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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.

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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.<sup>1</sup> 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

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<sup>1</sup> 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:<sup>2</sup> 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.

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<sup>2</sup> 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 led 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 discusses 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
Cholera	1970	1998	Passive reporting of cases and deaths	As soon as possible for first suspected case <sup>2</sup>	<p>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</p> <p>Often cholera is reported to WHO as acute watery diarrhoea in order to avoid the perceived negative consequences of reporting cholera</p>
African trypanosomiasis	1902	1998	Active case-finding by systematic population screening in high risk areas	Continually	<p>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</p>
Meningococcal disease	1966	1999	Passive reporting of cases and deaths	As soon as possible for first suspected case	<p>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</p> <p>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</p>

**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	<p>Dengue surveillance is difficult to set up and maintain. Dengue fever (DF) is difficult to recognize clinically because it has non-specific symptoms</p> <p>Diagnosis of DF cannot be done on clinical judgement alone. There is a lack of adequate laboratory infrastructure for dengue surveillance</p> <p>Data from Africa are missing from the global database</p> <p>A web-based system of reporting is under development that would allow the collection of more complete data</p>
Influenza	1947	2000	Reporting of strains of influenza from isolates	Weekly	<p>The surveillance system for influenza is a long-running, well-functioning, laboratory-based system, used as the basis for the composition of influenza vaccine</p> <p>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</p> <p>A web-based reporting system known as 'FluNet' has been established, which has greatly facilitated the reporting of outbreaks and isolates</p>

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

<b>Disease</b>	<b>Years covered</b>		<b>Type of surveillance</b>	<b>Reporting frequency</b>	<b>Strengths and weaknesses of reporting system</b>
HIV/AIDS	1981	1999	Passive reporting of AIDS cases  Reports of sero-positivity for HIV from unlinked anonymous testing of women in antenatal clinics and other population subgroups  Behavioural surveillance	Annually  Annually  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 Leishmania/ HIV coinfection	1997	1999	Passive reporting of cases	Annually	Global surveillance of leishmaniasis is very weak. Data are not systematically reported to WHO  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  The surveillance system is beginning to document the extent of the co-infection problem in the catchment areas of network centres

<sup>1</sup>Passive reporting is the reporting of cases that come to health services for treatment.

<sup>2</sup>Yellow fever, plague and cholera are subject to the International Health Regulations.

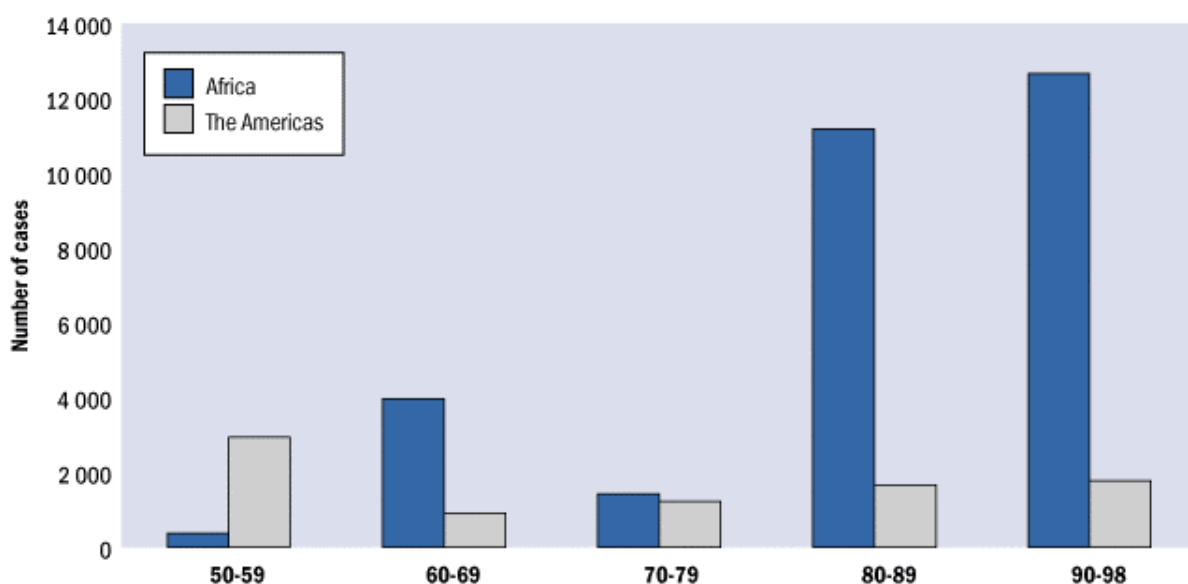
## CHAPTER 2

### 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%.

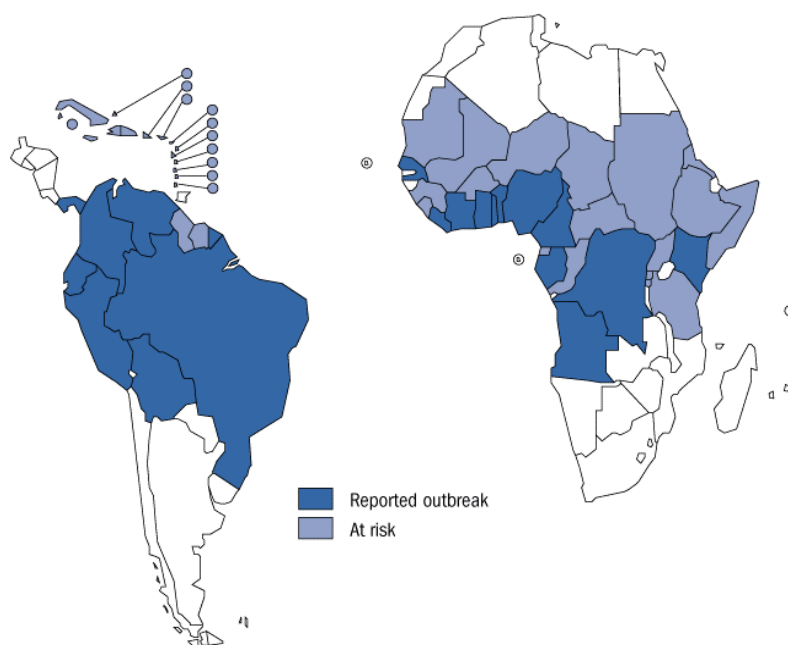
Fig. 2.1 Number of reported cases of yellow fever per decade, 1950-1998



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.<sup>1</sup>

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,<sup>2</sup> and is actively assisting countries to upgrade the capacity for laboratory testing.

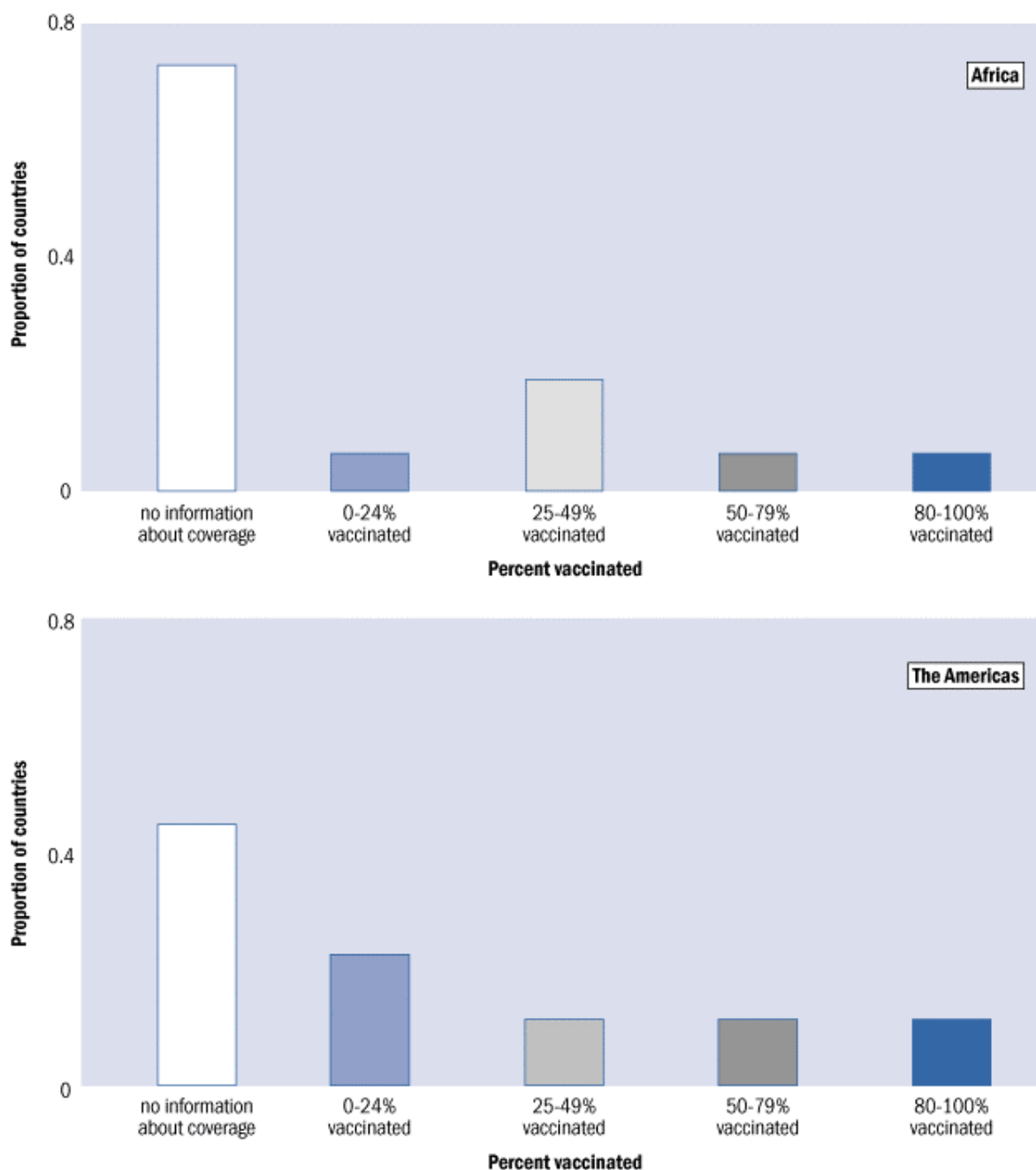
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<sup>1</sup> A recent literature search for all available reports of yellow fever outbreaks indicated that when epidemics were known about, they had been reported to WHO – although often fewer cases were reported than had occurred.

<sup>2</sup> *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<sup>3</sup> (Fig. 2.2).

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



<sup>3</sup>EPI information system: global summary, World Health Organization, 1998, WHO/EPI/GEN/98.10.

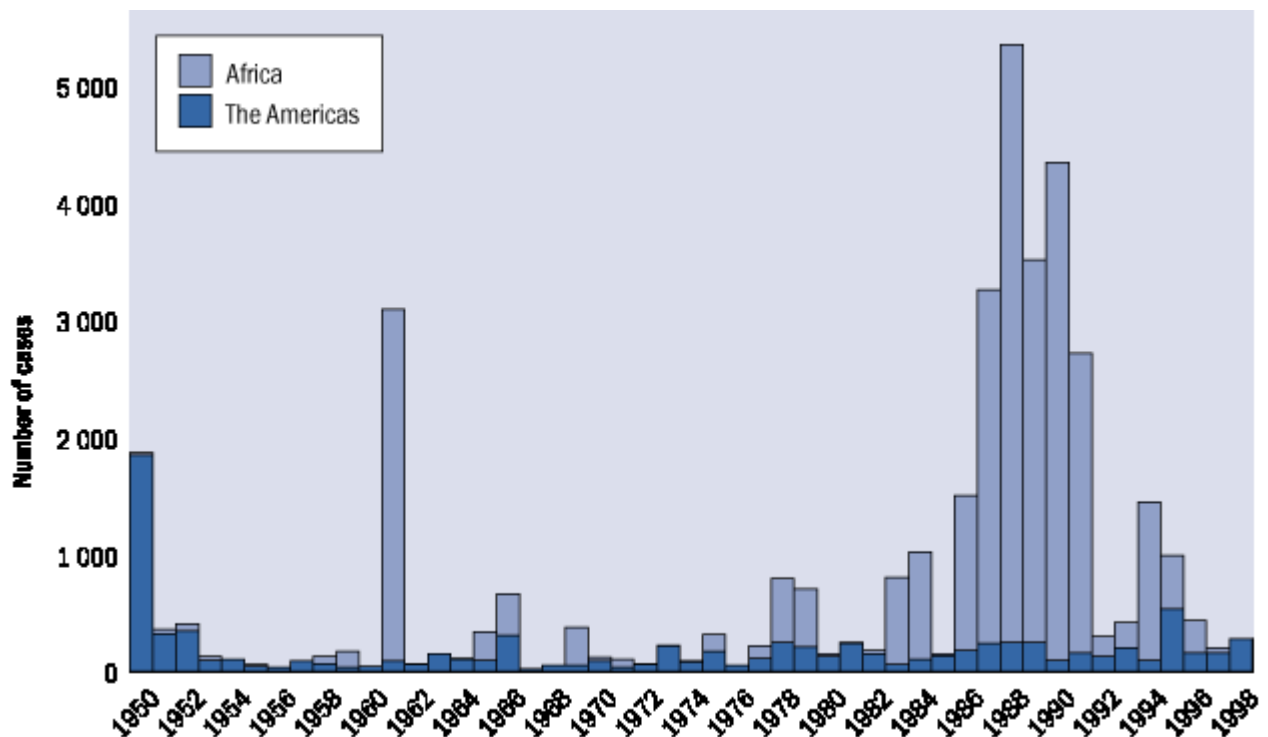
## Trends

- 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 Côte d'Ivoire 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 Côte d'Ivoire 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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*EPI Information System, Global summary, World Health Organization, 1998, WHO/EPI/GEN/98.10.*

