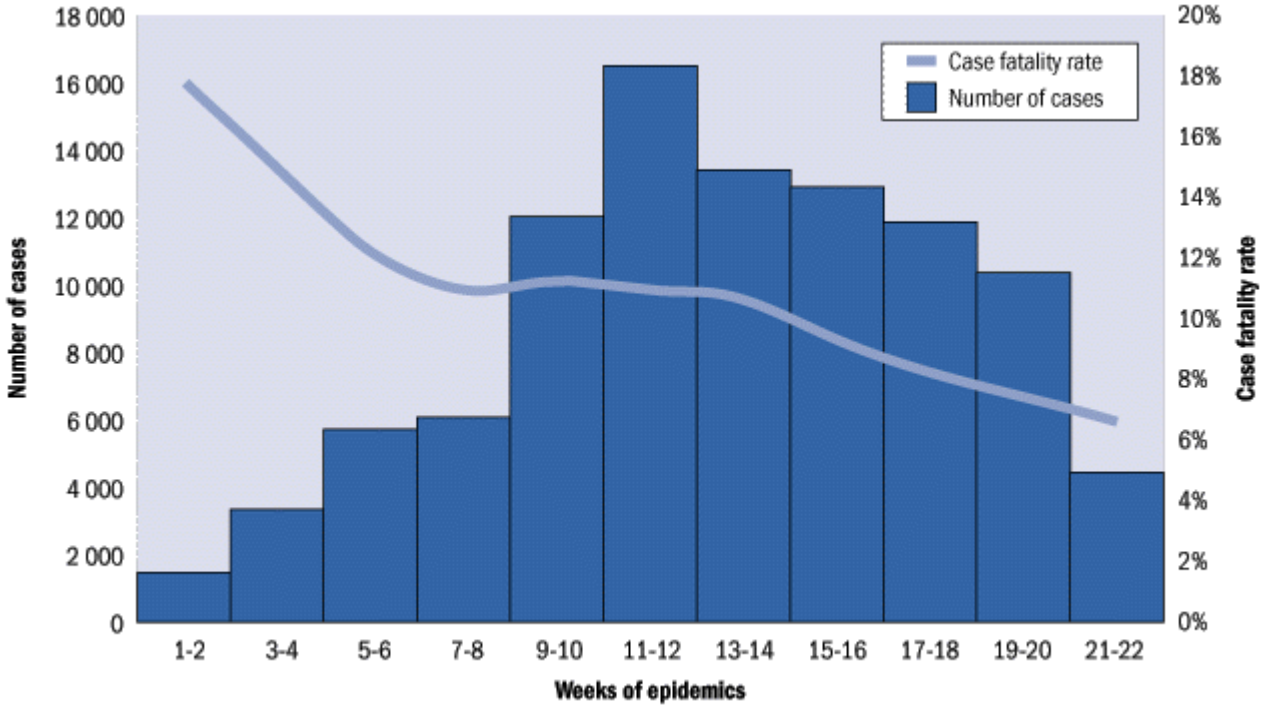
**Fig. 5.2 Seasonality of epidemics of meningococcal disease, reported number of cases per calendar week for selected epidemics in Africa, 1995-1999**




## *Deaths*

- The reported case fatality rate is higher in the beginning of an epidemic than at the end. Apart from a genuine change caused by better treatment, a major reason for this is a change in reporting practices. At the start of an epidemic there is a tendency for underreporting of less severe cases and the reverse as the epidemic progresses (Fig. 5.3).

**Fig. 5.3 Number of cases and case fatality rate of meningococcal disease outbreaks (n=22) in selected meningitis belt countries, 1993-1999**



## Conclusions

1. The number and intensity of epidemics of meningococcal disease in the meningitis belt has been increasing since the late 1970s with many large epidemics affecting tens of thousands of people.
2. Endemic bacterial meningitis is a major public health problem of at least equal proportions[2] to epidemic disease that is often neglected. It is most common in children; 50-60% of all cases of endemic meningococcal disease occur in children 3 months to 5 years old.
3. The epidemiology of meningococcal disease is complex, and although we have some knowledge about risk factors for epidemics, much more needs to be learned about disease transmission in order to develop effective strategies for prevention.

## References

### *Publications and Documents*

*International Co-ordinating Group (ICG) on vaccine provision for epidemic meningitis control. Summary report of the forth meeting*, World Health Organization,2000, WHO/EMC/DIS/ICG/2000.2.

*International Co-ordinating Group (ICG) on vaccine provision for epidemic meningitis control. Summary report of the forth meeting*, World Health Organization,1999, WHO/EMC/DIS/ICG/99.1.

*International Co-ordinating Group (ICG) on vaccine provision for epidemic meningitis control. Summary report of the third meeting*, World Health Organization,1998, WHO/EMC/DIS/ICG/98.1.

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Tikhomirov E., Santamaria M. and Esteves K, Meningococcal disease: public health burden and control, *World Health Statistics Quarterly*, 1997, 50, 170-177.

Response to epidemic meningitis in Africa, 1997. Report by IFRC-MSF-UNICEF-WHO to the International Co-ordinating Group (ICG), World Health Organization, 1997, EMC/DIS/ICG/97.8.

Lapeyssonnie, L. La méningite cérébrospinale en Afrique. *Bulletin of the World Health Organization*, 1963, 28 (supplement):3-114.

*Control of epidemic meningococcal disease, WHO practical guidelines*, World Health Organization, 1998, WHO/EMC/BAC/98.3

### *Web pages*

Meningococcal disease fact sheet:
http://www.who.int/inf-fs/en/fact105.html

Meningococcal disease in Disease Outbreak News:
http://www.who.int/emc/outbreak_news/disease_indices/men_index.html

WHO Meningitis web pages:
http://www.who.int/health-topics/meningitis.htm

[2] Estimates in the WHO practical guidelines *Control of epidemic meningococcal disease* indicate that at least 1.2 million endemic cases of meningococcal disease occur each year and that 135 000 of these patients die.

Number of cases and deaths reported to WHO 1998:
http://www.who.int/emc/diseases/meningitis/1998meningtable.html

Number of cases and deaths reported to WHO 1999:
http://www.who.int/emc/diseases/meningitis/1999meningtable.html

Number of cases and deaths reported to WHO 2000:
http://www.who.int/emc/diseases/meningitis/2000meningtable.html

## Table 5.1 Cases of meningococcal disease reported to WHO and number of countries reporting, 1966-1999

| Africa | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Algeria | | | 1,330 | 1,356 | 1,939 | 1,657 | 1,739 | 1,264 | 996 | 1,211 | 847 | | 993 | 2,821 | 829 | | |
| Angola | 95 | 83 | 107 | 104 | 147 | 215 | 133 | 132 | 138 | | | 1,151 | 33 | 130 | 361 | 32 | |
| Benin | 415 | 847 | 1,222 | 1,767 | 1,366 | 1,333 | 1,074 | 485 | 374 | 287 | 272 | 400 | 479 | 214 | 253 | 270 | 247 |
| Botswana | 14 | | | | | | | | | 4 | | 34 | 72 | 0 | 111 | 102 | 97 |
| Burkina Faso | 1,259 | 1,010 | 962 | 3,045 | 19,960 | | 2,921 | 2,301 | 1,317 | 1,321 | | 1,092 | 1,359 | 1,813 | 1,867 | 4,231 | 6,675 |
| Burundi | 46 | 98 | 118 | 7 | 22 | | 14 | 44 | 31 | 41 | | 34 | 58 | 718 | 43 | 76 | 58 |
| Cameroon | 395 | 1,708 | 532 | 248 | 264 | 114 | 3,071 | 2,003 | 26 | | | 265 | 819 | | 746 | 1,503 | 1,688 |
| Cap Verde | 1 | 1 | 2 | | | 0 | | 80 | 76 | | 10 | 0 | 10 | 10 | 29 | 7 | 17 |
| Central African Republic | 144 | 241 | 354 | 401 | 384 | 230 | 392 | 192 | 320 | 401 | 158 | 232 | 217 | 204 | 226 | 202 | 209 |
| Chad | 575 | 657 | 785 | 287 | 3,721 | 672 | 4,868 | 2,376 | 2,289 | 1,486 | 791 | 1,594 | 439 | 82 | 0 | 17 | 84 |
| Comoros | | | | | 25 | 34 | 4 | | | | | | | | | | |
| Congo | 17 | 15 | 22 | 41 | 41 | 103 | 102 | 103 | 78 | 57 | 118 | 171 | 198 | 209 | 160 | 88 | 7 |
| Cote d'Ivoire | 216 | 341 | 275 | 341 | 351 | 148 | 154 | | 30 | | | | 44 | 96 | | 67 | 51 |
| Dem. Rep. of the Congo | 191 | 329 | 549 | | 345 | 552 | | 1,705 | 563 | | | 1,149 | 945 | 1,975 | 1,036 | 563 | 797 |
| Djibouti | 41 | 24 | 0 | 2 | 9 | 11 | 24 | 21 | 38 | 18 | 36 | 11 | 37 | 19 | | | |
| Egypt | 514 | 204 | 264 | | 239 | 302 | 285 | 1,185 | 6,777 | 492 | 330 | 245 | 319 | 294 | 296 | 812 | 2,061 |
| Equatorial Guinea | 5 | 0 | | 62 | | | | | | | | | | | | | |
| Eritrea | | | | | | | | | | | | | | | | | |
| Ethiopia | 205 | 222 | 252 | 126 | | | | | 398 | 603 | 1,188 | 1,296 | 430 | 70 | 4,002 | 38,698 | 8,168 |
| Gabon | 42 | 31 | 42 | 30 | 13 | | 51 | 71 | 70 | | | 290 | 90 | 196 | 66 | 7 | 188 |
| Gambia | 85 | 668 | 154 | 73 | 52 | 60 | 31 | 39 | 18 | | 10 | 87 | 316 | 40 | 95 | 63 | |
| Ghana | 122 | 79 | 27 | … | … | 629 | 912 | 617 | 784 | 455 | 101 | 401 | 190 | 225 | 441 | 501 | 302 |
| Guinea | 71 | | 173 | 26 | 77 | 145 | 25 | 179 | 139 | | 17 | 26 | 21 | 15 | | 13 | 168 |
| Guinea-Bissau | 7 | 3 | 7 | 13 | 1 | 8 | 6 | 13 | 7 | | 224 | 47 | 30 | 19 | 11 | 37 | 14 |
| Kenya | 256 | 232 | 153 | 216 | 127 | 83 | 36 | 97 | | | 507 | 1,557 | 1,640 | 1,625 | 1,013 | 1,355 | 537 |
| Lesotho | 14 | 15 | 45 | 29 | | 2 | | | 13 | | 40 | 64 | | | | 51 | |
| Liberia | 12 | | | 0 | | | | 18 | 23 | | | 181 | 235 | 132 | 145 | 214 | 204 |
| Libyan Arab Jamahiriya | 405 | 343 | | 39 | 117 | 159 | 138 | 87 | 449 | 274 | 66 | 13 | 31 | 21 | 11 | 10 | 7 |
| Madagascar | 43 | 134 | 109 | 156 | 100 | 177 | 14 | 3 | | 0 | 13 | 0 | 2 | | | 8 | |
| Malawi | | 108 | | | 245 | 184 | | | | | | 2,451 | | | | 1,030 | |
| Mali | 329 | 276 | 752 | 13,228 | 4,573 | 1,813 | 628 | 1,005 | 416 | | 233 | 267 | 248 | 432 | 391 | 4,601 | 2,936 |
| Mauritania | 21 | | | 177 | 158 | 152 | 10 | | 106 | 44 | 34 | 1 | 1 | | | | |
| Mauritius | 1 | 1 | 3 | 4 | 1 | 1 | 1 | 0 | | 0 | | 0 | 0 | 0 | 0 | 0 | 0 |
| Morocco | 6,336 | | | 1,876 | 945 | 475 | 557 | 619 | 408 | 580 | 507 | 505 | 567 | 619 | 680 | 715 | 677 |
| Mozambique | 33 | 33 | 93 | 139 | 89 | 74 | 114 | 94 | 60 | 119 | 39 | 136 | 272 | 254 | 243 | 193 | 166 |
| Namibia | | | | | | | | | | | | | | | | | |
| Niger | 947 | 453 | 2,231 | 3,074 | 9,907 | | 2,233 | | | | 1,172 | 3,034 | 9,245 | 6,011 | 4,203 | 2,567 | 995 |
| Nigeria | 5,799 | 2,116 | 1,861 | 4,291 | 9,712 | 7,897 | 5,365 | 38 | | | | 13,496 | 37,090 | 3,515 | 1,605 | 461 | 1,092 |
| Reunion (France) | 4 | 3 | 1 | 1 | 8 | 13 | 9 | 5 | 7 | | 4 | 4 | 15 | 14 | 6 | 16 | 12 |
| Rwanda | 56 | 36 | 30 | 41 | 15 | 75 | 8 | 59 | 49 | 18 | | 8 | 3,165 | 5,169 | 1,447 | 658 | 162 |
| Sao Tome and Principe | 11 | 8 | 7 | | | 3 | | | | | | 0 | 1 | 4 | 1 | | |

## Table 5.1 Cases of meningococcal disease reported to WHO and number of countries reporting, 1966-1999

| Africa | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Senegal | 351 | 1,655 | 1,477 | 1,363 | 2,624 | 1,322 | 1,131 | 368 | 445 | 367 | 247 | 363 | 377 | 358 | 336 | 360 | 960 |
| Seychelles | | | | | | | | | | | | 0 | | 0 | | 0 | 3 |
| Sierra Leone | 349 | 27 | 14 | | 15 | 16 | 3 | 17 | | | | | 1 | 287 | 229 | 10 | |
| Somalia | | | | | | | | | | | | | | | | | |
| South Africa | 878 | 1,994 | 2,135 | 1,934 | 1,490 | | 2,080 | | | | | | | | | | |
| Sudan | 2,914 | | 6,607 | 5,662 | 2,774 | | 4,231 | | | 179 | 1,151 | 522 | 29,170 | 141 | 4,447 | 1,650 | 1,025 |
| Swaziland | 8 | 9 | 6 | 7 | 20 | 15 | 17 | 16 | 85 | 27 | 31 | | | | | | |
| Togo | 174 | 199 | 145 | 112 | 87 | 397 | 1,017 | 526 | 524 | | 245 | 840 | 619 | 326 | 213 | 28 | 119 |
| Tunisia | | 96 | 215 | 167 | 162 | 403 | 529 | 729 | 376 | 407 | 189 | 126 | 174 | 153 | 132 | 150 | 216 |
| Uganda | 51 | 41 | 46 | 32 | 32 | 122 | 24 | 118 | 118 | 194 | | 2,098 | 668 | 81 | 372 | 124 | 127 |
| United Rep.of Tanzania | 213 | 316 | 254 | 264 | 391 | | | | 124 | | | | 6,412 | | | 124 | 679 |
| Zambia | 72 | | | | | | | | | 257 | | 164 | 498 | 265 | 285 | 458 | 519 |
| Zimbabwe | 8 | 8 | 9 | 14 | 90 | 93 | 84 | 64 | 80 | | | | | 29 | 32 | 28 | 49 |
| Total no. of cases | 23,745 | 14,664 | 23,370 | 40,755 | 62,638 | 19,689 | 34,035 | 16,673 | 17,752 | 8,842 | 8,580 | 34,355 | 97,530 | 28,586 | 26,363 | 62,100 | 31,316 |
| No. of countries reporting | 46 | 41 | 41 | 40 | 41 | 38 | 39 | 36 | 36 | 25 | 28 | 42 | 43 | 41 | 38 | 43 | 37 |

## Table 5.1 Cases of meningococcal disease reported to WHO and number of countries reporting, 1966-1999

| Africa | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Algeria | 970 | 1,148 | 1,335 | 786 | 834 | 545 | 818 | 722 | 267 | 529 | 549 | 483 | … | … | 6 | 418 | 1,337 |
| Angola | | | 71 | 173 | 321 | 318 | 658 | 823 | 1,106 | 1,440 | 2,260 | 3,310 | 1,007 | | | 1,266 | 29 |
| Benin | 274 | 220 | 543 | 464 | 752 | 437 | 2,499 | 425 | 688 | | 2,146 | 1,377 | 1,294 | 1,775 | 442 | 1,115 | 346 |
| Botswana | 92 | 25 | 38 | | 18 | 25 | 30 | 83 | 97 | | | | | | | | 35 |
| Burkina Faso | 6,286 | 15,811 | 6,445 | 6,367 | 2,546 | 4,289 | 3,778 | 2,499 | 2,057 | 2,034 | 2,094 | 823 | 2,595 | 42,129 | 22,305 | 5,629 | 3,215 |
| Burundi | 108 | 58 | 15 | 59 | 43 | 67 | 92 | 37 | 546 | 2,739 | | 42 | | 138 | 33 | 91 | 71 |
| Cameroon | 2,622 | 1,486 | 1,549 | 1,457 | 625 | 1,838 | 2,086 | 2,684 | 2,625 | 27,752 | 5,372 | 578 | | 178 | 572 | 2,887 | 2,272 |
| Cap Verde | 7 | 3 | | | | 41 | 30 | 89 | 41 | 40 | 204 | 144 | | | | | |
| Central African Republic | 256 | 276 | 324 | 414 | 484 | 772 | 632 | 784 | 538 | 1,226 | 472 | | | 155 | 10 | 245 | 757 |
| Chad | 3,942 | 372 | 435 | 413 | 4,005 | 7,867 | 4,100 | 8,189 | 885 | 2,392 | 2,901 | 948 | 30 | 1,079 | 1,123 | 7,964 | 2,540 |
| Comoros | | | | | | 23 | | | | | | | | | | | 1 |
| Congo | | 44 | 7 | 4 | | 32 | 0 | 0 | | 0 | 0 | 0 | | | | | |
| Cote d'Ivoire | 11 | 52 | 618 | 22 | 70 | | | | | | | | | | 5 | 3 | 94 |
| Dem. Rep. Congo | 385 | 184 | 640 | 364 | 615 | 1,229 | | 88 | | | 102 | | 48 | 86 | 1,327 | 1,991 | 3,200 |
| Djibouti | | | | | | 64 | 68 | 22 | 31 | 5 | | | | 47 | | 0 | |
| Egypt | 2,016 | 813 | 848 | 824 | 998 | 3,327 | 3,894 | 2,986 | 1,646 | 1,165 | 896 | 800 | 671 | 661 | 156 | 489 | 402 |
| Equatorial Guinea | 4 | 18 | | | | | | | | | | | | | | | |
| Eritrea | | | | | | | | | | | | | | | 7 | 1 | 3 |
| Ethiopia | 867 | 214 | 378 | 513 | 458 | 359 | 48,139 | 2,537 | | | 78 | | 247 | 771 | | | 175 |
| Gabon | 53 | 92 | 13 | | 225 | | 169 | 135 | | | | | | | | | |
| Gambia | 1,109 | 47 | 38 | 44 | 30 | 43 | 86 | 49 | | | | | | | 1,390 | | |
| Ghana | 3,574 | 4,024 | 4,912 | 1,548 | 1,378 | 848 | 759 | 530 | 578 | 1,542 | 1,564 | 2,173 | 26 | 479 | 19,055 | 1,049 | 527 |
| Guinea | | 243 | 189 | 313 | 307 | 811 | 565 | 799 | 829 | 403 | 1,578 | 2,130 | 238 | 89 | 51 | 58 | 507 |
| Guinea-Bissau | | | 0 | | 0 | | 68 | | | | | 30 | | | | 114 | 2,836 |
| Kenya | 949 | | | | | 784 | 3,800 | | | | | | | | | | 146 |
| Lesotho | 21 | | | | | 9 | | | | | | | | | | | 0 |
| Liberia | 125 | 92 | 86 | | 121 | | | | | | 135 | 640 | | | | 101 | 114 |
| Libyan Arab Jamahiriya | 33 | 4 | 6 | 4 | 6 | 5 | 14 | 28 | 15 | 25 | 68 | | | | | 0 | |
| Madagascar | | | | | | | | | | | | | | | | | |
| Malawi | | | | | 600 | 148 | 2,972 | | | | | | | 269 | | | |
| Mali | 1,235 | 842 | 1,247 | 1,186 | 658 | 269 | 1,110 | 1,054 | | | | | 1,199 | 7,254 | 11,228 | 2,704 | 1,038 |
| Mauritania | 79 | 192 | 316 | … | 193 | 184 | 107 | 48 | 197 | 23 | 34 | | | 0 | 32 | 18 | 259 |
| Mauritius | 7 | 3 | 2 | 3 | 7 | 8 | 28 | 2 | 4 | 1 | 0 | 2 | | | 1 | | |
| Morocco | 943 | 886 | 616 | 629 | 720 | 1,348 | 1,802 | 826 | 529 | 226 | 405 | 462 | 341 | 349 | 217 | 439 | 96 |
| Mozambique | 112 | 64 | 9 | 242 | 76 | 140 | 94 | 65 | 87 | | | | 34 | 5,291 | 1,276 | 462 | 255 |
| Namibia | | | | | | | | | 130 | 364 | 104 | 2,773 | 76 | | | | |
| Niger | 1,377 | 2,136 | 1,133 | 20,140 | 3,383 | 2,437 | 4,353 | 2,262 | 4,208 | 8,171 | 11,025 | 11,838 | 43,203 | 16,145 | 4,910 | 2,328 | 5,510 |
| Nigeria | 507 | 719 | 752 | 15,548 | 13,609 | 8,059 | 8,689 | 6,842 | 6,991 | 6,418 | 4,209 | 5,298 | 7,376 | 108,568 | 3,229 | 5,948 | 1,946 |
| Reunion (France) | 3 | 4 | 7 | 3 | 13 | 3 | | 2 | | | | | | | | | |
| Rwanda | 150 | 221 | 51 | 195 | 158 | 182 | 384 | 180 | | 1,100 | 1,560 | | | | 10 | 291 | 62 |
| Sao Tome and Principe | 13 | 12 | 5 | 3 | 2 | | 2 | … | | | | | | | | 0 | |

## Table 5.1 Cases of meningococcal disease reported to WHO and number of countries reporting, 1966-1999

| Africa | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Senegal | 3,712 | | 512 | 825 | 98 | 20 | 2 | … | | | 0 | 0 | 41 | 11 | 13 | 977 | 4,939 |
| Seychelles | 8 | 9 | 12 | 13 | 15 | 3 | 12 | 5 | 16 | 6 | 10 | 7 | | | | | |
| Sierra Leone | 4 | 18 | 168 | | | | | | | | | | 157 | | | | 8 |
| Somalia | 32 | 7 | 3 | 16 | | 22 | 106 | | | | | | | | | 0 | |
| South Africa | 612 | 588 | 528 | 501 | 664 | 934 | 873 | 850 | 760 | 510 | 87 | | | | | | |
| Sudan | 3,028 | 541 | 317 | 452 | 443 | 32,016 | 7,051 | 1,326 | 737 | 716 | 1,147 | 391 | 276 | 340 | 297 | 697 | 33,313 |
| Swaziland | 50 | | | | | | | | | | | | | | | | |
| Togo | 332 | 237 | 243 | 333 | 554 | 171 | 884 | 158 | | | 339 | 228 | 619 | 693 | 3,262 | 335 | 249 |
| Tunisia | 717 | 631 | 676 | 972 | 1,557 | 699 | 580 | 459 | 430 | 451 | 422 | 325 | 278 | | | 0 | |
| Uganda | 1,804 | 97 | | | | 90 | 1,501 | 3,498 | 1,529 | 1,079 | 1,230 | | | | | | |
| United Rep.of Tanzania | | | | | | 0 | 1,249 | 686 | 6,923 | 4,279 | 2,289 | | | 1,286 | 194 | | 372 |
| Zambia | | | 178 | 180 | 1,508 | 1,480 | 1,426 | 1,772 | 3,272 | 3,622 | 2,092 | | | 1,897 | 130 | 122 | 100 |
| Zimbabwe | 113 | 81 | 445 | | 43 | 33 | 77 | 31 | 118 | 29 | | | | | 58 | 77 | 10 |
| Total no. of cases | 38,542 | 32,514 | 25,710 | 55,010 | 38,137 | 71,979 | 105,587 | 43,575 | 37,880 | 68,287 | 45,372 | 34,802 | 59,756 | 189,690 | 71,339 | 37,819 | 66,764 |
| No. of countries reporting | 42 | 40 | 41 | 34 | 39 | 43 | 42 | 38 | 30 | 29 | 32 | 24 | 20 | 24 | 28 | 33 | 35 |

## Table 5.1 Meningococcal disease, cases reported to WHO and number of countries reporting, 1966-1999

| The Americas | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Antigua and Barbuda | | | | | | | | | | 2 | | | | | | | | |
| Bahamas | | | | | | | | | | | | | | 2 | | | | |
| Barbados | | 2 | | | | 2 | 1 | | | | | 1 | | | | | | |
| Belize | | 4 | | | | | 7 | 4 | 4 | 1 | 3 | | | | | | | |
| Bermuda | | | | | | | | | 2 | | | | | | | | | |
| Bolivia | 6 | 3 | | | | | | | | 11 | | | | | | | | |
| Brazil | | | | | | | | | | | | | | | | | | |
| Canada | 51 | 58 | 56 | 99 | 145 | 154 | 252 | 270 | 224 | 268 | 241 | 241 | 347 | | | | | |
| Cayman Islands | | | | | | | | | | | | | | | 0 | 0 | 1 | 0 |
| Chile | 171 | 97 | | | | | | | | 28 | 37 | 46 | 64 | 202 | 151 | 222 | 162 | 107 |
| Colombia | 307 | 313 | 327 | | | | | | | 86 | 386 | 623 | 372 | 262 | 266 | 293 | 201 | 220 |
| Costa Rica | | | | | | | | | | 16 | 5 | 8 | 1 | | 4 | | | |
| Cuba | 15 | 15 | 15 | 37 | 40 | 38 | | 27 | 41 | 31 | 72 | 78 | 185 | | 560 | | | |
| Dominica | | | | | | | | | | | | | 4 | | | | | |
| Ecuador | | | | | | | | 5 | 3 | | | 14 | | | 13 | | | |
| El Salvador | | | | | | | | | | | | | | | | | | |
| French Guiana | | | | | | 1 | | | | 2 | 3 | 2 | 2 | | | | | |
| Grenada | | | | | | | | | | | | | 3 | | | | | |
| Guadeloupe | 1 | | | | | | 2 | 7 | 4 | 3 | | 6 | | | | | | |
| Guatemala | | | | | | | | | | | | | | | 2 | | | |
| Haiti | | | | | 70 | 40 | 26 | | 176 | 47 | 51 | | 43 | 1 | | | | |
| Honduras | | | 42 | 48 | | | | | | | | | | | 5 | 6 | 3 | 4 |
| Jamaica | 8 | 6 | | | | 9 | 39 | 27 | 20 | 2 | | | | | | | | |
| Martinique | | | | | | | | 1 | | | | | | | | | | |
| Mexico | | | | | | | | | | | 11 | 4 | 6 | 4 | | | | |
| Nicaragua | | | | | | | | | | | | | | | | | | |
| Panama | 2 | 6 | 2 | 10 | 5 | 5 | 4 | 1 | 2 | 1 | 7 | 11 | | | 15 | 14 | 10 | 19 |
| Paraguay | 18 | 15 | | 45 | 29 | | 54 | 95 | 65 | 133 | 101 | 51 | 10 | 59 | 69 | 60 | 15 | 13 |
| Peru | 103 | 53 | | 70 | 101 | 89 | | 75 | 192 | 122 | 181 | 169 | 98 | 213 | 170 | | | |
| Puerto Rico | 20 | 15 | 20 | 29 | 5 | 14 | 5 | 13 | 6 | | | | 13 | 10 | 13 | | | |
| Saint Kitts and Nevis | | | | | | 1 | 1 | 1 | | 1 | | | | | | | | |
| Suriname | | | | | | | | | | | | | | | 4 | | | |
| Trinidad and Tobago | 4 | | 1 | | | | 3 | 1 | | | | | | | | | 6 | 1 |
| Turks and Caicos Islands | | | | | | | | | | | | | | 2 | | | | |
| United States of America | 3,381 | 2,161 | 2,623 | 2,951 | 2,505 | 2,262 | 1,323 | 1,378 | 1,346 | 1,478 | 1,605 | 1,828 | 2,505 | 2,724 | 2,840 | 3,525 | 3,056 | 2,736 |
| Uruguay | 5 | 3 | 3 | | 4 | 2 | 492 | 530 | 85 | 278 | 336 | 63 | 52 | 22 | 27 | 17 | 24 | 11 |
| Venezuela | 2 | 13 | 13 | 5 | | 8 | 12 | 16 | 15 | 20 | | | | | | | | |
| Total no. of cases | 4,094 | 2,764 | 3,102 | 3,294 | 2,904 | 2,625 | 2,221 | 2,451 | 2,185 | 2,530 | 3,039 | 3,145 | 3,705 | 3,501 | 4,139 | 4,137 | 3,478 | 3,111 |
| No. of countries reporting | 15 | 15 | 10 | 9 | 9 | 13 | 14 | 16 | 15 | 19 | 14 | 15 | 15 | 11 | 15 | 8 | 9 | 9 |

