

Getting Ahead of the Curve

**A strategy for combating infectious diseases
(including other aspects of health protection)**

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Contents

Executive summary	9
Global threat	9
An ever-changing risk	9
The threat of infectious diseases	10
New and emerging diseases	10
Success stories	12
Strengthening surveillance	12
Strengthening services	13
Action proposed	14
Chapter 1: Introduction	17
Chapter 2: Reasons to be concerned - threats and challenges	23
FACTORS DRIVING CHANGE	24
Impact of technology	25
Environmental change and land use	27
Global travel and trade	29
Climate change	32
Microbial adaptation	34
Human behaviour	35
Impaired immune systems	37
SOME IMPORTANT THREATS	38
Threat: emerging and re-emerging infections	38
Threat: 400 diseases can transmit from animals to people	45
Threat: infection and the consumer	47
Threat: lapses in control measures	50
Threat: the spectre of bioterrorism	51

Chapter 3: Key priorities	55
New and emerging infections	55
Tuberculosis	56
Health care associated infection	62
Antimicrobial resistance	64
Infectious diseases in children	69
Blood-borne and sexually transmitted viruses	72
Chronic diseases	76
New vaccines	78
Terrorism	82
Chapter 4. Some success stories	85
Reduction in Malaria deaths in Vietnam	85
Meningococcal C disease in children dramatically reduced in England	86
Breakthrough in the control of leprosy in Sri Lanka	88
Confronting AIDS in the Caribbean	90
Peru set to halve new tuberculosis cases every ten years	91
Listeriosis in pregnant women in the United Kingdom	92

Chapter 5. A modern system to combat the infectious disease threat	95
WORLD CLASS SURVEILLANCE	96
ORGANISATION OF SERVICES	101
Department of Health	101
Local authorities	102
The NHS	103
Public Health Laboratory Service	104
Other national bodies concerned with infectious disease control	107
DIAGNOSTIC AND REFERENCE MICROBIOLOGY LABORATORIES	110
Local laboratories	110
Public health laboratories	111
Specialist and reference laboratories	111
Standardisation of testing	112
PUBLIC HEALTH LEGISLATION	114
THE WORKFORCE DEALING WITH TREATMENT, PREVENTION AND CONTROL OF INFECTIOUS DISEASES	117
HEALTH PROTECTION	120
RESEARCH, DEVELOPMENT AND INNOVATION	126
COMMUNICATING WITH THE PUBLIC	129
Chapter 6. The strategy: proposed action	131

Executive Summary

- Infectious diseases have been a threat to people's survival, health and well-being since human life began. Post-war optimism that their conquest was near has proved dramatically unfounded.
- This document sets out an infectious diseases strategy for England. The production of such a strategy was one of the pledges in the Government's White Paper 'Saving Lives: Our Healthier Nation'.
- The strategy sets out to: describe the scope and nature of the threat posed by infectious diseases to the health of the population of England; and establish the priorities for action to combat the present as well as possible future threat posed by infectious diseases.
- In its development the strategy has been shaped by experience and opinion which strongly supports the need for a broad based approach to health protection as a whole - infectious disease control as well as measures to address the risks posed by chemical and radiation hazards. These other aspects of health protection have been added to the core aims of the strategy and the changes it seeks to bring about. It proposes a strengthened and modernised system to respond to these challenges.

A global threat

- At the beginning of the 21st century, infectious diseases are a major global threat: to health, to prosperity, to social stability, to security. Infectious diseases account for 41% of the global disease burden with infections such as HIV/AIDS, tuberculosis and malaria accounting for millions of deaths in the world's population each year.

An ever-changing risk

- The problem of infectious diseases is never static. Micro-organisms like viruses and bacteria co-exist with people and share a common environment. A number of important factors create change in this delicate balance and some increase the risk to human health from infectious diseases. They include: global travel and trade; the growth of technology; adaptation of micro-organisms producing strains that are more virulent and resistant to treatment; increases in the numbers of people with weakened immune systems (e.g. cancer and transplant patients); changes in environmental and land use.

The threat of infectious diseases

- In England, though the major infectious diseases kill only a small number of people compared to the past, infection is still important. For example:
 - 40% of people consult a health professional each year because of infection;
 - as many as 5,000 patients may die as a result of hospital acquired infection each year in the United Kingdom and there are substantial costs of hospital acquired infection to the NHS;
 - a number of major national crises over the last few years have been a direct consequence of infectious diseases (e.g. BSE and vCJD, foot and mouth disease, deaths of children and students from meningitis, NHS winter pressures from influenza and bronchitis, the Lanarkshire *E. coli* O157 outbreak);
 - infections account for 70,000 deaths each year;
 - the number of people living with diagnosed Human Immunodeficiency Virus (HIV) is estimated to rise to 29,000 by the end of 2003, an increase of 40% over the end of 1999 prevalence.
- The potential threats to health from infectious diseases in England today are diverse and include: the threat of new or previously unrecognised diseases, the threat of animal diseases that can transmit to humans, the threat from poor hygiene, slack disease control measures or poor standards of medical care.
- The terrorist attacks on New York City and Washington DC on September 11th 2001 and subsequent deliberate releases of anthrax have reinforced the need for measures against terrorism to be part of this strategy.

New and emerging diseases

- One important issue is the scale of emergence of new or previously unrecognised infectious diseases. Since the early 1970s at least 30 previously unknown infectious diseases have become prominent, for which there is no fully effective treatment. Infectious diseases recognise no international boundaries, so that a newly emergent disease in another part of the world must be assessed as a potential threat to this country.

- The infectious diseases which have emerged in the last three decades have been a major cause of illness and death and have generated great public concern. HIV, which causes AIDS, was not clinically recognised before the early 1980s. UNAIDS has estimated that 40 million people are living with HIV/AIDS world-wide towards the end of 2001, the majority of whom were in sub-Saharan African countries. In 2001 alone, around 3 million people died of AIDS and over 4 million adults were newly infected as were over 800,000 children less than 15 years old.
- Ebola virus emerged in 1976 in Sudan and Zaire when it caused an outbreak of a terrifying illness which caused internal bleeding and, often, death. So far outbreaks have been limited to a small number of areas of the world. Variant Creutzfeldt-Jakob disease (vCJD), a serious and uniformly fatal disease of the brain was first recognised in 1996 and it is now believed to have arisen from people eating meat from cattle infected with Bovine Spongiform Encephalopathy (BSE).
- In 1918-9 the world suffered a major influenza pandemic in which in one year at least 25 million people died world-wide, including around 228,000 people in Britain. Most experts believe that it is not a question of whether there will be another severe influenza pandemic but when. The emergence of a virulent strain of influenza virus amongst chickens in Hong Kong in 1997 ('bird flu') which began to infect people was a warning of what could have happened if the conditions had been different. The strain of influenza virus (H5N1) was first found in terns in 1961. It became widespread amongst chickens in Hong Kong in the mid 1990s. The first human case occurred in 1997. This strain of influenza virus had not been shown to affect people before and prompt action to kill 1.2 million chickens and 400,000 other birds in the Hong Kong markets stopped the outbreak.
- Given the nature of the micro-organisms that cause infection, the pattern of human behaviour and changes to the environment, further newly emergent infectious diseases are inevitable. It is essential to expect the unexpected. Good surveillance, early assessment of potential problems and strong contingency plans are clearly essential if we are to recognise them early and respond efficiently to minimise their impact.