*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/vaccines-diseases/diseases/Yellow_fever.htm)

[http://www.who.int/emc/diseases/Yellow\\_fever](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							
<b>Africa:</b> 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
<b>America:</b> 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**

<b>Africa</b>	<b>1967</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>
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**

<b>Africa</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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**

<b>The Americas</b>	<b>1950</b>	<b>1951</b>	<b>1952</b>	<b>1953</b>	<b>1954</b>	<b>1955</b>	<b>1956</b>	<b>1957</b>	<b>1958</b>	<b>1959</b>	<b>1960</b>	<b>1961</b>	<b>1962</b>	<b>1963</b>	<b>1964</b>	<b>1965</b>	<b>1966</b>
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**

<b>The Americas</b>	<b>1967</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>
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																	
<b>Total no. of cases</b>	<b>12</b>	<b>47</b>	<b>48</b>	<b>86</b>	<b>28</b>	<b>55</b>	<b>212</b>	<b>76</b>	<b>168</b>	<b>44</b>	<b>102</b>	<b>240</b>	<b>205</b>	<b>120</b>	<b>231</b>	<b>140</b>	<b>50</b>
<b>Total no. of deaths</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>64</b>	<b>21</b>	<b>41</b>	<b>148</b>	<b>45</b>	<b>95</b>	<b>35</b>	<b>82</b>	<b>91</b>	<b>161</b>	<b>104</b>	<b>104</b>	<b>77</b>	<b>43</b>
<b>No. of countries reporting</b>	<b>5</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>6</b>	<b>5</b>	<b>6</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>6</b>	<b>7</b>	<b>6</b>	<b>5</b>	<b>4</b>	<b>5</b>

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

<b>The Americas</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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		
<b>Total no. of cases</b>	<b>95</b>	<b>126</b>	<b>175</b>	<b>235</b>	<b>240</b>	<b>237</b>	<b>88</b>	<b>151</b>	<b>119</b>	<b>192</b>	<b>89</b>	<b>522</b>	<b>148</b>	<b>147</b>	<b>269</b>
<b>Total no. of deaths</b>	<b>67</b>	<b>91</b>	<b>131</b>	<b>211</b>	<b>199</b>	<b>191</b>	<b>69</b>	<b>90</b>	<b>81</b>	<b>81</b>	<b>40</b>	<b>213</b>	<b>81</b>	<b>80</b>	<b>109</b>
<b>No. of countries reporting</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>5</b>	<b>7</b>



## 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.<sup>1</sup>

## ***History***

Cases of human plague have been known from time immemorial.<sup>2</sup> 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.<sup>3</sup>

## ***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).

---

<sup>1</sup> Plague that can be transmitted via the respiratory route is known as pneumonic plague.

<sup>2</sup> Pollitzer R. *Plague*. Geneva, World Health Organization, 1954 (Monograph series).

<sup>3</sup> Datta KK. *Plague epidemiology, prevention and control*. National Institute of Communicable Diseases, Delhi, India, 1994.

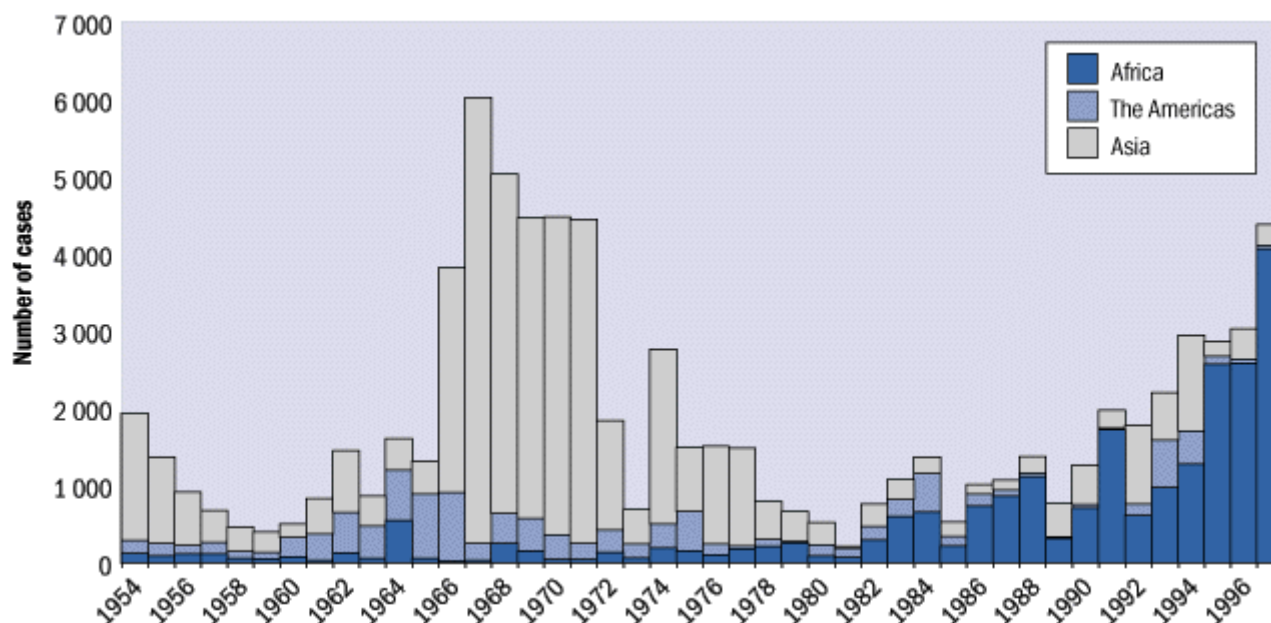
## Strengths and weaknesses of the data

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

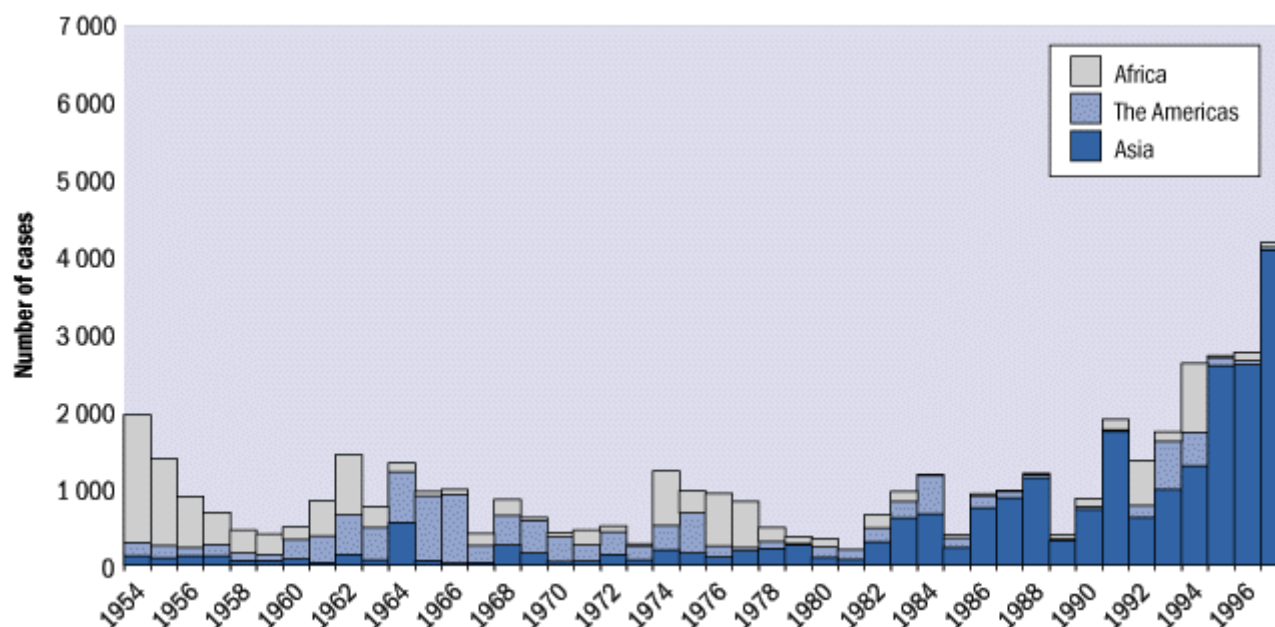
- Reports of plague were received from 38 countries during the period 1954-1997. These reports included notification of 80 613 cases and 6587 deaths. The maximum number of reported plague cases (6004) occurred in 1967 and the minimum (200) occurred in 1981.
- There are seven countries, namely Brazil, 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 in 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<sup>4</sup> and the United Republic of Tanzania have accounted for 62.5% of the total plague cases reported in Africa during the last 15 years.

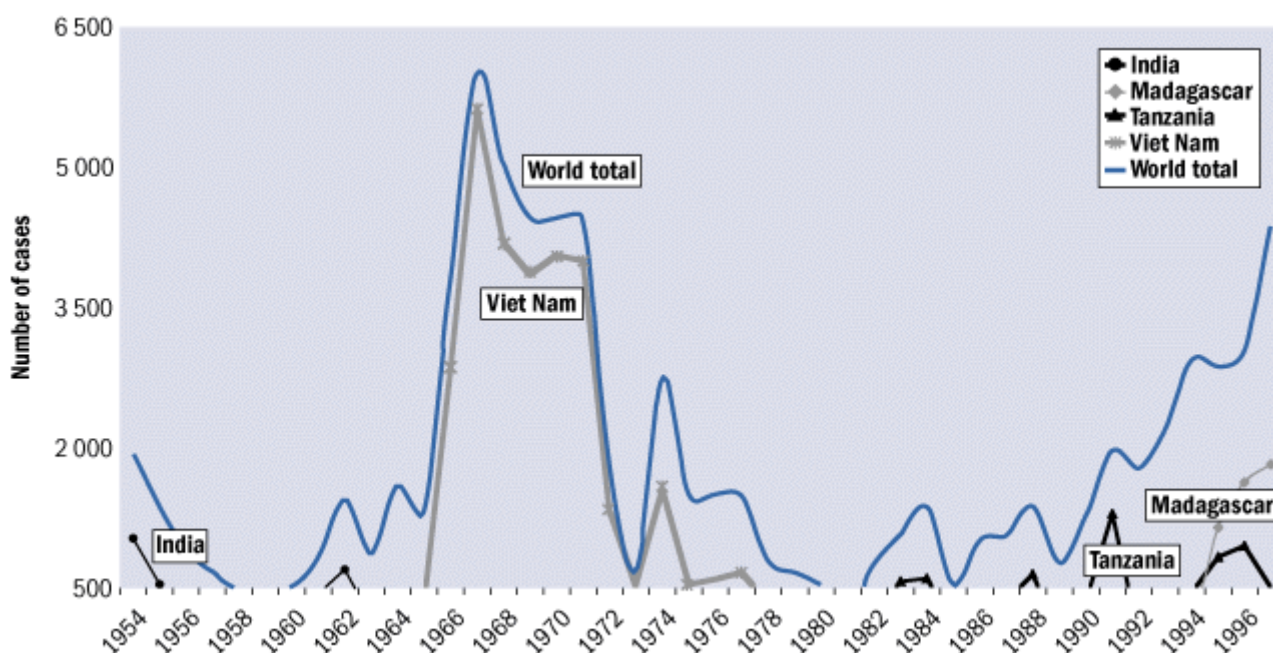
<sup>4</sup> Madagascar reports all suspected cases of plague, including those that are not confirmed in laboratories. For example in 1997, there were 2863 cases of human plague reported, 1858 of which were bacteriologically negative.