## Table 5.1 Meningococcal disease, cases reported to WHO and number of countries reporting, 1966-1999

| The Americas | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Antigua and Barbuda | | | | | | | | | | | | | | | |
| Bahamas | | | | | | | | | | | | | | | 3,114 |
| Barbados | | | | | | | | | | | | | | | |
| Belize | | | | | | | | | | | | | | | 1 |
| Bermuda | | | | | | | | | | | | | | | 0 |
| Bolivia | | | | | | | | | | | | | | | |
| Brazil | | | | | | | | | 702 | 863 | 971 | 1,106 | | | 149 |
| Canada | 221 | 202 | 248 | 299 | 319 | 419 | 429 | 419 | 443 | 379 | 334 | 281 | 185 | | 126 |
| Cayman Islands | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | | | | | |
| Chile | 98 | 137 | 125 | 151 | 176 | 230 | 257 | 322 | 391 | 490 | | | | | 536 |
| Colombia | 79 | 72 | 106 | 109 | 161 | 280 | 143 | 248 | 197 | 53 | | | | | 148 |
| Costa Rica | | | | | | | | | | | | | | | |
| Cuba | | | | | | | | | | | | | | | 42 |
| Dominica | | | | | | | | | | | | | | | |
| Ecuador | | | | | | | | | | | | | | | |
| El Salvador | | | | | | | | | | | | | | | 9 |
| French Guiana | | | | | | | | | | | | | | | |
| Grenada | | | | | | | | | | | | | | | |
| Guadeloupe | | | | | | | | | | | | | | | |
| Guatemala | | | | | | | | | | | | | | | 2 |
| Haiti | | | | | | | | | | | | | | | |
| Honduras | 11 | 10 | 4 | 7 | 4 | 7 | 3 | 5 | 3 | | | | | | 0 |
| Jamaica | | | | | | | | | | | | | | | |
| Martinique | | | | | | | | | | | | | | | |
| Mexico | | | | | | | | | | | | | | | 0 |
| Nicaragua | | | | | | | | | | | | | | | 55 |
| Panama | 15 | 25 | 19 | 71 | 86 | 103 | 112 | 54 | 40 | 31 | | | | | 20 |
| Paraguay | 28 | 14 | 6 | 9 | 8 | 8 | 5 | 12 | 25 | 17 | | | | | 7 |
| Peru | | | | | | | | | | | | | | | 84 |
| Puerto Rico | | | | | | | | | | | | | | | |
| Saint Kitts and Nevis | | | | | | | | | | | | | | | |
| Suriname | | | | | | | | | | | | | | | |
| Trinidad and Tobago | 1 | 0 | 0 | 2 | 1 | 1 | 3 | 2 | 6 | 4 | | | | | 13 |
| Turks and Caicos Islands | | | | | | | | | | | | | | | |
| United States of America | 2,746 | 2,479 | 2,594 | 2,930 | 2,964 | 2,727 | 2,451 | 2,130 | 2,134 | 2,637 | 2,886 | 3,243 | 3,437 | | 2,633 |
| Uruguay | 24 | 28 | 21 | 40 | 45 | 62 | 107 | 86 | 87 | | | | | | 12 |
| Venezuela | | | | | | | | 36 | 55 | 43 | 73 | | | | |
| Total no. of cases | 3,223 | 2,967 | 3,123 | 3,619 | 3,764 | 3,837 | 3,510 | 3,315 | 4,083 | 4,517 | 4,264 | 4,630 | 3,622 | | 6,951 |
| No. of countries reporting | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 11 | 12 | 10 | 4 | 3 | 2 | 0 | 19 |

## Table 5.1 Meningococcal disease, cases reported to WHO and number of countries reporting, 1966-1999

| Asia | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Afghanistan | 0 | | | | | | | | | | | | | | 3 | 3 | 9 |
| Bahrain | 51 | 2 | 21 | 38 | 1 | 13 | 1 | 10 | 18 | 10 | 6 | 3 | 2 | 4 | 1 | 2 | 3 |
| Bhutan | | | | | | | | | | | | | | | | | |
| Brunei Darussalam | | | | | | | 1 | | 1 | | 1 | | | | | | |
| Cambodia | | | | | | | | | | | | | | 10 | | | |
| China | | | | | | | | | | | | | | 109,304 | 108,774 | | |
| Cyprus | 12 | 7 | 17 | 2 | 6 | 1 | 9 | 5 | 1 | 2 | 6 | 1 | 0 | 0 | 3 | 2 | 1 |
| Hong Kong SAR | 10 | 55 | 32 | | 10 | 5 | 10 | 11 | 11 | 13 | 9 | 10 | 4 | 33 | 29 | 18 | 15 |
| India | | | | | | | | | | | | | | | | | |
| Iran (Islamic Republic of) | 3,985 | 5,977 | 3,585 | 3 | 285 | 853 | 807 | 540 | 1,446 | 858 | 250 | 571 | 1,467 | 176 | 108 | 400 | 412 |
| Iraq | 1,224 | 1,177 | 1,087 | 925 | 643 | 984 | 892 | 1,005 | 1,345 | 1,901 | 58 | 44 | 160 | 220 | 56 | 108 | 1,914 |
| Israel | 52 | 42 | 69 | 35 | 46 | 21 | 29 | 39 | 26 | 51 | 40 | 43 | 57 | 61 | 42 | 35 | 48 |
| Japan | 144 | 117 | 122 | | 72 | 49 | 58 | 45 | 27 | 33 | 33 | 42 | 28 | 25 | 24 | 23 | 15 |
| Jordan | 143 | 210 | 212 | 104 | 80 | 102 | 130 | 159 | 291 | 182 | 166 | 185 | 98 | 103 | 64 | 102 | 69 |
| Kuwait | 44 | 21 | | 12 | 1 | | | 15 | 115 | 31 | 17 | 20 | 10 | 0 | 5 | 3 | 4 |
| Kyrgyzstan | | | | | | | | | | | | | | | | | |
| Lao People's Dem. Republic | | | | | | | | | | | | | | | | | |
| Lebanon | 150 | 188 | 130 | 85 | 68 | | | 39 | | | | | | | | 1 | 1 |
| Macao SAR | | 20 | 5 | | | | 2 | | | | | | | 0 | 5 | 0 | |
| Malaysia | | | | | | | | | | | | | 15 | | 86 | | |
| Maldives | | | | | | | | | | | | | | | | | |
| Mongolia | | | | | | | | | 2,765 | | | | | | 359 | 502 | 634 |
| Myanmar | | | | | | | | 36 | | | | | | | | 8 | |
| Nepal | | | | | | | | | | | | | | | | | |
| Oman | | | | | | | | | | 88 | 75 | 24 | 52 | 32 | 34 | 40 | 0 |
| Pakistan | | | | | | 597 | 451 | 516 | 222 | 374 | 471 | 391 | 1,583 | 2,804 | 2,042 | 1,188 | 1,097 |
| Philippines | 1,091 | 816 | 840 | 212 | 635 | 909 | 846 | 1,198 | | | | | | | | | |
| Qatar | | 11 | 5 | 4 | 3 | 6 | 10 | | | | | | 5 | 0 | | 0 | |
| Republic of Korea | | 9 | 15 | 3 | 4 | 7 | | | 2 | | 2 | | | | 3 | | |
| Saudi Arabia | | | | | | | | | | 850 | 353 | 216 | 160 | 107 | 169 | 146 | 165 |
| Singapore | | | | | | | 3 | | | | | | | | | | |
| Sri Lanka | | | | | | | | | | | | | | | | | |
| Syrian Arab Republic | | 1 | 6 | 0 | 1 | 1 | 3 | 6 | 4 | 13 | 6 | 10 | 16 | 21 | 253 | 195 | 213 |
| Thailand | | | | | | | | 7 | 19 | 25 | 41 | 33 | 32 | 26 | 25 | 21 | 13 |
| Turkey | | | | | | | | | | | | | | | 509 | 1,027 | 1,354 |

## Table 5.1 Meningococcal disease, cases reported to WHO and number of countries reporting, 1966-1999

| Asia | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| United Arab Emirates | | | | | | | | | | 28 | 5 | 15 | | 29 | 62 | 90 | 55 |
| Viet Nam | 83 | | | | | | 836 | | | | | 5,477 | | 1,988 | 2,627 | 1,559 | 1,087 |
| West Bank and Gaza Strip | | | | | | | | | | | | | | | | | |
| Yemen | | | | | | | | | | 61 | | 325 | 152 | | 946 | 593 | 243 |
| Total no. of cases | 6,989 | 8,653 | 6,146 | 1,423 | 1,855 | 3,548 | 4,088 | 3,631 | 6,293 | 4,520 | 1,539 | 7,410 | 3,841 | 114,943 | 116,229 | 6,066 | 7,352 |
| No. of countries reporting | 13 | 15 | 14 | 12 | 14 | 13 | 16 | 15 | 15 | 16 | 17 | 17 | 17 | 20 | 24 | 24 | 21 |

| Oceania | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Samoa | | | | 1 | 1 | | | | 1 | | | | | 12 | 11 | 9 | 2 |
| Australia | | | | | | | | | | | | | | 84 | 71 | 53 | 54 |
| Cook Islands | | | | | | | | | | | | | | | 17 | 11 | 1 |
| Fiji | | | | 73 | 83 | | | | | | | | 1 | 131 | 103 | 112 | 66 |
| French Polynesia | 3 | 1 | | | | 5 | | | | | | 1 | 4 | 80 | 108 | 167 | 135 |
| Guam | | | | | | | | | | | | 1 | 1 | 20 | 22 | 7 | 15 |
| Kiribati | | | | | | | | | | | | | | 14 | 81 | 23 | 30 |
| Marshall Islands | | | | | | | | | | | | | | | | | |
| Micronesia (Fed. States of) | | | | | | | | | | | | | | 17 | 19 | 6 | 10 |
| Nauru | | | | | | | | | | | | | | 1 | 0 | 2 | 0 |
| New Caledonia | 6 | | | 14 | 36 | | | | | | | | | 28 | 2 | 0 | 7 |
| New Zealand | 162 | 157 | 74 | 46 | 39 | 23 | 41 | 33 | 38 | 54 | | | | 48 | 26 | 19 | 12 |
| Niue | | | | | | | | | | | | | | 0 | 1 | | 0 |
| Northern Mariana Islands | | | | | | | | | | | | | | | | | |
| Palau | | | | | | | | | | | | | | | | | |
| Papua New Guinea | | | | | | | | | | | | | | | | | |
| Samoa | | | | | | | | | | | | 30 | 38 | 4 | 20 | 4 | 29 |
| Solomon Islands | | | | | | | | | | | | | | 14 | 1 | 0 | |
| Tokelau | | | | | | | | | | | | | | 1 | 0 | | 0 |
| Tonga | | | 3 | | | | | 16 | | | 1 | | | 2 | 20 | 0 | 0 |
| Tuvalu | | | | | | | | | 37 | 9 | 39 | | | 0 | 6 | 6 | 6 |
| Vanuatu | 1 | 2 | | | | | | | | | | | | 5 | 18 | 2 | 4 |
| Wallis and Futuna | | | | | | | | | | | | | | 0 | 0 | 2 | |
| Total no. of cases | 172 | 160 | 77 | 134 | 159 | 28 | 41 | 49 | 76 | 63 | 40 | 32 | 44 | 461 | 526 | 423 | 371 |
| No. of countries reporting | 4 | 3 | 2 | 4 | 4 | 2 | 1 | 2 | 3 | 2 | 2 | 3 | 4 | 18 | 19 | 17 | 17 |

## Table 5.1 Meningococcal disease, cases reported to WHO and number of countries reporting, 1966-1999

| Asia | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Afghanistan | | 16 | | 331 | 218 | 388 | 426 | | | | | | | | | 27 |
| Bahrain | 4 | 4 | 6 | 3 | 27 | 5 | 4 | 4 | 0 | 10 | 1 | 2 | 0 | 8 | | 15 |
| Bhutan | | | | 188 | | | | | | | | | | | | |
| Brunei Darussalam | | | | | | | | | | | | | 3 | | | |
| Cambodia | | | | | | | | | | | | | | | | |
| China | | | | | | | | | | | 5,000 | 5,863 | 5,771 | 5,730 | 4,751 | |
| Cyprus | | 4 | 2 | 3 | 2 | 5 | 0 | 2 | 0 | 0 | 1 | 0 | 4 | 8 | | 0 |
| Hong Kong SAR | 12 | | | | | | | | 2 | 1 | 0 | 3 | 1 | 2 | | |
| India | | | 10,466 | 20,972 | 9,080 | 16,834 | 22,263 | 16,757 | 11,995 | 8,112 | | | | 3,460 | 4,443 | 4,297 |
| Iran (Islamic Republic of) | 888 | 830 | 813 | 676 | 565 | 711 | 709 | 500 | 546 | 281 | 322 | 306 | 156 | 102 | 45 | 304 |
| Iraq | 1,583 | 1,597 | 1,666 | 1,415 | 1,010 | 1,814 | 2,259 | | 5,792 | 4,534 | 3,923 | 3,427 | 211 | 131 | 188 | 40 |
| Israel | 68 | 65 | 52 | 57 | 94 | 87 | 81 | 67 | 52 | 71 | 104 | 81 | 78 | 51 | | 92 |
| Japan | 1 | | | | | | | | 10 | 11 | 7 | 6 | 3 | 4 | 5 | 6 |
| Jordan | 45 | 83 | 72 | 47 | 71 | 78 | 110 | 58 | 29 | 39 | 45 | 35 | 44 | 27 | | 37 |
| Kuwait | 2 | 5 | 7 | 6 | 26 | 17 | 21 | 15 | 4 | 6 | 7 | 6 | 9 | | 16 | 49 |
| Kyrgyzstan | | | | | | | | | | | | | 298 | 478 | 336 | |
| Lao People's Dem. Republic | | | | | | | | | | 258 | 481 | 561 | 860 | 1,103 | | |
| Lebanon | | | | | | | | | | 3 | 5 | 20 | 54 | | | 9 |
| Macao SAR | 2,032 | | | | | | | | 0 | 0 | 0 | 0 | | | | |
| Malaysia | | | | | | | | | | | | | | | | |
| Maldives | | | | | | | | | | | | | 1 | 0 | 3 | 3 |
| Mongolia | 477 | 589 | 574 | 606 | 585 | 711 | 735 | 776 | 748 | 411 | 393 | 3,084 | 2,739 | 881 | 480 | 263 |
| Myanmar | | | | | | | | | | 143 | | | 65 | | | 3 |
| Nepal | | | | | | | | 703 | 786 | 759 | | | | | | 18 |
| Oman | 3 | 12 | 9 | 7 | 126 | 41 | 33 | | 27 | 7 | 15 | 2 | 4 | 7 | | 4 |
| Pakistan | | 5,590 | 592 | 6,048 | 5,927 | 5,918 | 4,481 | 5,309 | 5,143 | 5,505 | | | 6,621 | 7,998 | | 0 |
| Philippines | | | | | | | | | | | | | | | | |
| Qatar | 0 | 58 | 54 | 2 | 13 | 1 | 0 | 1 | 0 | 1 | | | 8 | 10 | | 8 |
| Republic of Korea | | | | | | | | | | | | | | | | 13 |
| Saudi Arabia | 360 | 142 | 85 | 59 | 1,841 | 305 | 92 | 101 | 74 | 88 | 52 | 30 | 58 | 38 | | 40 |
| Singapore | | | | | | | | | | | | | | | | |
| Sri Lanka | | | | | | | | 36 | 68 | 89 | 41 | 70 | 61 | 68 | 54 | 71 |
| Syrian Arab Republic | 238 | 245 | | 393 | 506 | 510 | 614 | 478 | 232 | 443 | 285 | 371 | 190 | 190 | | 0 |
| Thailand | 21 | 66 | 100 | 50 | 90 | 95 | 98 | 23 | 25 | 28 | | | 75 | 71 | 60 | 68 |
| Turkey | 1,414 | 1,352 | 1,419 | 1,361 | 1,422 | 1,943 | 1,966 | 2,030 | 1,878 | | | 1,195 | 1,071 | | | |

## Table 5.1 Meningococcal disease, cases reported to WHO and number of countries reporting, 1966-1999

| Asia | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| United Arab Emirates | 69 | 52 | 20 | 73 | 248 | 108 | 45 | 73 | 62 | 47 | 166 | 56 | 14 | 10 | | 23 |
| Viet Nam | 2,413 | | | | | | | | 1,846 | 1,917 | 1,794 | 2,272 | 2,236 | 1,468 | | |
| West Bank and Gaza Strip | | | | 0 | 1 | 0 | 12 | 11 | 2 | 4 | 2 | 7 | 0 | 2 | | 0 |
| Yemen | 546 | 849 | 1,229 | 682 | | 8,211 | 4,264 | | | 646 | 433 | | | | | 0 |
| Total no. of cases | 10,176 | 11,559 | 17,166 | 32,979 | 21,852 | 37,782 | 38,213 | 26,944 | 29,321 | 23,414 | 13,077 | 17,397 | 20,635 | 21,847 | 10,381 | 5,390 |
| No. of countries reporting | 19 | 18 | 17 | 21 | 19 | 20 | 20 | 18 | 24 | 27 | 22 | 22 | 28 | 24 | 11 | 26 |

| Oceania | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Samoa | 1 | | | | | | | | 1 | 0 | | 0 | | | | |
| Australia | 77 | | | | | | | 295 | 285 | 292 | 378 | 383 | 382 | 426 | | 421 |
| Cook Islands | | | | | | | | | 4 | 4 | 4 | 4 | | 6 | | |
| Fiji | 132 | | | | | | | | 75 | 57 | 195 | 89 | | | | |
| French Polynesia | 188 | | | | | | | | 72 | 74 | 47 | 21 | | | | |
| Guam | 18 | | | | | | | | 11 | 25 | 19 | 23 | 15 | 10 | | |
| Kiribati | | | | | | | | | 6 | 38 | 48 | 32 | | | | |
| Marshall Islands | | | | | | | | | | 3 | 8 | 7 | | | | |
| Micronesia (Fed. States of) | 4 | | | | | | | | 5 | | 3 | | | | | |
| Nauru | | | | | | | | | 1 | | | 2 | | | | |
| New Caledonia | 6 | | | | | | | | 104 | 123 | 84 | 73 | | | | |
| New Zealand | 32 | | | | | | | | | | | | | 87 | | |
| Niue | | | | | | | | | 1 | 0 | 1 | 0 | | 2 | | |
| Northern Mariana Islands | | | | | | | | | 1 | 1 | 2 | 0 | | | | |
| Palau | | | | | | | | | | | | 2 | | | | |
| Papua New Guinea | | | | | | | | | 1,575 | 1,593 | 1,676 | 1,651 | 1,517 | | | |
| Samoa | 2 | | | | | | | | 39 | 44 | 35 | 36 | | | | |
| Solomon Islands | | | | | | | | | 47 | 55 | 54 | 93 | 50 | 4 | | |
| Tokelau | | | | | | | | | | 1 | 0 | 0 | | | | |
| Tonga | | | | | | | | | 2 | 1 | 0 | 1 | | | | |
| Tuvalu | | | | | | | | | 2 | | | | | | | |
| Vanuatu | | | | | | | | | 15 | 35 | 21 | 15 | | | | |
| Wallis and Futuna | | | | | | | | | 1 | 2 | 5 | 9 | | | | |
| Total no. of cases | 460 | | | | | | | | 2,247 | 2,348 | 2,580 | 2,441 | 1,964 | 535 | | 421 |
| No. of countries reporting | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 19 | 18 | 18 | 20 | 4 | 6 | 0 | 1 |

## Table 5.1 Meningococcal disease, cases reported to WHO and number of countries reporting, 1966-1999

| Europe | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Albania | | | | | | | | | | | | | | | 29 | 30 | 51 |
| Austria | 190 | 146 | 124 | 103 | 128 | 122 | 110 | 80 | 90 | 90 | 73 | 56 | 72 | 72 | 69 | 59 | 58 |
| Belgium | 41 | 50 | 39 | 131 | 352 | 518 | 519 | 428 | 228 | 136 | 94 | 114 | 121 | 100 | 158 | 127 | 124 |
| Bulgaria | 104 | 150 | 156 | 155 | 159 | 114 | 139 | 128 | 117 | 134 | 136 | 128 | 104 | 106 | 107 | 128 | 103 |
| Croatia | | | | | | | | | | | | | | | | | |
| Czech Republic | | | | | | | | | | | | | | | | | |
| Czechoslovakia [1] | 77 | 76 | 67 | 79 | 75 | 66 | 46 | 51 | 57 | 57 | 79 | 90 | | | 136 | 143 | 172 |
| Denmark | 6 | 5 | 9 | 5 | 7 | 13 | 9 | 15 | 21 | | | | | | 113 | 120 | 115 |
| Estonia | | | | | | | | | | | | | | | | | |
| Finland | 19 | 29 | 23 | | 136 | 105 | 111 | 255 | 646 | 456 | 120 | 147 | 84 | 55 | 64 | 66 | 62 |
| France | 614 | 516 | 782 | 910 | 1,105 | 1,360 | 1,440 | 1,560 | 1,109 | 1,505 | 1,591 | 1,596 | 2,016 | | 1,661 | 1359 | 1,080 |
| Germany | 1,405 | 1,405 | 1,166 | 1,211 | 1,869 | 1,704 | 1,660 | 1,482 | 1,552 | 1,366 | 1,234 | 1,161 | 1,331 | 1,400 | 1,161 | 1,348 | 1,202 |
| Greece | 198 | 374 | 1,075 | 540 | 639 | 383 | 481 | 765 | 313 | 306 | 208 | 241 | 282 | 219 | 188 | 147 | 131 |
| Hungary | 99 | 91 | 84 | 82 | 95 | 69 | 73 | 62 | 55 | 60 | 75 | 55 | 95 | 74 | 103 | 82 | 59 |
| Iceland | 9 | 7 | 8 | 9 | 3 | 4 | 9 | 13 | 5 | 35 | 83 | 55 | | | 14 | 18 | 10 |
| Ireland | 17 | 19 | 22 | 17 | 17 | 22 | 29 | 29 | 37 | 45 | 41 | 32 | 30 | | 104 | 114 | |
| Italy | 984 | 1,604 | 2,714 | 2,412 | 2,916 | 2,510 | 1,516 | 1,250 | 790 | 848 | | | | 597 | 625 | 676 | 585 |
| Latvia | | | | | | | | | | | | | | | 168 | 165 | 169 |
| Lithuania | | | | | | | | | | | | | | | | | 277 |
| Luxembourg | 3 | 3 | 1 | 3 | 3 | 6 | 5 | 3 | 4 | 3 | 5 | 2 | 1 | 4 | | 4 | 2 |
| Malta | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | | | | 0 | 0 | 0 |
| Monaco | | | | | | 1 | | 2 | | | | | | | | | 0 |
| Netherlands | 516 | 303 | 253 | 211 | 183 | 202 | 248 | 171 | 161 | 95 | 129 | 117 | 186 | 181 | 171 | | 136 |
| Norway | 43 | 54 | 63 | 92 | 104 | 79 | 78 | 119 | 176 | 327 | 321 | 271 | 327 | 328 | 227 | 260 | 255 |
| Poland | 915 | 951 | 1,102 | 1,163 | 246 | 201 | 228 | 233 | 228 | 208 | 241 | 248 | 272 | 305 | 5,100 | 5,400 | 27,569 |
| Portugal | 405 | 301 | 253 | 196 | 525 | 836 | 701 | 733 | 351 | | 249 | 183 | 249 | 209 | 193 | 253 | 211 |
| Romania | 189 | 120 | 103 | 687 | 1,052 | 396 | 252 | 279 | 212 | 191 | 216 | 261 | 355 | 417 | 496 | 503 | 425 |
| Russian Federation | 491 | 532 | 656 | 2,012 | 4,912 | 6,716 | 13,326 | 21,353 | 16,956 | 15,290 | 15,677 | 15,712 | 6,907 | 6,694 | 8,062 | 10,375 | 10,781 |
| Slovakia | | | | | | | | | | | | | | | | | |
| Slovenia | | | | | | | | | | | | | | | | | |
| Spain | 657 | 766 | 857 | 753 | 1,510 | 3,663 | 2,620 | 2,244 | 2,090 | 1,909 | 1,860 | 2,550 | 4,419 | 6,618 | 4,807 | 5,177 | 4,029 |
| Sweden | 164 | 106 | 118 | 107 | 98 | 105 | 92 | 100 | 160 | 233 | 205 | 142 | 139 | 116 | 110 | 89 | 97 |
| Switzerland | 104 | 62 | 67 | 96 | 139 | 148 | 142 | 107 | 113 | 86 | 92 | 73 | 68 | 87 | 80 | 93 | 87 |
| United Kingdom | 584 | 424 | 752 | 1,360 | 1,645 | 2,298 | 1,825 | 2,394 | 2,799 | 3,207 | 2,152 | 1,543 | 243 | 236 | 84 | 6 | 9 |
| Yugoslavia | 1,143 | 1,497 | 1,367 | 17 | 2,608 | 2,420 | 1,788 | 1,593 | 1,119 | 1,322 | 847 | 1,011 | 986 | 712 | 542 | 617 | 603 |
| Total no. of cases | 8,979 | 9,591 | 11,861 | 12,353 | 20,526 | 24,061 | 27,447 | 35,449 | 29,390 | 27,909 | 25,728 | 25,788 | 18,287 | 18,530 | 24,572 | 27,359 | 48,402 |
| No. of countries reporting | 26 | 26 | 26 | 25 | 26 | 27 | 26 | 27 | 26 | 24 | 24 | 23 | 21 | 20 | 27 | 27 | 29 |

[1] Czechoslovakia dissolved on 31 December 1992.

## Table 5.1 Meningococcal disease, cases reported to WHO and number of countries reporting, 1966-1999

| Europe | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Albania | 55 | 47 | 79 | 111 | 73 | 77 | 115 | 86 | 97 | | | 103 | 42 | | | |
| Austria | 65 | 49 | 53 | 57 | 63 | 77 | 57 | 49 | 38 | | | 60 | 81 | 98 | | |
| Belgium | 114 | 53 | 43 | 38 | 35 | 51 | 59 | 45 | 39 | | | 121 | 193 | 210 | | 9 |
| Bulgaria | 104 | 105 | 136 | 150 | 161 | 142 | 124 | 80 | 102 | | | | | | | 82 |
| Croatia | | | | | | | | | | | | | | | | 52 |
| Czech Republic | | | | | | | | | | | 193 | 195 | 232 | 216 | | 73 |
| Czechoslovakia [1] | 167 | 180 | 128 | 135 | 106 | 113 | 99 | 98 | 90 | | | | | | | |
| Denmark | 121 | 139 | 138 | 202 | 195 | 175 | 199 | 201 | 183 | 226 | | 220 | 235 | 226 | | |
| Estonia | | | | | | | | | | | | | 24 | 18 | | 7 |
| Finland | 49 | 49 | 50 | 37 | 51 | 20 | 25 | 31 | 29 | | | 42 | | 76 | | 54 |
| France | 886 | 867 | 840 | 859 | 620 | 511 | 513 | 426 | 429 | 442 | | 365 | 310 | 364 | | |
| Germany | 1,124 | 1,144 | 1,279 | 1,260 | 1,112 | 4,417 | | 807 | 813 | | | 708 | 655 | 687 | 809 | 729 |
| Greece | 102 | 106 | 105 | 88 | 85 | 76 | 87 | 131 | 69 | | | | 143 | 79 | | |
| Hungary | 67 | 70 | 53 | 53 | 53 | 33 | 53 | 34 | 41 | | | | | 20 | 12 | 26 |
| Iceland | 20 | 14 | 13 | 11 | 9 | 7 | 6 | 6 | 12 | | | 26 | 22 | 17 | | |
| Ireland | | | | | | 73 | 42 | | | | | 95 | 271 | 199 | | |
| Italy | 776 | 708 | 842 | 610 | 478 | 377 | 338 | 309 | 141 | | | 63 | 138 | 164 | | 113 |
| Latvia | 162 | 183 | 154 | 145 | 132 | 117 | 81 | 97 | 62 | | | 17 | 43 | 45 | | 8 |
| Lithuania | 289 | 307 | 277 | 155 | 188 | | 106 | 112 | 103 | | | | | | | 16 |
| Luxembourg | | | | | | | | | | | | | | | | |
| Malta | 0 | 0 | 2 | 1 | 1 | 1 | 2 | 2 | 1 | | | 3 | 4 | 10 | | 29 |
| Monaco | 1 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | | | | | | | |
| Netherlands | 123 | 144 | 166 | 205 | 205 | 236 | 472 | 505 | 443 | 518 | 563 | 422 | 460 | 583 | | 505 |
| Norway | 367 | 306 | 322 | 278 | 253 | 165 | 186 | 171 | 163 | 197 | 126 | 102 | 158 | 138 | | |
| Poland | 7,823 | 7,596 | 6,613 | 6,587 | 6,297 | 4,847 | 5,139 | 3,952 | 3,713 | | | 176 | 167 | 145 | 142 | |
| Portugal | 247 | 271 | 480 | 602 | 298 | 276 | 266 | 221 | 181 | | | | 183 | 172 | | 126 |
| Romania | | | | | | 1,077 | 580 | | | | | 13 | 11 | 15 | | |
| Russian Federation | 12,446 | 12,830 | 12,054 | 10,092 | 9,009 | 8,430 | 7411 | 6,615 | 5,860 | 5,167 | | | 3,839 | | | |
| Slovakia | | | | | | | | | | | | 12 | 29 | 98 | | 87 |
| Slovenia | | | | | | | | | | | | 12 | 9 | 11 | | 4 |
| Spain | 4,456 | 3,392 | 2,911 | 2,670 | 2,197 | 1,505 | 1,636 | 1,258 | 1,308 | 1,377 | | 255 | 970 | 1481 | | |
| Sweden | 85 | 68 | 78 | 83 | 95 | 80 | 103 | 102 | 130 | 114 | 88 | 66 | 99 | 84 | | |
| Switzerland | 107 | 93 | 94 | 131 | 77 | 123 | 120 | 121 | 143 | 106 | 120 | 104 | 119 | 95 | | 121 |
| United Kingdom | | | | | | 148 | | 1,415 | 1,390 | 1,559 | 1,651 | 1,541 | 2,097 | 1,777 | | |
| Yugoslavia | 682 | 587 | 547 | 542 | 421 | 462 | 543 | 472 | 320 | | | | | | | |
| Total no. of cases | 30,438 | 29,311 | 27,457 | 25,102 | 22,214 | 23,617 | 18,362 | 17,346 | 15,901 | 9,706 | 2,741 | 4,721 | 10,534 | 7,028 | 963 | 2,041 |
| No. of countries reporting | 26 | 26 | 26 | 26 | 26 | 28 | 27 | 27 | 27 | 9 | 6 | 23 | 26 | 26 | 3 | 17 |

[1] Czechoslovakia dissolved on 31 December 1992.