Success stories

- It is possible to turn the tide against many of the major infectious disease problems. Experience around the world has shown that in developing countries without major resources there are many success stories. Poliomyelitis is well on its way to being eliminated worldwide. In England, the vaccination programme introduced against meningococcal C infection has been remarkably successful. In the first 9 months of 1999, before the immunisation campaign started, there were 551 confirmed cases and 47 deaths. In the same period of 2001 there were 79 confirmed cases of Group C meningococcal infection and 3 deaths.

Strengthening surveillance

- Although this country is respected internationally for its work on infectious disease surveillance, the present system falls short of what is necessary fully to protect the public health.
- Much infection goes unreported or is under-notified so that routine surveillance information at local and national level gives an incomplete picture of the size and nature of the threat to health from infectious diseases. There are gaps in surveillance so that it is impossible properly to track some major problems – for example antimicrobial resistance. There is no formal point of co-ordination for the many separate infectious disease surveillance systems.
- Good surveillance is the cornerstone of a system to control infectious diseases in the population. Without it, tracking disease trends, identifying new infectious disease threats, designing effective vaccines, spotting serious outbreaks and monitoring control measures would all be impossible.

Strengthening services

- This country has traditionally had a much stronger public health system than many other countries. Under the overall leadership of the Department of Health, the prevention, investigation and control of infectious diseases in the population is addressed at national, regional and local level.
- Specialist agencies, notably the Public Health Laboratory Service and its Communicable Disease Surveillance Centre, provide expertise in informing policy, in co-ordinating surveillance activities and in the investigation of outbreaks and epidemics. A network of expert committees also provides advice.
- At local level health authorities (through their Directors of Public Health and Consultants in Communicable Disease Control) work together with local authorities to address infectious disease problems in local communities. In hospitals, designated teams deal with hospital acquired infection.
- Regional directors of public health have assumed overall responsibility for co-ordinating health protection activities in their regions. This has been particularly effective in the two recent emergencies - the foot and mouth outbreak (when measures had to be taken to protect human health as a result of disposal on a huge scale of animal carcasses) and the threat of terrorism in the Autumn of 2001.
- Despite these strengths there is much that needs to be done to modernise these services. There is no integrated approach to encompass all aspects of health protection (infectious diseases, chemical and radiation hazards) from national, to regional, to local level. Regional directors of public health have no formal role despite the major responsibilities they carry in reality. The current health authorities are being abolished and it is essential that there is a structure which reflects the role different agencies should play following this reorganisation of the NHS. As for microbiology laboratories, they are under a variety of management arrangements and follow no standard diagnostic criteria in their operations. They are under no requirement to report infections for public health purposes and there is a need to step up the level of security in all laboratories against the spectre of bioterrorism.
- Building on the existing strengths of this public health system, the proposals in the strategy aim to modernise it.

Action proposed

- The strategy sets out a series of proposed actions to create a modern system to prevent, investigate and control the infectious diseases threat and address health protection more widely. These include:
 - **a new National Infection Control and Health Protection Agency** combining the existing functions of the Public Health Laboratory Service and three other national bodies (the National Radiological Protection Board, the Centre for Applied Microbiology and Research, and the National Focus for Chemical Incidents) to provide an integrated approach to protecting the health of the public against infectious diseases as well as chemical and radiological hazards.
 - **a local health protection service** delivered by the new Agency, working with the NHS and local authorities to deliver specified functions relating to the prevention, investigation and control of infectious diseases as well as chemical and radiological hazards.
 - **a national expert panel** to assess the threat from new and emerging infectious diseases.
 - **a strengthened and expanded system of infectious disease surveillance** bringing in modern methods of data capture and integrating information from human infections with that from animals and from environmental monitoring.
 - **new action plans to address infectious disease priorities:** tuberculosis, health care associated infection, antimicrobial resistance, blood-borne and sexually transmitted viruses and chronic diseases caused by micro-organisms.
 - **rationalisation of microbiology laboratories and introduction of standards** for diagnosis and profiling of micro-organisms.
 - **a new Inspector of Microbiology** post to ensure that laboratories meet their responsibilities for public health surveillance, to ensure compliance with standards and check that security is in place to reduce the risk of loss or misuse of microbiological agents.
 - **a programme of new vaccine development.**

- **strengthened clinical and preventive services for dealing with infection in childhood through the National Service Framework for Children.**
- **further development of plans to combat the threat to public health of deliberate release of biological, chemical or radiological agents.**
- **better public information and involvement on infectious diseases and their risks.**
- **stronger professional education and training programmes.**
- **a research and innovation programme.**
- **a review of the law on infection control to determine what changes are needed to underpin the strategy.**