## 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



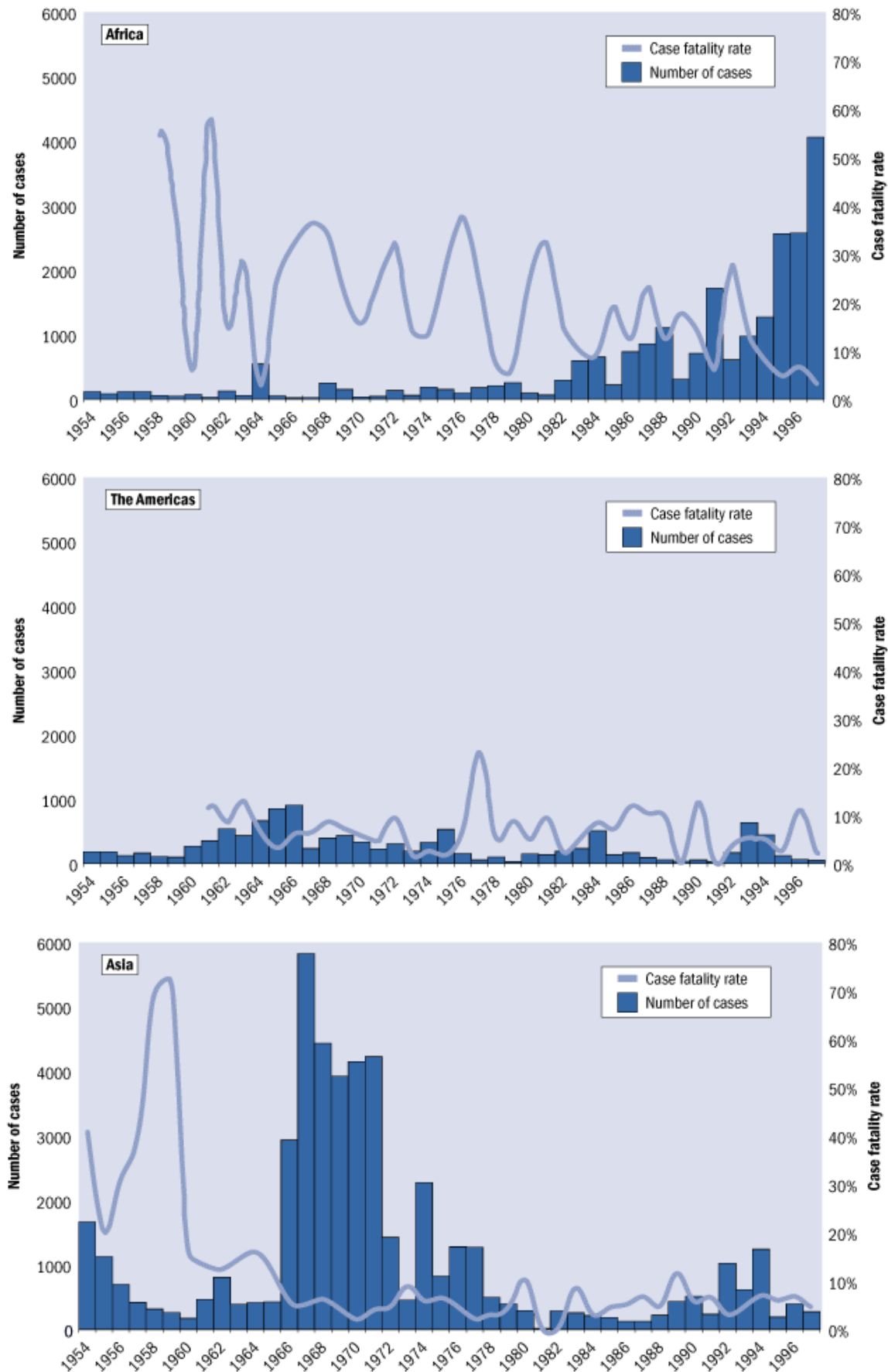
- In India, large plague outbreaks occurred during the first half of the twentieth century. There were also outbreaks in 1954, 1963, and then again 30 years later in 1994. Although the exact circumstances are unknown, factors contributing to the re-emergence of plague in India in 1994, are thought to include ecological changes created by the earthquake in September 1993 that disturbed the equilibrium density of domestic rodents and their fleas.<sup>5</sup> 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.

<sup>5</sup> 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**

### ***Publications and Documents***

*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 <sup>1</sup>	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 <sup>1</sup>			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

<sup>1</sup> Includes suspected cases.

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

<b>The Americas</b>	<b>1954</b>	<b>1955</b>	<b>1956</b>	<b>1957</b>	<b>1958</b>	<b>1959</b>	<b>1960</b>	<b>1961</b>	<b>1962</b>	<b>1963</b>	<b>1964</b>	<b>1965</b>	<b>1966</b>	<b>1967</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>
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
<b>Asia</b>	<b>1954</b>	<b>1955</b>	<b>1956</b>	<b>1957</b>	<b>1958</b>	<b>1959</b>	<b>1960</b>	<b>1961</b>	<b>1962</b>	<b>1963</b>	<b>1964</b>	<b>1965</b>	<b>1966</b>	<b>1967</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>
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 <sup>1</sup>		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

<sup>1</sup> Includes suspected cases.

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

<b>Africa</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>
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 <sup>1</sup>	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 <sup>1</sup>		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

<sup>1</sup> Includes suspected cases.

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

<b>The Americas</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>
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
<b>Asia</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>
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 <sup>1</sup>	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

<sup>1</sup> Includes suspected cases.

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

<b>Africa</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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 <sup>1</sup>	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 <sup>1</sup>	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

<sup>1</sup> Includes suspected cases.



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

<b>The Americas</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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
<b>Asia</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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 <sup>1</sup>	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

<sup>1</sup> 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.<sup>1</sup>

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’<sup>2</sup> 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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<sup>1</sup> Goma Epidemiology Group. Public health impact of the Rwandan refugee crisis: What happened in Goma, Zaire in July 1994? *Lancet*, 1995, 345:359-361.

<sup>2</sup> 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.

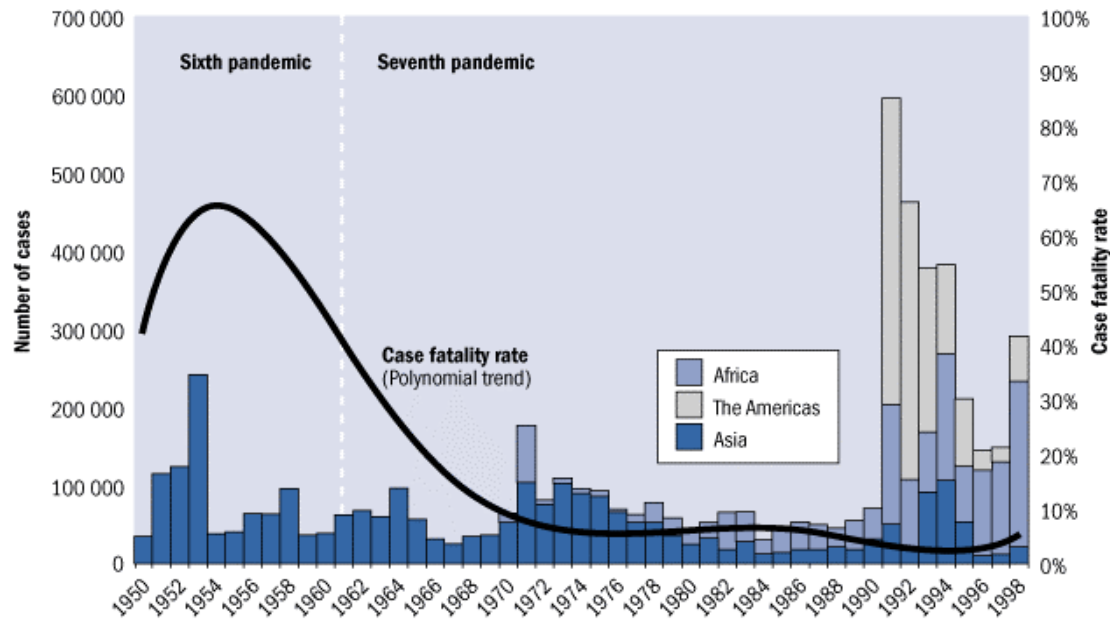
## Trends

### 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**

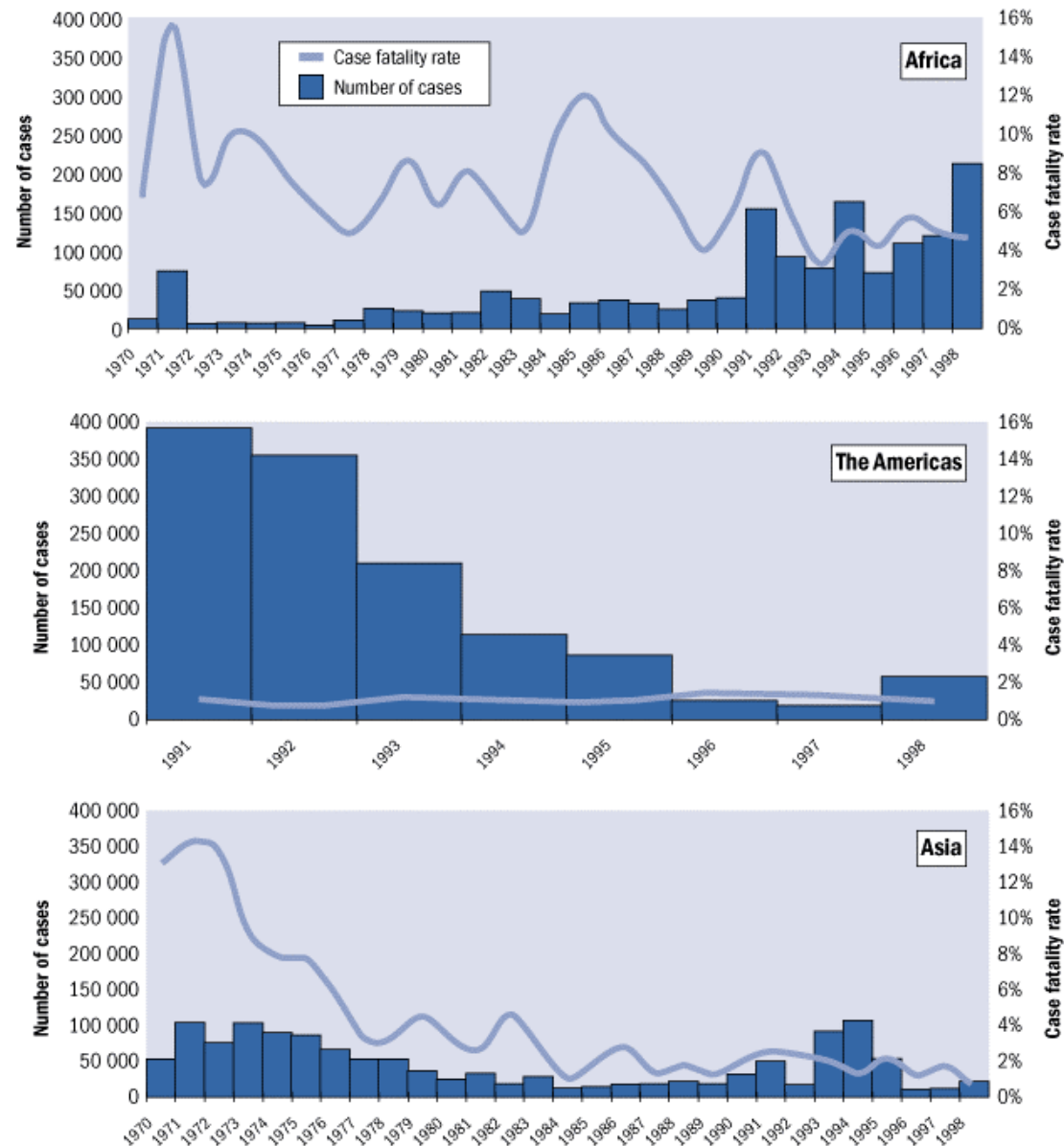


#### Deaths

- 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.

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*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](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**

<b>Africa</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>
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			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**

<b>Africa</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>
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								
<b>Total no. of cases</b>	<b>11,086</b>	<b>72,654</b>	<b>5,137</b>	<b>6,337</b>	<b>6,074</b>	<b>6,650</b>	<b>3,180</b>	<b>9,502</b>	<b>24,643</b>	<b>21,586</b>	<b>18,742</b>	<b>19,415</b>	<b>46,924</b>	<b>37,383</b>	<b>17,504</b>
<b>Total no. of deaths</b>	<b>747</b>	<b>11,427</b>	<b>386</b>	<b>636</b>	<b>582</b>	<b>504</b>	<b>194</b>	<b>462</b>	<b>1,591</b>	<b>1,869</b>	<b>1,185</b>	<b>1,581</b>	<b>2,988</b>	<b>1,903</b>	<b>1,711</b>
<b>No. of countries reporting</b>	<b>16</b>	<b>23</b>	<b>18</b>	<b>16</b>	<b>17</b>	<b>14</b>	<b>14</b>	<b>13</b>	<b>20</b>	<b>19</b>	<b>16</b>	<b>18</b>	<b>16</b>	<b>15</b>	<b>19</b>
<b>Oceania <sup>1</sup></b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>
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 <sup>2</sup>										13			2,214	321	19
Tuvalu															
<b>Total no. of cases</b>			<b>43</b>		<b>6</b>			<b>1,310</b>	<b>533</b>	<b>64</b>	<b>3</b>	<b>6</b>	<b>2,217</b>	<b>326</b>	<b>20</b>
<b>Total no. of deaths</b>			<b>1</b>		<b>1</b>			<b>21</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>17</b>	<b>1</b>	<b>0</b>
<b>No. of countries reporting</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>

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

<sup>2</sup>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**

<b>Africa</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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**