# CHAPTER 6
# DENGUE AND DENGUE HAEMORRHAGIC FEVER

## Background of the disease

In recent years dengue fever (DF) has become a major international health problem affecting tropical and sub-tropical regions around the world - especially urban and peri-urban areas. The geographic distribution of dengue, the frequency of epidemic cycles, and the number of cases of dengue have increased sharply during the last two decades. In addition, the frequency of a potentially lethal complication of dengue, called dengue haemorrhagic fever (DHF) has begun to occur on a regular basis in countries where only dengue occurred previously.

Dengue fever is caused by four distinct but closely related dengue viruses called serotypes (DEN-1, DEN-2, DEN-3, and DEN-4) and transmitted to humans through the bites of infected mosquitos (*Aedes aegypti* is the primary vector).

Dengue fever is a severe flu-like illness that affects infants, young children and adults, but rarely causes death. Symptoms vary according to age. Infants and young children may be asymptomatic or have undifferentiated fever and rash, whereas older children or adults are more likely to have a more severe set of symptoms including high fever that starts quickly, sometimes with two peaks, and/or severe headache, pain behind the eyes, muscle and joint pains, nausea and vomiting and rash. Infection with dengue confers immunity to infection with the same dengue serotype, but aside from short-lived protection does not prevent infection with other serotypes.

DHF is a life threatening complication of dengue characterized by high fever lasting 2-7 days, haemorrhagic phenomena (including vascular leakage of plasma), low numbers of platelets and sometimes circulatory failure. The condition of some patients progresses to shock. This is known as dengue shock syndrome (DSS), which could be rapidly fatal if appropriate volume replacement therapy is not administered promptly. Without proper treatment, DHF case fatality rates can exceed 20%. With modern intensive supportive therapy, it can be reduced to less than 1%.

While the mechanisms that cause DHF are not completely understood, it is widely accepted that antibodies from previous dengue infections can predispose some individuals to develop DHF when infected by a second dengue serotype. Thus the co-circulation of several different dengue serotypes in a geographical area favours the occurrence of DHF in that area.

### *Transmission*

Dengue viruses are transmitted to humans through the bites of infective female *Aedes* mosquitos. Mosquitos acquire the virus while feeding on the blood of an infected person. Once infected, a mosquito is capable of transmitting the virus to susceptible individuals for the rest of its life, during probing and blood feeding. Infected female mosquitos may also transmit the virus to the next generation of mosquitos by transovarial transmission i.e. via its eggs, but the role of this in sustaining transmission of virus to humans has not yet been delineated. Humans are the main amplifying host of the virus, although studies have shown that in some parts of the world monkeys may become infected and perhaps serve as a source of virus for uninfected mosquitos. The virus circulates in the blood of infected humans for 2-7 days, at approximately the same time as they have fever; *Aedes* mosquitos may acquire the virus when they feed on an individual at this time.

### *History*

Beginning with the latter part of the eighteenth century, and throughout the nineteenth and early twentieth centuries major epidemics of dengue-like illness have been reported in the Americas, southern Europe, north Africa, the eastern Mediterranean, Asia, and Australia, as well as on islands in the Indian

Ocean, the south and central Pacific and the Caribbean.[1] The beginning of these more frequent reports coincides with the time that the *Ae. aegypti* mosquito, the primary dengue vector, began spreading from Africa throughout the tropics, via sailing vessels used in commerce and in the slave trade, and when people began moving more frequently between continents. The mosquito adapted very well to urban environments, living in close proximity to people, breeding in small containers that collect rainwater and in water storage vessels.

There are a number of ecological factors associated with the middle and later parts of the twentieth century which have lead to a dramatic increase in DF, and to the emergence of DHF as a significant public health problem in the Americas and Asia. First, there has been a large increase in unplanned urbanization, resulting in large populations living in high-density areas with inadequate systems of water and solid waste management. These areas provide excellent breeding places for *Ae. aegypti* mosquitos.

In addition, two specific occurrences, one in Southeast Asia and the other in the Americas, were additional catalysts for the spread of dengue. First, activities associated with World War II and the immediate post-war period are particularly implicated in the increase of DF and DHF in South-East Asia. The existing water supply and sewage systems were destroyed during the war resulting in more favourable breeding places for *Ae. aegypti.* Second, the movement of (mostly susceptible) troops to the war theatre for short periods of time, presented the virus with a large supply of new susceptible hosts on a continuous basis, increasing the spread of disease. The subsequent movement of those hosts and or war machinery to other areas facilitated the circulation of virus serotypes throughout the region, and fostered hyperendemicity (the circulation of more than one serotype at the same time). During the post-war period millions of susceptible people from the poor rural countryside moved to the cities, providing a continuous influx of large susceptible populations living in poor peri-urban areas that were hyperendemic for dengue.

This led to both the increase in DF and the emergence of DHF as major public health problems. DHF was discovered in Manila in 1953. There had been sporadic reports of disease with symptoms similar to DHF previously, but these were considered to be unusual occurrences. Since 1953, DHF has been increasing in its frequency, geographical scope, and number of cases.

In the Americas, the lapse in mosquito eradication programmes had important consequence for dengue. The *Ae. aegypti* eradication programmes to fight against yellow fever were discontinued in the early 1970s. Subsequently, there was a re-infestation of the Americas with *Ae. aegypti.* The combination of the re-infestation of the Americas with the primary vector for dengue combined with unplanned rapid urbanization and increased travel and commerce has played an important part in the increase of dengue and emergence of DHF in the Americas.

## Description of the data

For Asia, WHO has reports of cases and deaths from dengue from 1995-1998. Case reporting from the Americas is available from 1960, and reporting of deaths from 1989. There are separate reports for DF and DHF from the Americas but not from other continents. Although dengue infections occur in Africa they are not routinely reported from Africa.

## Strengths and weaknesses of dengue surveillance

Dengue surveillance is difficult to establish and maintain. DF is a complex disease whose symptoms are difficult to distinguish from other common febrile illnesses. Surveillance for DHF holds special problems. First, there are many places where DHF is a rare occurrence. In these places DHF may not be suspected as a cause of particular symptoms. Second, diagnosing DHF cannot be done by clinical judgement alone. Correctly identifying a case of DHF requires laboratory tests (hemotocrits, platelet

[1] There had been some sporadic reports of dengue-like illness before that time – the very first report of an epidemic of a dengue-like illness dates back to an epidemic in China just prior to the year 1000.

counts, virologic or serologic tests) of samples of blood collected from patients with haemorrhagic symptoms. Laboratory equipment to perform these tests are not always available in health centres.

As in other diseases the case definitions used for reporting differ among countries, and some countries report only laboratory confirmed cases whereas other report suspected cases as well. Finally, some countries report cases and deaths from DF and DHF/DSS separately, whereas in other countries reports of DF and DHF are combined. Problems of under-diagnosis, incomplete reporting and reporting delay also weaken surveillance.

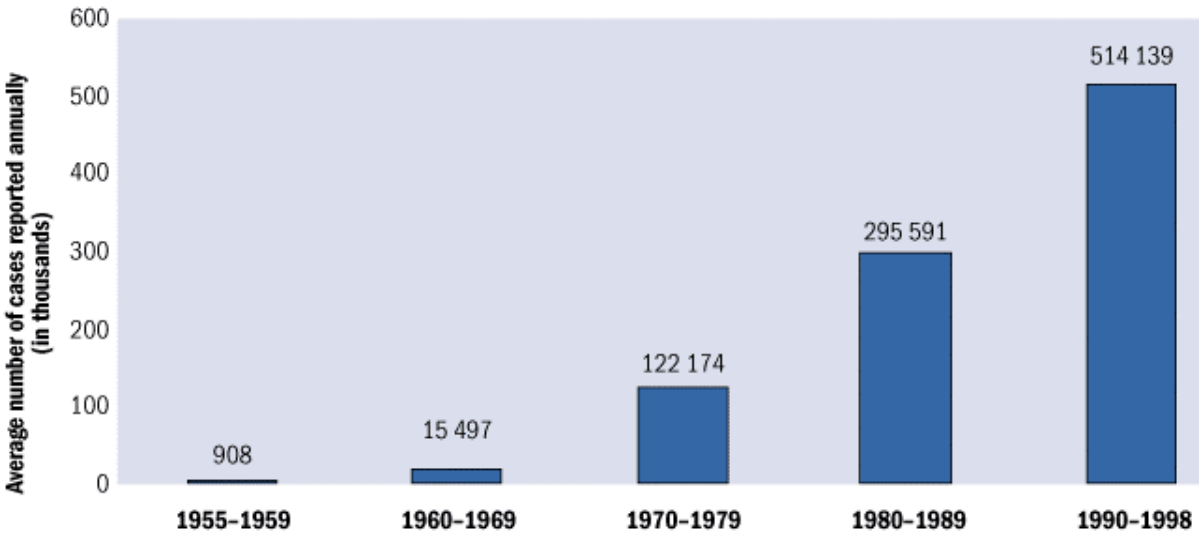
Laboratories play a very important role in surveillance of dengue – not only in confirming DF and DHF cases but also in monitoring serotypes and strains circulating in the population. For example, the introduction of a new serotype may be an important indicator of future epidemics of DHF/DSS. In many countries laboratories need considerable strengthening to conduct adequate surveillance of dengue.

The lack of any systematic reports of dengue cases from Africa is a clear weakness in global surveillance efforts for dengue.

## Trends

- The global incidence of DF and DHF has grown dramatically in recent decades (Fig. 6.1).

**Fig 6.1 Dengue/dengue hemorrhagic fever, average annual number of cases of reported to WHO, 1955-1998**



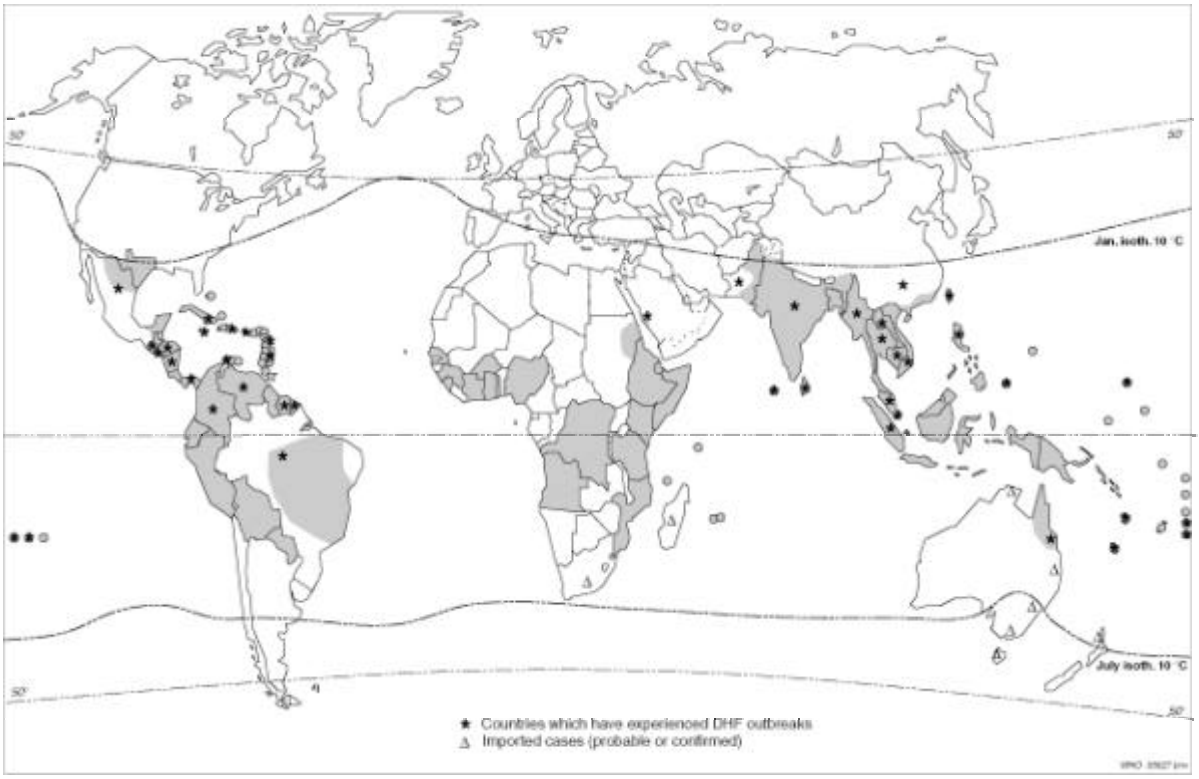

- Indigenous transmission of dengue has occurred in more than 100 countries in Africa, the Americas, the eastern Mediterranean, South-East Asia and the Western Pacific (Map 6.1).

## Conclusions

1. The Americas, South-East Asia and the Western Pacific are most seriously affected. Some 2.5 billion people - two-fifths of the world's population - are now at risk for acquiring dengue.
2. A rapid rise in unplanned urbanization is bringing ever greater numbers of people into contact with *Ae. aegypti* mosquitos by increasing favourable breeding sites for the mosquitos. These include peri-urban and slum areas where household water storage is common and where solid waste disposal services are inadequate.

3. Infection with one serotype predisposes individuals to DHF when subsequently infected with a different serotype. DHF now occurs regularly in countries that previously reported only DF because of the introduction and circulation of multiple dengue virus serotypes.
4. Without proper treatment, DHF case fatality rates can exceed 20%. With supportive therapy, it can be reduced to less than 1%.

**Map 6.1 The general distribution of dengue fever and/or dengue haemorrhagic fever, 1975-1996**




## References

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Dengue haemorrhagic fever: diagnosis, treatment, prevention and control. 2nd edition. Geneva,World Health Organization, 1997.

### *Web pages*

Dengue and dengue haemorrhagic fever fact sheet:
http://www.who.int/inf-fs/en/fact117.html

WHO dengue web pages:
http://www.who.int/health-topics/dengue.htm

## Table 6.1 Dengue fever and dengue haemorrhagic fever, cases reported to WHO and number of countries reporting, 1955-1998

| | Dengue fever | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The Americas** | **1960** | **1961** | **1962** | **1963** | **1964** | **1965** | **1966** | **1967** | **1968** | **1969** | **1970** | **1971** | **1972** | **1973** | **1974** | **1975** | **1976** | **1977** | **1978** | **1979** |
| Anguilla | | | | | | | | | | | | | | | | | | | | |
| Antigua | 0 | 0 | 0 | 0 | 264 | 8 | 0 | 0 | 179 | | | | | | | | | 2 | | |
| Aruba | | | | | | | | | | | | | | | | | | | | |
| Bahamas | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | |
| Barbados | | | | | | | | | | | | | | | | | | 1,000 | | |
| Belize | | | | | | | | | | | | | | | | | | | 1,200 | |
| Bermuda | | | | | | | | | | | | | | | | | | | | |
| Bolivia | | | | | | | | | | | | | | | | | | | | |
| Bonaire | | | | | | | | | | | | | | | | | | | | |
| Brazil | | | | | | | | | | | | | | | | | | | | |
| British Virgin Islands | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 2 | 2 | | | | | | | |
| Cayman Islands | | | | | | | | | | | | | | | | | | | | |
| Colombia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | |
| Costa Rica | | | | | | | | | | | | | | | | | | | | |
| Cuba | | | | | | | | | | | | | | | | | | 477,440 | 75,692 | 1,497 |
| Dominica | | | 0 | 2 | 43 | 0 | | 0 | 41 | 0 | 0 | | | | | | | | | |
| Dominican Republic | 494 | 821 | 822 | 350 | 407 | 527 | | | 0 | 16 | 0 | | | | | | | | 102 | |
| Ecuador | | | | | | | | | | | | | | | | | | | | |
| El Salvador | | | | | | | | | | | | | | | | | | | 25 | |
| French Guiana | | | | | | | | | | | | | | 0 | 0 | 0 | | | | |
| Grenada | | | | | | | | | | 81 | 15 | 27 | | | 1 | | | | | |
| Guadeloupe | | | | | | | | | | | | | | | | | | | | |
| Guatemala | | | | | | | | | | | | | | | | | | | 100 | |
| Guyana | | | | | | | | | | | | | | | | | | | 51 | |
| Haiti | | | | | | | | | | | | | 3 | 103 | 447 | 28 | | | 1,013 | |
| Honduras | | | | | | | | | | | | | | | | | | | 112,492 | |
| Jamaica | 0 | 0 | 0 | 1,578 | 156 | 35 | 6 | 6 | 367 | 545 | 31 | 14 | 4 | 3 | 2 | 1 | | | | |
| Martinique | | | | | | | | | | | | | | | | 1 | | | | |
| Mexico | | | | | | | | | | | | 2 | | | | | | | | |
| Montserrat | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | |
| Netherlands Antilles | | | | | | | | | | | | | | | | | | | | |
| Nicaragua | | | | | | | | | | | | | | | | | | | | |
| Panama | | | | | | | | | | | | | | | | | | | | |
| Paraguay | | | | | | | | | | | | | | | | | | | | |

## Table 6.1 Dengue fever and dengue haemorrhagic fever, cases reported to WHO and number of countries reporting, 1955-1998

| | Dengue fever | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **The Americas** | **1960** | **1961** | **1962** | **1963** | **1964** | **1965** | **1966** | **1967** | **1968** | **1969** | **1970** | **1971** | **1972** | **1973** | **1974** | **1975** | **1976** | **1977** | **1978** | **1979** |
| Puerto Rico | 0 | 0 | 0 | 25,737 | 2,440 | 93 | 2 | 1 | 0 | 16,665 | 136 | 15 | 85 | 710 | 44 | 1,214 | | | | |
| Peru | | | | | | | | | | | | | | | | | | | | |
| St. Kitts and Nevis | 0 | 0 | 0 | 0 | 751 | 0 | 0 | 0 | | 0 | 0 | | | | | | | | 390 | |
| St. Lucia | 0 | | | | | | | | | | | | | | | | | | | |
| St. Martin | | | | | | | | | | | | | | | | | | | | |
| St. Vincent | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | |
| Suriname | | | | | | | | | | | | | | | | | | | 60 | |
| Trinidad and Tobago | | | | | | | | | | | | | | | | | | | 373 | |
| Turks and Caicos Islands | | | | | | | | | | | | | | | 30 | | | | | |
| United States of America | | | | | | | | | | | | | | | | | | | | |
| Venezuela | 56 | 0 | 0 | 0 | 18,306 | 4,040 | 7,750 | 1,330 | 383 | 3,917 | 405 | 5 | 25 | 5 | | | | | 100,000 | |
| Virgin Islands (USA) | | | | | | | | | | | | | | | | | | | | |
| Other Caribbean islands | | | | | | | | | | | | | | | | | | | | |
| Total no. of cases | 550 | 821 | 822 | 27,667 | 22,367 | 4,703 | 7,758 | 1,337 | 970 | 21,224 | 587 | 65 | 119 | 821 | 524 | 1,244 | 0 | 478,442 | 291,498 | 1,497 |
| No. of countries reporting | 12 | 11 | 12 | 12 | 12 | 12 | 10 | 10 | 9 | 9 | 9 | 6 | 5 | 5 | 6 | 5 | 0 | 3 | 12 | 1 |

## Table 6.1 Dengue fever and dengue haemorrhagic fever, cases reported to WHO and number of countries reporting, 1955-1998

**Dengue fever**

| The Americas | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Anguilla | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | | | 4 | 1 | 0 | 0 |
| Antigua | 1 | 77 | 5 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | | | 56 | 12 | 9 | 4 |
| Aruba | 0 | 0 | 0 | 0 | 0 | 24,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 37 | 10 | 0 | |
| Bahamas | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 87 | 2 | 0 | 0 | | | 1 | 0 | 0 | 126 |
| Barbados | 0 | 6 | 99 | 63 | 63 | 0 | 0 | 78 | 10 | 45 | 236 | 21 | 4 | 55 | 114 | 976 | 130 | 199 | 610 |
| Belize | 4 | 7 | 482 | 26 | 127 | 0 | 5 | 0 | 0 | 0 | 2 | 0 | 0 | | | 107 | 0 | 210 | 17 |
| Bermuda | | | | | | | | | | | | | | | | 0 | 0 | 0 | 0 |
| Bolivia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,994 | 4,847 | 0 | 0 | 0 | 0 | 0 | 0 | | 52 | 223 | 49 |
| Bonaire | | | | | | 6 | | | 0 | 0 | 0 | 0 | 0 | | | | | | |
| Brazil | 0 | 0 | 12,000 | 0 | 0 | 0 | 47,370 | 89,394 | 190 | 5,334 | 40,642 | 97,209 | 3,501 | 6,915 | 54,453 | 124,887 | 175,751 | 254,942 | 530,578 |
| British Virgin Islands | | | | | | | | | 13 | | 3 | 1 | 2 | 0 | 0 | 9 | 0 | 0 | 1 |
| Cayman Islands | | | | | | | | | | | | | | | | 1 | 0 | 0 | 1 |
| Colombia | 8,964 | 10,790 | 6,776 | 12,919 | 7,540 | 8,272 | 7,881 | 17,510 | 16,308 | 10,092 | 17,389 | 15,103 | 20,130 | 25,585 | 27,885 | 51,059 | 33,155 | 14,958 | 43,855 |
| Costa Rica | | | | | | | | | 0 | 0 | 0 | 0 | | 4,612 | 13,929 | 5,134 | 2,307 | 14,267 | 2,290 |
| Cuba | 169 | 344,203 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | 3,012 | |
| Dominica | 0 | 18 | 0 | 2 | 0 | 0 | 6 | 2 | 0 | 0 | 6 | 12 | 0 | 0 | 1 | 293 | 3 | 0 | 7 |
| Dominican Republic | 54 | 619 | 435 | 538 | 260 | 92 | 6 | 20 | 164 | 7 | 39 | 24 | 105 | 138 | 1,211 | 249 | 89 | 64 | 3,049 |
| Ecuador | | | | | | | | | 25 | 19 | 2,109 | 302 | 454 | 9,015 | 8,145 | 6,607 | 5,189 | 284 | 4,219 |
| El Salvador | 2,060 | 5,185 | 5,166 | 3,814 | 560 | 425 | 916 | 2,836 | 1,786 | 518 | 2,381 | 1,273 | 884 | 245 | 281 | 9,658 | 790 | 348 | 1,354 |
| French Guiana | | | | | | | 228 | | | | 29 | 269 | 569 | 178 | 164 | 896 | 364 | 851 | 534 |
| Grenada | 0 | 2 | 7 | 6 | 3 | 0 | 0 | 4 | 0 | 1 | 3 | 1 | 1 | 1 | 5 | 74 | 6 | 22 | |
| Guadeloupe | 0 | 0 | | | 339 | 216 | 120 | 344 | 41 | 37 | 12 | 51 | 75 | 0 | 0 | 156 | 186 | 0 | |
| Guatemala | 30 | 104 | 33 | 2 | | | | 2,318 | 5,175 | 7,448 | 5,757 | 10,968 | 1,286 | 1,907 | 2,872 | 3,980 | 3,679 | 5,379 | 1,593 |
| Guyana | 0 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 42 |
| Haiti | 255 | 44 | 211 | 483 | 328 | 20 | | | | | | 0 | 0 | | 0 | 0 | 0 | | |
| Honduras | 2,078 | 1,612 | 1,217 | 729 | 378 | 307 | 569 | 261 | 844 | 2,507 | 1,700 | 5,303 | 2,113 | 2,847 | 3,055 | 27,575 | 5,047 | 11,730 | 22,218 |
| Jamaica | 9 | 0 | 21 | 72 | 12 | 3 | 3 | 3 | 6 | 32 | 9 | 5 | 296 | 0 | 4 | 1,884 | 46 | 16 | 68 |
| Martinique | 0 | 10 | | | | | 0 | 0 | 97 | 16 | 4 | 0 | 38 | 0 | 0 | 519 | 430 | 235 | 44 |
| Mexico | 51,406 | 17,046 | 32,640 | 19,028 | 27,645 | 13,688 | 19,520 | 13,371 | 10,526 | 7,120 | 14,485 | 7,158 | 8,131 | 2,899 | 6,770 | 17,088 | 20,687 | 35,108 | 23,639 |
| Montserrat | | | | | | | | | 0 | 0 | 0 | 0 | 0 | | 15 | 75 | 3 | | 0 |
| Netherlands Antilles | | | | | | | | | | | | | | | | | | | |
| Nicaragua | | | | | | 17,483 | 484 | 64 | 203 | 659 | 4,137 | 1,885 | 4,936 | 8,938 | 20,469 | 19,260 | 2,792 | 3,126 | 13,592 |
| Panama | | | | | | | | | 0 | 0 | 0 | 0 | 0 | 14 | 790 | 3,083 | 811 | 1,710 | 2,717 |
| Paraguay | | | | | | | | | 405 | 41,800 | 0 | 0 | 0 | 0 | 0 | | 0 | | |

## Table 6.1 Dengue fever and dengue haemorrhagic fever, cases reported to WHO and number of countries reporting, 1955-1998

**Dengue fever**

| The Americas | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Puerto Rico | 921 | 8,350 | 9,536 | 2,789 | 1,865 | 2,376 | 10,659 | 5,835 | 6,539 | 9,003 | 9,450 | 10,305 | 13,000 | 6,600 | 22,000 | 6,765 | 4,655 | 6,955 | 14,828 |
| Peru | | | | | | | | | 0 | 0 | 7,858 | 714 | 1,971 | 897 | 1,478 | 2,732 | 6,395 | 1,151 | 988 |
| St. Kitts and Nevis | 0 | 23 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 1 | 8 | 27 | 6 | 0 | |
| St. Lucia | 6 | 0 | 31 | 0 | 0 | 0 | 164 | 1 | 2 | 4 | 2 | 4 | 0 | 5 | 0 | 52 | 65 | 14 | 3 |
| St. Martin | | 7 | | | | 2 | | | 0 | 0 | 0 | 0 | 0 | | | | | | |
| St. Vincent | 0 | | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 9 | 1 | 7 | 7 | 2 | 224 | 190 | 3 | 112 |
| Suriname | 0 | 22 | 25 | 0 | 0 | 0 | 64 | 1 | 5 | 4 | 16 | 40 | 24 | 171 | 75 | 344 | 677 | 90 | 1,230 |
| Trinidad and Tobago | 0 | 15 | 16 | 117 | 31 | 5 | 145 | 125 | 80 | 11 | 526 | 36 | 116 | 268 | 48 | 312 | 3,983 | 1,357 | 2,792 |
| Turks and Caicos Islands | | | | | | | | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| United States of America | 15 | 201 | 144 | 107 | 63 | 48 | 322 | 95 | 124 | 94 | 102 | 25 | 68 | 57 | 91 | 7 | 0 | | 0 |
| Venezuela | 39 | 71 | 39 | 6 | 20 | 2 | | 57 | 12 | 4,025 | 10,962 | 6,559 | 2,707 | 9,059 | 15,046 | 32,280 | 9,180 | 33,654 | 37,586 |
| Virgin Islands (USA) | 0 | 127 | 2 | 1 | 73 | 43 | 74 | 77 | 380 | 275 | 339 | 62 | 48 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other Caribbean islands | 7 | 138 | 44 | 11 | 4 | 3 | 170 | 7 | | | | | | 500 | 275 | | | | |
| Total no. of cases | 66,018 | 388,729 | 68,930 | 40,716 | 39,311 | 66,993 | 88,706 | 134,397 | 47,783 | 89,138 | 118,225 | 157,340 | 60,468 | 80,914 | 179,187 | 316,411 | 276,691 | 389,917 | 708,146 |
| No. of countries reporting | 32 | 32 | 30 | 30 | 30 | 33 | 31 | 32 | 40 | 39 | 42 | 43 | 42 | 35 | 37 | 40 | 42 | 39 | 35 |

## Table 6.1 Dengue fever and dengue haemorrhagic fever, cases reported to WHO and number of countries reporting, 1955-1998