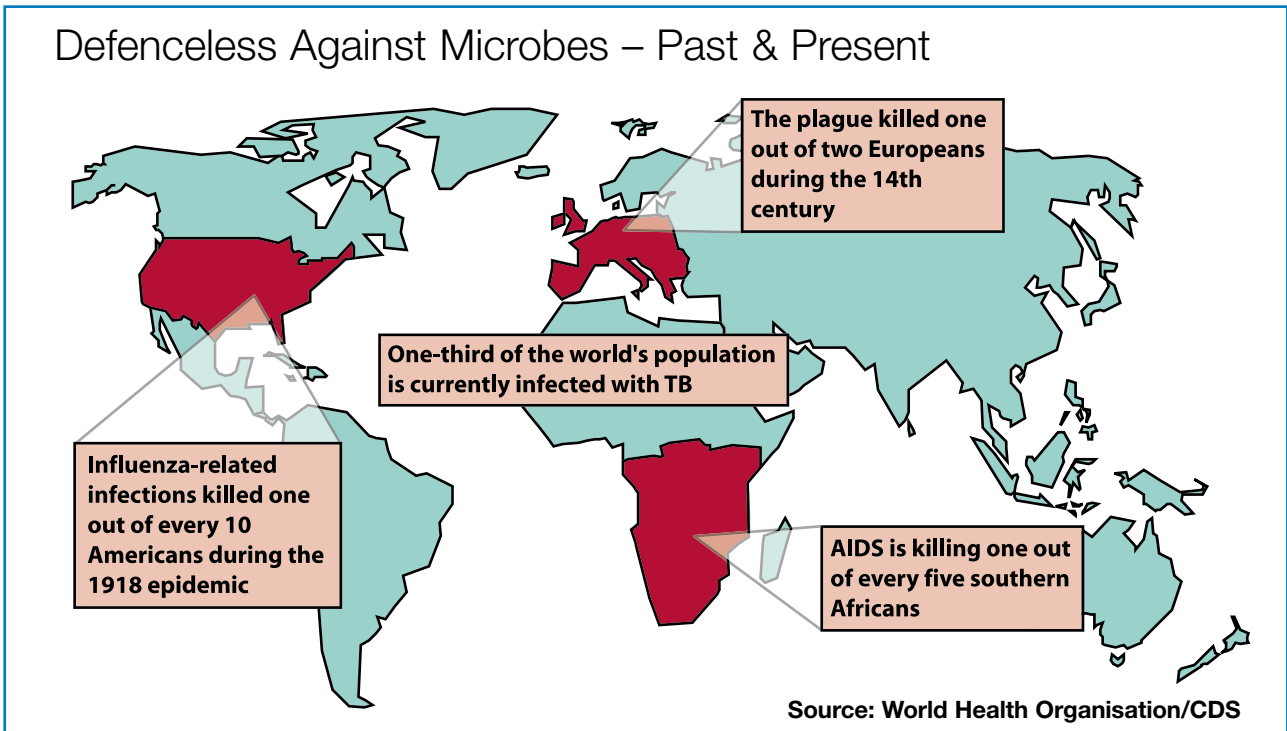
Chapter 1: Introduction

- 1.1 Infectious diseases have been the major health problems confronting humankind for as long as diseases have been documented or depicted in historical records, literature, art and scientific writing.**

‘Although the Soldiery retreated from the Field of Death, and encamped out of the City, the Contagion followed, and vanquish’d them; many in their Old Age, and others in their Prime, sunk under its cruelties; of the Female Sex most died; and hardly any children escaped; and it was not uncommon to see an Inheritance pass successively to three or four Heirs in as many Days; the Number of Sextons were not sufficient to bury the Dead.’

**Nathanial Hodges.
Loimologia: an account of the 1665 London Plague**

- 1.2 Between 1346 and 1350 there were 25 million deaths in Europe from the bubonic plague or ‘Black Death’ which reduced the population from 75 million to 50 million. One third of the 4 million population of England died. Between 1685 and 1801 the annual incidence of smallpox in London peaked at 2355 per 100,000 population and never fell below 313 per 100,000. In a three year period in the late 1830s a smallpox epidemic killed 42,000 people in Britain.**
- 1.3 The epidemics which scarred Victorian England – such as diphtheria, typhus, cholera, tuberculosis - began to be brought under control by a series of major sanitary reforms directed at the cities and towns of the industrial revolution. Clean water, safe disposal of sewage, reduction of overcrowding and gradual improvement in the nutritional status of the population eventually cut death rates from these and other major infectious diseases. The introduction of vaccines and antibiotics in the 20th century further contributed to the saving of lives which in the past would have been lost to infection. The most dramatic reductions in mortality were amongst children. As a result more people survived into middle and later life and the foundations were laid for the greater longevity and better health which characterised much of the 20th century in this country.**
- 1.4 The post-war development of powerful classes of drugs to treat infection led to a view in the 1960s and 1970s that it might be possible to conquer infectious diseases so that they would no longer pose a serious threat to human health.**



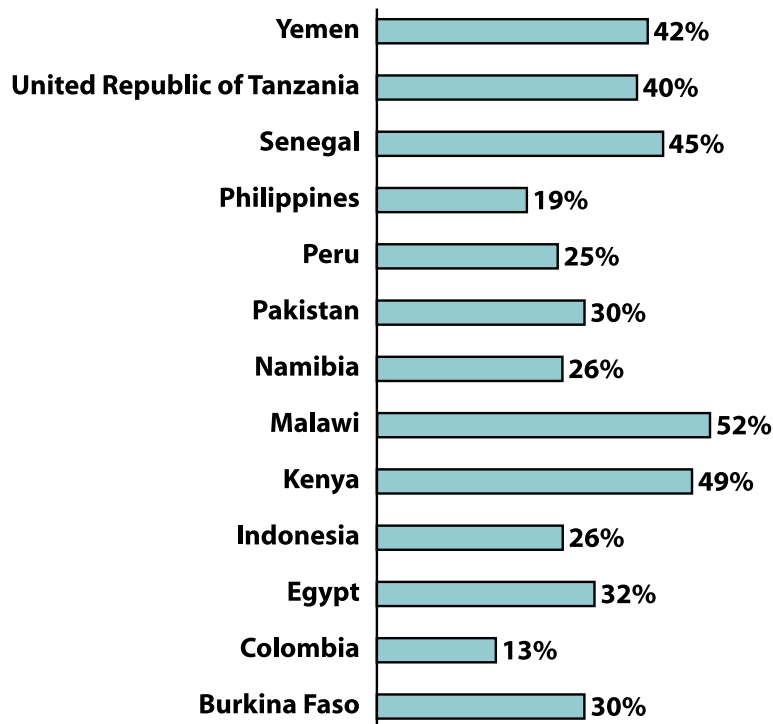
1.5 This optimism proved to be unfounded. Gradually more and more of the micro-organisms that caused infection became resistant to the effects of antimicrobial drugs. The widespread use of treatments which weaken the immune system (like chemotherapy for cancer or immunosuppression for transplantation), and the emergence of a large frail elderly population, meant that many more people were more susceptible to infection and fell victim to it. On top of this, very serious previously unrecognised infectious diseases (such as HIV/AIDS) emerged whilst infections (such as tuberculosis) considered by many to have been consigned to the history books began to strike again on a major scale.