<b>Africa</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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
<b>Total no. of cases</b>	<b>31,884</b>	<b>35,585</b>	<b>31,324</b>	<b>23,583</b>	<b>35,951</b>	<b>38,683</b>	<b>155,358</b>	<b>91,081</b>	<b>76,713</b>	<b>161,983</b>	<b>71,081</b>	<b>108,535</b>	<b>118,349</b>	<b>211,748</b>
<b>Total no. of deaths</b>	<b>3,837</b>	<b>3,490</b>	<b>2,658</b>	<b>1,500</b>	<b>1,445</b>	<b>2,288</b>	<b>13,998</b>	<b>5,291</b>	<b>2,532</b>	<b>8,128</b>	<b>3,024</b>	<b>6,216</b>	<b>5,853</b>	<b>9,856</b>
<b>No. of countries reporting</b>	<b>21</b>	<b>18</b>	<b>17</b>	<b>13</b>	<b>16</b>	<b>11</b>	<b>22</b>	<b>20</b>	<b>16</b>	<b>28</b>	<b>26</b>	<b>28</b>	<b>25</b>	<b>29</b>
<b>Oceania</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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 <sup>2</sup>														
Tuvalu						27		293						
<b>Total no. of cases</b>	<b>7</b>	<b>3</b>	<b>2</b>	<b>1</b>		<b>67</b>		<b>296</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>4</b>	<b>5</b>	<b>8</b>
<b>Total no. of deaths</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>		<b>1</b>		<b>8</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>No. of countries reporting</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>5</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>3</b>

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

<sup>2</sup>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**

<b>The Americas</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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**

<b>Asia</b>	<b>1950-1969</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>
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			
<b>Total no. of cases</b>	<b>1,355,747</b>	<b>52,429</b>	<b>103,308</b>	<b>75,064</b>	<b>102,148</b>	<b>89,077</b>	<b>85,316</b>	<b>65,469</b>	<b>52,460</b>	<b>52,511</b>	<b>35,732</b>	<b>24,015</b>	<b>32,343</b>	<b>17,991</b>	<b>27,877</b>
<b>Total no. of deaths</b>	<b>6,787</b>	<b>6,787</b>	<b>14,701</b>	<b>10,271</b>	<b>9,422</b>	<b>7,019</b>	<b>6,567</b>	<b>3,754</b>	<b>1,694</b>	<b>1,763</b>	<b>1,602</b>	<b>769</b>	<b>860</b>	<b>833</b>	<b>765</b>
<b>No. of countries reporting</b>	<b>23</b>	<b>22</b>	<b>15</b>	<b>16</b>	<b>15</b>	<b>14</b>	<b>18</b>	<b>19</b>	<b>21</b>	<b>21</b>	<b>22</b>	<b>17</b>	<b>18</b>	<b>14</b>	<b>11</b>

**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**

<b>Asia</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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						
<b>Total no. of cases</b>	<b>11,809</b>	<b>13,389</b>	<b>17,131</b>	<b>17,558</b>	<b>20,871</b>	<b>18,007</b>	<b>31,003</b>	<b>49,791</b>	<b>16,299</b>	<b>90,862</b>	<b>106,100</b>	<b>53,159</b>	<b>10,142</b>	<b>11,293</b>	<b>24,212</b>
<b>Total no. of deaths</b>	<b>119</b>	<b>276</b>	<b>477</b>	<b>238</b>	<b>378</b>	<b>224</b>	<b>628</b>	<b>1,286</b>	<b>372</b>	<b>1,809</b>	<b>1,393</b>	<b>1,158</b>	<b>122</b>	<b>196</b>	<b>172</b>
<b>No. countries reporting</b>	<b>9</b>	<b>11</b>	<b>11</b>	<b>10</b>	<b>12</b>	<b>13</b>	<b>13</b>	<b>16</b>	<b>18</b>	<b>25</b>	<b>26</b>	<b>18</b>	<b>13</b>	<b>18</b>	<b>16</b>



**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 <sup>1</sup>	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

<sup>1</sup> 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

<sup>1</sup> 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.

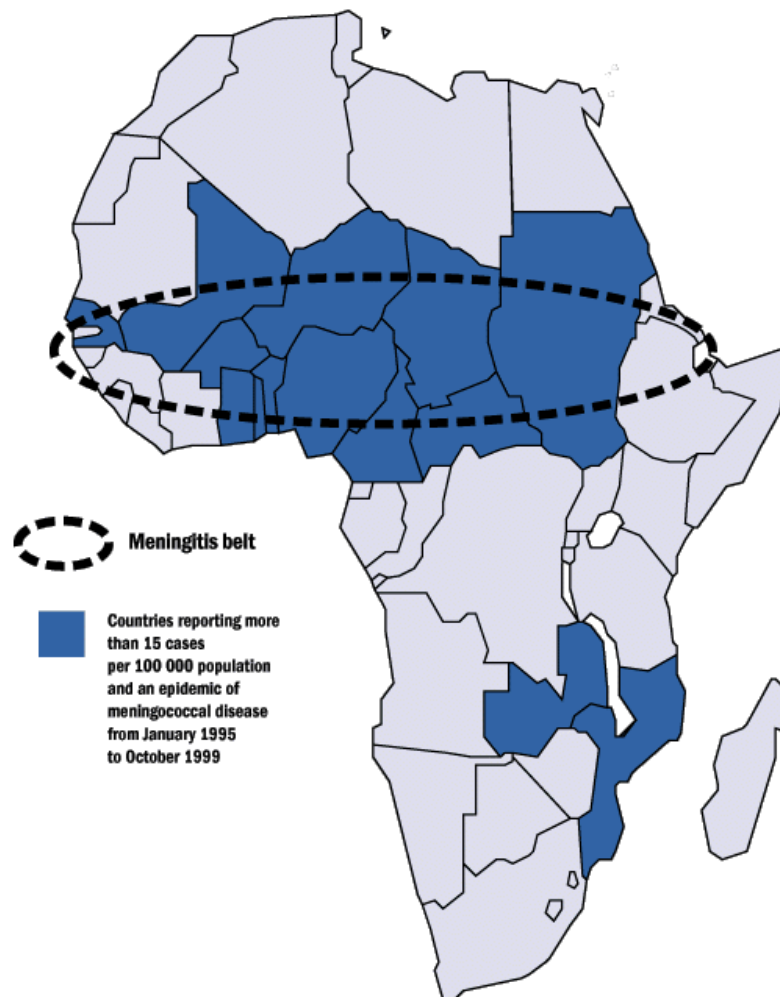
Meningococcal disease occurs as both an endemic and epidemic disease, and both forms cause substantial illness, and death, as well as persistent neurological defects, particularly deafness. Other consequences of the disease are loss of limbs, mental retardation and paralysis. Because of the severe consequences 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.<sup>1</sup>

<sup>1</sup> 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.

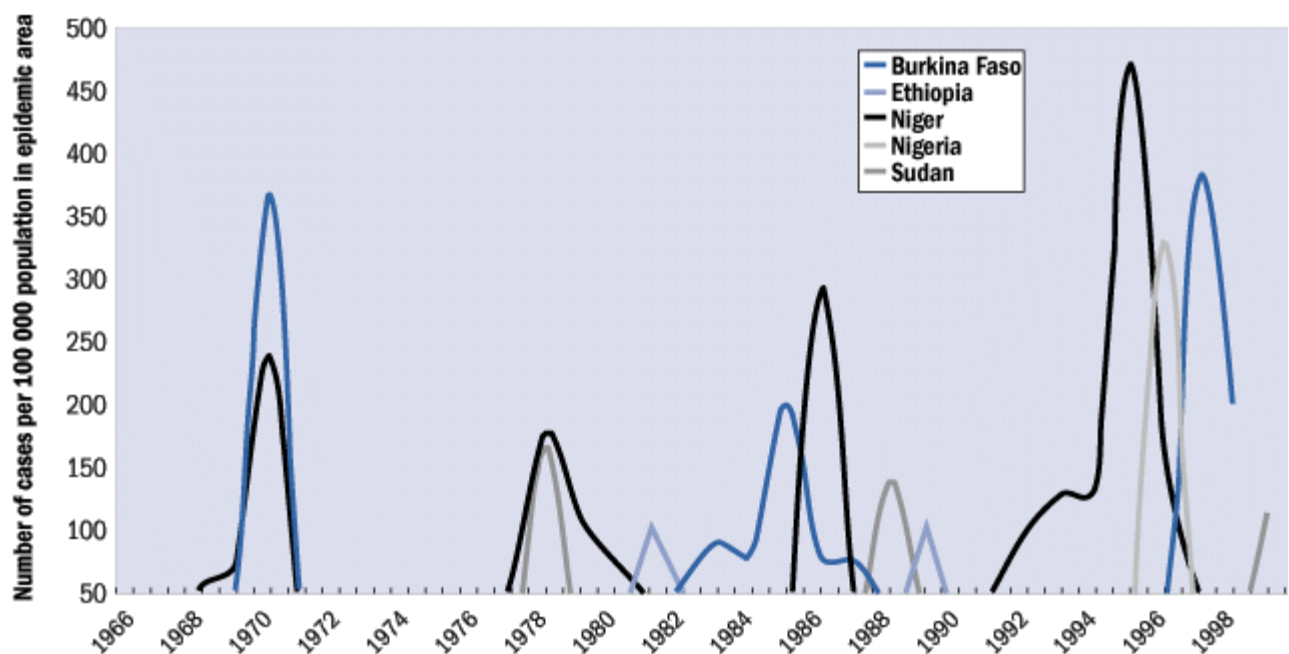
The weekly national level reporting for the meningitis belt in Africa, which has been going on for the last two years is a very promising development. The reporting system is more timely, and provides more detailed and more comparable data than previously available. It makes it possible to follow the 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 preceded 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.

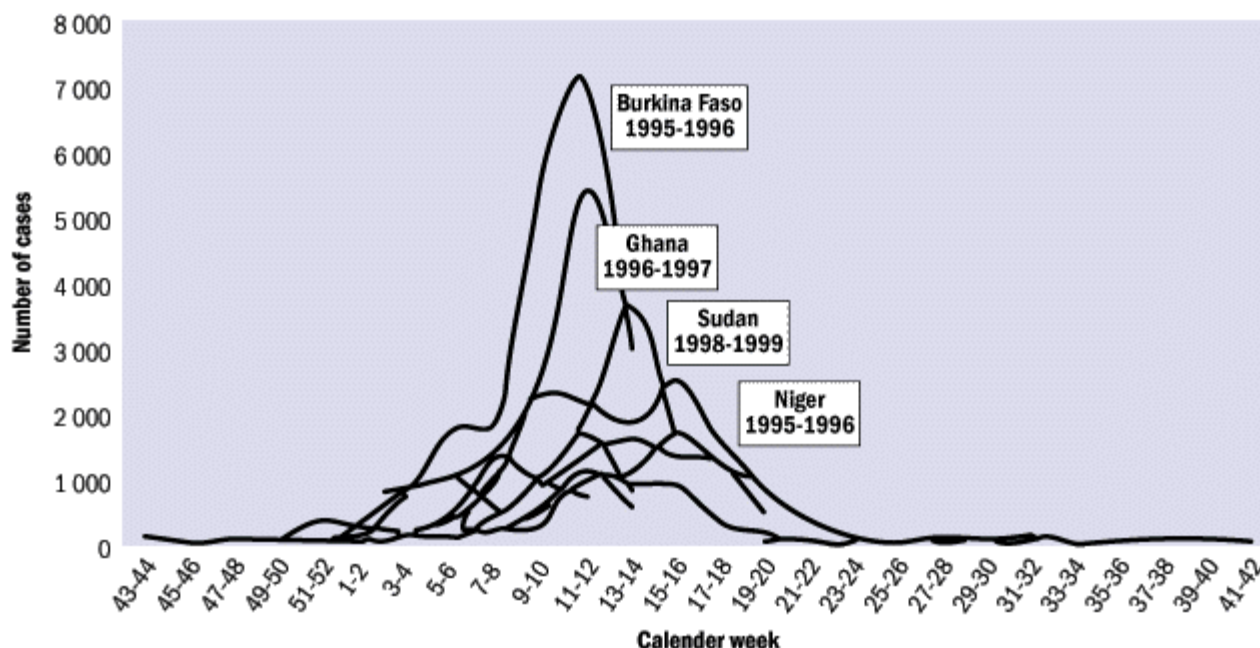
**Fig. 5.1 Epidemic cycles, meningococcal disease for selected African countries, 1966-1999**



### *Epidemics*

- The number of cases in the years immediately preceding 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).