**Dengue haemorrhagic fever**

| The Americas | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Argentina | | | | | | | | | | | | | | | | | | | |
| Aruba | | | | | | 2 | | | | | | | | | | | | | |
| Barbados | | | | | | | | | | | | | | | | 2 | | 3 | |
| Brazil | | | | | | | 3 | 1 | | | 274 | 188 | | | 24 | 105 | 2 | 35 | 89 |
| Belize | | | | | | | | | | | | | | | | | | | 1 |
| Bermuda | | | | | | | | | | | | | | | | | | | |
| Bolivia | | | | | | | | | | | | | | | | | | | 0 |
| Cayman Islands | | | | | | | | | | | | | | | | | | | |
| Colombia | | | | | | 1 | | | | 1 | 39 | 96 | 493 | 303 | 568 | 1,028 | 1,757 | 3,330 | 5,276 |
| Costa Rica | | | | | | | | | | | | | | | | 1 | | | |
| Cuba | | 10,312 | | | | | | | | | | | | | | | | 205 | |
| Curacao | | | | | | | | | | | | | | | | | | | |
| Dominica | | | | | | | | | | | | | | | | 11 | | | |
| Dominican Republic | | | | | | | | | 4 | | 2 | 7 | 2 | 4 | 100 | 38 | 17 | 3 | 176 |
| El Salvador | | | | | | | | 79 | 74 | | | 1 | 0 | 3 | 0 | 129 | 1 | | 2 |
| French Guiana | | | | | | | | | | | | | 38 | 2 | 1 | 1 | 6 | 3 | 1 |
| Grenada | | | | | | | | | | | | | | | | 1 | | | |
| Guadeloupe | | | | | | | | | | | | | | | | 7 | | | |
| Guatemala | | | | | | | | | | | | | | | | 1 | 19 | 6 | 1 |
| Haiti | | | | | | | | | | | | | | | | | | | |
| Honduras | | | | | | | | | | | | 16 | 1 | 1 | 4 | 15 | 0 | | 18 |
| Jamaica | | | | | | | | | | | | | | | | 108 | | | |
| Martinique | | | | | | | | | | | | | | | | 3 | | 15 | |
| Mexico | | | | | 8 | | | | | 4 | | 2 | | | 30 | 539 | 884 | 239 | 372 |
| Montserrat | | | | | | | | | | | | | | | | | | | |
| Nicaragua | | | | | | 7 | | | | | | | 559 | 97 | 249 | 806 | 49 | 68 | 432 |
| Panama | | | | | | | | | | | | | | | | 3 | | | 1 |
| Puerto Rico | | | | | | 2 | 31 | 17 | 8 | 12 | 6 | 14 | 9 | 8 | 137 | 24 | 24 | 62 | 133 |
| St. Lucia | | | | | | | 164 | | | | | | | | | | | 1 | 1 |
| Suriname | | | 3 | | | | | | | | | | | 7 | 1 | | | | 11 |
| Trinidad and Tobago | | | | | | | | | | | | | | | | | | 39 | 189 |
| Venezuela | | | | | | | | | | 2,665 | 3,325 | 1,980 | 649 | 2,884 | 3,607 | 5,380 | 1,680 | 6,300 | 5,723 |
| Total no. of cases | 0 | 10,312 | 3 | 0 | 8 | 12 | 198 | 97 | 86 | 2,682 | 3,646 | 2,304 | 1,751 | 3,309 | 4,721 | 8,202 | 4,439 | 10,309 | 12,426 |
| No. of countries reporting | 0 | 1 | 1 | 0 | 1 | 4 | 3 | 3 | 3 | 4 | 5 | 8 | 8 | 9 | 11 | 19 | 11 | 14 | 18 |

## Table 6.1 Dengue fever and dengue haemorrhagic fever, cases reported to WHO and number of countries reporting, 1955-1998

| Asia | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bangladesh | | | | | | | | | | | | | | | | |
| Cambodia | | | | | | | | | | | | | | | | |
| China | | | | | | | | | | | | | | | | |
| India | | | | | | | | | | | | | | | | |
| Indonesia | | | | | | | | | | | | | | 58 | 167 | 477 |
| Lao People's Dem. Rep. | | | | | | | | | | | | | | | | |
| Malaysia | | | | | | | | | 41 | | | | | | | |
| Maldives | | | | | | | | | | | | | | | | |
| Myanmar | | | | | | | | | | | | | | | | 1,654 |
| Philippines | 96 | 1,207 | 152 | 94 | 125 | 551 | 1,459 | 134 | 189 | 759 | 652 | 9,384 | 1,371 | 1,116 | 1,336 | 922 |
| Saudi Arabia | | | | | | | | | | | | | | | | |
| Singapore | | | | | | | 42 | | | | | 630 | 826 | 848 | 189 | 71 |
| Sri Lanka | | | | | | | | | | | 2 | 13 | 29 | 7 | 1 | 2 |
| Thailand | | | | 2,706 | 160 | 1,851 | 561 | 5,947 | 2,215 | 7,763 | 4,094 | 5,816 | 2,060 | 6,430 | 8,670 | 2,767 |
| Viet Nam | | | | | | 100 | | 283 | 374 | 559 | 171 | 53 | | | | |
| Total no. of cases | 96 | 1,207 | 152 | 2,800 | 285 | 2,502 | 2,062 | 6,364 | 2,819 | 9,081 | 4,919 | 15,896 | 4,286 | 8,459 | 10,363 | 5,893 |
| No. of countries reporting | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 3 | 4 | 5 | 4 | 5 | 5 | 6 |

## Table 6.1 Dengue fever and dengue haemorrhagic fever, cases reported to WHO and number of countries reporting, 1955-1998

| Asia | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bangladesh | | | | | | | | | | 4 | | | | | | |
| Cambodia | | | | | | | | | | 419 | 498 | 711 | 3,545 | 647 | 5,980 | 2,129 |
| China | | | | | | | | | 21,227 | | | | 85,293 | | | |
| India | | | | | | | | | | | | | | | | |
| Indonesia | 267 | 1,400 | 10,189 | 4,586 | 4,563 | 4,548 | 7,826 | 6,989 | 3,422 | 5,007 | 5,909 | 4,665 | 13,875 | 12,710 | 13,588 | 16,529 |
| Lao People's Dem. Rep. | | | | | | | | | 927 | 1,807 | 486 | | 204 | 22 | 1,774 | 365 |
| Malaysia | | | 1,487 | 2,200 | 830 | 790 | 780 | 929 | 862 | 668 | 524 | 3,052 | 790 | 702 | 367 | 1,408 |
| Maldives | | | | | | | | | | | | | | | 0 | 0 |
| Myanmar | 691 | 1,013 | 349 | 2,477 | 6,750 | 3,158 | 5,364 | 2,029 | 4,685 | 2,026 | 1,524 | 1,706 | 2,856 | 2,323 | 2,666 | 2,192 |
| Philippines | 438 | 1,570 | 710 | 1,665 | 603 | 460 | 376 | | 392 | 968 | 123 | 305 | 1,684 | 2,545 | | 839 |
| Saudi Arabia | | | | | | | | | | | | | | | | |
| Singapore | 116 | 64 | 1,187 | 229 | 59 | 30 | 92 | 384 | 156 | 244 | 133 | 216 | 205 | 86 | 126 | 354 |
| Sri Lanka | 3 | 8 | | | | | 4 | | | | | | | | | |
| Thailand | 11,540 | 23,786 | 8,280 | 8,160 | 17,767 | 9,616 | 38,768 | 12,547 | 11,478 | 43,382 | 25,670 | 22,250 | 30,025 | 69,101 | 80,076 | 27,837 |
| Viet Nam | | 763 | 14,320 | 4,261 | | 21,361 | 45,011 | 20,027 | 59,989 | 68,990 | 35,323 | 39,806 | 143,380 | 30,496 | 45,107 | 46,266 |
| Total no. of cases | 13,055 | 28,604 | 36,522 | 23,578 | 30,572 | 39,963 | 98,221 | 42,905 | 103,138 | 123,515 | 70,190 | 72,711 | 281,857 | 118,632 | 149,684 | 97,919 |
| No. of countries reporting | 6 | 7 | 7 | 7 | 6 | 7 | 8 | 6 | 9 | 10 | 9 | 8 | 10 | 9 | 9 | 10 |

## Table 6.1 Dengue fever and dengue haemorrhagic fever, cases reported to WHO and number of countries reporting, 1955-1998

| Asia | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bangladesh | | | | | | | | | | | | |
| Cambodia | 3,716 | 1,981 | 2,237 | 7,247 | 1,882 | 4,695 | 3,913 | 1,498 | 10,199 | 1,433 | 4,224 | 16,216 |
| China | | 51,510 | 37,886 | 376 | 902 | 46,095 | 359 | 2 | 6,114 | 13 | 647 | 15 |
| India | | | | | 6,291 | 2,683 | 11,125 | 7,494 | 7,847 | 16,517 | 1,177 | 707 |
| Indonesia | 23,864 | 44,573 | 10,362 | 22,807 | 21,120 | 17,620 | 17,418 | 18,783 | 35,102 | 44,650 | 30,730 | 71,087 |
| Lao People's Dem. Rep. | 9,699 | 1,212 | | 60 | | 138 | 343 | 2,585 | 7,781 | 8,197 | 1,536 | 3,755 |
| Malaysia | 2,025 | 1,428 | 2,564 | 4,880 | 6,628 | 5,473 | 5,589 | 3,133 | 6,543 | 14,255 | 19,544 | 27,370 |
| Maldives | 0 | 2,054 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,000 |
| Myanmar | 7,292 | 1,181 | 1,196 | 6,318 | 8,055 | 1,685 | 2,279 | 11,647 | 2,477 | 1,655 | 3,993 | 8,978 |
| Philippines | 859 | 2,922 | 305 | 588 | 1,865 | 3,980 | 5,715 | 5,603 | 7,413 | 13,614 | 12,811 | 31,829 |
| Saudi Arabia | | | | | | | | 315 | | | | |
| Singapore | 436 | 245 | 944 | 1,733 | 2,179 | 2,878 | 837 | 1,216 | 2,008 | 3,128 | 4,300 | 5,183 |
| Sri Lanka | | 10 | 203 | 1,350 | 1,048 | 656 | 750 | 582 | 440 | 1,298 | 980 | 800 |
| Thailand | 174,285 | 26,926 | 74,391 | 92,002 | 43,511 | 41,125 | 67,017 | 51,688 | 59,911 | 38,109 | 99,150 | 126,348 |
| Viet Nam | 354,517 | 85,160 | 40,205 | 37,569 | 111,817 | 51,311 | 53,674 | 44,944 | 80,447 | 89,963 | 108,000 | 150,898 |
| Total no. of cases | 576,693 | 219,202 | 170,293 | 174,930 | 205,298 | 178,339 | 169,019 | 149,490 | 226,282 | 232,832 | 287,092 | 445,186 |
| No. of countries reporting | 10 | 12 | 11 | 12 | 12 | 13 | 13 | 14 | 13 | 13 | 13 | 13 |

## Table 6.1 Dengue fever and dengue haemorrhagic fever, cases reported to WHO and number of countries reporting, 1955-1998

| Oceania | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Samoa | | | | | | | | | 0 | 1 | 1 | 0 | 0 | 0 | | |
| Australia | | | | | | | | | 15 | 13 | 0 | 375 | | | | |
| Cook Islands | | | | | | | | | | 357 | 0 | 0 | | | | |
| Fiji | 2,960 | 446 | 132 | 25 | 16,203 | 10 | 1 | 3 | 4 | 127 | 18 | 676 | 238 | 190 | 31 | 269 |
| French Polynesia | | | | | | | | | 4,241 | 617 | 673 | 247 | 1,546 | 453 | 261 | 229 |
| Guam | | | | | | | | | | | | | 0 | 0 | | |
| Kiribati | | | | | | | | | 44 | 808 | 109 | 11 | | | | |
| Marshall Islands | | | | | | | | | | | | | | | | |
| Micronesia (Fed. States of) | | | | | | | | | | | | | | | | |
| Nauru | | | | | | | | | 0 | 538 | 0 | 0 | | | | |
| New Caledonia | | | | | | | | | 118 | 631 | 1 | 0 | | | | 85 |
| New Zealand | | | | | | | | | 15 | 5 | 2 | 2 | 5 | 1 | | 1 |
| Niue | | | | | | | | | 0 | 618 | | 0 | | | | 269 |
| Palau | | | | | | | | | | | | | | | | |
| Papua New Guinea | | | | | | | | | | | 217 | | | | | |
| Samoa | | | | | | | | | 248 | 112 | 11 | 25 | 0 | 0 | | |
| Tokelau | | | | | | | | | | | | 0 | | | | |
| Tonga | | | | | | | | | | 3,552 | 432 | 259 | 575 | 180 | | 1 |
| Tuvalu | | | | | | | | | | 15 | 0 | 0 | 0 | 0 | | |
| Vanuatu | | | | | | | | | 31 | 16 | 7 | 0 | 3 | 0 | | |
| Wallis and Futuna | | | | | | | | | | | | | | | | |
| Total no. of cases | 2,960 | 446 | 132 | 25 | 16,203 | 10 | 1 | 3 | 4,716 | 7,410 | 1,471 | 1,595 | 2,367 | 824 | 292 | 854 |
| No. of countries reporting | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 11 | 14 | 14 | 15 | 9 | 9 | 2 | 6 |

## Table 6.1 Dengue fever and dengue haemorrhagic fever, cases reported to WHO and number of countries reporting, 1955-1998

| Oceania | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| American Samoa | | 4 | | | | 0 | 0 | 246 | 0 | 49 | | |
| Australia | | | | | 46 | 366 | 690 | 17 | 34 | 43 | 205 | 500 |
| Cook Islands | | | | 5 | 833 | 5 | 0 | 0 | 786 | 2 | 1,075 | |
| Fiji | 432 | 22 | 2,225 | 1,461 | | 349 | 39 | 0 | 27 | | | 24,780 |
| French Polynesia | 232 | 133 | 8,754 | | | 593 | 355 | 0 | 208 | | | |
| Guam | | 1 | | | | | | 0 | | | 1 | 2 |
| Kiribati | | 45 | | 0 | 0 | 0 | 0 | 0 | | | | |
| Marshall Islands | | | 81 | | | | | 0 | | | | |
| Micronesia (Fed. States of) | | | | | | | 0 | 0 | 20 | | | 275 |
| Nauru | | | | | | | | 0 | 0 | | | |
| New Caledonia | 5 | 60 | 2,499 | 92 | 16 | 10 | 0 | 0 | 1,820 | | 154 | 2,618 |
| New Zealand | | 1 | 3 | | | | | | | 11 | | |
| Niue | 6 | | | | | | 0 | 0 | 0 | | | |
| Palau | | 1,254 | | | | | 0 | 0 | 636 | | | |
| Papua New Guinea | | | | | 475 | | | | 0 | | | |
| Samoa | | | 450 | | | 3 | 2 | | 278 | 1,013 | 163 | 49 |
| Tokelau | | | | | | 0 | 0 | 0 | | | | |
| Tonga | | 17 | 4 | 896 | 115 | 35 | 8 | 0 | | 3 | | 460 |
| Tuvalu | | | | | | 811 | | 0 | 0 | | | |
| Vanuatu | | 2 | 58 | 52 | | 113 | 27 | 16 | | | | 131 |
| Wallis and Futuna | | | | | | 0 | 0 | | 3 | | | 395 |
| Total no. of cases | 675 | 1,539 | 14,074 | 2,506 | 1,485 | 2,285 | 1,121 | 279 | 3,812 | 1,121 | 1,598 | 29,210 |
| No. of countries reporting | 4 | 10 | 8 | 6 | 6 | 13 | 15 | 17 | 14 | 6 | 5 | 9 |

# CHAPTER 7
# INFLUENZA

## Background of the disease

Influenza, commonly known as the flu is an acute respiratory illness caused by influenza viruses A and B. It occurs all over the world and causes considerable morbidity and mortality each year. The name influenza was given by eighteenth century Italians, who blamed the disease on the influence of heavenly bodies.[1] New strains of influenza for which people have no immunity appear periodically, at irregular intervals, causing worldwide pandemics affecting vast numbers of people within short time-spans. There have been 31 documented influenza pandemics, since the first well-described pandemic of 1580, including three pandemics during the twentieth century (1918, 1957 and 1969). The pandemic of 1918-1919 called the 'Spanish flu' was particularly virulent, and killed an estimated 40 million worldwide.

The influenza virus is a complex, constantly changing virus. The physical structure of the influenza virus makes it particularly prone to small surface changes in antigens[2] during replication, which make it possible for the virus to evade the host's immune system.[3] This makes it possible for someone who has already been infected with influenza to become re-infected in subsequent years.

There are two main types of influenza viruses of public health importance,[4] namely influenza A and influenza B. A minor change in one or both surface antigens (H and/or N) of a virus may cause epidemics, because most people do not have enough antibody protection from past exposure to similar viruses. These small changes are known as antigenic drifts. A major change in one or both surface antigens (antigenic shift) occurs only in type A influenza. This type of change is most probably due to genetic recombination among influenza A viruses. An antigenic shift may cause a pandemic if the virus is easily transmitted from person to person.

Because of the changes in the influenza virus, immunity to flu is short-lived, and therefore large segments of the population are susceptible to influenza every year. Influenza is a seasonal illness in temperate climates. The flu season in the temperate zones is during the winter months – November to March in the northern hemisphere, and May to September in the southern hemisphere. A pie chart showing the influenza isolates from October 1997 to September 1998 and from October 1998 to September 1999 is presented in Fig. 7.1.

Influenza A viruses infect several different animals including pigs, horses, other mammals, and aquatic birds as well as humans, whereas influenza B virus only infects humans. From time to time, influenza A viruses in animals and birds jump species and infect humans. The virus that caused the pandemic of 1918 is believed to have originated in pigs, while the pandemics of 1957 and 1968 are believed to have originated in birds. Places where birds, pigs and humans live in close proximity are thought to play a particularly important role in creating a favourable environment for antigenic shifts and drifts. It is important to have excellent surveillance in such areas.

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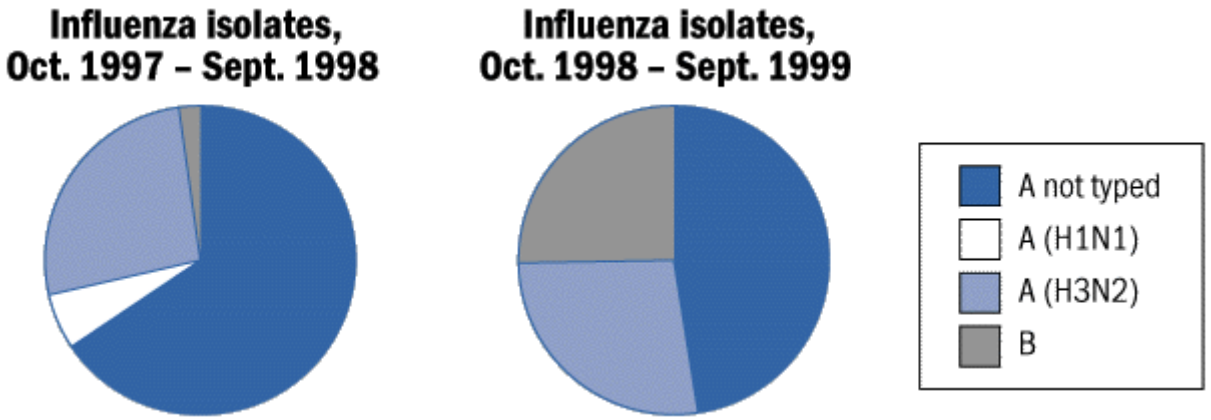
[1] Crosby AW, Influenza. In: Kiple KF. ed. *The Cambridge history of human disease*, Cambridge, Cambridge University Press, 1993.

[2] Antigens are protein or carbohydrate substances capable of stimulating an immune response.

[3] Variations occur when the virus replicates using cells which are infected with two different strains of influenza virus. The replication process for influenza viruses uses the machinery of infected cells to replicate. If two different viruses simultaneously infect the same cell, the result of replication will produce a new virus with characteristics that are a combination of the two original viruses. Thus there is constant reassortment of influenza viruses.

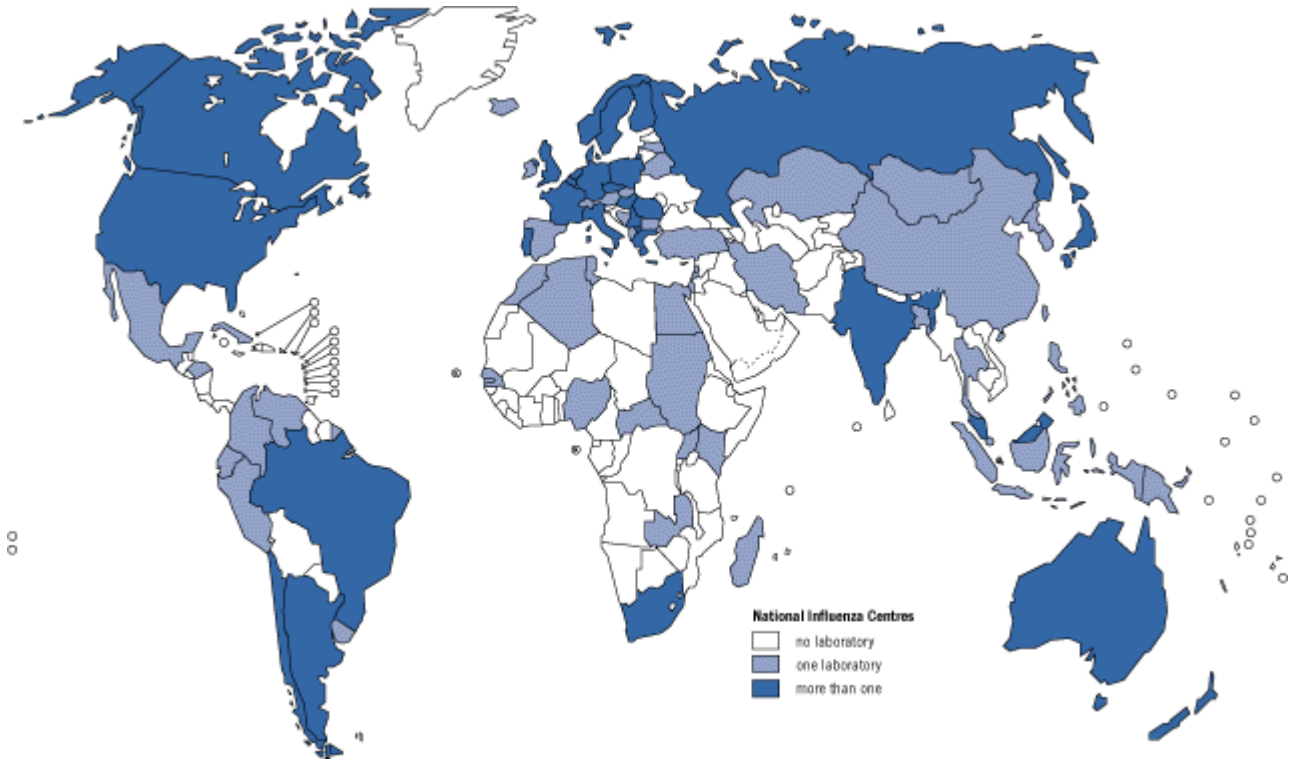
[4] There is also a type C influenza virus, but this causes a much milder disease not considered to be of major public health importance.

**Fig 7.1 Influenza isolates from 1997-1998, and 1998-1999 flu seasons**




Symptoms of influenza include fever (often higher in children), chills, cough, sore throat, runny or stuffy nose, headache, muscle aches, and often extreme fatigue. Its spread is primarily airborne, especially in crowded enclosed spaces. Most people recover completely within 1-2 weeks, however, severe complications can occur, particularly in children, elderly people, and other vulnerable groups. Bacterial pneumonia is the most common potentially fatal complication. Viral pneumonia, which is less common but more severe, is another complication of influenza.

**Map 7.1 WHO Influenza Surveillance Network, 1999**



Vaccination is one of the main influenza prevention methods. However, due to the constantly changing composition of the flu viruses in circulation, the influenza vaccine must be modified each year to match the current viruses. This entails having detailed knowledge about the circulating strains of influenza viruses. In order to do this, an international network for influenza surveillance was created, and WHO became responsible for its administration in 1948. The network now consists of 110 national influenza centres in 82 countries, and four WHO Collaborating Centres for Reference and Research on Influenza located in Atlanta, USA, London, UK, Melbourne, Australia and Tokyo, Japan. The distribution of the network of national centres is shown on Map 7.1.

This network helps to monitor influenza activity in all regions of the world and ensures that virus isolates and information are sent rapidly to the WHO Collaborating Centres for Virus Reference and Research for immediate strain identification. Some collaborating centres also deal with animal specimens. Results from the influenza network are reviewed each February and September, and a recommendation for the antigenic composition of next year's influenza vaccine is made by WHO and passed on to vaccine manufacturers. The recommendations from the February review relate to the composition of vaccines intended for the forthcoming winter in the northern hemisphere, whereas the recommendations from the September review relate to vaccines that will be used for the winter in the southern hemisphere. Table 7.2 presents the recommendations adopted by WHO from 1968 to 2000.[5]

## Description of the data

WHO has developed a web-based database called FluNet, (htpp://oms2.b3e.jussieu.fr/flunet) on which data from centres in the influenza network are entered. The data consists of weekly reports of influenza activity in each location, categorized as no activity, sporadic, local, regional and widespread outbreaks. It also includes the numbers of influenza specimens isolated by type, subtype and prototype. There is a cumulative seasonal summary included in the database, providing a description of recent and current influenza activity around the world. The data are geographically referenced at the country level, and charts, maps and tables are available for view on the FluNet website, which has an average of over 4000 hits per day. The database dates from 1997, and it includes data from countries in all continents.

## Strengths and weakness of the surveillance system

The WHO network of collaborating centres for influenza is a long-running surveillance system, that has provided important information on strains of influenza since its inception in 1947. The system ensures collection and immediate transport of influenza virus isolates to WHO Collaborating Centres together with epidemiological data for rapid virus characterization, which is the basis of the biannual updated recommendations for vaccine composition. The network has proven to be a reliable and successful system. However, it is important to increase worldwide coverage. There are many countries not included in the network, and other countries where there are too few centres to cover large geographic areas. Particular attention needs to be paid in those areas where animal hosts and humans live in close proximity, since those areas are considered to be the most likely places for new antigenic changes to take place.

Concerning dissemination of data on recent and current influenza activity, the web system has increased the access to information about current and recent influenza activity. In addition, information on current outbreaks of influenza is presented in the *Weekly Epidemiological Record.*

[5] Until 1998 reviews were held only once a year.

## Trends

- Influenza continues to cause considerable morbidity and mortality each year.
- Epidemiological characteristics of influenza viruses, such as attack rate and virulence are unpredictable, and change from year to year.
- There was an epidemic of avian influenza in chickens and ducks in Hong Kong Special Administrative Region, (SAR) in 1997 that was transmitted to humans. Fortunately, the virus did not transmit from person to person, and soon died out after the reservoir of domestic birds was completely depleted by the killing of approximately 1.6 million chickens, ducks and geese by Hong Kong (SAR) authorities.This type of jump in species is not a rare occurrence for influenza viruses and continued vigilance is necessary. The fact that the genetic analysis of this new strain was done in a timely manner is a positive indication for the functioning of the influenza surveillance network.
- The influenza virus constantly mutates, and periodically causes worldwide pandemics to which almost everyone is susceptible.
- No one knows when the next pandemic will occur.

## Conclusions

1. The WHO influenza surveillance network is functioning well, but needs to maintain constant surveillance over influenza viruses.
2. Because of the potential of new strains of influenza to cause widespread morbidity and mortality, influenza pandemic planning is of utmost importance. A WHO pandemic plan exists, and its implementation is vital.

## References

### *Publications and Documents*

Influenza Pandemic Preparedness Plan. The role of WHO and guidelines for national and regional planning. World Health Organization, 1999, WHO/CDS/CSR/EDC/99.1.