1.6 Looked at globally a range of key facts illustrate the scale of the problem of infection:

- HIV/AIDS, tuberculosis and malaria are now the world's major killers of children and young adults causing more than 13 million deaths a year;
- In some countries in sub-Saharan Africa up to 1 in 4 of the population is now living with HIV infection or full-blown AIDS; whilst nearly 42 million children in 27 countries will lose one or both parents to AIDS by 2010;
- Up to one percentage point of a country's Gross Domestic Product (GDP) is lost when 10% of the population is affected by HIV/AIDS;
- There are over 300 million episodes of acute malaria mainly affecting the world's poorest countries;

The death of a child

Percentage of women aged 15 to 49 years, married or previously married, who have had at least one child die



Source: World Health Organisation 1999

- 1.7 In the last year of the 20th century, infectious diseases accounted for an estimated 25% of deaths world-wide, 43% of deaths in low income countries and 63% of deaths among children under five years of age. The scale of this in human terms is illustrated by the high proportion of women in some parts of the world who experience the tragedy of losing a child.
- 1.8 Standing at the beginning of a new Millennium and trying to place the problem of infectious disease in context, it is difficult to escape the conclusion that it must be viewed as a global threat. A threat not just to the health, survival and well-being of populations but to the economies of many countries, to social stability and to security in some parts of the world.
- 1.9 A great deal of effort and funding is being directed by governments and international aid agencies at the major infectious disease problems in the worst affected parts of the world. For example:
- The UK Government's Department for International Development allocated £131 million of its £488 million health programme to combat infectious diseases;

- **The heightened global interest in communicable diseases has created support for a Global Health Fund. This is an international alliance of partners, including developing countries, developed countries, private foundations, civil society and UN and multilateral agencies, to support the expanded coverage of critical interventions for the prevention and treatment of HIV/AIDS, tuberculosis and malaria.**

Some major global initiatives to combat infectious diseases

- Roll back malaria: WHO and partner organisations;
- Stop TB initiative: WHO and partner organisations;
- Global Alliance for Vaccine and Immunisation (GAVI);
- Global AIDS Fund launched at G8 summit (eight nations include Canada, France, Germany, Italy, Japan, United States, United Kingdom and the Russian Federation).

Economic impact of major infectious disease outbreaks – some examples

YEAR	COUNTRY	DISEASE	COST (US\$)
1997	Hong Kong	'bird flu'	22 million*
1994	India	Plague	2 billion
1998	Tanzania	Cholera	36 million
1991	Peru	Cholera	770 million
1990-8	United Kingdom	BSE	38 billion
1999	Malaysia	Nipah virus	540 million*
1999	New York	West Nile Fever	Almost 100 million
1999	Russian Federation	Tuberculosis	Over 4 billion
1979-94	New York City	Tuberculosis	Over 1 billion

* Conservative estimates
Source: World Health Organisation

1.10 The prevention and control of infectious disease in England must be set in this wider context. Firstly, because as a developed country we have an important part to play through funding, practical support and expertise in helping the developing world to curb the rampant spread of infection. Secondly, because the micro-organisms that cause infection acknowledge no boundaries. International travel, migration of populations, and import and export of goods and foodstuffs make their spread inevitable.

The burden of infectious disease in England

- 40% of people consult their doctor every year because of an infection;
- Infections account for 70,000 deaths each year;
- Infections put over 150,000 people into hospital each year;
- 1 in 11 young sexually active women are infected with genital chlamydia;
- Number of people living with diagnosed HIV are estimated to rise to 29,000 by the end of 2003, an increase of 40% over the end of 1999 prevalence;
- The proportion of serious infections with *Staphylococcus aureus* that involve bacteria resistant to infection have risen from less than 5% a decade ago to over 40% today.

Infectious disease issues that have made headline news in the last few years



- 1.11 Recent problems, for example the winter floods, and the foot and mouth disease epidemic, have highlighted the need for an integrated approach to the management of such events, where the potential infectious hazard is one part of a wider picture that requires a multi-agency response. Although foot and mouth disease is an infection in animals, the control measures gave rise to a number of associated hazards with implications for human health which had to be addressed in the round.
- 1.12 When planning for or dealing with an event at the local level where the cause is initially unknown, the elements of the emergency response and investigation are broadly similar, whether the cause turns out to be infectious, chemical or radiological.
- 1.13 In formulating an infectious diseases strategy it is sensible to consider these three areas of public health protection together, and to link the needs of infectious disease control with the systems for managing chemical and radiation hazards.
- 1.14 This document sets such a strategy for England. Its production was one of the pledges in the government's White Paper *Saving Lives: Our Healthier Nation*. The strategy has been produced after listening to the views of a wide range of individuals and organisations. In particular the Chief Medical Officer chaired a group with a very wide membership which discussed the issues in depth. The strategy has drawn on this process and has also built in the latest thinking on wider health protection which is now incorporated into the strategy.
- 1.15 The strategy sets out to:
- Describe the scope and nature of the threat posed by infectious diseases to the health of the population of England;
 - Establish the priorities for action to combat the present as well as the possible future threat posed by infectious diseases;
 - Integrate the infectious disease challenge with wider health protection needs;
 - Propose a strengthened and modernised system to respond to these challenges.

Chapter 2:

Reasons To Be Concerned – Threats And Challenges

- 2.1 The decline in death and serious illness from infectious diseases in England during the 20th century was striking:
- In 1901 the death rate from infectious disease was 369 per 100,000 population; by 2000 that rate had fallen to 9 per 100,000.
 - Infection after childbirth (puerperal fever) killed 2,000 women in 1901 and 2 in the year 2000.
 - In 1953, there were 2,832 cases of paralytic poliomyelitis, in the year 2000 there were none.
 - In 1949 there were 371,341 cases of measles, which killed 290 children and was probably the cause of almost 400 cases of severe encephalitis but in the year 2000 there were only 72 confirmed cases, 1 death from late onset complications, and four cases of measles encephalitis.
- 2.2 These spectacular improvements were hard won. They resulted in part from the improvements in sanitation, living standards and hygiene (referred to in the previous chapter). They demonstrate the very important role played by comprehensive, well-organised vaccination programmes in childhood. They also reflect the contribution made by advances and improvements in medical care, notably the development of antimicrobial drug therapies.
- 2.3 Infections are caused by living organisms - viruses, bacteria, fungi and protozoa. These micro-organisms co-exist on the planet with other forms of life, including people. Many micro-organisms are essential to our well-being and survival - for example, the bacteria that colonise the human gut. Whether they cause infection is determined by a wide range of factors - the environment, people's susceptibility and the genetic make-up of the micro-organism and the human population.
- 2.4 With this complex range of factors the profile of infectious diseases is never static. It constantly changes in response to alterations in the environment, variations in the genetic make-up of micro-organisms, shifts in the pool of susceptible people and completely unexpected or unpredicted events.

“Infectious disease is one of the great tragedies of living things...
.....the struggle for existence between two different forms of life
.....incessantly the pitiless war goes on without quarter or
armistice, a nationalism of species against species”

Hans Zinsser. *Rats, Lice & History*. Boston: Little Brown & Co., 1935

- 2.5 All of these changes can produce a wide spectrum of threats to the health of the population from infectious diseases at the beginning of the 21st century. They are the reasons why infectious diseases will remain a major source of concern to human health for the foreseeable future.