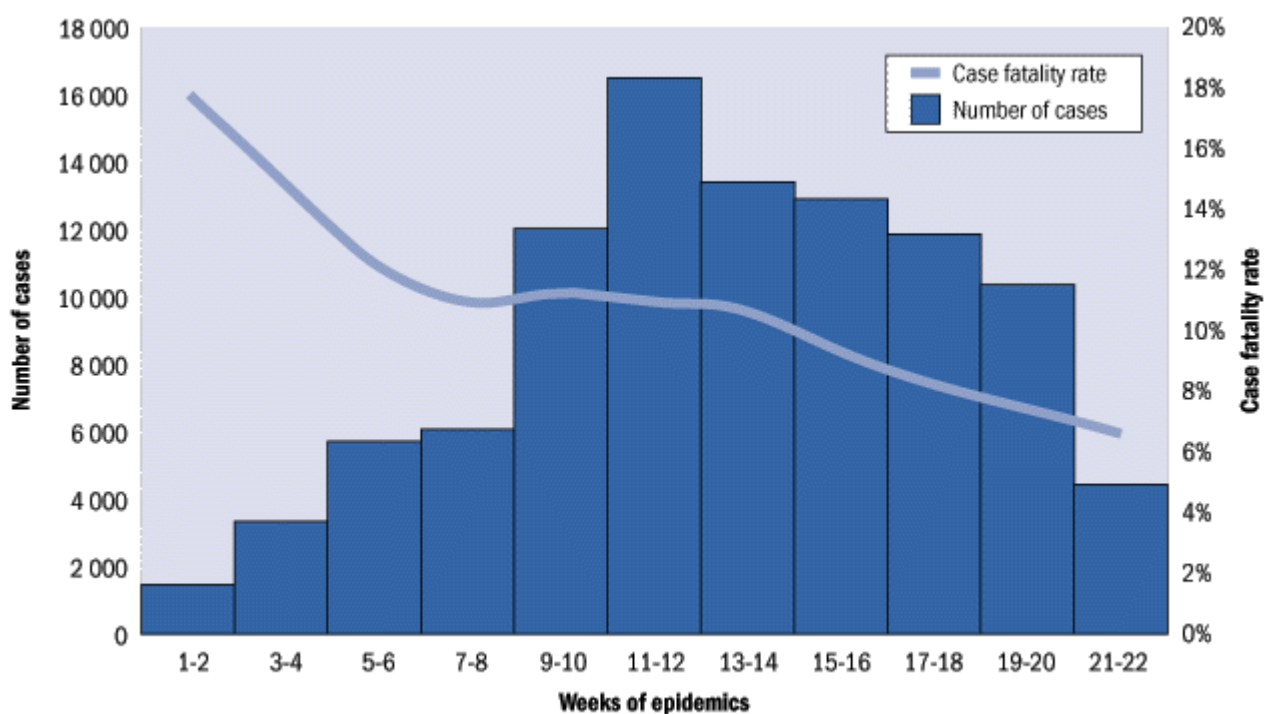
**Fig. 5.2 Seasonality of epidemics of meningococcal disease, reported number of cases per calendar week for selected epidemics in Africa, 1995-1999**



**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<sup>2</sup> 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 fourth meeting*, World Health Organization, 2000, WHO/EMC/DIS/ICG/2000.2.

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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](http://www.who.int/emc/outbreak_news/disease_indices/men_index.html)

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

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<sup>2</sup> 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**

<b>Africa</b>	<b>1966</b>	<b>1967</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>
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			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**

<b>Africa</b>	<b>1966</b>	<b>1967</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>
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**

<b>Africa</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>
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**

<b>The Americas</b>	<b>1966</b>	<b>1967</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>
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								
<b>Total no. of cases</b>	<b>4,094</b>	<b>2,764</b>	<b>3,102</b>	<b>3,294</b>	<b>2,904</b>	<b>2,625</b>	<b>2,221</b>	<b>2,451</b>	<b>2,185</b>	<b>2,530</b>	<b>3,039</b>	<b>3,145</b>	<b>3,705</b>	<b>3,501</b>	<b>4,139</b>	<b>4,137</b>	<b>3,478</b>	<b>3,111</b>
<b>No. of countries reporting</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>9</b>	<b>9</b>	<b>13</b>	<b>14</b>	<b>16</b>	<b>15</b>	<b>19</b>	<b>14</b>	<b>15</b>	<b>15</b>	<b>11</b>	<b>15</b>	<b>8</b>	<b>9</b>	<b>9</b>

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

<b>The Americas</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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				
<b>Total no. of cases</b>	<b>3,223</b>	<b>2,967</b>	<b>3,123</b>	<b>3,619</b>	<b>3,764</b>	<b>3,837</b>	<b>3,510</b>	<b>3,315</b>	<b>4,083</b>	<b>4,517</b>	<b>4,264</b>	<b>4,630</b>	<b>3,622</b>	<b>0</b>	<b>6,951</b>
<b>No. of countries reporting</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>10</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>19</b>

**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**

<b>Asia</b>	<b>1966</b>	<b>1967</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>
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
<b>Oceania</b>	<b>1966</b>	<b>1967</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>
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	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**

<b>Asia</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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
<b>Oceania</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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 <sup>1</sup>	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	1,359	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

<sup>1</sup> 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	1999
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 <sup>1</sup>	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	

<sup>1</sup> 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.<sup>1</sup> 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 led 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

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<sup>1</sup> 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.

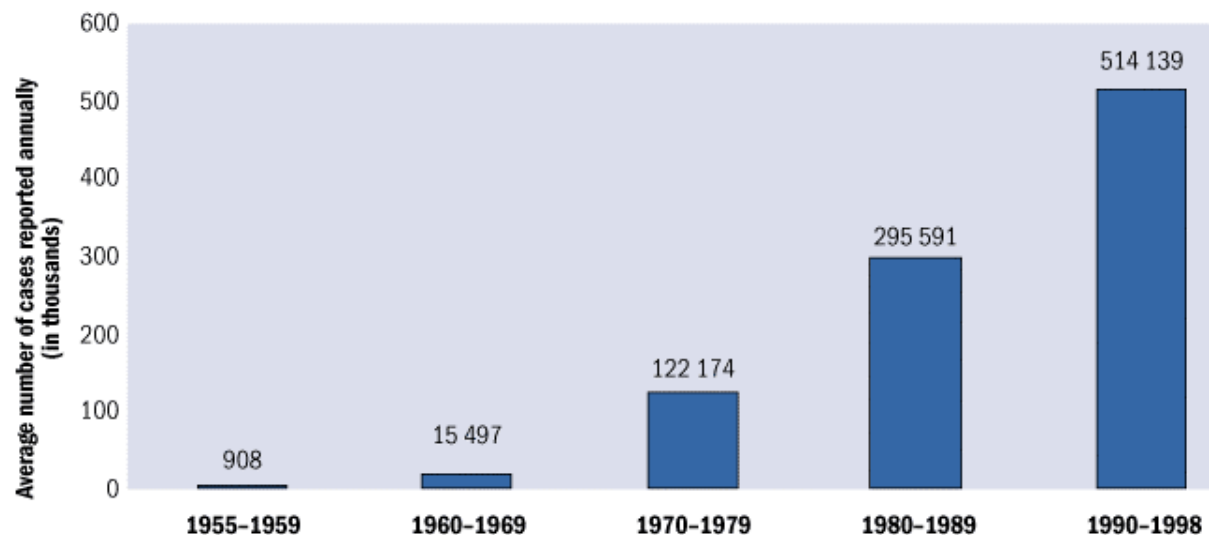
Laboratories play a very important role in surveillance of dengue – not only in confirming DF and DHF cases but also in monitoring serotypes and strains circulating in the population. For example, the introduction of a new serotype may be an important indicator of future epidemics of DHF/DSS. In many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



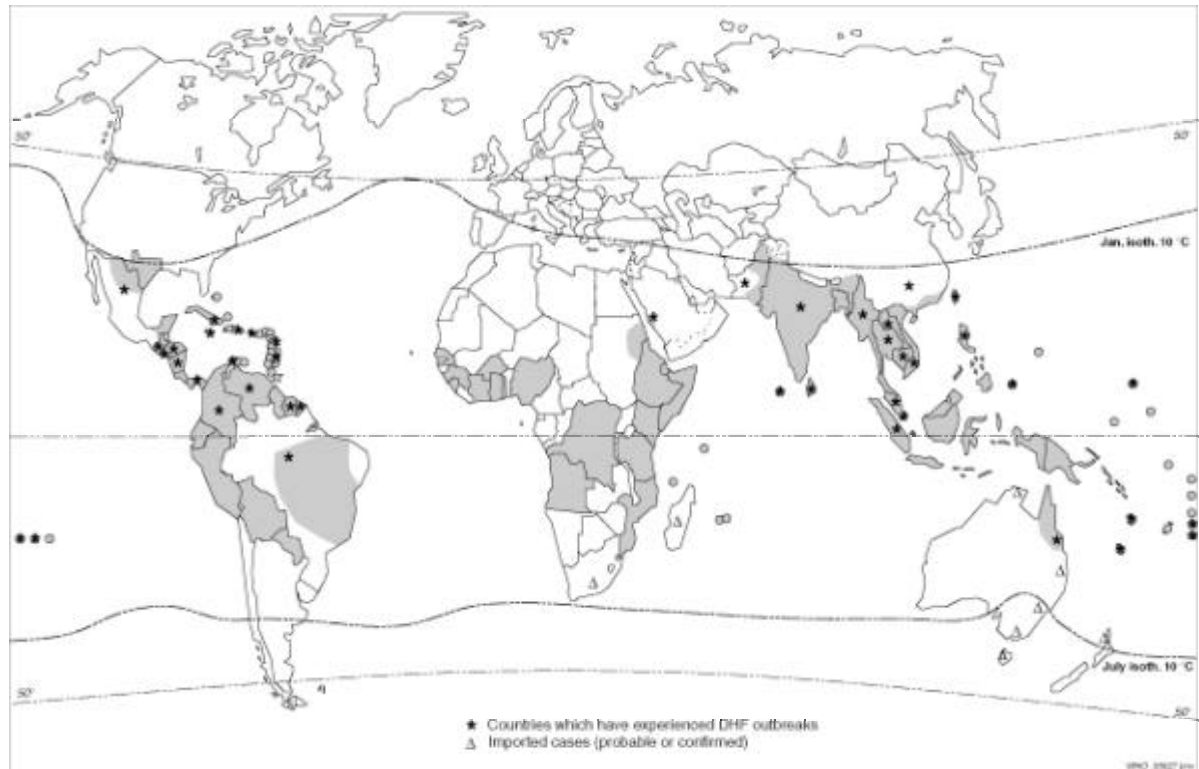
- Indigenous transmission of dengue has occurred in more than 100 countries in Africa, the Americas, the eastern Mediterranean, South-East Asia and the Western Pacific (Map 6.1).

## 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

### ***Publications and Documents***

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**

The Americas	Dengue fever																			
	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
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**

<b>The Americas</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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**

<b>Asia</b>	<b>1955</b>	<b>1956</b>	<b>1957</b>	<b>1958</b>	<b>1959</b>	<b>1960</b>	<b>1961</b>	<b>1962</b>	<b>1963</b>	<b>1964</b>	<b>1965</b>	<b>1966</b>	<b>1967</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>
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**

<b>Asia</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>
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**

<b>Asia</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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**

<b>Oceania</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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.<sup>1</sup> 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<sup>2</sup> during replication, which make it possible for the virus to evade the host's immune system.<sup>3</sup> 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,<sup>4</sup> 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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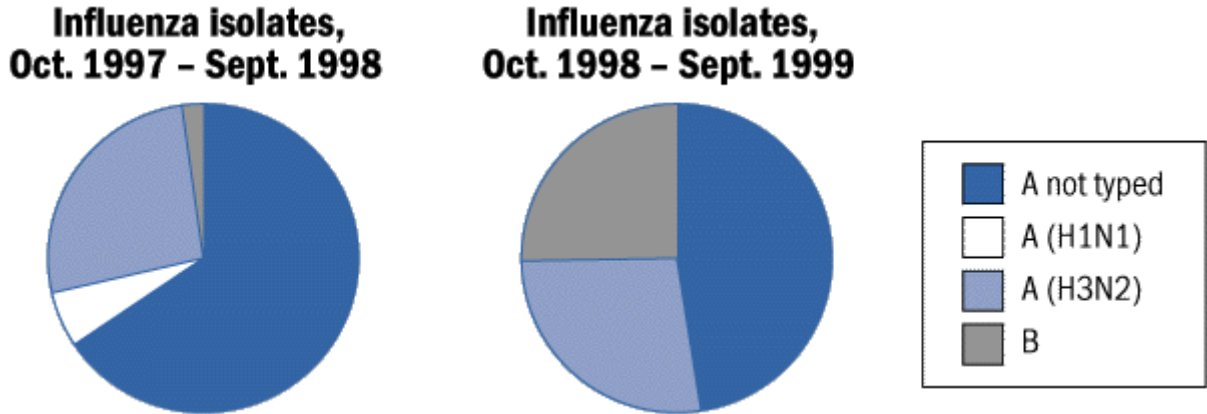
<sup>1</sup> Crosby AW, Influenza. In: Kiple KF. ed. *The Cambridge history of human disease*, Cambridge, Cambridge University Press, 1993.

<sup>2</sup> Antigens are protein or carbohydrate substances capable of stimulating an immune response.

<sup>3</sup> 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.