### *Web pages*

The WHO Influenza Programme fact sheet:
http://www.who.int/emc/diseases/flu/index.html

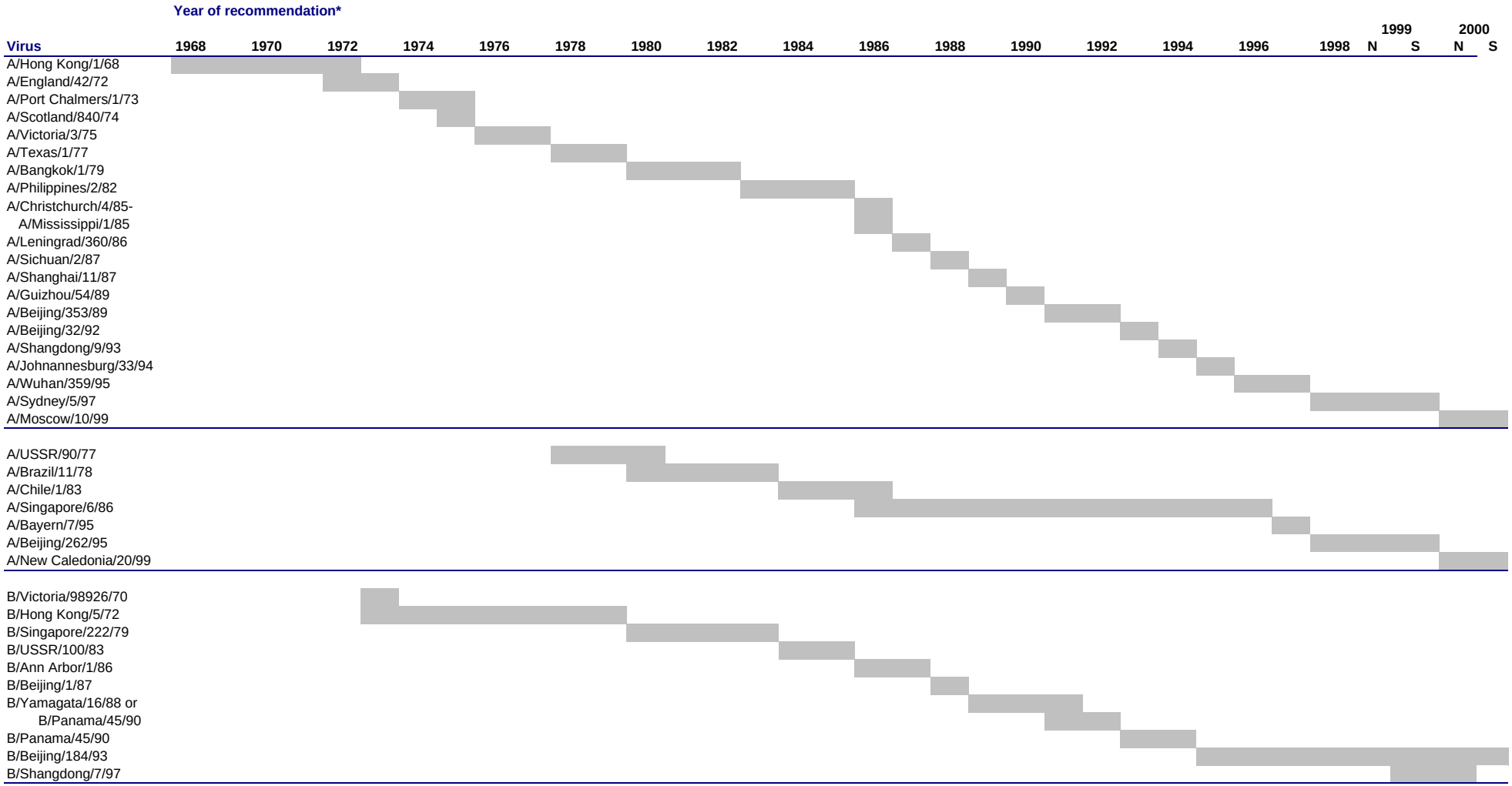
Influenza fact sheet:
http://www.who.int/emc/diseases/flu/index.html

Influenza A(H5N1) fact sheet:
http://www.who.int/emc/diseases/flu/index.html

FluNet:
http://www.oms2.b3e.jussieu.fr/flunet/

WHO influenza web pages
http://www.who.int/health-topics/influenza.html

## Fig. 7.2 Viruses recommended for inclusion in the influenza virus vaccines, 1968-2000



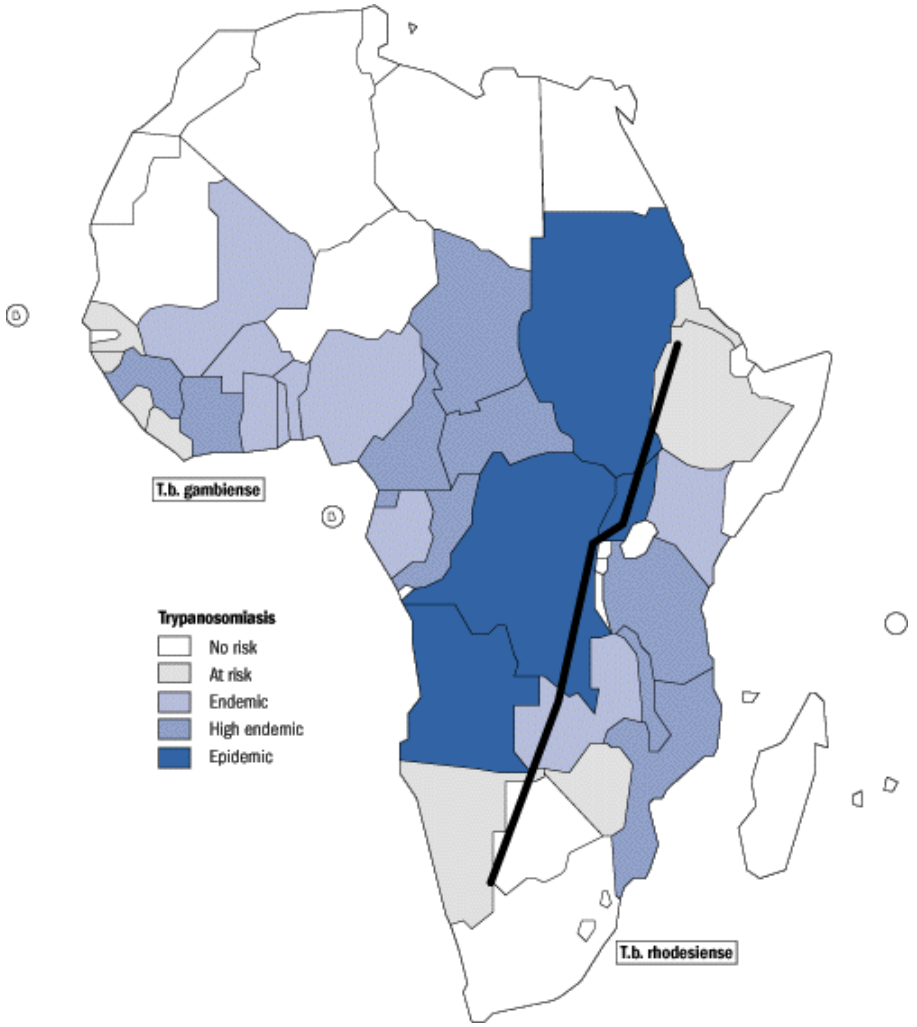

*Formal WHO recommendations first issued in 1973; beginning 1999 there have been two recommendations per year, one for the northern hemisphere (N) and the other for the southern hemisphere (S).

# CHAPTER 8
# AFRICAN TRYPANOSOMIASIS

## Background of the disease

Human African trypanosomiasis, commonly known as sleeping sickness, which had been virtually eliminated from Africa during the 1960s, has come back as a disease of major public health importance. It is caused by two different species of trypanosomes,[6] namely *Trypanosoma brucei gambiense* in West and Central Africa, and *Trypanosoma brucei rhodesiense* in East Africa. *T. b. gambiense* has a chronic and protracted course, and may last several years whereas *T. b. rhodesiense* is acute and can cause death in a matter of weeks or months. Both types of sleeping sickness are fatal if left untreated. Sleeping sickness is found uniquely in sub-Saharan Africa (Map 8.1).

**Map 8.1 Distribution of gambiense and rhodesiense sleeping sickness in sub-Saharan Africa, 1999**




Infection begins with the bite of an infected tsetse fly (*Glossina* species). During the first stage, trypanosomes multiply in the bloodstream and lymphatic system. This stage may last for years in the

[6] A trypanosome is a parasitic protozoa that causes a number of serious diseases in humans including sleeping sickness and Chagas disease.

case of gambiense sleeping sickness. At this stage there are few specific symptoms apart from the characteristic swollen cervical lymph nodes. The second stage begins when the parasite crosses the blood-brain barrier and invades the central nervous system. It is only at this second stage that the disease presents neurological symptoms and characteristic signs, including alteration of the mental state, tone disorders, sensory disorders, and coordination problems. At this stage, sleeping sickness causes an alteration of the circadian sleep/wake cycle. Other consequences include endocrinological, cardiovascular and renal disorders. The natural progression of the disease without treatment is towards body wasting, somnolence, coma, and death.

Trypanosomes are able to evade the immune system of the host because of their enormous potential for antigenic variation (over 1000 variants). It is very difficult to treat, particularly after it has crossed the blood-brain barrier. The medicines themselves are often in short supply, difficult to administer, and can be fatal. It has been estimated that between 3 and 5% of those treated in the last stage of illness die from the treatment itself. In addition, resistance to currently used drugs is a serious problem.[7] There is a clear need for new drugs, as well as better access to currently used ones.

## *Transmission*

African sleeping sickness is transmitted primarily by bites from infected tsetse flies. Transmission is also possible through contamination with infected blood or through the placenta (congenital). There are seven different species of tsetse fly which can transmit the disease, and all live uniquely in sub-Saharan Africa. Tsetse flies have a life span on average of between one and six months. They live in warm, shady, humid areas. Once infected with trypanosoma, they remain infective for life.

Gambiense sleeping sickness occurs mainly in lowland rain forests of West and Central Africa. It is spread primarily by peri-domestic tsetse flies, living in areas surrounding human habitats such as cultivated land, and near small rivers or pools of water, frequented by people. Thus, there is close contact between people and tsetse flies as people go about their daily activities. Gambiense sleeping sickness is a chronic disease with a long latency period and people can be infective for many years without knowing. Studies have indicated that a small number of tsetse flies can maintain endemic transmission cycles at relatively high levels.[8] In light of the above, it is not surprising that it is very difficult to stop transmission of gambiense sleeping sickness completely in a given locality, and in many villages, sleeping sickness recurs periodically.

Rhodesiense sleeping sickness is much more virulent than gambiense and infected people usually die within a matter of months. Tsetse flies that carry the disease live primarily in the savannah woodlands of eastern and southern Africa. Humans are affected when they go into the savannah for activities such as gathering wood, gathering honey, hunting, fishing, keeping cattle or cultivating land.

An important feature of African trypanosomiasis is its focal nature. It tends to occur in circumscribed zones. Observed prevalence rates vary greatly from one geographical area to another, and even between one village and another within the same area. Thus, it is important to understand the ecology and resulting transmission patterns in each locality.

## *Surveillance*

Sleeping sickness is one of the few communicable diseases where systematic population screening is necessary, particularly for gambiense sleeping sickness which has a very long almost asympotomatic period. There are several reasons for this including the difficulty of diagnosis which cannot normally

[7] Barrett MP and Fairlamb AH The biochemical basis of arsenical-diamidine crossresistance in African trypanosomes, *Parasitology Today*, 1999, 15(4):136-140.

[8] Lyons M, African Trypanosomiasis. In: Kiple, ed, *The Cambridge History of Human Disease,* Cambridge University Press, 1993.

be made in remote primary health care facilities,[9] the difficulty and high risk of treatment for the late stage, for which special skills are required, and the near impossibility of vector control. Therefore, the control measure most often used for gambiense sleeping sickness is systematic screening of the population to detect all cases, including those in both the first and second stage of disease, and then curing them. Guidelines for sleeping sickness surveillance have been developed by WHO in collaboration with sleeping sickness endemic countries.[10]

### *History*

Sleeping sickness is an old disease. It was known to the slave traders, who rejected Africans with the characteristic swollen cervical glands, because they knew that these people would die untimely deaths.[11] There have been three particularly severe epidemics during the twentieth century. The first was from 1896 until 1906 in Uganda and the Congo basin, the second during the 1920s, and the third began in the 1970s and continues until the present time. Intensive systematic screening by mobile teams, of many millions of people per year at risk, halted the epidemic of the 1920s. The illness was practically eliminated by 1960. Such active population screening was not continued, at least partly because the disease had nearly disappeared from Africa. Not surprisingly, with the breakdown of the control system, the disease has re-emerged as a major health problem in recent years.

## Description of the data

The data are provided by national African trypanosomiasis control programmes, and have been collected at special treatment centres, primarily through systematic screening programmes and referrals. Data provided are sometimes supplemented by published reports. Countries do not have an obligation to report cases of African trypanosomiasis to WHO, and therefore there are gaps in the database both in the number of cases reported and the number of people screened. The case reports are based on cases registered for treatment and include:

1. Village of origin of patients.
2. Disease stage.
3. Number of re-infections.
4. Number of deaths among treated subjects.
5. Sero-positive/parasite-positive ratio.

Data on the number of cases and the population screened are available from the beginning of the century.

[9] Serological detection with the CATT test (Card Agglutination Trypanosomiasis Test), is commonly used in screening. However, this test has insufficient specificity (too many false positives) to be used as a definitive diagnosis. Parasitological examinations are sufficiently specific, but are not sensitive enough unless done over a period of several successive days, because the level of parasites in the blood oscillates rapidly. If the blood is taken during the part of the cycle when few parasites are circulating, then a parasitological examination is likely to be negative, even though the disease is present. Appropriate treatment depends on whether or not the parasite has passed the blood/brain barrier. A spinal tap is needed for determining this.

[10] *Trypanosomiase Humaine Africaine: Surveillance epidemiologique et systeme d'information geographique (S.I.G),* Geneva, World Health Organization, 1996.

[11] Jansens PG, Kivits M and Vuylsteke. *Medicine et hygiene en Afrique Centrale de 1885 a nos jours.* Foundation Roi Baudoin, 1992.

## Strengths and weaknesses of the data

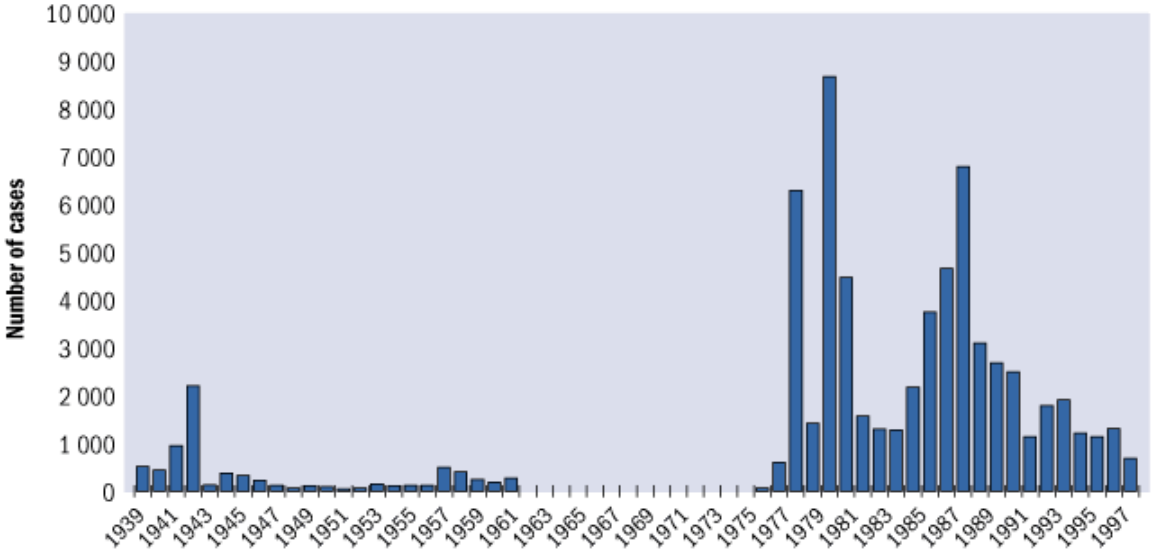
Only cases registered at special treatment centres are reported, and there are very few cases that come to the treatment centre without having either acute clinical disturbance or having been screened first. Therefore, the number of cases reported must be interpreted in light of the number of cases screened.

There are also problems of comparability with the reported data. There is a good deal of variability in the serological tests in time and space. In addition, the definition of cases, in the absence of parasitological confirmation, is difficult and depends on the number of tests used and the thresholds selected. These may change from one location to another.

Because sleeping sickness is such a focal disease, prevalence should refer only to the areas at risk. Aggregation to the national level is misleading, and obscures the problem. It is almost impossible to measure incidence rates of gambiense sleeping sickness, because the variable and long asymptomatic period of the disease makes it impossible to know when infection began with any accuracy. There is little or no information on mortality outside hospitals, since most of the deaths take place in rural areas with poor or non-existing civil registration systems. In particular, mortality in infants is difficult to measure, even with systematic screening, because of the well known systematic underreporting of infant deaths. In addition, it is very difficult to obtain age/sex breakdowns.

It is important to understand the context in which the data are collected, in order to be able to interpret epidemic curves produced from surveillance data. This can be illustrated by examining the reports from Uganda (Fig. 8.1). Between 1962 and 1975 no cases were reported. Increased reporting during 1977 to 1983 reflected an epidemic of rhodesiense sleeping sickness in Busuga (south-eastern Uganda). However the increases shown between 1986 and 1992 corresponded to both the resumption of systematic population screening for gambiense sleeping sickness in the western part of the country and to a resurgence of rhodesiense sleeping sickness in Busuga.

**Fig. 8.1 Reported number of cases of African trypanosomiasis in Uganda, 1939-1998**




| | |
|---|---|
| 1960s | Disease eliminated from Uganda |
| 1970-1975 | No data available |
| 1977-1983 | Epidemic of *T.b. rhodesiense* Busuga, south-eastern Uganda |
| 1986-1992 | Epidemic of *T.b. rhodesiense* continuing, plus resumption of systematic screening for *T.b. gambiense* in western Uganda |

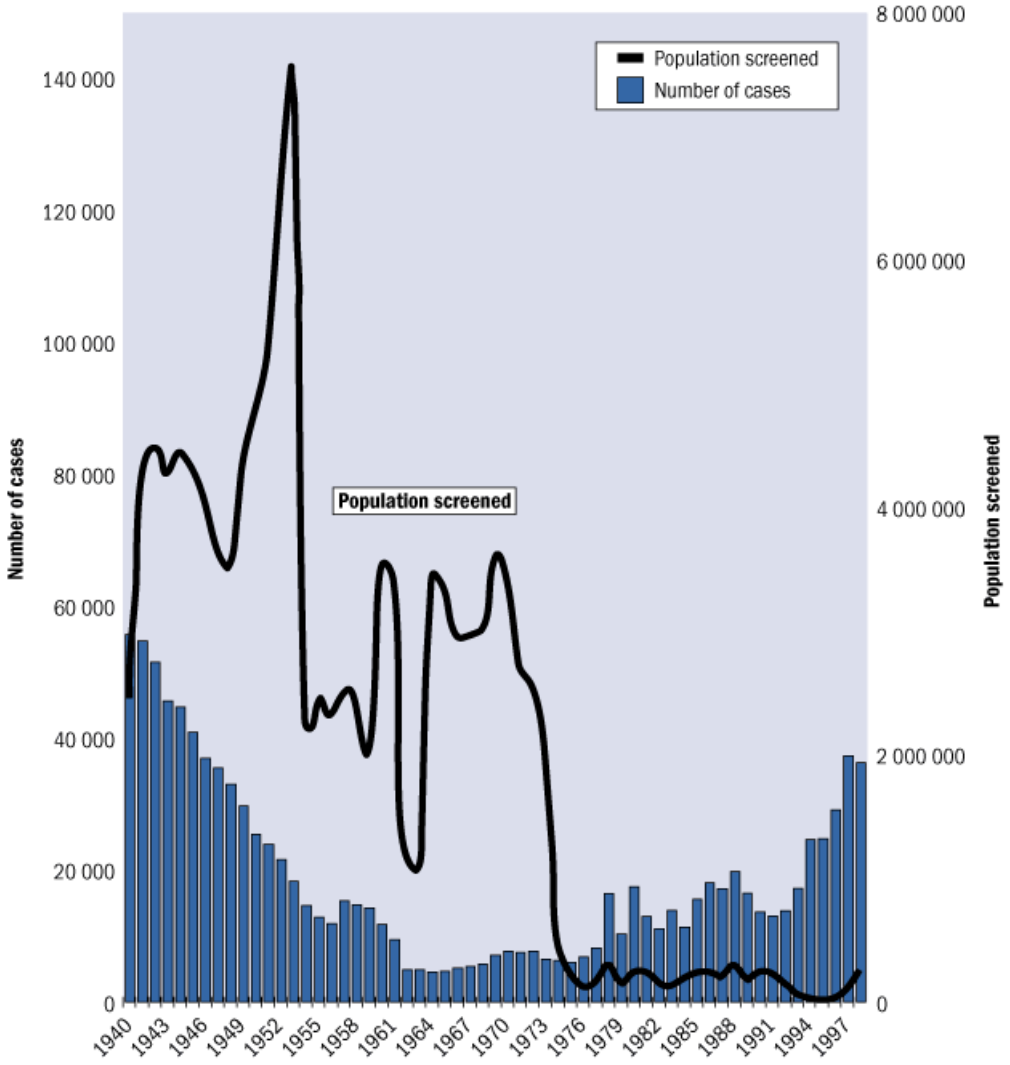
### *Trends*

- Between 1940 and 1960, the reported number of cases of sleeping sickness declined dramatically, from nearly 60 000 cases per year to almost zero. These data present a relatively accurate reflection

of the trends during this period as there was systematic screening of populations at risk during these years (Fig. 8.2).

- Beginning in the mid-1970s and continuing until the present, there has been a steep increase in the number of cases reported. At the same time, population screening has been reduced to a very small number of people. This means that the number of reported cases is a gross underestimate of the current number of cases, since population screening is the main case-finding technique.
- Fig. 8.2 also illustrates the role that systematic population screening and subsequent treatment of cases play in the control of sleeping sickness. When the screening and treatment process stopped, it was followed by a dramatic increase in disease.
- The remoteness of the areas in which the disease occurs, and the focal nature of the disease, make it difficult to estimate the incidence and prevalence of the disease. In 1999, there were a total of 40 000 cases reported. However, only 3 to 4 million of the estimated 60 million people at risk of the disease were either actively screened, or had access to a health centre with diagnostic and treatment capability.
- In many countries there is no surveillance and the situation is poorly understood. These countries include Ghana, Nigeria, Sierra Leone, and Liberia.

**Figure 8.2 Number of reported cases of African trypanosomiasis and population screened, 1940-1998**



- The number of cases in Angola is increasing rapidly. Access to epidemic areas is extremely difficult because of the state of war.
- The Democratic Republic of the Congo is the worst hit country. More than 70% of the reported cases come from this country. Prevalence of more than 70% have been found in the Bandundu and Equateur provinces. In these provinces sleeping sickness is the largest cause of mortality.[12]
- The epidemic is progressing in Sudan, where only a few NGOs are treating the new cases.
- African trypanosomiasis is still a serious problem in the Cote d'Ivoire and in Guinea. In other West African countries, few cases have been reported and there is currently regular surveillance of at-risk areas.
- There is a continuing epidemic of rhodesiense sleeping sickness in the United Republic of Tanzania and Uganda.
- The number of new cases seeking treatment in the second stage of illness has been increasing for the past three years. In addition, the number of treatment failures during the second stage is increasing and is currently between 15 and 30%. The reason for this increase in treatment failure during the second stage remains unclear.

## Conclusions

1. Sleeping sickness is in the midst of resurgence in sub-Saharan Africa.
2. It is urgent that systematic population screening in high-risk areas, together with appropriate treatment be re-established.
3. The current capacity in sub-Saharan African countries for effective surveillance of sleeping sickness is insufficient, in view of the logistic difficulties of surveillance, and the need for technical expertise for testing and treating patients, which is not available at peripheral health facilities. Because of this, most cases are not detected, not treated, and therefore fatal.

## References

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Human African Trypanosomiasis Treatment and Drug Resistance Network. Report of the first meeting. Geneva, World Health Organization, 1999, WHO/CDS/CSR/EDC/99.5.

### *Web pages*

WHO African trypanosomiasis web pages:
http:/www.who.int/health-topics/afrtryps.htm

[12] Ekwanzala M et al. In the heart of darkness: sleeping sickness in Zaire. *Lancet,* 1996, 348:1427-1430.

## Table 8.1 African trypanosomiasis, cases reported to WHO, number of countries reporting, and population screened, 1902-1998

| Africa | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 | 1910 | 1911 | 1912 | 1913 | 1914 | 1915 | 1916 | 1917 | 1918 | 1919 | 1920 | 1921 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | | | | | | | | | | | | | | | | | | | | |
| Benin | | | | | | | | | | | | | | | | | | | | |
| Botswana | | | | | | | | | | | | | | | | | | | | |
| Burkina Faso | | | | | | | | | | | | | | | | | | | | |
| Burundi | | | | | | | | | | | | | | | | | | | | |
| Cameroon | | | | | | | | | | | | | | | | | | | | |
| Central African Republic | 1,324 | 3,628 | 1,941 | 1,646 | 12 | 747 | 478 | 1,712 | 5,444 | 6,737 | 3,610 | 8,185 | 3,636 | 4,041 | 2,695 | 2,230 | 5,347 | 4,351 | 11,905 | 5,446 |
| Chad | | | | | | | | | | | | | 180 | | | | | 653 | 2,046 | 1,760 |
| Congo | | | | | | | | | | | | | | | | | | | | |
| Cote d'Ivoire | | | | | | | | | | | | | | | | | | | | |
| Dem. Rep. of the Congo | | | | | | | | | | | | | | | | | | | | |
| Equatorial Guinea | | | | | | | | | | | | | | | | | | | | |
| Gabon | | | | | | | | | | | | | | | | | | | | 1,198 |
| Gambia | | | | | | | | | | | | | | | | | | | | |
| Ghana | 0 | 1 | 6 | 7 | 3 | 34 | 16 | 45 | 52 | 83 | 104 | 57 | 12 | 17 | 8 | 12 | 10 | 14 | 27 | 8 |
| Guinea | | | | | | | | | | | | | | | | | | | | |
| Guinea-Bissau | | | | | | | | | | | | | | | | | | | | |
| Kenya | | | | | | | | | | | | | | | | | | | | |
| Mali | | | | | | | | | | | | | | | | | | | | |
| Mozambique | | | | | | | | 2 | 0 | 2 | 2 | 2 | 1 | 6 | 3 | 1 | 0 | 1 | 1 | 0 |
| Niger | | | | | | | | | | | | | | | | | | | | |
| Nigeria | | | | | | | | | | | | | | | | | | | | |
| Rwanda | | | | | | | | | | | | | | | | | | | | |
| Senegal | | | | | | | | | | | | | | | | | | | | |
| Sierra Leone | | | | | | | | | | | | | | | | | | | | |
| Sudan | | | | | | | | | | 268 | 140 | 139 | 24 | 210 | 232 | 113 | 331 | 707 | 280 | 723 |
| United Rep. of Tanzania | | | | | | | | | | | | | | | | | | | | |
| Togo | | | | | | | | | | | | | | | | | | | | |
| Uganda | | | | | | | | | | | | | | | | | | | | |
| Zambia | | | | | | | | | | | | | | | | | | | | |
| Total no. of cases | 1,324 | 3,629 | 1,947 | 1,653 | 15 | 781 | 494 | 1,759 | 5,496 | 7,090 | 3,856 | 8,383 | 3,853 | 4,274 | 2,938 | 2,356 | 5,688 | 5,726 | 14,259 | 9,135 |
| No. of countries reporting | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 4 | 4 | 4 | 5 | 4 | 4 | 4 | 4 | 5 | 5 | 6 |
| No. of countries reporting screening | | | | | | | | | | | | | | | | | | | | |
| Population screened | | | | | | | | | | | | | | | | | | | | |

## Table 8.1 African trypanosomiasis, cases reported to WHO, number of countries reporting, and population screened, 1902-1998

| Africa | 1922 | 1923 | 1924 | 1925 | 1926 | 1927 | 1928 | 1929 | 1930 | 1931 | 1932 | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | | | | | 23 | 1,320 | 5,147 | 3,165 | 3,303 | 2,719 | 2,241 | 3,994 | 3,787 | 1,442 | 1,658 | 1,809 | 2,704 | 1,900 | 2,483 |
| Benin | | | | | | | | | | | | | 6,331 | | | | | 428 | 593 |
| Botswana | | | | | | | | | | | | | | | | | | | |
| Burkina Faso | | | | | | | | 969 | 903 | 8,104 | | | | 15,214 | | | | 3,072 | 10,193 |
| Burundi | | | | | | | | | | | | | | | | | | | |
| Cameroon | | | | | | | | | | 1,937 | | | | | | | | | |
| Central African Republic | 1,466 | 941 | 1,474 | 5,464 | 5,275 | 3,074 | 10,221 | 1,819 | 8,430 | 4,776 | 1,802 | 4,249 | 3,847 | 8,798 | 10,422 | 7,492 | 13,012 | 5,853 | 4,740 |
| Chad | | | | | | 117 | | | | 2,347 | | 2,434 | | | | | | | |
| Congo | | | | | | | | | | | | | | | | | | | |
| Cote d'Ivoire | | | | | | | | | | | | | 1,492 | 4,457 | | | | 4,374 | 3,487 |
| Dem. Rep. of the Congo | | | | | | | | | 33,502 | | | | | | 18,708 | | | | 11,837 |
| Equatorial Guinea | | | | | | | | | | | | 748 | 370 | 332 | 256 | 234 | 201 | 149 | 538 |
| Gabon | | | 55 | | | | | 2,239 | | 4,737 | | 1,699 | 1,363 | 1,008 | 1,670 | | | | |
| Gambia | | | | | | | | | | | | | | | | | | | |
| Ghana | 3 | 15 | 6 | 26 | 37 | 67 | 94 | 121 | 224 | 250 | 685 | 1,179 | 1,973 | 3,885 | 4,820 | 5,599 | 5,611 | 6,826 | 6,165 |
| Guinea | | | | | | | | | | | | | 5,369 | | | | | 3,891 | 8,008 |
| Guinea-Bissau | | | | | | | | | | | | | | | | | | | |
| Kenya | | | | | | | | | | | | | | | | | | | |
| Mali | | | | | | | | | | | | | 2,580 | | | | | 1,675 | 2,395 |
| Mozambique | 0 | 0 | 1 | 3 | 1 | 9 | 19 | 31 | 27 | 18 | 79 | 27 | 15 | 11 | 44 | 18 | 9 | 11 | 12 |
| Niger | | | | | | | | | | | | | 369 | | | | | 55 | 35 |
| Nigeria | | | | | | | | | | | | | | 84,364 | | | | | |
| Rwanda | | | | | | | | | | | | | | | | | | | |
| Senegal | | | | | | | | | | | | | 55 | | | | | 2,882 | 2,140 |
| Sierra Leone | | | | | | | | | | | | | | | | | | | |
| Sudan | 544 | 851 | 367 | 222 | 82 | 77 | 29 | 18 | 38 | 62 | 63 | 83 | 32 | 91 | 150 | 89 | 110 | 109 | 40 |
| United Rep. of Tanzania | 79 | 49 | 104 | 476 | 459 | 360 | 1,751 | 3,262 | 1,750 | 1,449 | 2,868 | 2,304 | 1,475 | 1,075 | 536 | 306 | 411 | 633 | 943 |
| Togo | | | | | | | | | | | | | | | | | 1,883 | 1,922 | 1,500 |
| Uganda | | | | | | | | | | | | | | | | | | 502 | 425 |
| Zambia | | | | 3 | 5 | 22 | 6 | 0 | 6 | 4 | 12 | 11 | 13 | 160 | 28 | 34 | 94 | 24 | 53 |
| Total no. of cases | 2,092 | 1,856 | 2,007 | 6,194 | 5,882 | 5,046 | 17,267 | 11,624 | 48,183 | 26,403 | 7,750 | 16,728 | 29,071 | 120,837 | 38,292 | 15,581 | 24,035 | 34,306 | 55,587 |
| No. of countries reporting | 5 | 5 | 6 | 6 | 7 | 8 | 7 | 9 | 9 | 11 | 7 | 10 | 15 | 12 | 10 | 8 | 9 | 17 | 18 |
| No. of countries reporting screening | | | | | | | | | | | | | | | | | | 8 | 8 |
| Population screened | | | | | | | | | | | | | | | | | | 1,059,395 | 2,434,265 |