Factors Driving Change

- 2.6 The important factors which are producing change in the risks posed by infectious diseases are:

- Impact of technology;
- Environmental change and land use;
- Global travel and trade;
- Climate change;
- Microbial adaptation;
- Human behaviour;
- Impaired immune systems.

- 2.7 Examples of how these factors have affected the risk of infectious disease are described below. In addition, these factors can also affect other possible risks to health. For instance:

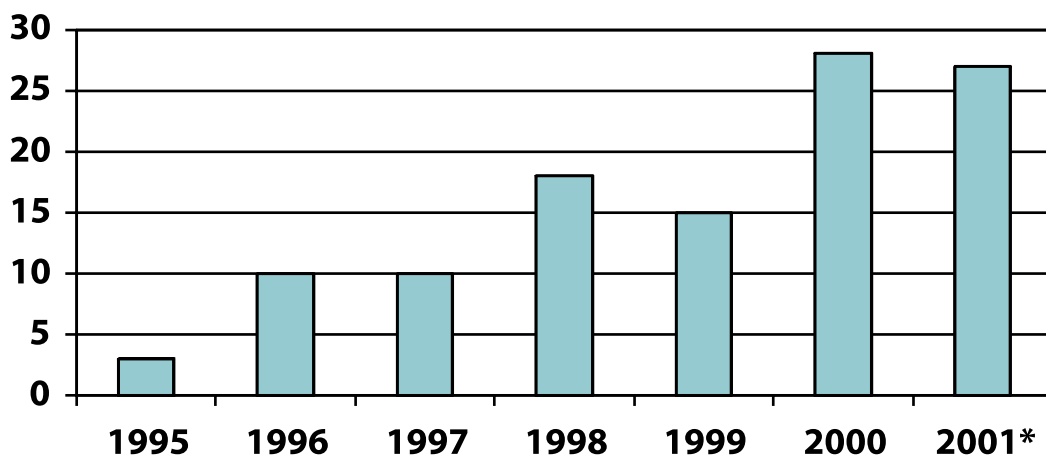
- The recent explosion in mobile phone use has led to public health concerns about exposure to radiowaves and the siting of base stations;
- The increase in global travel and trade together with changes in human behaviour has led to an increase in exposure to ultraviolet radiation and more people getting skin cancer;
- The development of new analytical techniques which can detect very low levels of chemicals in food or human tissues leads to concern about the health significance of these contaminants;

Impact of technology

- 2.8 Throughout the 20th century, to the present day and in to the future, technological advance has been and will be a dominant feature of our society. These often beneficial new technologies can sometimes have an unforeseen impact on human health by creating the opportunity for infection to be transmitted. The most obvious examples are in the field of health care where more invasive procedures have increased the chances of patients being infected as a complicating side effect of their treatment. However, outside of medicine new technologies have been associated with increased incidence of infection.
- 2.9 In 1986 the first cow in England was diagnosed with a disease called Bovine Spongiform Encephalopathy (BSE). By October 2001, over 179,000 cows in Great Britain had developed BSE and 101 people had become sick and died from a new disease called variant Creutzfeldt–Jakob disease (vCJD). Both the cattle and the human disease are forms of a group of diseases called transmissible spongiform encephalopathies which produce irreversible and fatal brain damage.
- 2.10 These tragic events appear to have resulted from technological changes in the animal and human food chains. The use of ruminant –derived protein feed given to cattle, coupled with changes in the rendering industry, including use of lower temperatures, probably allowed a ‘cycle of amplification’ of the disease in cattle. Infected cattle material then entered the human food chain, with some exposure to infected material arising through a technology called ‘mechanical recovery of meat’. This involved the production of meat paste from pressure-stripping the bones of animals and using this paste within processed meat products such as pies, burgers and sausages. Potentially dangerous nervous tissues, such as spinal cord, have now been banned from this process.

Cases of variant Creutzfeldt-Jakob disease in the United Kingdom

Number of definite and probable cases



* data up to 5 November 2001, total number of definite and probable cases of vCJD = 111

- 2.11** Air conditioning is a beneficial, and in some circumstances, an essential technology which is part and parcel of the modern world. It does however carry risks to health. In 1976, more than 200 elderly people attending an American Legion convention in Philadelphia developed a severe form of pneumonia of whom 34 died. Investigations revealed the cause to be a previously unrecognised organism, *Legionella pneumophila*, and the disease became known as legionnaires' disease. The first cases of legionnaires' disease in this country were diagnosed in 1977. There then followed a series of large outbreaks of the disease in the 1980s associated with cooling water systems. An outbreak of the disease in Stafford in 1985 affected 68 people of whom 23 died, and resulted in a Government Committee of Inquiry. The outbreak was traced to a cooling tower which was discharging *Legionella* bacteria into the air. Two further outbreaks occurred in central London: an outbreak centred on the headquarters of the British Broadcasting Corporation (BBC) in 1988 made 79 people ill and three died; in the Piccadilly outbreak in early 1989, 33 people suffered from the disease and five died.
- 2.12** Now that they have been recognised, the risks from the increasing use of water based cooling systems and air conditioning units can be reduced, but constant vigilance is required. The UK has stringent health and safety regulations to minimise risk to human health from *Legionella* contaminated water systems. As a result of these controls, explosive outbreaks of legionnaires' disease have become rare in the last decade. However, elsewhere in Europe, large outbreaks with many deaths continue to occur. These have been associated with whirlpool spas on public display in the Netherlands and Belgium and contaminated water systems in buildings such as hotels and hospitals in other countries. In June 2001 the world's largest outbreak of legionnaires' disease to date occurred in Murcia, Spain with over 500 confirmed cases reported.