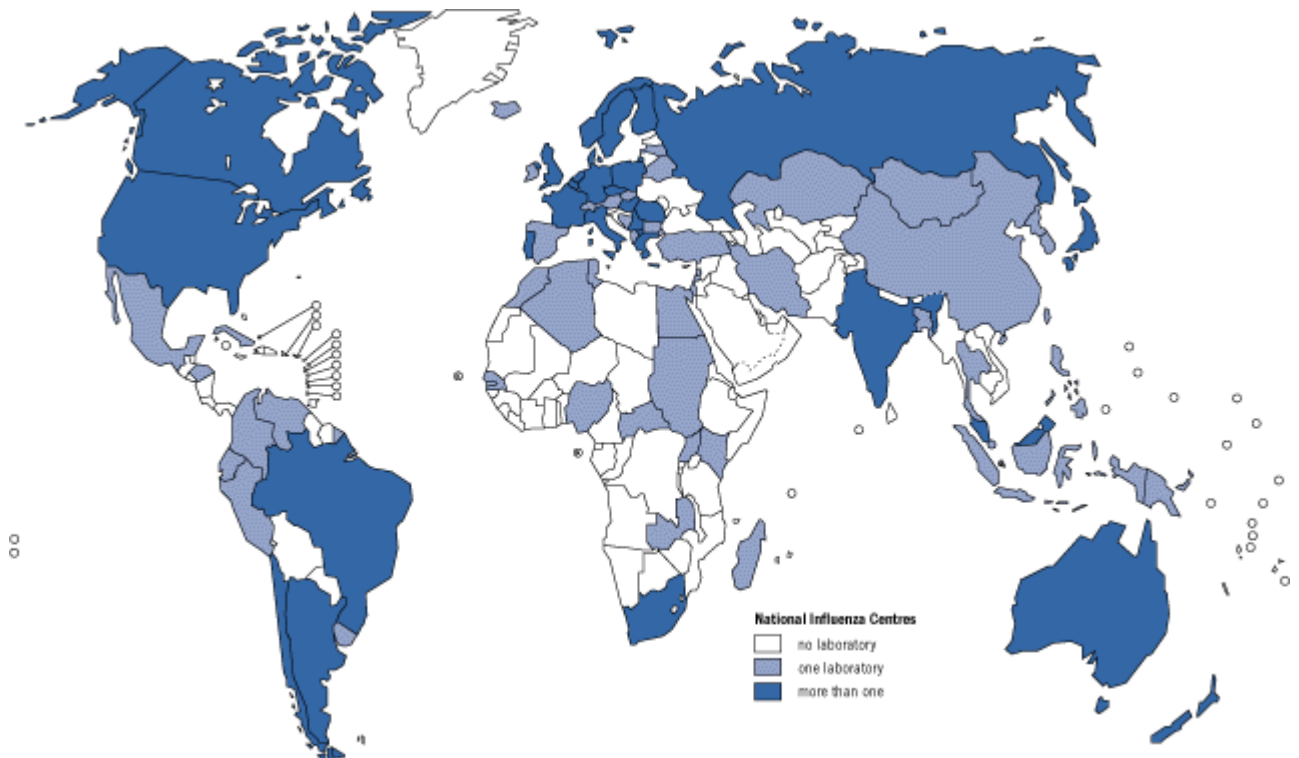
<sup>4</sup> There is also a type C influenza virus, but this causes a much milder disease not considered to be of major public health importance.

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.<sup>5</sup>

### **Description of the data**

WHO has developed a web-based database called FluNet, (<http://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*.

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<sup>5</sup> 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.

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### *Web pages*

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<http://www.who.int/emc/diseases/flu/index.html>

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

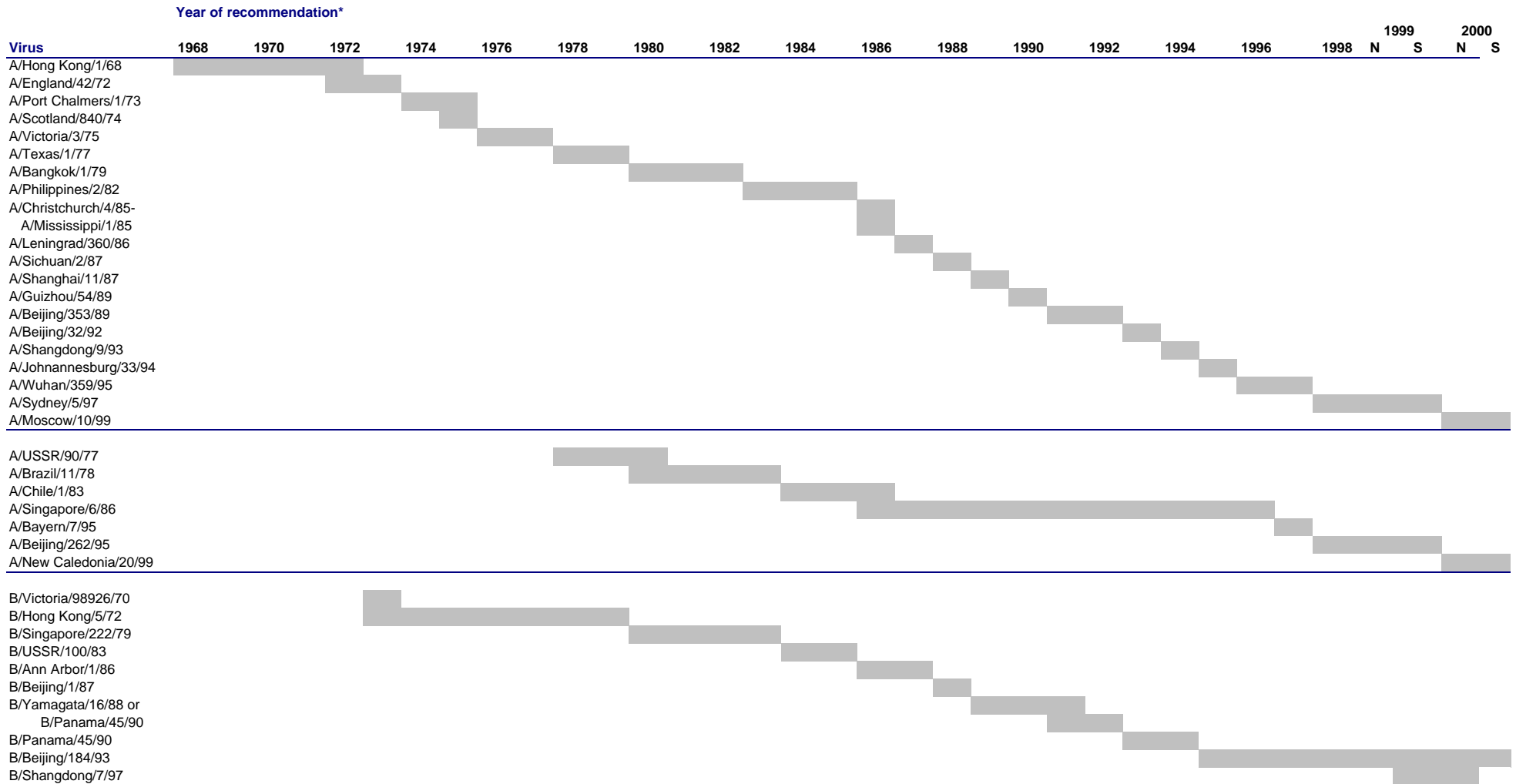
Influenza A(H5N1) fact sheet:  
<http://www.who.int/emc/diseases/flu/index.html>

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).



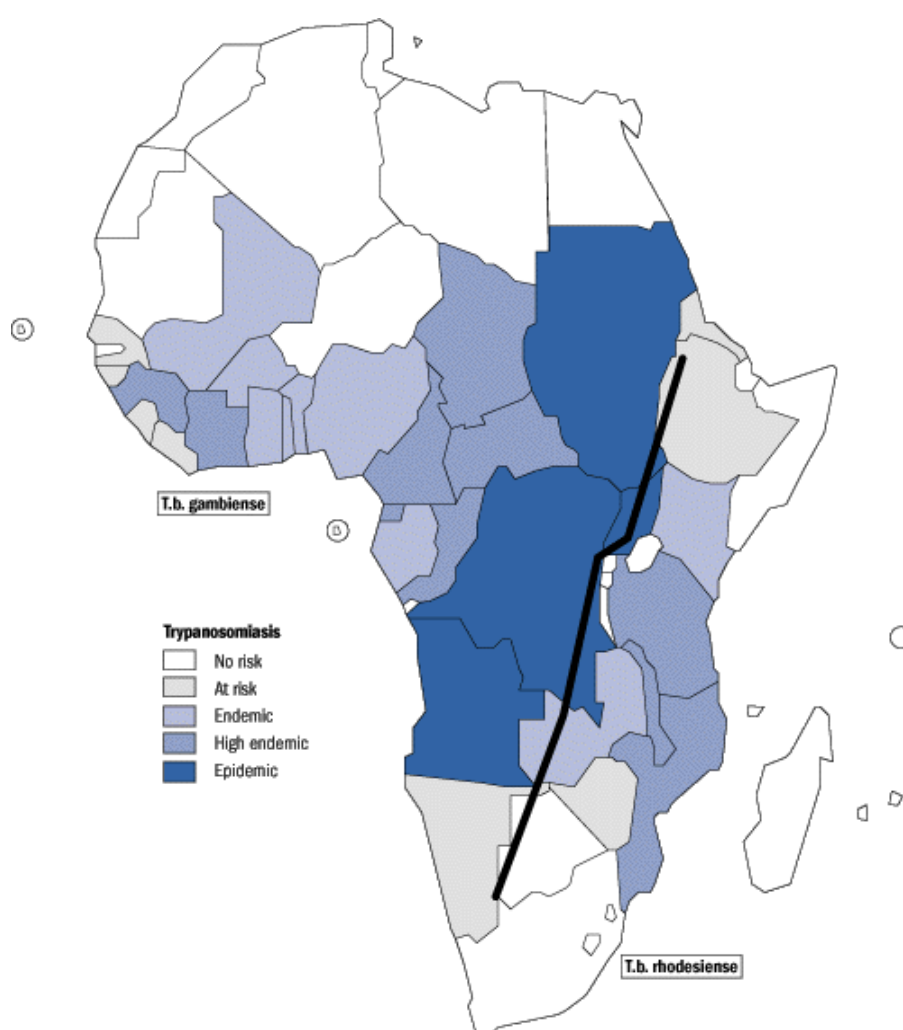
## CHAPTER 8

### 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,<sup>6</sup> 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

<sup>6</sup> 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.<sup>7</sup> 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.<sup>8</sup> 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 asymptomatic period. There are several reasons for this including the difficulty of diagnosis which cannot normally

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

<sup>8</sup> 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,<sup>9</sup> 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.<sup>10</sup>

## **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.<sup>11</sup>

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.

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<sup>9</sup> 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.

<sup>10</sup> *Trypanosomiase Humaine Africaine: Surveillance épidémiologique et système d'information géographique (S.I.G)*, Geneva, World Health Organization, 1996.

<sup>11</sup> Jansens PG, Kivits M and Vuylsteke. *Medicine et hygiène en Afrique Centrale de 1885 à nos jours*. Foundation Roi Baudoin, 1992.

## Strengths and weaknesses of the data

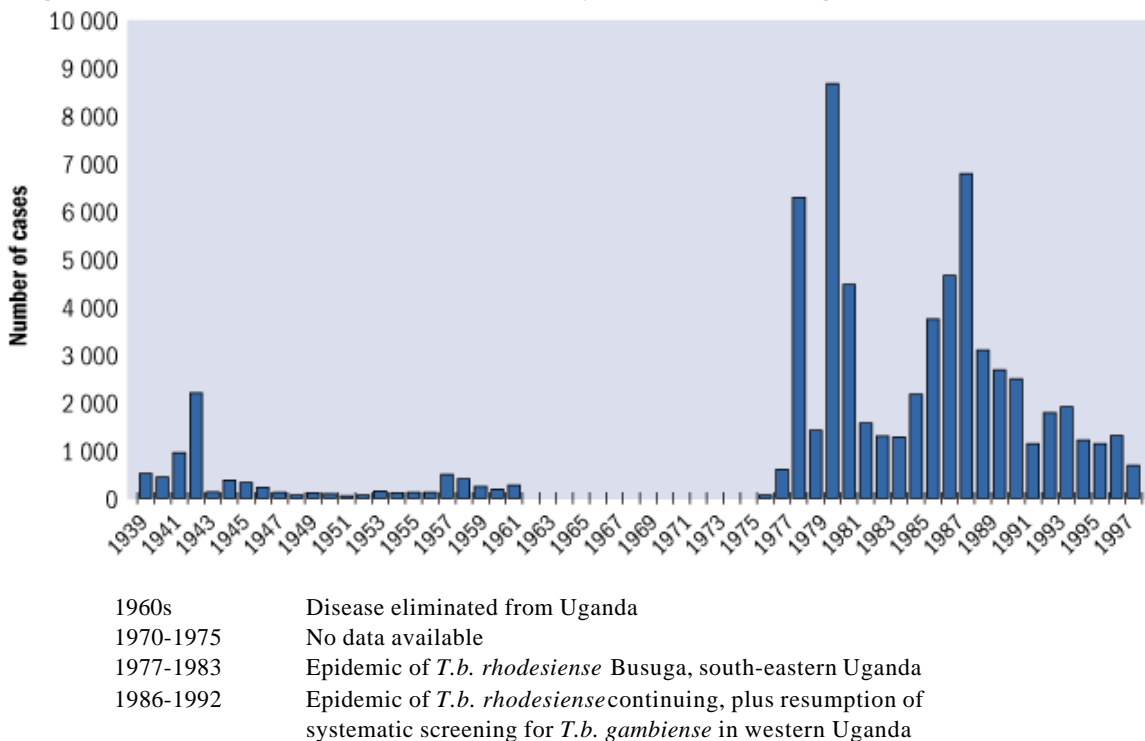
Only cases registered at special treatment centres are reported, and there are very few cases that come to the treatment centre without having either acute clinical disturbance or having been screened first. Therefore, the number of cases reported must be interpreted in light of the number of cases screened.