## Table 8.1 African trypanosomiasis, cases reported to WHO, number of countries reporting, and population screened, 1902-1998

| Africa | 1941 | 1942 | 1943 | 1944 | 1945 | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | 2,147 | 2,277 | 2,446 | 2,420 | 2,269 | 3,519 | 3,474 | 3,647 | 4,318 | 2,499 | 1,052 | 989 | 1,286 |
| Benin | 1,030 | 1,514 | 1,027 | 762 | 805 | 542 | 339 | 322 | 381 | 271 | 233 | 212 | 145 |
| Botswana | | | | | | | | | | | | | |
| Burkina Faso | 6,665 | 5,713 | 3,280 | 3,491 | 1,904 | 1,217 | 1,270 | 1,190 | 1,020 | 982 | 839 | 741 | 753 |
| Burundi | | | | | | | | | | | | | |
| Cameroon | | | | | | | | | | | | | |
| Central African Republic | 3,984 | 3,781 | 6,309 | 5,140 | 4,168 | 4,455 | 3,306 | 738 | 1,093 | 934 | 2,361 | 1,038 | 546 |
| Chad | | | | | | | | | | 545 | 536 | 1,141 | 816 |
| Congo | | | | | | | | | | | | | |
| Cote d'Ivoire | 4,231 | 4,955 | 3,430 | 4,739 | 3,945 | 2,767 | 2,446 | 3,378 | 3,567 | 3,534 | 2,964 | 2,690 | 2,783 |
| Dem. Rep. of the Congo | 10,951 | 9,968 | 10,093 | 10,142 | 11,080 | 8,426 | 9,289 | 9,873 | 7,609 | 6,109 | 6,086 | 5,242 | 3,804 |
| Equatorial Guinea | 348 | 313 | 217 | 174 | 248 | 205 | 236 | 287 | 317 | 211 | 174 | 217 | 174 |
| Gabon | | | | | | | | | | | | | |
| Gambia | | | | | | | | | | | | | |
| Ghana | 5,630 | 4,758 | 4,500 | 4,872 | 5,059 | 4,226 | 4,477 | 3,312 | 2,200 | 2,586 | 2,498 | 2,348 | 1,480 |
| Guinea | 11,000 | 10,350 | 7,669 | 6,787 | 5,788 | 5,861 | 5,475 | 5,457 | 4,029 | 3,458 | 2,826 | 2,548 | 1,978 |
| Guinea-Bissau | | | | | | | | | | | 1,945 | 2,169 | 1,793 |
| Kenya | | | | | | | | | | | | | |
| Mali | 2,500 | 2,021 | 1,250 | 1,208 | 1,166 | 822 | 629 | 711 | 724 | 678 | 529 | 625 | 765 |
| Mozambique | 66 | 129 | 305 | 200 | 180 | 152 | 253 | 249 | 184 | 188 | 197 | 209 | 238 |
| Niger | 96 | 69 | 68 | 30 | 34 | 12 | 18 | 9 | 5 | 3 | 2 | 4 | 2 |
| Nigeria | | | | | | | | | | | | | |
| Rwanda | | | | | | | | | | | | | |
| Senegal | 2,685 | 1,867 | 2,245 | 1,657 | 1,700 | 1,951 | 1,993 | 1,720 | 1,406 | 1,070 | 734 | 611 | 483 |
| Sierra Leone | | | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | | | |
| Sudan | 117 | 75 | 78 | 76 | 36 | 56 | 47 | 75 | 34 | 60 | 132 | 75 | 204 |
| United Rep. of Tanzania | 585 | 456 | 439 | 825 | 546 | 806 | 653 | 681 | 1,412 | 974 | 477 | 346 | 732 |
| Togo | 1,559 | 849 | 909 | 578 | 388 | 447 | 243 | 150 | 166 | 100 | 88 | 152 | 73 |
| Uganda | 934 | 2,190 | 123 | 367 | 317 | 214 | 107 | 54 | 104 | 78 | 38 | 48 | 134 |
| Zambia | 72 | 74 | 98 | 99 | 118 | 100 | 101 | 60 | 73 | 58 | 15 | 80 | |
| Total no. of cases | 54,600 | 51,359 | 45,486 | 44,567 | 40,751 | 36,778 | 35,356 | 32,913 | 29,642 | 25,338 | 23,726 | 21,485 | 18,189 |
| No. of countries reporting | 18 | 18 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | 20 | 20 | 20 | 19 |
| No. of countries reporting screening | 8 | 8 | 8 | 8 | 8 | 8 | 7 | 7 | 9 | 9 | 10 | 10 | 10 |
| Population screened | 4,235,275 | 4,470,391 | 4,237,993 | 4,415,153 | 4,269,309 | 4,038,992 | 3,630,219 | 3,492,632 | 4,298,686 | 4,835,315 | 5,280,769 | 6,414,634 | 7,422,053 |

## Table 8.1 African trypanosomiasis, cases reported to WHO, number of countries reporting, and population screened, 1902-1998

| Africa | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | 997 | 1,015 | 418 | 177 | 93 | 32 | 63 | 14 | 16 | 9 | 66 | 177 | 103 | 36 |
| Benin | 127 | 148 | 201 | 117 | 118 | 85 | 84 | 64 | 42 | 1 | 34 | 20 | 22 | 11 |
| Botswana | | | | | | | | | | | | | 127 | 42 |
| Burkina Faso | 846 | 862 | 1,005 | 767 | 742 | 714 | 476 | 627 | 463 | 375 | 313 | 221 | 199 | 197 |
| Burundi | | | | | | | | | | | | | | |
| Cameroon | | | | | | | | 80 | 116 | 65 | 83 | 85 | 62 | 425 |
| Central African Republic | 506 | 557 | 123 | 118 | 78 | 22 | 42 | 20 | 18 | 29 | 18 | 51 | 58 | 24 |
| Chad | 439 | 470 | 277 | 277 | 384 | 213 | 402 | 311 | 258 | 194 | 92 | 97 | 186 | 99 |
| Congo | | | | | | | | 75 | 20 | 33 | 64 | 24 | 40 | 28 |
| Cote d'Ivoire | 1,165 | 855 | 1,450 | 1,337 | 1,354 | 867 | 835 | 968 | 918 | 848 | 577 | 394 | 320 | 275 |
| Dem. Rep. of the Congo | 2,734 | 2,117 | 1,604 | 1,560 | 1,296 | 1,098 | 131 | 569 | 495 | 739 | 970 | 1,324 | 2,020 | 2,574 |
| Equatorial Guinea | 121 | 135 | 93 | 115 | 70 | 59 | 70 | 76 | 85 | 72 | 84 | 97 | 55 | 30 |
| Gabon | | | 90 | 132 | 120 | 83 | 109 | 186 | 166 | 109 | 119 | 135 | 91 | 94 |
| Gambia | | | | | | 830 | 448 | | | | | | | |
| Ghana | 992 | 710 | 778 | 893 | 830 | 928 | 603 | 322 | 257 | 409 | 356 | 408 | 324 | 235 |
| Guinea | 1,850 | 1,800 | 1,600 | 1,470 | 1,226 | 950 | 1,078 | 865 | | | | | | |
| Guinea-Bissau | 1,212 | 1,328 | 880 | 642 | 623 | 700 | 665 | 418 | 335 | 268 | 232 | 304 | | |
| Kenya | | | | | | | | | | | | | | |
| Mali | 854 | 812 | 958 | 875 | 1,146 | 1,208 | 1,187 | 1,166 | 833 | 771 | 538 | 432 | 351 | 259 |
| Mozambique | 267 | 170 | 127 | 221 | 167 | 83 | 88 | 66 | 52 | 39 | 34 | 80 | 57 | 113 |
| Niger | 3 | 1 | 2 | 14 | 3 | 4 | 2 | 3 | 3 | 2 | 1 | 0 | 0 | 22 |
| Nigeria | | | | 5,045 | 4,862 | 4,549 | 3,789 | 2,129 | | | | | | |
| Rwanda | | | | | | | | | | | | | | |
| Senegal | 336 | 168 | 146 | 231 | 168 | 127 | 126 | 125 | 124 | 63 | 35 | 97 | 37 | 35 |
| Sierra Leone | 60 | 77 | 43 | 45 | 65 | 28 | 32 | | | | | | | |
| Sudan | 561 | 310 | 973 | 159 | 169 | 410 | 280 | 81 | 41 | 27 | 14 | 1 | 0 | 0 |
| United Rep. of Tanzania | 1,230 | 923 | 646 | 411 | 555 | 825 | 825 | 765 | 355 | 510 | 616 | 473 | 800 | 560 |
| Togo | 55 | 138 | 175 | 110 | 71 | 66 | 36 | 72 | 55 | 60 | 34 | 28 | 67 | 97 |
| Uganda | 103 | 114 | 108 | 490 | 394 | 233 | 177 | 257 | | | | | | |
| Zambia | 3 | 30 | 25 | 20 | 68 | 69 | 93 | 103 | 81 | 108 | 155 | 99 | 128 | 110 |
| Total no. of cases | 14,461 | 12,740 | 11,722 | 15,226 | 14,602 | 14,183 | 11,641 | 9,362 | 4,733 | 4,731 | 4,435 | 4,547 | 5,047 | 5,266 |
| No. of countries reporting | 21 | 21 | 22 | 23 | 23 | 24 | 24 | 24 | 21 | 21 | 21 | 21 | 21 | 21 |
| No. of countries reporting screening | 4 | 4 | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 3 | 5 | 4 | 3 | 3 |
| Population screened | 2,078,756 | 2,452,988 | 2,283,694 | 2,507,145 | 2,442,161 | 1,911,377 | 3,515,406 | 2,643,711 | 1,147,689 | 1,047,708 | 3,426,349 | 3,269,501 | 2,932,467 | 2,961,117 |

## Table 8.1 African trypanosomiasis, cases reported to WHO, number of countries reporting, and population screened, 1902-1998

| Africa | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | 36 | 14 | 26 | 22 | 6 | 4 | 3 | 126 | 83 | 118 | 337 | 170 | 306 | 145 | 163 |
| Benin | 17 | 23 | 11 | 4 | 9 | 6 | 3 | 5 | 19 | 41 | 6 | 4 | 0 | 1 | 0 |
| Botswana | 36 | 37 | 59 | 272 | | | | | | | | | | | |
| Burkina Faso | 164 | 262 | 145 | 114 | 79 | 73 | 68 | 94 | 82 | 74 | 62 | 64 | 134 | 153 | 44 |
| Burundi | | | | | | | | | | | | | | | |
| Cameroon | 219 | 211 | 229 | 125 | 349 | 283 | 326 | 385 | 674 | 379 | 240 | 153 | 269 | 399 | 1,079 |
| Central African Republic | 34 | 24 | 63 | 175 | 112 | 91 | 85 | 35 | 53 | 29 | 71 | 54 | 26 | 58 | 431 |
| Chad | 66 | 54 | 31 | 22 | 23 | 11 | 9 | 6 | 102 | 157 | 108 | | | | 19 |
| Congo | 134 | 54 | 56 | 172 | 49 | 12 | 91 | 107 | 184 | 137 | 235 | 357 | 626 | 539 | 252 |
| Cote d'Ivoire | 376 | 176 | 148 | 104 | 110 | 131 | 98 | 219 | 269 | 502 | 391 | 428 | 378 | 410 | 253 |
| Dem. Rep. of the Congo | 3,247 | 4,959 | 6,172 | 5,121 | 5,206 | 4,118 | 4,298 | 3,755 | 3,818 | 4,390 | 5,790 | 5,167 | 4,817 | 5,103 | 5,703 |
| Equatorial Guinea | | | | | | | | | | | | 26 | 95 | 75 | 81 |
| Gabon | 80 | 44 | 59 | 38 | 43 | 32 | 47 | 56 | 63 | 117 | 254 | 429 | 340 | 209 | 70 |
| Gambia | | | | | | 9 | 18 | 9 | 35 | 2 | 16 | | | | |
| Ghana | 174 | 169 | 101 | 156 | 130 | 85 | 94 | 79 | 57 | 42 | 34 | 24 | 18 | 17 | 23 |
| Guinea | | | | | 114 | 107 | 93 | 78 | 68 | 108 | 93 | 96 | 78 | 55 | 84 |
| Guinea-Bissau | | | | | | | | | | | | | | | |
| Kenya | | | | | | | | | | | | | | | |
| Mali | 356 | 233 | 231 | 190 | 210 | 388 | 188 | 164 | 105 | 105 | 83 | 65 | 34 | 27 | 36 |
| Mozambique | 43 | 26 | 35 | 20 | 27 | 11 | 5 | 14 | 19 | 20 | 83 | 100 | 83 | 108 | 70 |
| Niger | 9 | 0 | 4 | 0 | 2 | 1 | | | | | | | | | |
| Nigeria | | | | | | | | | | | | | | | |
| Rwanda | | | | | | | | | | | | | | | |
| Senegal | 43 | 16 | 16 | 15 | 17 | 10 | 2 | 3 | 4 | 1 | | | | | |
| Sierra Leone | | | | | | | | | | | | | | | |
| Sudan | 22 | 6 | 8 | 2 | 22 | 115 | 287 | 296 | 431 | 614 | 1,500 | 1,124 | 1,163 | 1,104 | 1,074 |
| United Rep. of Tanzania | 403 | 530 | | 569 | 612 | 477 | 487 | 440 | 623 | 650 | 747 | 473 | 341 | | |
| Togo | 93 | 83 | 23 | 79 | 26 | 25 | 17 | 11 | 4 | 20 | 14 | 11 | 12 | 6 | 3 |
| Uganda | | | | | | | | | 52 | 586 | 6,266 | 1,409 | 8,648 | 4,450 | 1,560 |
| Zambia | 80 | 77 | 127 | 196 | 396 | 387 | | | | | | | | | |
| Total no. of cases | 5,632 | 6,998 | 7,544 | 7,396 | 7,542 | 6,376 | 6,219 | 5,882 | 6,745 | 8,092 | 16,330 | 10,154 | 17,368 | 12,859 | 10,945 |
| No. of countries reporting | 20 | 20 | 19 | 20 | 20 | 21 | 19 | 19 | 20 | 20 | 19 | 18 | 18 | 17 | 18 |
| No. of countries reporting screening | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| Population screened | 2,991,580 | 3,600,710 | 3,414,392 | 2,675,709 | 2,518,500 | 1,910,024 | 471,588 | 222,968 | 106,110 | 156,608 | 293,059 | 128,849 | 234,614 | 226,892 | 133,909 |

## Table 8.1 African trypanosomiasis, cases reported to WHO, number of countries reporting, and population screened, 1902-1998

| Africa | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Angola | 88 | 252 | 1,105 | 1,272 | 810 | 1,191 | 1,557 | 1,498 | 2,094 | 2,406 | 1,796 | 1,274 | 2,478 | 6,726 | 8,291 | 6,610 |
| Benin | 13 | 1 | 2 | 2 | 3 | 1 | 1 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| Botswana | | | | | | | | | | | | | | | | |
| Burkina Faso | 43 | | | | 56 | | | 27 | 27 | 20 | 2 | 18 | 13 | 12 | 2 | |
| Burundi | | | | | | | | | | | | | | | | |
| Cameroon | 3,113 | 1,038 | 1,102 | 585 | 341 | 106 | 66 | 65 | 41 | 22 | 16 | 12 | 8 | 9 | 6 | 55 |
| Central African Republic | 59 | 76 | 140 | 69 | 170 | 171 | 308 | 118 | 535 | 365 | 264 | 362 | 673 | 434 | 708 | 1,069 |
| Chad | 18 | 19 | 185 | 219 | 337 | 421 | 187 | 20 | 212 | 133 | 65 | 213 | 401 | 178 | 131 | 134 |
| Congo | 439 | 436 | 561 | 391 | 302 | 567 | 642 | 580 | 703 | 727 | 754 | 418 | 475 | 474 | 142 | 201 |
| Cote d'Ivoire | 289 | 246 | 243 | 208 | 181 | 315 | 287 | 365 | 349 | 456 | 462 | 404 | 596 | | 18 | 21 |
| Dem. Rep. of the Congo | 6,282 | 7,150 | 8,769 | 10,514 | 9,696 | 9,587 | 9,814 | 7,712 | 5,824 | 7,757 | 11,384 | 19,340 | 18,158 | 19,342 | 25,200 | 27,044 |
| Equatorial Guinea | 72 | 66 | 291 | 366 | 98 | 59 | 36 | 28 | 30 | 85 | 32 | 62 | 38 | 46 | 68 | 59 |
| Gabon | 89 | 63 | 59 | 31 | 35 | 30 | 78 | 43 | 32 | 18 | 94 | 85 | 41 | | 11 | 6 |
| Gambia | | | | | | | | | | | | | | | | |
| Ghana | 5 | 7 | 11 | 7 | 7 | 4 | 15 | 4 | 6 | 16 | | | | | | |
| Guinea | 59 | 60 | 37 | 31 | 42 | 60 | 34 | 41 | 29 | 24 | 27 | 26 | 33 | 47 | 92 | 57 |
| Guinea-Bissau | | | | | | | | | | | | | | | | |
| Kenya | | | | | | | | 90 | 7 | 2 | 2 | 1 | 0 | 0 | 6 | 20 |
| Mali | 83 | | 50 | | | | | | | | 27 | 17 | 11 | 5 | 0 | 0 |
| Mozambique | 118 | 88 | 59 | 16 | 8 | 2 | 6 | 3 | 7 | 24 | 10 | 16 | | | | |
| Niger | | | | | | | | | | | | | | | | |
| Nigeria | | | | | | | | | | | | | | | | |
| Rwanda | | | | | | | | | | | | | | | | |
| Senegal | | | | | | | | | | | | | | | | |
| Sierra Leone | | | | | | | | | | | | | | | | |
| Sudan | 1,290 | | 200 | 65 | 58 | 193 | 56 | 67 | 58 | 28 | 62 | 69 | 56 | 157 | 737 | |
| United Rep. of Tanzania | 412 | 473 | 474 | 446 | 264 | 174 | 187 | 180 | 466 | 513 | 303 | 319 | 422 | 400 | 508 | 194 |
| Togo | 5 | 2 | 1 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 3 | 0 | 1 | |
| Uganda | 1,287 | 1,259 | 2,158 | 3,730 | 4,646 | 6,770 | 3,081 | 2,667 | 2,481 | 1,126 | 1,770 | 1,891 | 1,200 | 1,125 | 1,300 | 677 |
| Zambia | | | | | | | | | | | | | | | | |
| Total no. of cases | 13,764 | 11,236 | 15,447 | 17,952 | 17,055 | 19,652 | 16,355 | 13,510 | 12,901 | 13,724 | 17,071 | 24,527 | 24,606 | 28,955 | 37,221 | 36,147 |
| No. of countries reporting | 19 | 16 | 18 | 17 | 18 | 17 | 17 | 19 | 19 | 19 | 19 | 19 | 18 | 16 | 18 | 15 |
| No. of countries reporting screening | 2 | 3 | 4 | 2 | 3 | 6 | 6 | 7 | 6 | 5 | 5 | 5 | 1 | 0 | 6 | 9 |
| Population screened | 118,807 | 189,216 | 227,773 | 224,587 | 184,957 | 289,534 | 158,321 | 228,898 | 137,244 | 130,291 | 41,158 | 36,604 | 853 | 853 | 102,284 | 247,677 |

# CHAPTER 9
# HUMAN IMMUNODEFICIENCY VIRUS AND ACQUIRED IMMUNE DEFICIENCY SYNDROME (HIV/AIDS)

## Background of the disease

AIDS (Acquired Immune Deficiency Syndrome) is caused by a virus, HIV (Human Immunodeficiency Virus) first isolated in 1983. It has been identified in over 200 countries and territories worldwide and is spreading rapidly in many affected populations, particularly in developing countries.

HIV belongs to an unusual group of viruses called retroviruses, which include viruses causing leukaemia in humans, cats, cattle and other animals, and certain other viruses found in monkeys, apes, sheep and pigs. Retroviruses also belong to a subgroup called lentiviruses, because they are slow to cause disease.

There are two main strains of HIV: HIV-1 that has caused the majority of infections and AIDS cases and HIV-2, which is concentrated in selected countries. Of the other known related viruses, a type of retrovirus found in many other primates (Simian Immunodeficiency Virus, SIV) may be the most likely contender for the origin of HIV. Different strains of SIV have been found in various monkey and ape species in Africa, and some cause an AIDS-like disease in their host. One of the most similar to HIV-1, however, is the SIV found in chimpanzees. Many viruses mutate, or change, more easily than more complex organisms. HIV itself has numerous varieties and has been shown to mutate even within an individual during the progress of the infection. AIDS develops in a HIV-positive person after years of infection, as HIV steadily weakens the body's immune system and increases its vulnerability to pneumonia, tuberculosis, diarrhoea, tumours and other opportunistic illnesses. With the number of people infected with HIV continuing to rise, the number of people falling sick and dying of AIDS will multiply.

While the origins of AIDS remain obscure, it is known that HIV occurred as long ago as the 1950s in isolated individuals. It began to be widespread in the mid- to late-1970s but, because of the long incubation period, the virus did not cause widespread disease until the 1980s. In its early stages the viral epidemic progresses unseen.

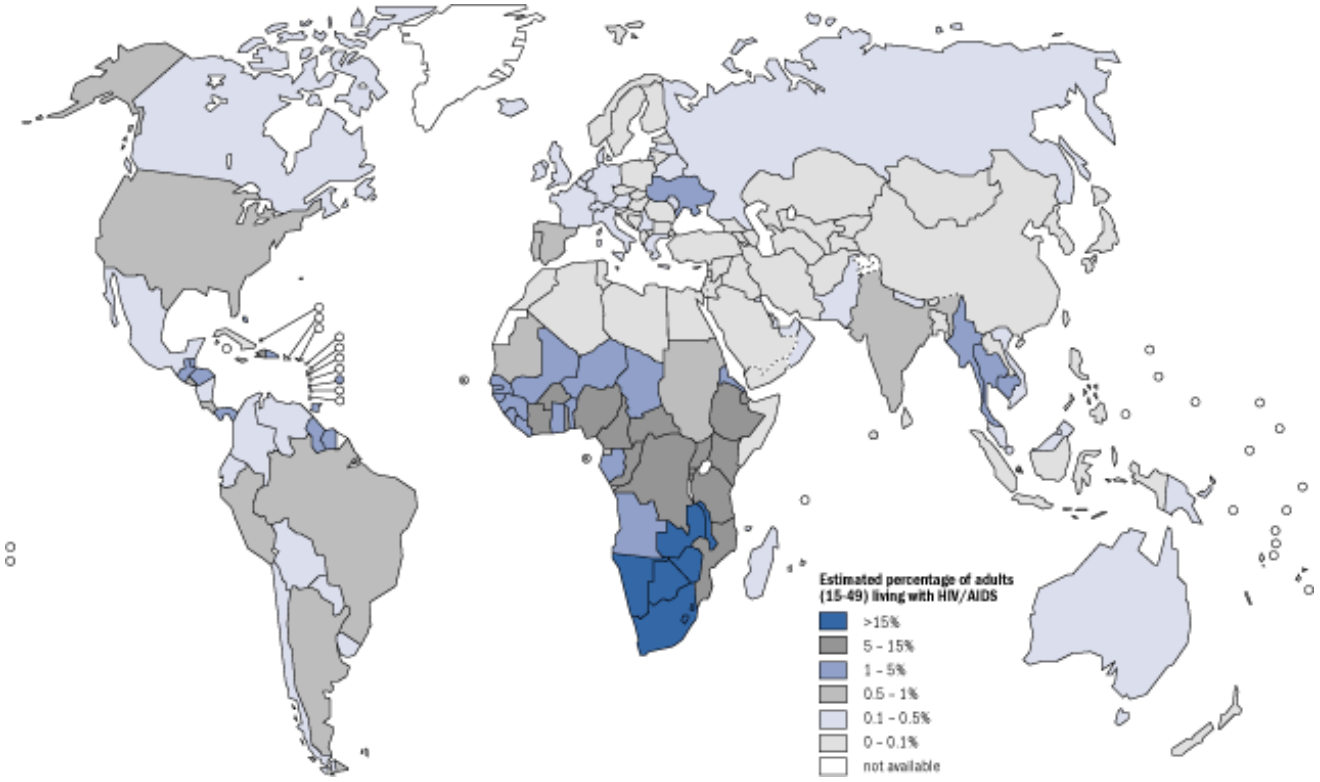
By the 1990s, however, AIDS itself reached epidemic proportions in many countries. Of the estimated 34.3 million people living with HIV at the end of 1999, 24.5 million live in sub-Saharan Africa, the hardest hit region. The estimated percentage of adults living with HIV reaches up to 26% in some countries in this region (Map 9.1). AIDS has become the main cause of death in parts of Africa and is responsible for the majority of adult hospital admissions in some cities. Many AIDS patients are never diagnosed, and their deaths may be attributed to other causes.

### *Transmission*

HIV is easily killed outside the human body and therefore can only be transmitted directly from person to person, either by sexual contact, exchange of blood or body fluids or from mother to child. Sexual transmission of HIV is relatively inefficient and repeated unprotected exposures are normally required. Since the global HIV epidemic is driven mainly by sexual transmission, the level and intensity of risk behaviours (vaginal or anal unprotected sex) in a given community are the main determinants of the spread of the virus. Therefore, HIV incidence and prevalence can vary greatly from country to country and even within countries, depending on several factors, some well documented and others still being investigated. These factors may determine the probability of exposure to HIV infection (e.g. level and extent of risk behaviours, high HIV prevalence in the community), others may influence the probability of HIV transmission per exposure (e.g. the prevalence of other sexually transmitted infections (STIs), levels of condom use, circumcision). In view of the importance of these determinants, information

from behavioural surveillance studies and STI incidence and prevalence can help better explain epidemic curves and monitor the impact of interventions. The concept of 2nd generation HIV surveillance, introduced by WHO and UNAIDS, integrates AIDS and HIV surveillance with additional sources of essential data to better monitor the epidemic.[1]

**Map 9.1 Estimated percentage of adults (15–49 years old) infected with HIV, as of 1999[2]**




## Description of the data

The worldwide spread of HIV and the development of AIDS are being closely monitored worldwide. HIV surveillance is carried out to assess the seriousness of the situation, to monitor the rate of HIV spread (its incidence and prevalence), to increase awareness of the medical, social, economic, political impact of the disease and to promote effective planning and policy in relation to HIV/AIDS.

For most purposes precise data are not needed, as long as the general trends and the range or order of magnitude of the existing infection can be measured. However, for some purposes, such as measuring the impact of specific interventions, or for testing the efficacy of vaccines and treatments, precise data must be obtained.

Both data on the reported number of clinical AIDS cases and on seroprevalence of HIV infection are being collected. In assessing the seriousness of the AIDS pandemic, the level of HIV infection in a population is more informative than the number of people who have already progressed to AIDS. HIV infection is usually measured by sentinel seroprevalence studies, that is, the regular testing of selected groups of people for the presence of antibodies to HIV.

[1] *Guidelines for second generation HIV surveillance*. World Health Organization and UNAIDS, 2000, WHO/CDS/EDC/2000.5.

[2] Source: Report on the global HIV/AIDS epidemic, UNAIDS/CO.13E.