Legionnaires' disease in Murcia, Spain

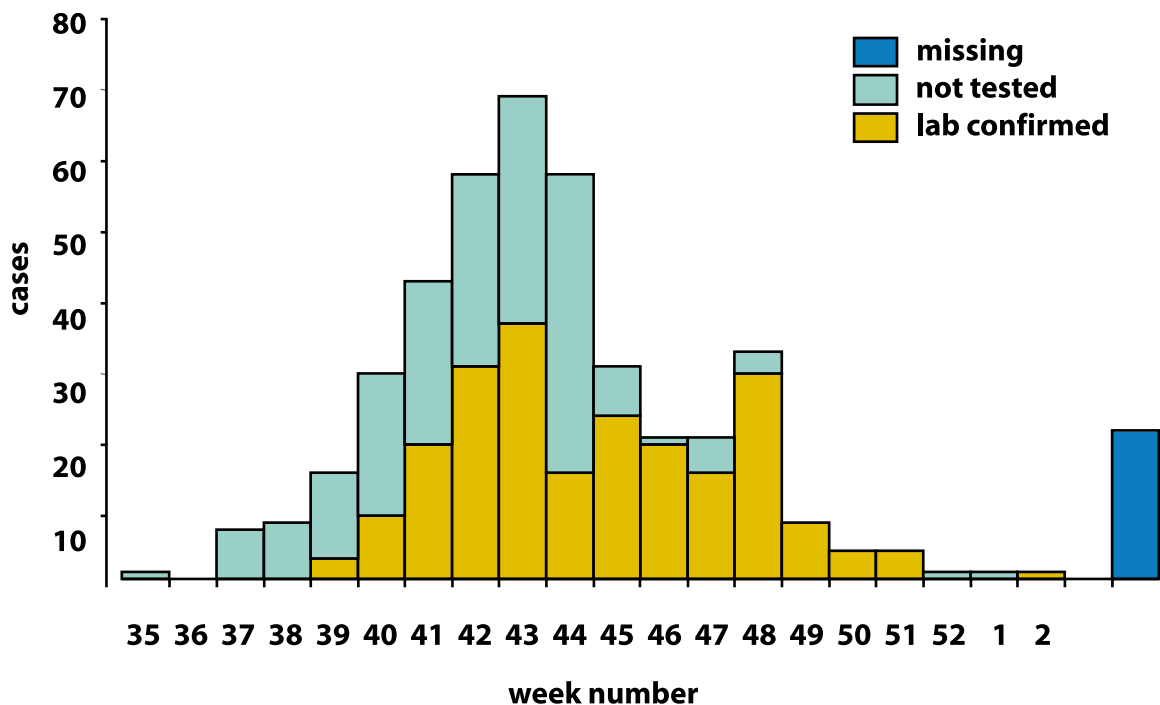
At the end of June 2001 a very large and explosive outbreak of legionnaires' disease occurred in Murcia, a Spanish city of 360,000 people. Around 800 cases of pneumonia were diagnosed, of which more than 500 were confirmed as legionnaires' disease. Three quarters of the people affected were male and about two thirds were aged over 50 years. Several people were admitted to intensive care units and at least one person is known to have died.

Nearly 80% of all the people affected lived in a small area to the north and northwest of the city centre. Although the source of the outbreak was not confirmed, the outbreak pattern and environmental investigations pointed to one or more poorly maintained cooling tower whose contaminated aerosol was dispersed over the area where most of the people lived. The local health authorities took rapid steps to identify and control the outbreak and implemented appropriate control measures to prevent the occurrence of further cases.

Environmental change and land use

- 2.13** The development of land which would previously have been inaccessible to human use increases the risk of exposure to infection from animals or carried by insects. Thus, agricultural, mining and forestry developments into remote or wilderness areas create the opportunity for new or previously unrecognised infectious diseases to affect people.

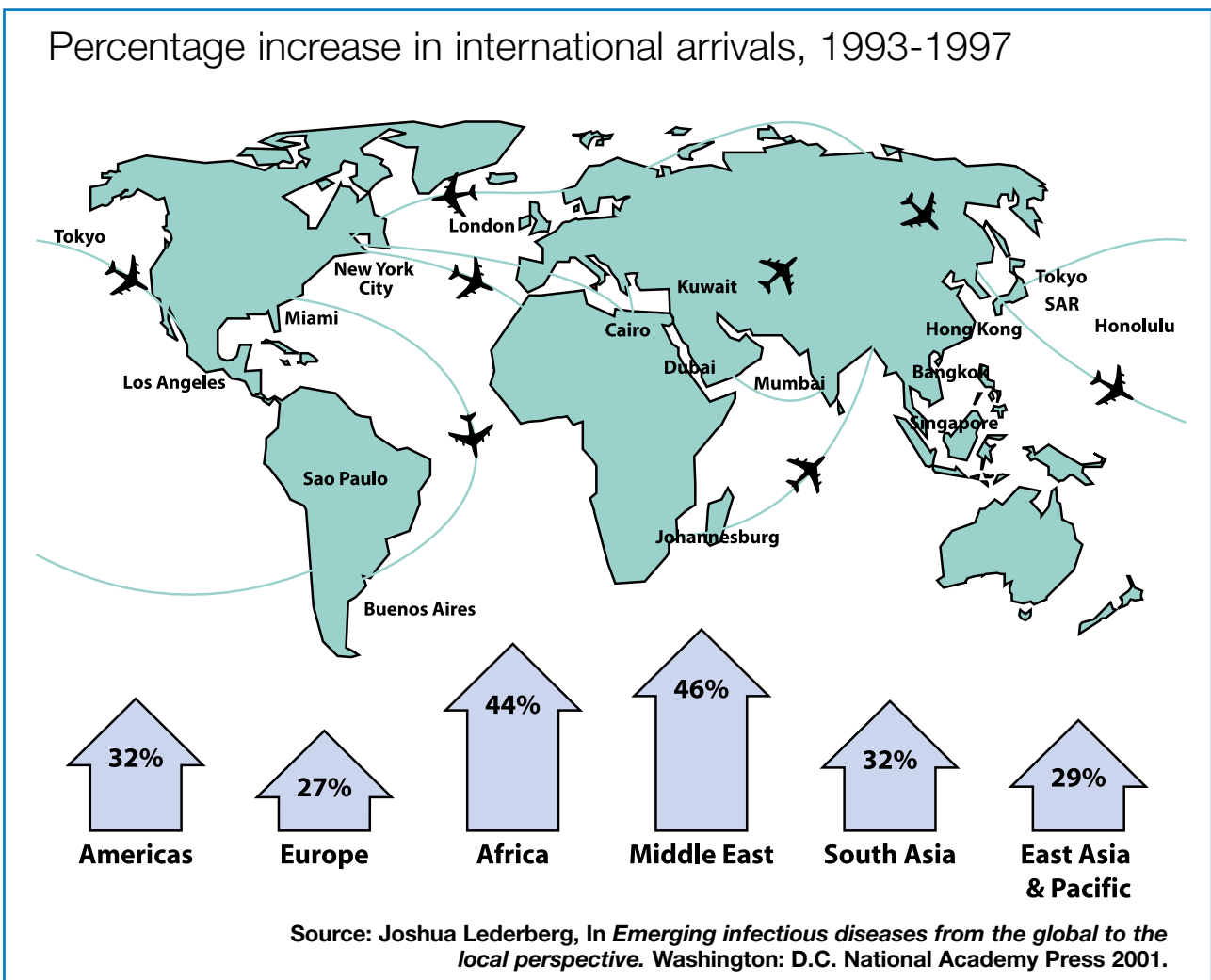
Cases of Ebola Haemorrhagic Fever
(n=426) - Uganda, 30 August 2000 - 9 January 2001