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**



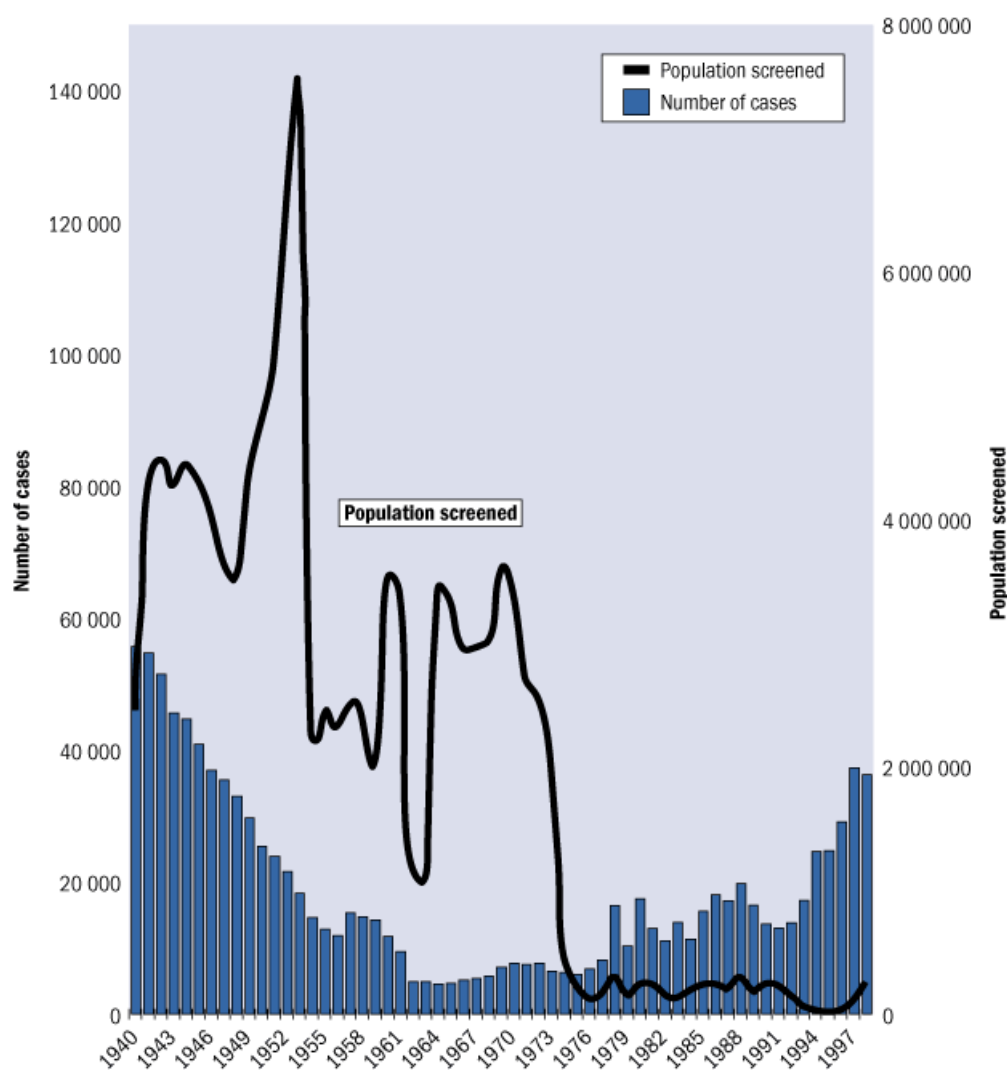
## Trends

- 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.<sup>12</sup>
- 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.

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### ***Web pages***

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

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<sup>12</sup> 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	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**

<b>Africa</b>	<b>1941</b>	<b>1942</b>	<b>1943</b>	<b>1944</b>	<b>1945</b>	<b>1946</b>	<b>1947</b>	<b>1948</b>	<b>1949</b>	<b>1950</b>	<b>1951</b>	<b>1952</b>	<b>1953</b>
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**

<b>Africa</b>	<b>1954</b>	<b>1955</b>	<b>1956</b>	<b>1957</b>	<b>1958</b>	<b>1959</b>	<b>1960</b>	<b>1961</b>	<b>1962</b>	<b>1963</b>	<b>1964</b>	<b>1965</b>	<b>1966</b>	<b>1967</b>
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
<b>Total no. of cases</b>	<b>14,461</b>	<b>12,740</b>	<b>11,722</b>	<b>15,226</b>	<b>14,602</b>	<b>14,183</b>	<b>11,641</b>	<b>9,362</b>	<b>4,733</b>	<b>4,731</b>	<b>4,435</b>	<b>4,547</b>	<b>5,047</b>	<b>5,266</b>
<b>No. of countries reporting</b>	<b>21</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>23</b>	<b>24</b>	<b>24</b>	<b>24</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>21</b>
<b>No. of countries reporting screening</b>	<b>4</b>	<b>4</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>3</b>	<b>3</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>3</b>
<b>Population screened</b>	<b>2,078,756</b>	<b>2,452,988</b>	<b>2,283,694</b>	<b>2,507,145</b>	<b>2,442,161</b>	<b>1,911,377</b>	<b>3,515,406</b>	<b>2,643,711</b>	<b>1,147,689</b>	<b>1,047,708</b>	<b>3,426,349</b>	<b>3,269,501</b>	<b>2,932,467</b>	<b>2,961,117</b>

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

<b>Africa</b>	<b>1968</b>	<b>1969</b>	<b>1970</b>	<b>1971</b>	<b>1972</b>	<b>1973</b>	<b>1974</b>	<b>1975</b>	<b>1976</b>	<b>1977</b>	<b>1978</b>	<b>1979</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>
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**

<b>Africa</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>
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.

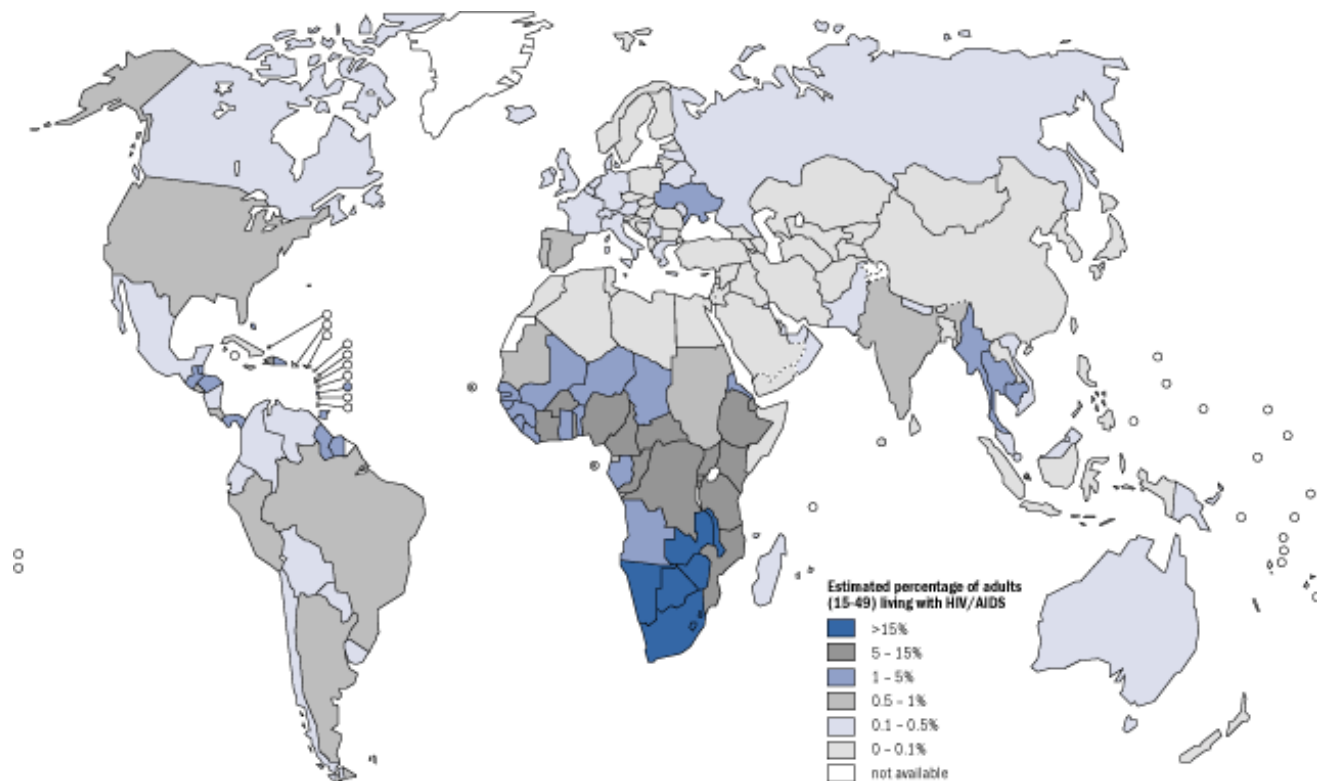
By the 1990s, however, AIDS itself reached epidemic proportions in many countries. Of the estimated 34.3 million people living with HIV at the end of 1999, 24.5 million live in sub-Saharan Africa, the hardest hit region. The estimated percentage of adults living with HIV reaches up to 26% in some countries 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 2<sup>nd</sup> generation HIV surveillance, introduced by WHO and UNAIDS, integrates AIDS and HIV surveillance with additional sources of essential data to better monitor the epidemic.<sup>1</sup>

**Map 9.1 Estimated percentage of adults (15–49 years old) infected with HIV, as of 1999<sup>2</sup>**



### 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.

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

<sup>2</sup> Source: Report on the global HIV/AIDS epidemic, UNAIDS/CO.13E.



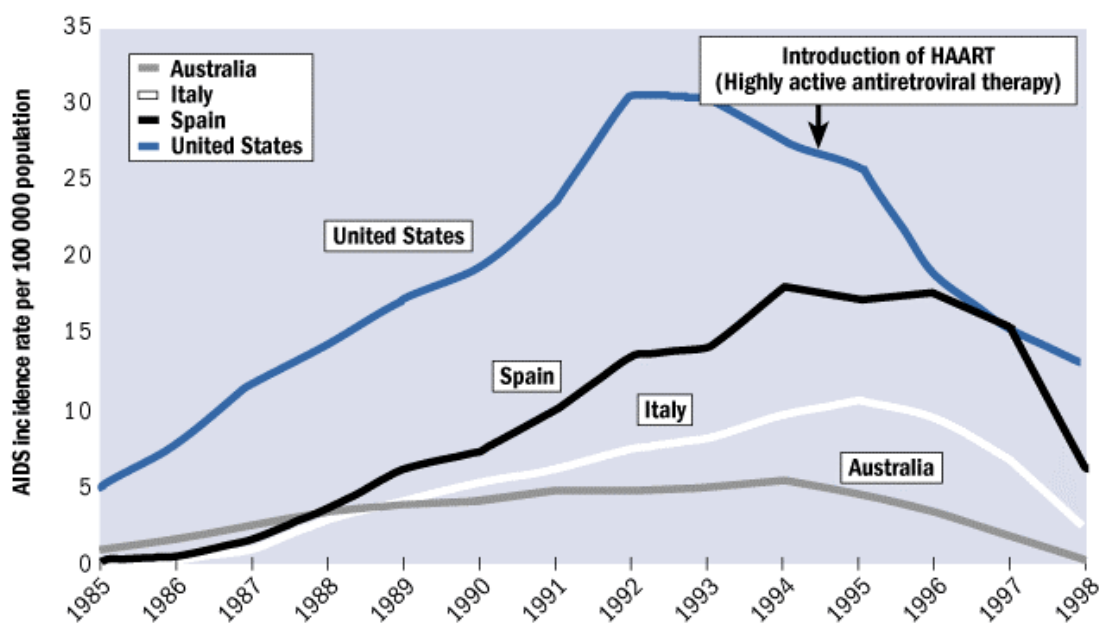
### **AIDS case surveillance**

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<sup>3</sup>**



<sup>3</sup> 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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- 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/fixcenter/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](http://www.cdc.gov/nchstp/hiv_aids/surveillance.htm)

**Table 9.1 AIDS, cases reported to WHO and number of countries reporting, 1979-1999<sup>1</sup>**

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

<sup>1</sup> AIDS cases reported to WHO as of 15 November 1999.

<sup>2</sup> 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<sup>1</sup>**

The Americas	1979-1996	1997	1998	1999	Total <sup>2</sup>	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

The Americas	1979-1996	1997	1998	1999	Total <sup>2</sup>	Last report
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	

<sup>1</sup> AIDS cases reported to WHO as of 15 November 1999.

<sup>2</sup> Total includes cases with unknown date of reporting.

**Table 9.1 AIDS, cases reported to WHO and number of countries reporting, 1979-1999<sup>1</sup>**

Asia	1979-1996	1997	1998	1999	Total <sup>2</sup>	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

Asia	1979-1996	1997	1998	1999	Total <sup>2</sup>	Last report
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	

<sup>1</sup> AIDS cases reported to WHO as of 15 November 1999.

<sup>2</sup> 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<sup>1</sup>**

Europe	1979-1996	1997	1998	1999	Total <sup>2</sup>	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

Europe	1979-1996	1997	1998	1999	Total <sup>2</sup>	Last report
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	

<sup>1</sup> AIDS cases reported to WHO as of 15 November 1999.

<sup>2</sup> Total includes cases with unknown date of reporting.