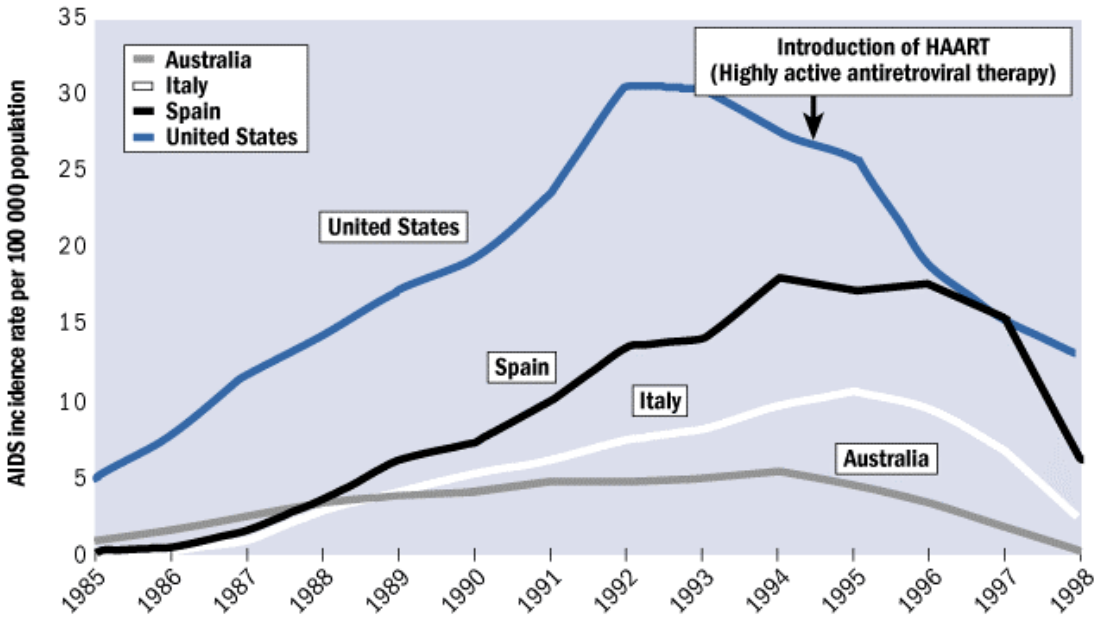
## *AIDS case surveillance*

WHO has requested countries to submit regular reports on cases of AIDS since 1981 (Table 9.1). Updates on aggregated information by sex, age and presumed mode of transmission are gathered annually. The reported AIDS figures give a useful general overview but cannot be assumed to give an accurate or strictly comparable picture of the epidemic in different countries. While giving a general idea of the increase of AIDS in a population, the figures do not reflect the actual prevalence of AIDS disease so much as the accuracy of detection, diagnosis and reporting of the disease syndrome.

Nearly all countries have AIDS case-reporting systems in place, but the quality of the AIDS case reports varies significantly. The considerable variation in the percentage of AIDS cases that are reported to WHO from different countries reflects differences in the quality and extent of available services and testing facilities and the extent to which the population has access to and uses the facilities. Other main reasons for the variation in reporting between countries are the AIDS case definitions used, whether HIV testing is required or not for reporting, the availability and use of guidelines for diagnosing and reporting AIDS, the availability of HIV testing, the willingness and capacity to collect, compile and analyse the information and the regularity and completeness of reporting to WHO.

In spite of the limitations, information from reported AIDS cases is used in different ways. These include alerting countries to the presence of HIV in new areas or population groups, to assess the disease burden and AIDS-associated morbidity, to raise awareness and commitment, to provide information on the sociodemographic characteristics of the groups most affected, including sex ratios, age groups and main modes of transmission, and, in some situations, to estimate HIV prevalence and incidence through back-calculation.

**Fig. 9.1 Reported cases of AIDS in industrialized countries[3]**




[3] Source: UNAIDS/WHO working group on HIV/AIDS and STI surveillance.

### *HIV sentinel surveillance*

The main epidemiological tool used to monitor trends in HIV infection prevalence in population groups is HIV sentinel surveillance. This is HIV screening of selected groups in the population, including those who are easily accessible, such as pregnant women (whose blood is routinely taken for other reasons) and people thought to be at high risk of HIV. This may include men who have sex with men, intravenous drug injectors, sex workers and people attending sexually transmitted infections (STI) clinics. Surveillance is usually repeated at the same sites at regular intervals (serial surveillance) to indicate how levels of infection are changing over time in specific areas and certain population groups. Levels of HIV in the wider population and among those at low risk are also important indicators of the parameters of the epidemic. Data may sometimes be obtained by screening blood donors, although their representativeness of the wider population is limited. Population-based studies, though complex and costly, can provide a better measure of the prevalence of HIV in the general population. However, the results of several population-based studies have shown that, in generalized epidemics, sentinel surveillance in pregnant women can be used as an indication (a proxy) for the prevalence in the adult, sexually-active population.

## Strengths and weaknesses of the data

### *AIDS case surveillance*

A number of factors need to be kept in mind when interpreting these data. In the first place, they come from surveillance systems of varying quality, and as such are subject to all the limitations of international comparisons. For example, the proportion of AIDS cases which are reported ranges widely, from less than 10% in some countries to almost 90% in others. In addition, countries use different AIDS case definitions. Stigma and discrimination associated with the disease may contribute to the reluctance in diagnosing and reporting AIDS cases. Next, the development of AIDS occurs fairly late in the natural history of the disease. For the most part, those who have developed AIDS in 1999 are those who were infected 5-10 years ago or even earlier. Thus, the AIDS data presented here reflect HIV transmission patterns that took place years ago. Also, there is considerable variation in the speed of progression from HIV to AIDS between children and adults. Very few of the children infected at birth survive beyond the age of five. Progression rates have also changed dramatically in industrialized countries, where the introduction of Highly Active Anti-Retroviral Therapy has contributed to decreases of up to 70% in the number of reported AIDS cases and related AIDS deaths (Fig. 9.1).

The term AIDS refers to the most severe clinical manifestations of infection with HIV. It includes a number of specific opportunist infections and/or associated diseases or cancers. People with AIDS usually die of associated illnesses like tuberculosis, chronic diarrhoea and wasting, pneumonia, meningitis, tumours or other infections that their immune system can no longer fight. The underlying cause of death, immunodeficiency caused by HIV, may not be recognized.

The AIDS figures given are reported numbers, not percentages of respective populations. This may lead to a biased perception of the seriousness of the epidemic in different populations unless relative population sizes are taken into account. Furthermore, AIDS figures only reflect the final, terminal stage of HIV infection, not the number of people who have the virus . The term "AIDS case" refers only to those people with full AIDS syndrome, that is, the final stage of HIV infection, who meet the national AIDS case definition. It does not include anyone with only mild symptoms of disease or those with HIV infection but no symptoms. Some people may even die of HIV-related problems without meeting the strict criteria for AIDS. Some claim that the term "AIDS case" itself is becoming less useful over time. Many medical practitioners are tending to use terms such as HIV or AIDS related illness instead.

### *HIV sentinel surveillance*

HIV sentinel surveillance can provide more accurate indications of trends of HIV infection in the selected population groups and sites, particularly when conducted regularly at yearly intervals. HIV sentinel surveillance is a relatively simple and cheap epidemiological tool. Its flexibility and low cost make it feasible and sustainable even in resource poor settings. More than 10 years of experience have shown that, when conducted regularly, HIV sentinel surveillance can provide valuable information on the general trends in HIV prevalence in different population groups.

HIV sentinel surveillance may be conducted in existing health facilities (e.g. antenatal clinics (ANC), STI clinics) or in communities or sub-population groups, often through outreach work (e.g. sex workers, injecting drug users). Most surveys of HIV seroprevalence, particularly sentinel surveillance, are not based on a representative sample of the national populations but on convenient samples in selected sites that may at best represent only the specific population at the selected site. Therefore, while the use of unlinked anonymous testing methodologies can reduce the potential participation bias, selection biases remain a potential source of error. Other sources of bias or confounding surrounding HIV estimates based on limited convenient samples include:

Non-representative samples:

Samples of convenience, may be used, e.g. hospital or ANC patients. These people may not be truly representative and have higher or lower levels of HIV than the general population or population sub-groups.

Geographic bias:

If more easily accessible populations are sampled, they may represent people at higher risk than those in less accessible areas where there is lower prevalence of HIV; where facilities are used for sentinel surveillance, only areas with functioning facilities and sufficient patient load can be included in the system.

## Trends

- WHO and UNAIDS have estimated that by the end of 1999, 34.3 million people were living with HIV worldwide. It is also estimated that during 1999, 5.4 million people (including 620 000 children below 15 years of old) became infected. (Table 9.2).

- Of the 5.4 million people newly infected with HIV in 1999, 4 million live in sub-Saharan Africa, the hardest-hit region. There are now more women than men among the 24.5 million adults and 1 million children estimated to be living with HIV/AIDS in sub-Saharan Africa.

- Asia continues to have relatively low prevalence rates. There are an estimated 5.6 million adults and children living with HIV/AIDS in South-East Asia.

- An estimated 1.3 million adults and children live with HIV in Latin America and the Caribbean. These are mainly men who have unprotected sex with other men and injecting drug users who share needles.

- In 1999, Eastern Europe and Central Asia have seen the sharpest increase in HIV infections. Most of the 420 000 people living with HIV/AIDS in these countries have been infected through injecting drug use.

- In the industrialized countries of North America, Western Europe and the Pacific, the availability of antiretroviral therapy has continued to reduce progression to AIDS, deaths and mother-to-child transmission of HIV. In most of these countries, however, the number of new HIV infections has remained relatively constant in recent years, with an estimated 1.5 million people living with HIV at the end of 1999.

- Unsafe blood transfusions, a largely preventable mode of transmission, are causing a relatively small but still significant number of AIDS cases in many regions, particularly in the Middle East. Perinatal transmission, now also preventable to a large extent, is an important cause of AIDS in sub-Saharan Africa. However, paediatric AIDS is more likely to be underreported due to the diagnostic difficulties in resource-poor settings.

- Assumed modes of HIV transmission in AIDS cases reported during recent years vary considerably from region to region For example, about 90% of reported AIDS cases in sub-Saharan Africa have reportedly been infected through heterosexual transmission. The proportion is much lower in other regions, although a substantial number of AIDS cases have been infected heterosexually in Asia, Latin America and North Africa/Middle East. The pattern in industrialized countries is mixed but it should be noted that heterosexual transmission is increasingly a cause of HIV infection in reported AIDS cases in these countries. In industrialized countries, Eastern Europe and Asia, a high proportion of reported infections is due to injecting drug use.

## Conclusions

1. HIV/AIDS continues to spread in all regions of the world but at very different rates. The situation is most dramatic in sub-Saharan Africa, where the highest HIV prevalence rates are found and the number of AIDS cases will continue to rise in the next 5-10 years. An estimated 55% of infected adults in sub-Saharan Africa are women. Meanwhile, the introduction of effective therapies has reduced dramatically the progression to AIDS and death in industrialized countries.

2. The gap between rich and poor countries seems to be widening owing to the lack of access to effective therapies and to means for preventing mother-to-child transmission. On the other hand, the success in reducing AIDS mortality and perinatal infections in the industrialized countries cannot mask the failure of preventive programmes in reducing the rate of new infections.

3. Surveillance of HIV infections and AIDS cases remains an essential tool to monitor the epidemic, assess its impact and for planning effective interventions at national level. Collection and analysis of information at regional and global levels enables the close monitoring of the spread of HIV, the assessment of the burden of disease and advocacy for an intensified response to the epidemic.

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*WHO recommended surveillance standards*, World Health Organization, 1999, WHO/CDS/CSR/ISR/99.2.

*AIDS epidemic update*, World Health Organization and UNAIDS, 1999.

Global AIDS Surveillance Part I, *Weekly Epidemiological Record*, 1999, 74**:** 401-408.

Global AIDS Surveillance Part II, *Weekly Epidemiological Record*, 1999, 74**:** 409-420.

Chin J, Public health surveillance of AIDS and HIV infections, *Bulletin of the World Health Organization*, 1990, 68(5):529-536.

Chin, J. and Mann JM, Global surveillance and forecasting of AIDS. *Bulletin of the World Health Organization*, 1989, 67:1-7 (1989).

*Report on the global HIV/AIDS epidemic*, World Health Organization and UNAIDS, 1998.

## *Web pages*

WHO HIV/AIDS/STI web pages:
http://www.who.int/health-pages/hiv.htm

UNAIDS web pages:
http://www.unaids.org

Monitoring the AIDS Pandemic network:
http://www.hri.ca/partners/fxbcenter/aidsprogram/index.htm

United States Bureau of the Census:
http://www.census.gov:80/ftp/pub/ipc/www/hivaidsn.html

Centers for Disease Control:
http://www.cdc.gov/nchstp/hiv_aids/surveillance.htm

## Table 9.1 AIDS, cases reported to WHO and number of countries reporting, 1979-1999[1]

| Africa | 1979-1996 | 1997 | 1998 | 1999 | Total [2] | Last report |
|---|---|---|---|---|---|---|
| Algeria | 298 | 39 | 49 | 24 | 410 | 15/Nov/99 |
| Angola | 1,510 | 416 | 507 | | 2,433 | 26/Mar/99 |
| Benin | 1,783 | 1,030 | | | 2,813 | 06/Jun/98 |
| Botswana | 4,815 | 2,335 | 2,992 | | 10,142 | 10/Jun/99 |
| Burkina Faso | 9,136 | 2,216 | 2,166 | | 13,518 | 11/Jun/99 |
| Burundi | 8,776 | 470 | 581 | 2,187 | 12,014 | 30/Jun/99 |
| Cameroon | 9,626 | 3,950 | 5,410 | | 18,986 | 29/Oct/99 |
| Cape Verde | 187 | 39 | 43 | | 269 | 29/Jan/99 |
| Central African Republic | 7,016 | 0 | | | 7,016 | 30/May/97 |
| Chad | 5,239 | 2,753 | 2,129 | | 10,121 | 03/Jun/99 |
| Comoros | 15 | 3 | 2 | | 20 | 12/Oct/99 |
| Congo | 10,223 | 0 | | | 10,223 | 06/Sep/96 |
| Cote d'Ivoire | 37,898 | 5,949 | 5,685 | | 49,532 | 30/Aug/99 |
| Dem. Rep. of the Congo | 38,841 | 4,948 | 3,746 | 22 | 47,557 | 20/Oct/99 |
| Djibouti | 1,238 | 434 | 111 | | 1,783 | 06/Apr/99 |
| Egypt | 143 | 25 | 33 | 14 | 215 | 04/Aug/99 |
| Equatorial Guinea | 231 | 90 | | | 321 | 03/Nov/98 |
| Eritrea | 2,917 | 1,260 | 1,610 | 1,086 | 6,873 | 30/Jun/99 |
| Ethiopia | 21,579 | 7,981 | 8,314 | | 37,874 | 04/Jul/99 |
| Gabon | 1,660 | 0 | | | 1,660 | 31/Dec/97 |
| Gambia | 437 | 74 | 126 | | 637 | 15/Jun/99 |
| Ghana | 20,859 | 3,833 | 4,854 | | 29,546 | 20/May/99 |
| Guinea | 3,080 | 1,005 | 1,222 | | 5,307 | 14/Jun/99 |
| Guinea-Bissau | 823 | 0 | | | 823 | 31/Oct/96 |
| Kenya | 74,042 | 4,885 | 2,565 | | 81,492 | 28/Sep/98 |
| Lesotho | 1,872 | 2,203 | 3,242 | | 7,317 | 31/Dec/98 |
| Liberia | 128 | 104 | 40 | | 272 | 26/Oct/98 |
| Libyan Arab Jamahiriya | 20 | 7 | 5 | | 32 | 25/May/99 |
| Madagascar | 29 | 6 | 2 | | 37 | 07/Oct/99 |
| Malawi | 47,270 | 3,705 | | | 50,975 | 21/May/98 |
| Mali | 3,642 | 711 | 620 | 290 | 5,263 | 14/Oct/99 |
| Mauritania | 532 | | | | 532 | 31/May/97 |
| Mauritius | 34 | 7 | 5 | 4 | 50 | 12/Nov/99 |
| Morocco | 372 | 92 | 93 | | 557 | 24/Feb/99 |
| Mozambique | 4,826 | 1,661 | 4,376 | | 10,863 | 25/Mar/99 |
| Namibia | 5,977 | 807 | | | 6,784 | 30/Sep/99 |
| Niger | 3,002 | 217 | 425 | | 3,644 | 11/Jun/99 |
| Nigeria | 6,057 | 745 | 18,490 | 984 | 26,276 | 13/Sep/99 |
| Reunion | 166 | 0 | | | 166 | 31/Dec/95 |
| Rwanda | 14,553 | 1,350 | | | 15,903 | 31/Dec/97 |
| Sao Tome and Principe | 24 | 11 | 25 | 10 | 70 | 14/Oct/99 |
| Senegal | 1,982 | 411 | 151 | 144 | 2,688 | 30/Sep/99 |
| Seychelles | 23 | 4 | 5 | | 32 | 09/Jun/99 |
| Sierra Leone | 224 | 67 | 26 | | 317 | 21/Aug/98 |
| Somalia | 13 | - | - | - | 13 | 05/Oct/99 |
| South Africa | 12,825 | | | | 12,825 | 30/Oct/96 |
| Sudan | 1,562 | 270 | 511 | 392 | 2,735 | 05/Oct/99 |
| Swaziland | 1,329 | 1,466 | 733 | | 3,528 | 15/Jul/99 |
| Togo | 7,993 | 1,211 | 1,623 | | 10,827 | 08/Mar/99 |
| Tunisia | 393 | 62 | 44 | 20 | 519 | 21/Jul/99 |
| Uganda | 51,344 | 1,962 | 1,406 | | 54,712 | 31/Mar/99 |
| United Rep. of Tanzania | 92,593 | 10,592 | 8,867 | | 112,052 | 11/Aug/99 |
| Zambia | 43,266 | 1,676 | | | 44,942 | 31/Jul/97 |
| Zimbabwe | 63,937 | 6,732 | 4,113 | | 74,782 | 30/Nov/98 |
| Total no. of cases | 628,360 | 79,814 | 86,947 | 5,177 | 800,298 | |
| No. of countries reporting | 54 | 51 | 40 | 12 | 54 | |

[1] AIDS cases reported to WHO as of 15 November 1999.

[2] Total includes cases with unknown date of reporting.

-. No AIDS surveillance.

## Table 9.1 AIDS, cases reported to WHO and number of countries reporting, 1979-1999[1]

| The Americas | 1979-1996 | 1997 | 1998 | 1999 | Total [2] | Last report |
|---|---|---|---|---|---|---|
| Anguilla | 5 | 0 | | | 5 | 30/Dec/95 |
| Antigua and Barbuda | 87 | 7 | 2 | | 96 | 31/May/99 |
| Argentina | 11,357 | 2,058 | 1,492 | 259 | 15,166 | 01/Oct/99 |
| Aruba | 22 | 2 | | | 24 | 30/Apr/97 |
| Bahamas | 2,475 | 389 | 234 | | 3,098 | 28/Feb/99 |
| Barbados | 762 | 113 | 168 | | 1,043 | 16/Sep/99 |
| Belize | 198 | 0 | | | 198 | 30/Apr/97 |
| Bermuda | 322 | 13 | 5 | 6 | 346 | 15/Nov/99 |
| Bolivia | 149 | 21 | 9 | | 179 | 16/Apr/98 |
| Brazil | 120,576 | 17,187 | 7,564 | | 145,327 | 30/Nov/98 |
| British Virgin Islands | 12 | 3 | 1 | 0 | 16 | 31/Oct/98 |
| Canada | 15,386 | 444 | 105 | | 15,935 | 31/Aug/98 |
| Cayman Islands | 21 | 1 | 2 | | 24 | 31/May/99 |
| Chile | 1,976 | 435 | 366 | 44 | 2,821 | 31/Mar/99 |
| Colombia | 7,844 | 589 | | | 8,433 | 31/Dec/97 |
| Costa Rica | 1,166 | 233 | 162 | 19 | 1,580 | 31/May/99 |
| Cuba | 578 | 128 | 140 | | 846 | 31/Aug/99 |
| Dominica | 51 | 19 | 12 | 5 | 87 | 15/Nov/99 |
| Dominican Republic | 4,021 | 392 | 320 | | 4,733 | 10/Sep/99 |
| Ecuador | 610 | 128 | 134 | | 872 | 28/Feb/98 |
| El Salvador | 1,823 | 409 | 146 | | 2,378 | 15/Nov/99 |
| French Guiana | 606 | 35 | | | 641 | 31/Dec/97 |
| Grenada | 99 | 4 | | | 103 | 30/Nov/97 |
| Guadeloupe | 752 | 38 | | | 790 | 31/Dec/97 |
| Guatemala | 1,639 | 760 | 993 | | 3,392 | 31/Aug/99 |
| Guyana | 842 | 115 | 96 | | 1,053 | 31/Oct/98 |
| Haiti | 4,967 | 3,932 | | | 8,899 | 28/Feb/99 |
| Honduras | 7,288 | 929 | | | 8,217 | 28/Jan/98 |
| Jamaica | 2,060 | 370 | 320 | 225 | 2,975 | 31/May/99 |
| Martinique | 413 | 23 | | | 436 | 31/Dec/97 |
| Mexico | 34,406 | 3,364 | 1,905 | | 39,675 | 31/May/99 |
| Montserrat | 7 | 0 | 1 | | 8 | 31/May/99 |
| Neth. Antilles and Aruba | 233 | 0 | | | 233 | 31/Mar/96 |
| Nicaragua | 152 | 18 | 10 | 2 | 182 | 30/Apr/99 |
| Panama | 1,357 | 341 | 195 | 49 | 1,942 | 15/Nov/99 |
| Paraguay | 294 | 96 | 34 | | 424 | 15/Jul/98 |
| Peru | 6,618 | 1,058 | 954 | 310 | 8,940 | 30/Sep/99 |
| Saint Kitts and Nevis | 54 | 4 | | | 58 | 08/Sep/97 |
| Saint Lucia | 90 | 15 | 6 | | 111 | 28/Feb/99 |
| Saint Vincent & the Grenadines | 87 | 24 | 28 | | 139 | 31/Dec/98 |
| Suriname | 211 | 0 | | | 211 | 31/Dec/96 |
| Trinidad and Tobago | 2,495 | 118 | | | 2,613 | 02/Jul/97 |
| Turks and Caicos Islands | 39 | 0 | | | 39 | 03/Nov/93 |
| United States of America | 622,898 | 50,000 | 44,532 | | 717,430 | 15/Nov/99 |
| Uruguay | 840 | 173 | 180 | | 1,193 | 22/Sep/99 |
| Venezuela | 7,088 | 194 | | | 7,282 | 24/Apr/98 |
| Total no. of cases | 864,976 | 84,182 | 60,116 | 919 | 1,010,193 | |
| No. of countries reporting | 46 | 46 | 30 | 10 | 46 | |

[1] AIDS cases reported to WHO as of 15 November 1999.

[2] Total includes cases with unknown date of reporting.

## Table 9.1 AIDS, cases reported to WHO and number of countries reporting, 1979-1999[1]

| Asia | 1979-1996 | 1997 | 1998 | 1999 | Total [2] | Last report |
|---|---|---|---|---|---|---|
| Afghanistan | - | - | - | - | - | 17/Oct/99 |
| Armenia | 10 | 2 | 2 | 1 | 15 | 02/Nov/99 |
| Azerbaijan | 4 | 5 | 3 | 0 | 12 | 02/Nov/99 |
| Bahrain | 40 | 15 | 11 | 4 | 70 | 28/Jun/99 |
| Bangladesh | 7 | 3 | 0 | | 10 | 31/Mar/98 |
| Bhutan | 0 | | | | 0 | 30/Nov/96 |
| Brunei Darussalam | 10 | 2 | 0 | 0 | 12 | 31/Jul/99 |
| Cambodia | 1,312 | 572 | 1,494 | 1,456 | 4,834 | 30/Jun/99 |
| China | 155 | 126 | 136 | 2 | 419 | 15/Oct/99 |
| Cyprus | 75 | 10 | 6 | 6 | 97 | 09/Aug/99 |
| Dem. Peoples Rep. of Korea | 0 | 0 | | | 0 | 30/Nov/96 |
| Georgia | 16 | 6 | 2 | 3 | 27 | 02/Nov/99 |
| Hong Kong SAR | 245 | 64 | 63 | 37 | 409 | 30/Jun/99 |
| India | 5,182 | 2,108 | 1,148 | | 8,438 | 31/Aug/99 |
| Indonesia | 119 | 34 | 74 | 38 | 265 | 15/Nov/99 |
| Iran (Islamic Republic of) | 154 | 40 | 21 | | 215 | 25/Jan/99 |
| Iraq | 102 | 2 | 4 | 0 | 108 | 18/Apr/99 |
| Israel | 420 | 45 | 36 | 47 | 548 | 02/Nov/99 |
| Japan | 1,437 | 250 | 231 | 148 | 2,066 | 27/Jun/99 |
| Jordan | 47 | 12 | 11 | 1 | 71 | 10/Aug/99 |
| Kazakhstan | 7 | 8 | 9 | 1 | 25 | 02/Nov/99 |
| Kuwait | 24 | 2 | 19 | 1 | 46 | 18/May/99 |
| Kyrgyzstan | 19 | 2 | 6 | | 27 | 30/Jun/98 |
| Lao People's Dem. Rep. | 30 | 48 | 27 | | 105 | 07/Oct/99 |
| Lebanon | 104 | 8 | 35 | | 147 | 02/Mar/99 |
| Macao SAR | 9 | 2 | 4 | 2 | 17 | 30/Jun/99 |
| Malaysia | 911 | 568 | 875 | 540 | 2,894 | 30/Jun/99 |
| Maldives | 4 | 1 | 0 | | 5 | 30/Apr/97 |
| Mongolia | 0 | 0 | 0 | 1 | 1 | 04/Aug/99 |
| Myanmar | 1,783 | 554 | 231 | | 2,568 | 31/Mar/98 |
| Nepal | 118 | 101 | 42 | | 261 | 30/Jun/99 |
| Oman | 288 | 36 | 33 | 10 | 367 | 11/Aug/99 |
| Pakistan | 128 | 19 | 23 | 3 | 173 | 24/May/99 |
| Philippines | 299 | 23 | 41 | 41 | 404 | 11/Oct/99 |
| Qatar | 84 | 4 | 1 | 4 | 93 | 10/Jun/99 |
| Republic of Korea | 63 | 33 | 37 | 14 | 147 | 10/Oct/99 |
| Saudi Arabia | 237 | 112 | 39 | 26 | 414 | 01/Aug/99 |
| Singapore | 271 | 88 | 125 | 61 | 545 | 15/Oct/99 |
| Sri Lanka | 69 | 9 | 15 | | 93 | 11/Feb/99 |
| Syrian Arab Republic | 45 | 8 | 8 | 4 | 65 | 28/Jul/99 |
| Tajikistan | - | - | - | - | - | 02/Nov/99 |
| Thailand | 63,158 | 26,000 | 25,847 | 13,601 | 128,606 | 31/Oct/99 |
| Turkey | 221 | 33 | 34 | 16 | 304 | 02/Nov/99 |
| Turkmenistan | 1 | 0 | | | 1 | 30/Nov/95 |
| United Arab Emirates | 8 | | | | 8 | 28/Feb/91 |
| Uzbekistan | 4 | 1 | 2 | 0 | 7 | 02/Nov/99 |
| Viet Nam | 1,082 | 400 | 935 | 319 | 2,736 | 07/Aug/99 |
| West Bank and Gaza Strip | 20 | 9 | 3 | 1 | 33 | 21/Aug/99 |
| Yemen | 82 | 40 | 34 | | 156 | 25/Feb/99 |
| Total no. of cases | 78,404 | 31,405 | 31,667 | 16,388 | 157,864 | |
| No. of countries reporting | 47 | 45 | 43 | 32 | 47 | |

[1] AIDS cases reported to WHO as of 15 November 1999.

[2] Total includes cases with unknown date of reporting.

-: No AIDS surveillance.

## Table 9.1 AIDS, cases reported to WHO and number of countries reporting, 1979-1999[1]

| Europe | 1979-1996 | 1997 | 1998 | 1999 | Total [2] | Last report |
|---|---|---|---|---|---|---|
| Albania | 8 | 2 | 1 | 0 | 11 | 02/Nov/99 |
| Austria | 1,643 | 130 | 110 | 32 | 1,915 | 02/Nov/99 |
| Belarus | 15 | 2 | 4 | 2 | 23 | 02/Nov/99 |
| Belgium | 2,213 | 136 | 166 | 84 | 2,599 | 02/Nov/99 |
| Bosnia and Herzegovina | 17 | 0 | | | 17 | 25/Jun/97 |
| Bulgaria | 45 | 8 | 3 | 4 | 60 | 02/Nov/99 |
| Croatia | 108 | 12 | 17 | 7 | 144 | 02/Nov/99 |
| Czech Republic | 90 | 21 | 8 | 6 | 125 | 02/Nov/99 |
| Denmark | 1,994 | 108 | 71 | 43 | 2,216 | 02/Nov/99 |
| Estonia | 14 | 3 | 4 | 1 | 22 | 02/Nov/99 |
| Finland | 251 | 17 | 20 | 6 | 294 | 02/Nov/99 |
| France | 44,559 | 2,836 | 2,026 | | 49,421 | 02/Nov/99 |
| Germany | 15,615 | 1,414 | 922 | 288 | 18,239 | 02/Nov/99 |
| Greece | 1,501 | 238 | 143 | 82 | 1,964 | 02/Nov/99 |
| Hungary | 245 | 32 | 35 | 16 | 328 | 02/Nov/99 |
| Iceland | 41 | 2 | 2 | 5 | 50 | 02/Nov/99 |
| Ireland | 578 | 31 | 41 | 24 | 674 | 02/Nov/99 |
| Italy | 37,139 | 3,782 | 2,484 | 1,111 | 44,516 | 02/Nov/99 |
| Latvia | 17 | 3 | 11 | 6 | 37 | 02/Nov/99 |
| Lithuania | 11 | 3 | 8 | 4 | 26 | 02/Nov/99 |
| Luxembourg | 117 | 10 | 10 | 2 | 139 | 02/Nov/99 |
| Malta | 41 | 2 | 4 | 0 | 47 | 02/Nov/99 |
| Monaco | 39 | 1 | 0 | 0 | 40 | 02/Nov/99 |
| Netherlands | 4,288 | 342 | 291 | 133 | 5,054 | 02/Nov/99 |
| Norway | 561 | 38 | 39 | 0 | 638 | 02/Nov/99 |
| Poland | 477 | 117 | 132 | 68 | 794 | 02/Nov/99 |
| Portugal | 3,781 | 919 | 888 | 432 | 6,020 | 02/Nov/99 |
| Republic of Moldova | 7 | 10 | 4 | 2 | 23 | 02/Nov/99 |
| Romania | 4,485 | 650 | 645 | 148 | 5,928 | 02/Nov/99 |
| Russian Federation | 255 | 13 | 98 | 29 | 395 | 02/Nov/99 |
| San Marino | 4 | 4 | 4 | 2 | 14 | 02/Nov/99 |
| Slovakia | 13 | 5 | 3 | 1 | 22 | 02/Nov/99 |
| Slovenia | 60 | 1 | 14 | 6 | 81 | 02/Nov/99 |
| Spain | 42,783 | 6,068 | 4,202 | 1,911 | 54,964 | 02/Nov/99 |
| Sweden | 1,481 | 77 | 63 | 42 | 1,663 | 02/Nov/99 |
| Switzerland | 5,527 | 567 | 428 | 119 | 6,641 | 02/Nov/99 |
| The F.Y.R. of Macedonia | 23 | 0 | 3 | 3 | 29 | 02/Nov/99 |
| Ukraine | 226 | 193 | 287 | 316 | 1,022 | 02/Nov/99 |
| United Kingdom of G.B. and N.I | 13,682 | 1,379 | 964 | 412 | 16,437 | 02/Nov/99 |
| Yugoslavia | 608 | 56 | 114 | 28 | 806 | 02/Nov/99 |
| Total no. of cases | 184,562 | 19,232 | 14,269 | 5,375 | 223,438 | |
| No. of countries reporting | 40 | 40 | 39 | 38 | 40 | |

[1] AIDS cases reported to WHO as of 15 November 1999.