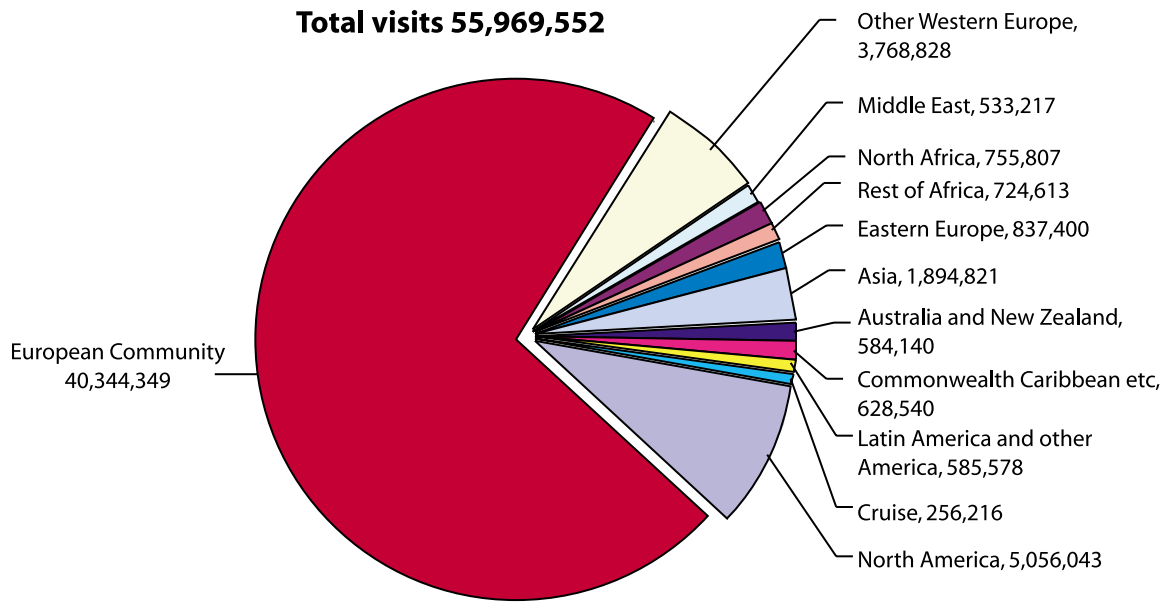
- 2.14 This is the way in which another previously unrecognised infectious disease emerged in 1976 and posed a major threat to health in Zaire (now the Democratic Republic of Congo) and Sudan. The disease was named Ebola after the river near where it first struck and it was established to be part of a class of infections called haemorrhagic fever which cause internal bleeding and are often fatal illnesses. Despite extensive study the natural reservoir of Ebola virus is unknown. However monkeys may also be infected and may be a link to humans. It is thought that Ebola haemorrhagic fever was transmitted from a monkey to a forest worker during the clearance of trees.
- 2.15 Fortunately, this terrifying infectious disease has not spread widely but it continues to demonstrate its potentially lethal impact. As recently as last year, (August 2000 – February 2001) a major outbreak of Ebola haemorrhagic fever took place in Gulu, Northern Uganda. A total of 426 people caught the disease and 224 died. A team from more than 10 countries was assembled to support the Ugandan Ministry of Health in containing the epidemic, although the outbreak still spread to two other districts. One contact reached London but fortunately was not an infected person.
- 2.16 Lassa fever virus, whose natural host is the multimammate rat, is endemic in parts of West Africa. Over the years a few cases have been imported into the UK, the last in the year 2000 in an aid-worker recently returned from Sierra Leone.
- 2.17 Within this country the use of natural wastes in animal feeds or as fertilisers may result in infection or contamination with various micro-organisms. Fresh fruit and vegetables may also be contaminated by the use of contaminated water for irrigation, or by wild or domesticated animals or by agricultural workers.
- 2.18 Each Spring there is usually an outbreak of cryptosporidiosis in the north of England. In 2001 there was no increase in cases and this coincided with the epidemic of foot and mouth disease. Whilst the exact cause of the annual outbreaks has not been established, the most likely explanation has been contamination of water supplies by infected animals grazing in their vicinity. The reduction in the number of cases of cryptosporidiosis last Spring might therefore be associated with the drastic reduction in the number of animals in the water supply catchment area. A reduction in the number of visits to the countryside and farms might provide an alternative, or additional, explanation.

Global travel and trade

- 2.19 People are now travelling more than ever, and to destinations where disease patterns differ. The speed of travel, often by air, means that people incubating an infectious disease may not become ill until after they have arrived in another country. It has been estimated that there is international cross-border movement of two million people per day, including one million between the borders of developing and developed countries each week. This rising trend in travel to ever more exotic locations has been mirrored by a rising trend in infections such as the most serious form of malaria, known as *falciparum* or cerebral malaria.
- 2.20 Not only the destination, but also the nature of travel may put travellers at risk of infection. People may be subject to unusual overcrowding, favouring person-to-person spread of airborne infections. The infections they acquire may subsequently spread in the UK. An example of this phenomenon is the occurrence of a form of bacterial meningitis in pilgrims to Mecca and their contacts.