**Table 9.1 AIDS, cases reported to WHO and number of countries reporting, 1979-1999<sup>1</sup>**

<b>Oceania</b>	<b>1979-1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>Total <sup>2</sup></b>	<b>Last report</b>
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
<b>Total no. of cases</b>	<b>8,500</b>	<b>523</b>	<b>544</b>	<b>101</b>	<b>9,668</b>	
<b>No. of countries reporting</b>	<b>23</b>	<b>23</b>	<b>22</b>	<b>5</b>	<b>23</b>	

<sup>1</sup> AIDS cases reported to WHO as of 15 November 1999.

<sup>2</sup> Total includes cases with unknown date of reporting.

**Table 9.2 Regional HIV/AIDS statistics and features, end of 1999<sup>1</sup>**

	<b>Epidemic started</b>	<b>Adults &amp; children living with HIV/AIDS</b>	<b>Adults &amp; children newly infected with HIV in 1999</b>	<b>Adult prevalence rate<sup>2</sup></b>	<b>% HIV positive women</b>	<b>Main mode(s) of transmission for those living with HIV/AIDS</b>
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%	

<sup>1</sup> Source: Report on the global HIV/AIDS epidemic, UNAIDS/CO.13E.

<sup>2</sup> 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 skulls 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.<sup>4</sup> 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.<sup>5</sup>

The geographical distribution of leishmaniasis is restricted to tropical and temperate regions, the living area of the sandfly. The leishmaniasis are considered to be endemic in 88 countries (16 developed countries and 72 developing countries) on four continents. Ninety 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.

<sup>4</sup> Allison MJ. Leishmaniasis. In: Kiple KF. ed. *The Cambridge History of Human Disease*, Cambridge, Cambridge University Press, 1993.

<sup>5</sup> 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;<sup>6</sup> 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.<sup>7</sup>

There is reason to believe that the number of cases of leishmaniasis is increasing.<sup>8</sup> 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.<sup>9</sup> 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 recommended 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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<sup>6</sup> *Joint appeal, emergency assistance to control visceral leishmaniasis (kala azar) in Sudan, 1993* World Health Organization and UNICEF, 1993, (unpublished report).

<sup>7</sup> 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.

<sup>8</sup> Desjeux P. Leishmaniasis, Public Health Aspects and Control, *Clinics in Dermatology*, 1996, 14:417–424.

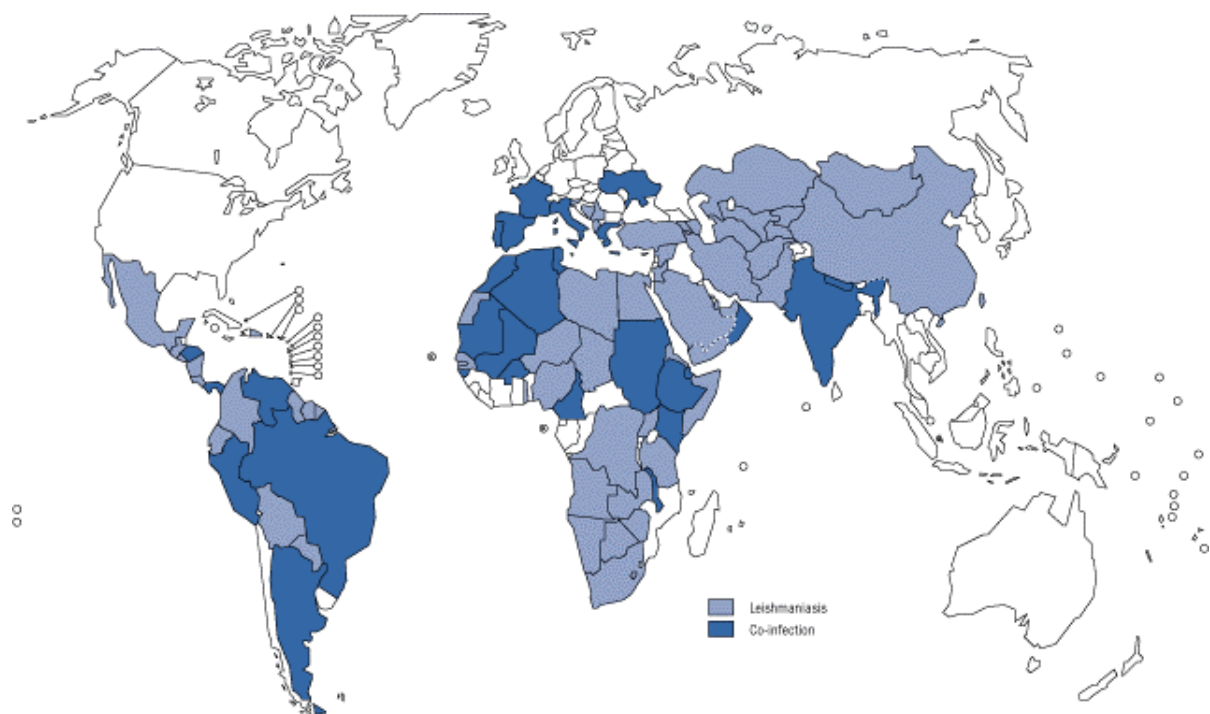
<sup>9</sup> Hewitt S. et al. Anthroponotic cutaneous leishmaniasis in Kabul, Afghanistan: vertical distribution of cases in apartment blocks. *Transaction of the Royal Society of Tropical Medicine and Hygiene*, 1998, 92:273-274.

### ***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.<sup>10</sup> 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**



<sup>10</sup> 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.

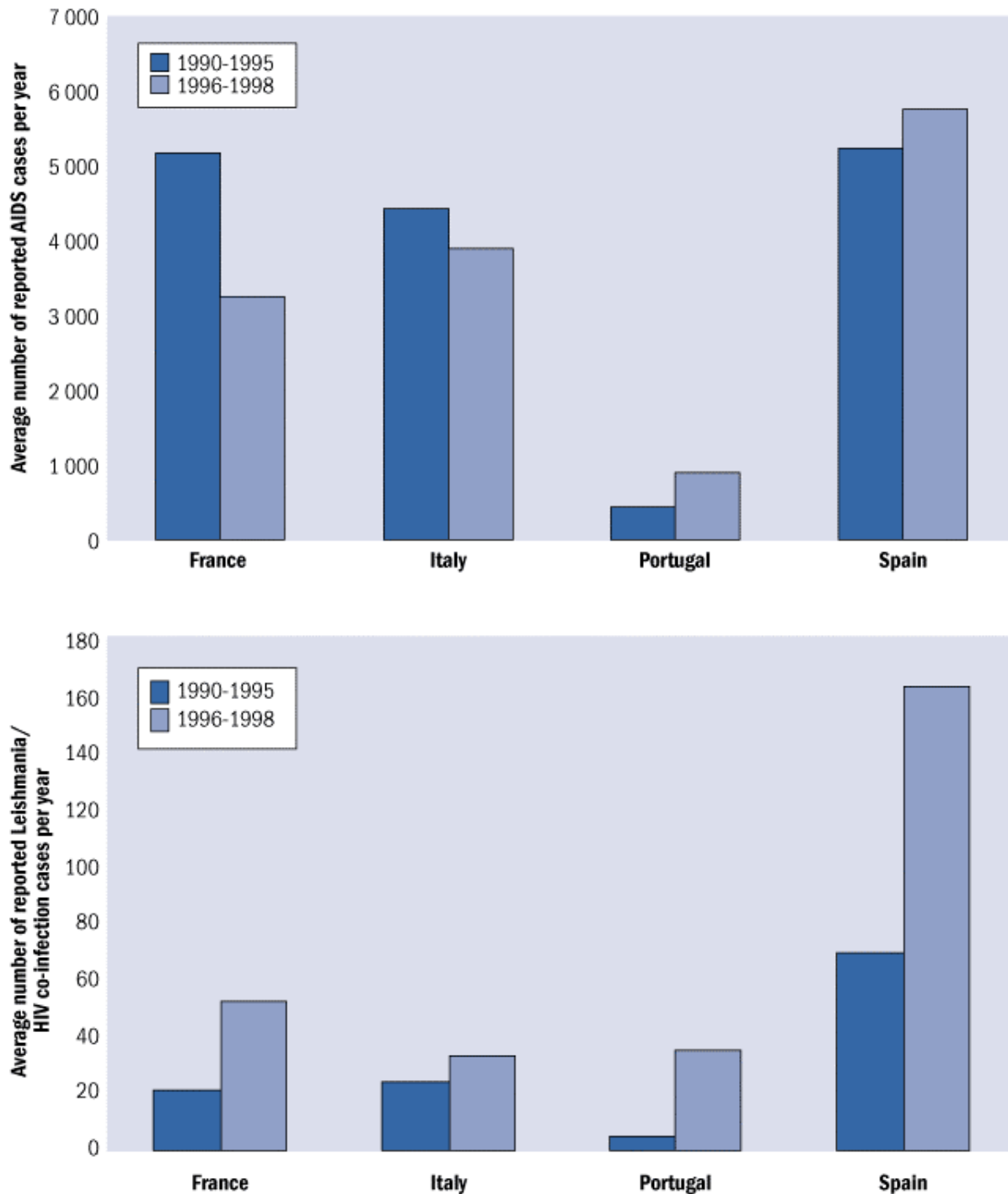
## Trends

### *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).



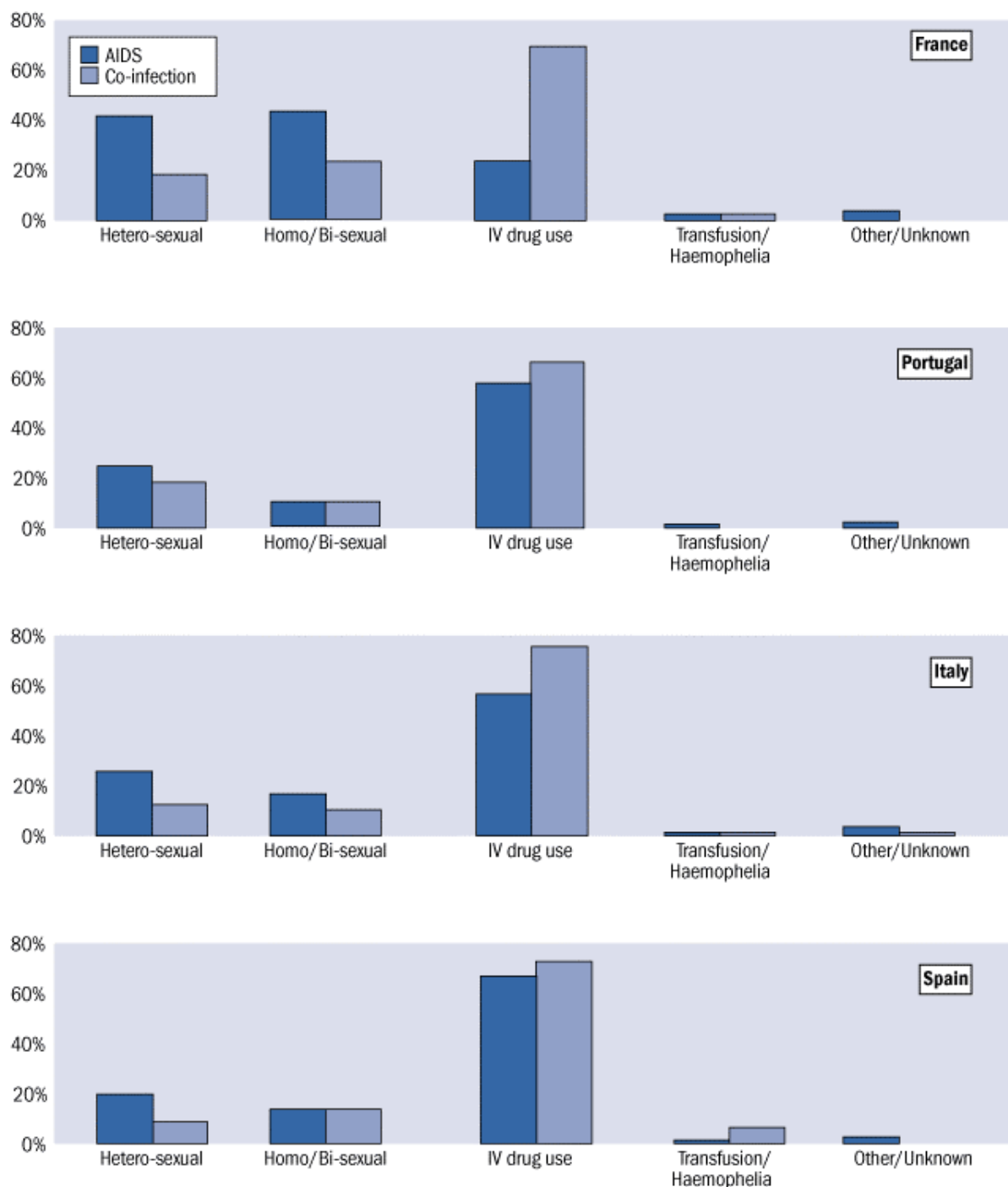
Fig. 10.1 Average number of AIDS cases and *Leishmania*/HIV co-infection cases per year, reported to WHO, south-western Europe, 1990- June 1998



- 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.<sup>11</sup>
- Over 70% of the cases of *Leishmania*/HIV co-infection reported from south-western Europe is among intravenous drug users (Fig. 10.2).

<sup>11</sup>*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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- 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.).