[2] Total includes cases with unknown date of reporting.

## Table 9.1 AIDS, cases reported to WHO and number of countries reporting, 1979-1999[1]

| Oceania | 1979-1996 | 1997 | 1998 | 1999 | Total [2] | Last report |
|---|---|---|---|---|---|---|
| American Samoa | 0 | 0 | 0 | | 0 | 27/Sep/98 |
| Australia | 7,466 | 357 | 273 | 44 | 8,140 | 30/Jun/99 |
| Cook Islands | 0 | 0 | 0 | | 0 | 28/Sep/98 |
| Fiji | 8 | 0 | 0 | | 8 | 11/Aug/98 |
| French Polynesia | 54 | 0 | 0 | | 54 | 02-Sep-98 |
| Guam | 42 | 5 | 7 | 6 | 60 | 31/Jul/99 |
| Kiribati | 3 | 1 | 2 | | 6 | 31/Jul/99 |
| Mariana Islands | 7 | 1 | 0 | | 8 | 15/Apr/98 |
| Marshall Islands | 2 | 0 | 0 | | 2 | 27/Feb/98 |
| Micronesia (Federated States of) | 2 | 0 | 0 | | 2 | 01/Apr/98 |
| Nauru | 0 | 0 | 0 | | 0 | 20/Oct/97 |
| New Caledonia and Dependencies | 55 | 8 | 3 | 1 | 67 | 12/Jul/99 |
| New Zealand | 615 | 31 | 26 | 9 | 681 | 30/Jun/99 |
| Niue | 0 | 0 | 0 | | 0 | 08/Sep/98 |
| Palau | 1 | 0 | 0 | | 1 | 28/Feb/98 |
| Papua New Guinea | 225 | 120 | 232 | 41 | 618 | 31/Mar/99 |
| Samoa | 6 | 0 | 0 | | 6 | 28/Sep/98 |
| Solomon Islands | 0 | 0 | 0 | | 0 | 03/Aug/97 |
| Tokelau | 0 | 0 | | | 0 | 02/Sep/97 |
| Tonga | 13 | 0 | 1 | | 14 | 03/Sep/98 |
| Tuvalu | 0 | 0 | 0 | | 0 | 08/Oct/97 |
| Vanuatu | 0 | 0 | 0 | | 0 | 21/Sep/98 |
| Wallis and Futuna Islands | 1 | 0 | 0 | | 1 | 17/Aug/98 |
| Total no. of cases | 8,500 | 523 | 544 | 101 | 9,668 | |
| No. of countries reporting | 23 | 23 | 22 | 5 | 23 | |

[1] AIDS cases reported to WHO as of 15 November 1999.

[2] Total includes cases with unknown date of reporting.

## Table 9.2 Regional HIV/AIDS statistics and features, end of 1999[1]

| | Epidemic started | Adults & children living with HIV/AIDS | Adults & children newly infected with HIV in 1999 | Adult prevalence rate[2] | % HIV positive women | Main mode(s) of transmission for those living with HIV/AIDS |
|---|---|---|---|---|---|---|
| Sub-Saharan Africa | late '70s – early '80s | 24.5 million | 4 million | 8.57% | 55% | Hetero |
| North Africa and Middle East | late '80s | 220 000 | 20 000 | 0.12% | 20% | IDU, Hetero |
| South and South- East Asia | Late '80s | 5.6 million | 800 000 | 0.54% | 35% | Hetero, IDU |
| East Asia and Pacific | Late '80s | 530 000 | 120 000 | 0.06% | 13% | IDU, Hetero, MSM |
| Latin America | Late '70s – early '80s | 1.3 million | 150 000 | 0.49% | 25% | MSM, IDU, Hetero |
| Caribbean | Late '70s – early '80s | 360 000 | 60 000 | 2.11% | 35% | Hetero, MSM |
| Eastern Europe and Central Asia | early '90s | 420 000 | 130 000 | 0.21% | 25% | IDU |
| Western Europe | late '70s – early '80s | 520 000 | 30 000 | 0.23% | 25% | MSM, IDU |
| North America | late '70s – early '80s | 900 000 | 45 000 | 0.58% | 20% | MSM, IDU, Hetero |
| Australia and New Zealand | late '70s – early '80s | 15 000 | 500 | 0.13% | 10% | MSM, IDU |
| Total | | 34.3 million | 5.4 million | 1.07% | 47% | |

[1] Source: Report on the global HIV/AIDS epidemic, UNAIDS/CO.13E.
[2] The proportion of adults (15-49 years of age) living with HIV/AIDS in 1998 using 1999 population numbers.

# CHAPTER 10
# LEISHMANIASIS AND LEISHMANIA/HIV CO-INFECTION

## Background of the disease

### *Leishmaniasis*

Leishmaniasis is a parasitic infection transmitted by the bite of an infected female sandfly whose hosts are animals, such as dogs or rodents, or human beings. Leishmaniasis is a highly focal disease with widely scattered foci. The parasite may survive for decades in asymptomatic infected people, who are of great importance for the transmission since they can spread visceral leishmaniasis indirectly through the sandflies. The parasites can also be transmitted directly from person to person through the sharing of infected needles which is often the case with the *Leishmania*/HIV co-infection. The disease has four main forms, depending on the parasite species and the cellular immune system of the patient:

*Cutaneous leishmaniasis* produces skin lesions mainly on the face, arms and legs. Although this form is often self-healing, it can create serious disability and permanent scars. After recovery or successful treatment, cutaneous leishmaniasis induces immunity to re-infection by the species of *Leishmania* that caused the disease.

*Diffuse cutaneous leishmaniasis* is difficult to treat due to disseminated lesions that resemble leprosy and do not heal spontaneously. This form especially is related to a defective immune system and it is often characterized by relapses after treatment.

*Mucocutaneous leishmaniasis*, also called 'espundia' in South America, causes disfiguring lesions to the face; it destroys the mucous membranes of the nose, mouth and throat. Reconstructive surgery of deformities is an important part of therapy.

*Visceral leishmaniasis*, also known as 'kala azar', is characterized by irregular fever, weight loss, swelling of the liver and spleen and anaemia. It is the most severe form of Leishmaniasis, and is usually fatal if left untreated. The incubation period can be months or years and, unlike the cutaneous forms of leishmaniasis, it involves the internal organs. After treatment and recovery, patients may develop chronic cutaneous leishmaniasis that requires long and expensive treatment.

Leishmaniasis has a long history. Designs on pre-Colombian pottery and the existence of thousand-year old sculls with evidence of leishmaniasis prove that the disease has been present in the Americas for a long time. It has also been present in Africa and India since at least the mid-eighteenth century.[4] Today, an estimated 12 million cases of leishmaniasis exist worldwide with an estimated number of 1.5 - 2 million new cases occurring annually; 1 - 1.5 million cases of cutaneous leishmaniasis and 500 000 cases of visceral leishmaniasis.[5]

The geographical distribution of leishmaniasis is restricted to tropical and temperate regions, the living area of the sandfly. The leishmaniases are considered to be endemic in 88 countries (16 developed countries and 72 developing countries) on four continents. Ninty percent of cases with cutaneous forms of leishmaniasis occur in Afghanistan, Algeria, Brazil, Iran, Peru, Saudi Arabia and Syria, while ninety per cent of visceral leishmaniasis cases are found in Bangladesh, Brazil, India, Nepal and Sudan.

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[4] Allison MJ. Leishmaniasis. In: Kiple KF. ed. *The Cambridge History of Human Disease*,Cambridge, Cambridge University Press, 1993.

[5] Desjeux P. and UNAIDS. *Leishmania and HIV in gridlock*. Geneva, World Health Organization and UNAIDS, 1998, WHO/CTD/LEISH/98.9 and UNAIDS/98.23.

Visceral leishmaniasis can cause large-scale epidemics with high case fatality. For example, Western Upper Nile State in South Sudan experienced a major outbreak of visceral leishmaniasis between 1984 and 1994. This was the first epidemic in this area and therefore people were very susceptible to the disease. Because of an accumulation of risk factors such as civil unrest, disruption of health systems, malnutrition, underlying diseases and due to absence of diagnostic facilities and first line drugs at local level, the mortality rate was very high and 40 000 people were reported to have died due to the disease. Studies indicate that in some villages up to half of the population succumbed to the disease;[6] one study suggests that during this ten-year period visceral leishmaniasis claimed 100 000 lives in a population of around 300 000 in Western Upper Nile State.[7]

There is reason to believe that the number of cases of leishmaniasis is increasing.[8] This is partly due to man-made environmental changes which increase human exposure to the sandfly vector. Extracting timber, mining, building dams, widening areas under cultivation, new irrigation schemes, road construction in primary forests such as the Amazon, widespread migration from rural to urban areas and fast urbanization worldwide are among the main causes for an increased exposure to the sandfly. According to agencies operating clinics in the city of Kabul, Afghanistan, an estimated 270 000 cases of cutaneous leishmaniasis occurred in 1996 among the less than 2 million inhabitants of the city.[9] Kabul is a city where a lot of movement of people from rural to urban areas takes place. Another risk factor is the movement of susceptible populations into endemic areas, including large-scale migration of populations for economic reasons such as the development of agro-industrial projects.

### *Interaction between surveillance and response*

Early case detection and treatment are the most important control measures for leishmaniasis. In anthroponotic leishmaniasis in which humans are the only reservoir, early detection and treatment reduces morbidity and mortality. Treatment reduces or eliminates parasite loads, and this in turn reduces transmission. Thus surveillance and control are directly linked. The main limitations to treatment are high cost and the relatively long treatment period. In severe situations such as epidemics and highly endemic areas vector control is also used. It consists of house spraying or the use of insecticide-impregnated bed nets.

For zoonotic visceral leishmaniasis, which is usually fatal if left untreated, priority is also given to the detection and treatment of human cases. Other control measures include large-scale screening and testing of dogs, the main reservoir, spraying of houses and animal shelters, and individual protection. Environmental management measures such as destroying breeding and resting sites of the vector have been recommenced for zoonotic cutaneous leishmaniasis control.

With the use of insecticide-impregnated bed nets and new tests for serological diagnosis, progress has been made in the prevention and control of leishmaniasis infection. However, better methods are still needed such as more affordable drugs with shorter treatment periods.

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[6] *Joint appeal, emergency assistance to control visceral leishmaniasis (kala azar) in Sudan, 1993* World Health Organization and UNICEF, 1993, (unpublished report).

[7] Seaman J, Mercer AJ, Sondorp E. The Epidemic of Visceral Leishmaniasis in Western Upper Nile, Southern Sudan: Course and Impact from 1984 to 1994. *International Journal of Epidemiology*, 1996, 25:862–871.

[8] Desjeux P. Leishmaniasis, Public Health Aspects and Control, *Clinics in Dermatology*, 1996, 14:417–424.

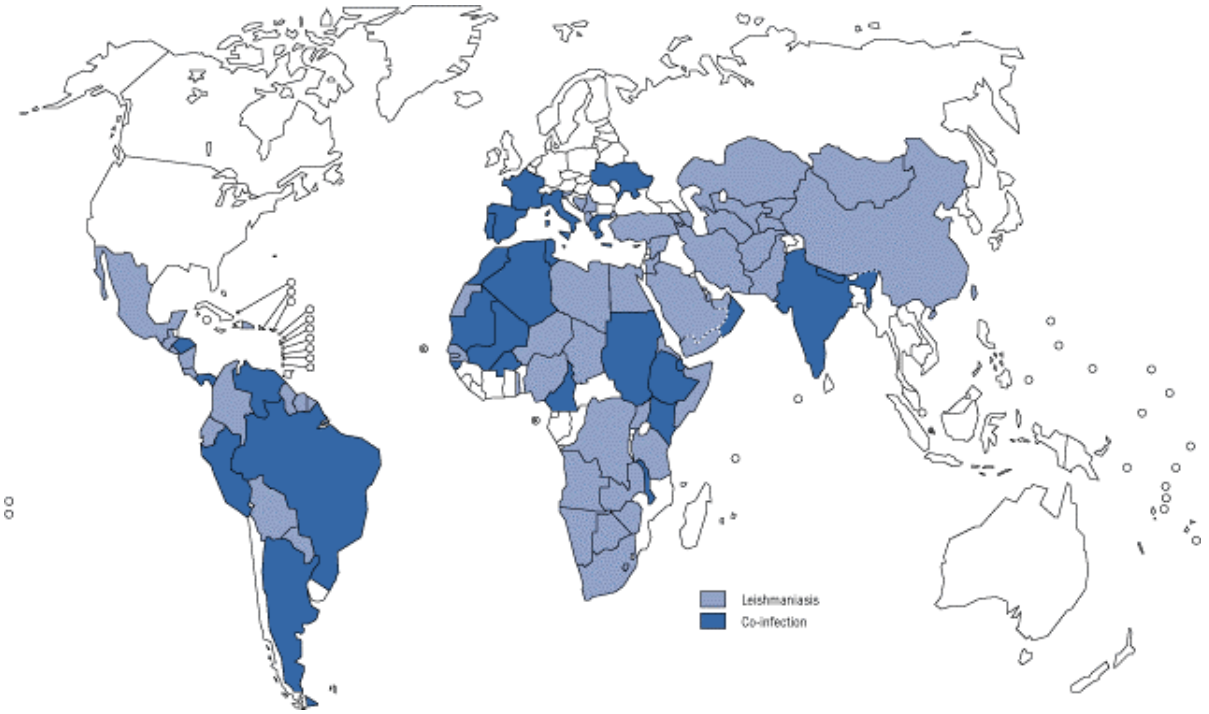
[9] Hewitt S. et al. Anthroponotic cutaneous leishmaniasis in Kabul, Afghanistan: vertical distribution of cases in apartment blocks. *Transaction of the Royal Society of Tropical Medicine and Hygiene*, 1998, 92:273-274.

## *Leishmania*/HIV co-infection

Leishmaniasis is one of the opportunistic infections that attack HIV-infected individuals, most of the co-infection involves the visceral form of leishmaniasis.[10] Recently more notice has been taken of *Leishmania*/HIV co-infection.

Map 10.1 shows the global distribution of reported cases of *Leishmania*/HIV co-infection and the distribution of leishmaniasis cases. Up to 1999, 31 countries have reported *Leishmania*/HIV co-infection. There is concern that *Leishmania*/HIV co-infection may increase the transmission of leishmaniasis, particularly the visceral form. The overlap in the geographical areas with high risk of both HIV and leishmaniasis is increasing, with the spread of leishmaniasis (typically a rural disease) into urban areas and the increased spread of HIV into rural areas. Leishmaniasis patients are highly susceptible to HIV infection and in HIV- infected patients, leishmaniasis accelerates the onset of AIDS by cumulative immuno-suppression and by stimulation of the replication of the virus. It also may change asymptomatic *Leishmania* infections into symptomatic ones. In addition, since visceral leishmaniasis can be spread intravenously, sharing of needles by intravenous drug users is a direct way of spreading leishmaniasis.

**Map 10.1 Global distribution of reported cases of leishmaniasis and *Leishmania*/HIV co-infection, 1990–1998**




[10] Desjeux P. and UNAIDS. *Leishmania and HIV in gridlock*, World Health Organization and UNAIDS, 1998, WHO/CTD/LEISH/98.9 and UNAIDS/98.23.

## Description of the global surveillance system and data

In 1994 a surveillance network with 13 institutions was set up to monitor *Leishmania*/HIV co-infection. The main objective is to improve case management (detection and treatment) and to coordinate preventive measures. Today the surveillance network includes 28 institutions in 13 countries. Most institutions are situated in Europe.

The institutions follow standard guidelines and use standard case report forms in order to ensure a common approach. The individual case reports provide detailed information on age, sex, geographical location, travel to endemic countries and details on the HIV and leishmaniasis infection. The institutions report annually to WHO.

## Strengths and weaknesses of the data

Surveillance is limited to the *Leishmania*/HIV co-infection; no regular global surveillance exists on leishmaniasis itself, even though leishmaniasis is notifiable in 33 out of the 88 countries where it occurs.

The surveillance system of *Leishmania*/HIV co-infection is just beginning and coverage of areas that are at risk is still incomplete. At present, most of the surveillance is carried out in Europe, although the problem of co-infection is widespread. Out of the 28 surveillance institutions, 17 are located in south-western Europe. In addition, the fact that visceral leishmaniasis is not recognized as an official opportunistic infection means that it is often not reported in HIV/AIDS notification systems. Furthermore, because the immune system of HIV patients is impaired and due to the presence of other opportunistic diseases, leishmaniasis is difficult to diagnose in HIV patients.

## Trends

### *Leishmania/HIV co-infection in south-western Europe*

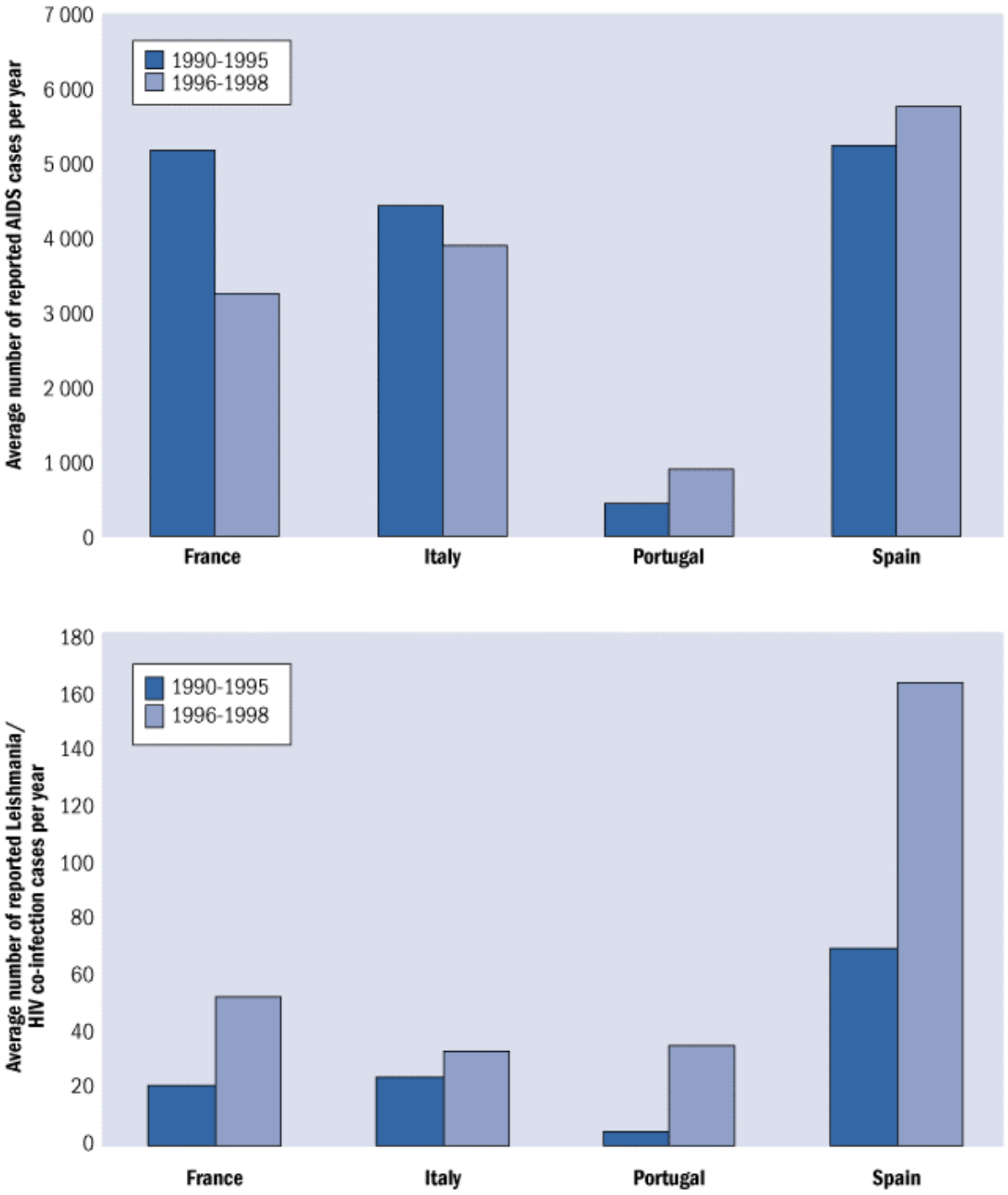
- Since 1990, cases of co-infection have been reported from 31 countries worldwide (Map 10.1). Most cases have been reported in south-western Europe; where the surveillance system was first implemented and where most of the surveillance centres are located.

- While the total number of cases reported from this area in the period 1990 until June 1998 was 1440, almost 50% have been reported in the last two-and-a-half years (717 cases between 1996 – June 1998). This may represent better reporting as awareness builds up in the area, rather than an increasing trend in infection. However, if the trend continues to rise, it may be advisable to formulate preventive measures, such as the use of bed nets in south-western Europe by HIV positive campers.

- On average, all four countries reported more cases of *Leishmania*/HIV co-infection per year during the last two-and-a-half years, as compared to the period 1990-1995. In Portugal the number of cases reported to WHO between 1996 and June 1998 has gone up seven-fold as compared to the six-year period before (Fig. 10.1).

- On average the number of cases of *Leishmania*/HIV co-infection reported during the last two-and-a-half years has increased relative to the number of reported AIDS cases in the same period (Fig. 10.1).

**Fig. 10.1 Average number of AIDS cases and *Leishmania*/HIV co-infection cases per year, reported to WHO, south-western Europe, 1990- June 1998**

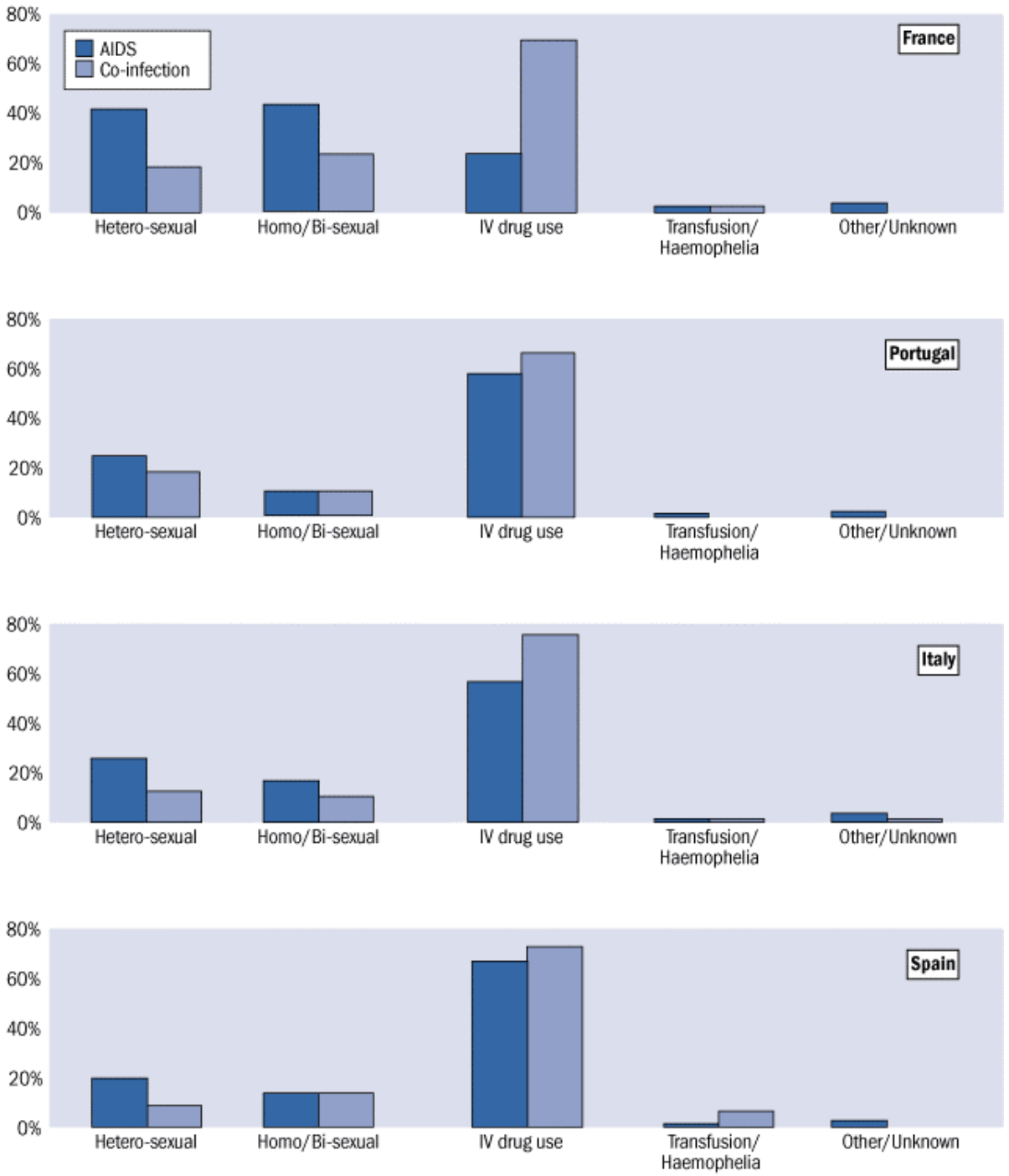



- In south-western Europe *Leishmania*/HIV co-infection is highest in adult males. Over 55% of the cases in this area have been reported to occur in the age group from 31 to 40 years. Over 83% of the reported cases are male.[11]

- Over 70% of the cases of *Leishmania*/HIV co-infection reported from south-western Europe is among intravenous drug users (Fig. 10.2).

[11]Leishmania/HIV co-infection, south-western Europe, 1990–1998, *Weekly Epidemiological Record, 1999,* 74,(44): 365-376.

**Fig. 10.2 Percentage distribution of reported cases of *Leishmania*/HIV co-infection* and AIDS**, according to probable mode of HIV transmission, south-western Europe, 1997-1999**




* Mode of probable transmission for *Leishmania*/HIV co-infection is based on the HIV transmission for 1990-1998.
**Mode of probable transmission for AIDS is based on 1998.

- A comparison between probable mode of transmission for *Leishmania*/ HIV co-infection and AIDS, indicates that in all four countries a higher proportion of reported co-infection cases was transmitted by intravenous drug use than HIV infections, as reflected in AIDS cases (Fig. 10.2). This finding was statistically significant for all countries, except for Portugal. This is consistent with the fact that *Leishmania*/HIV co-infection can be transmitted by the use of contaminated needles.

- In Spain, 6% of the cases of co-infection has as probable mode of transmission the transfusion of blood or blood products as opposed to only 1% in the AIDS cases (Fig. 10.2).

## Conclusions

1. Through the surveillance network, whose member institutions use standard case report forms and guidelines, more reliable information on the impact of the *Leishmania*/HIV co-infection has become available. Case management in terms of diagnosis has improved due to good standardization and coordination between the member institutions.

2. Currently, the geographical focus of the surveillance network for *Leishmania*/HIV co-infection is on south-western Europe. The surveillance network should be extended to cover affected areas in Asia, South America, and East Africa.

3. It is feared that the *Leishmania*/HIV co-infection may increase in the near future. The main reason for this is the overlapping geographical distribution of leishmaniasis and HIV due to the spread of HIV into suburban and rural areas and the spread of visceral leishmaniasis into urban areas.

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Desjeux P. Leishmaniasis, Public Health Aspects and Control, *Clinics in Dermatology* , 1996,14:417-423.

*Manual on visceral leishmaniasis control*, World Health Organization, 1996, WHO/LEISH/96.40, (available in English, French, Spanish, Arabic).

### *Web pages*

WHO Leishmaniasis web pages:
http://www.who.int/health-topics/leishmaniasis.htm

### *Videos*

Visceral leishmaniasis: A killing disease (18 mn.).