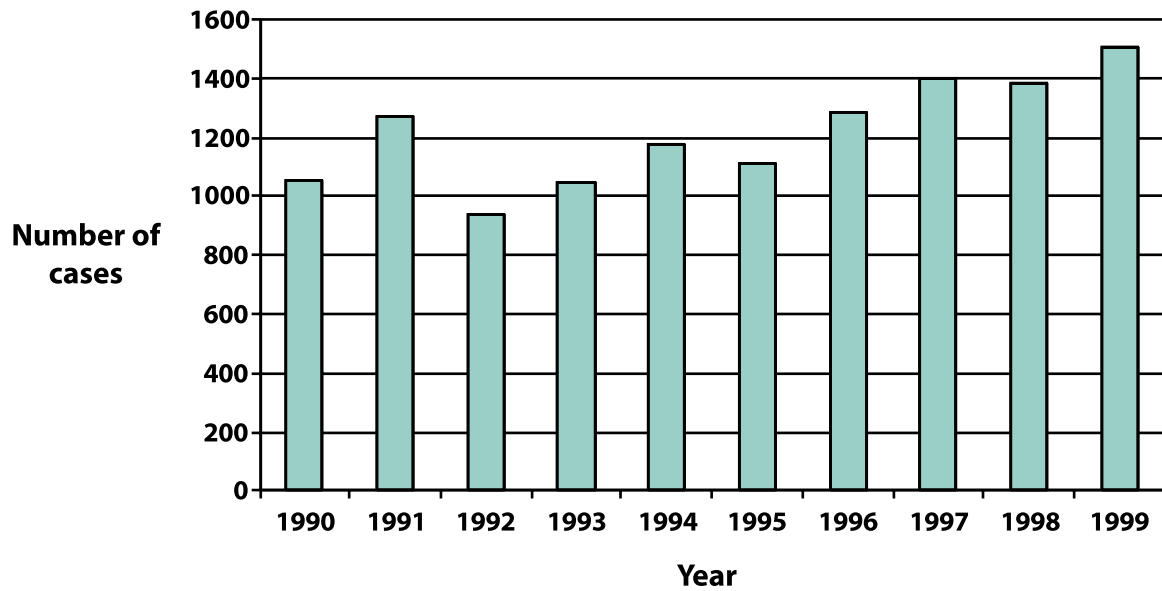


Number of visits abroad by UK residents, 2000



Source: International Passenger Survey, ONS

Cases of falciparum malaria, UK 1990-1999



Meningitis outbreaks and pilgrimages to Mecca

The annual Islamic pilgrimage to Mecca, the Hajj, attracts over two million pilgrims from many countries worldwide. Approximately 25,000 people travel from Britain. The pilgrimage has been associated with international outbreaks of meningococcal disease. The first reported outbreak, caused by *Neisseria meningitidis* serogroup A, followed the 1987 Hajj. After this outbreak, the Saudi Arabian government made vaccination against *Neisseria meningitidis* serogroup A compulsory for all Hajj pilgrims, rather than just for pilgrims from sub-Saharan countries as before.

The Hajj 2000 (15th-18th March 2000) was followed by an outbreak of meningococcal meningitis due to a strain (*Neisseria meningitidis* serogroup W135) that is uncommon in the UK. Cases were reported from Europe, South Africa, the USA and from some countries in North Africa, the Middle East and Asia. In the UK, 45 cases of invasive meningococcal infection caused by the outbreak strain were reported during 2000. Eight people (18%) died. Most of the early cases were pilgrims, but the outbreak subsequently spread to contacts of pilgrims and to others in the local communities in Britain with no known direct link.

Further cases followed the 2001 Hajj (3rd-6th March 2001). Thirty four cases of invasive meningococcal disease due to the W135 strain were reported to the PHLS meningococcal reference unit in Manchester from March 2001 to August 2001. With 10 deaths reported, the case fatality rate was 29%.

The UK is now making concerted efforts to ensure that all future pilgrims are immunised with a quadrivalent meningococcal vaccine which covers this strain. The Saudi Arabian government has made immunisation with the quadrivalent vaccine a visa entry requirement for Hajj pilgrims.



Climate change

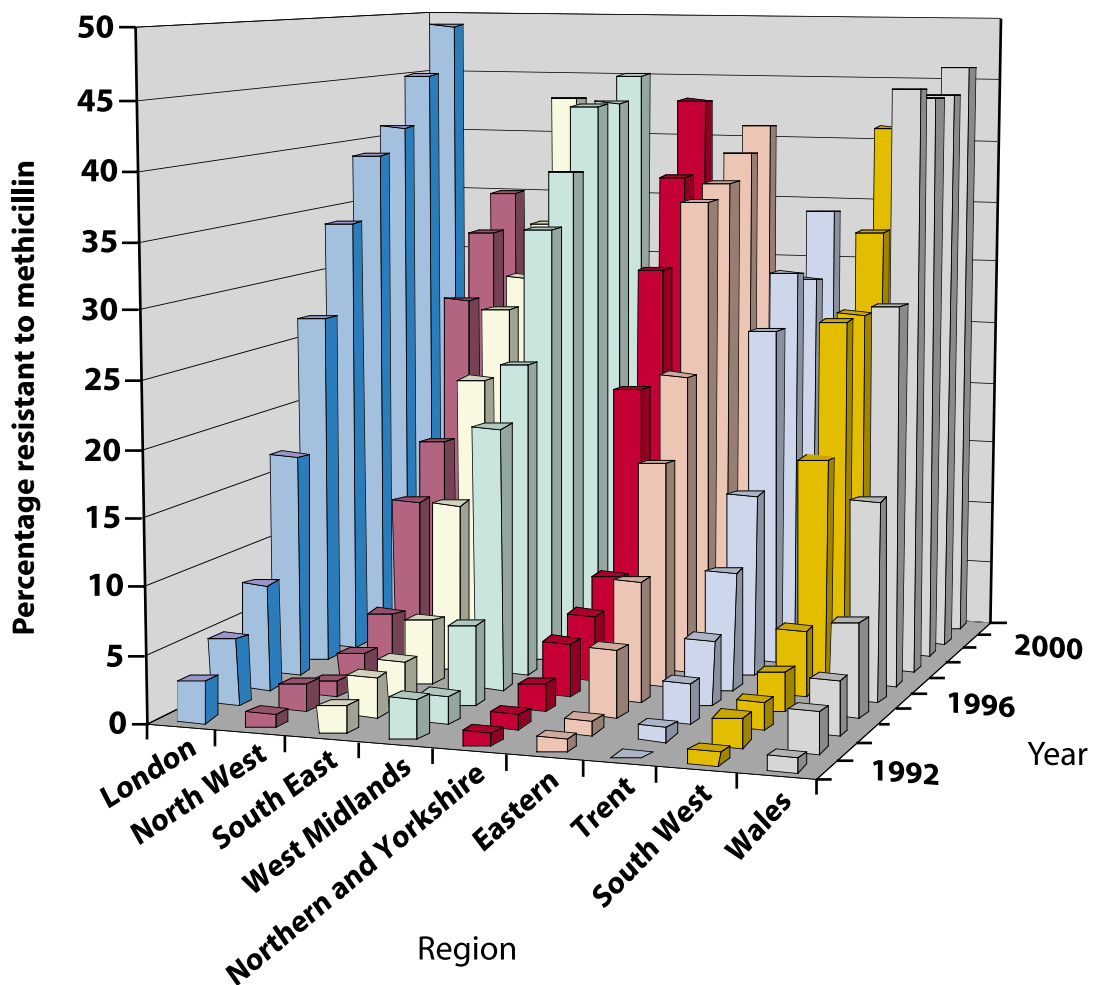
- 2.21 In February 2001, the Department of Health published the first major review of the potential of climate change to impact on health for the population of the United Kingdom (Health Effects of Climate Change: an expert review for comment. London: Department of Health, 2001). The report ranged more widely than considering the possible impact of climate change on infectious disease patterns. However, in relation to them it showed the effect of warmer winter temperatures, increased occurrence of winter storms and summer droughts.
- 2.22 In future, climate change may produce an increase in some water-borne infectious diseases but the overall impact is likely to be small. Risks include:
- Increased pathogen survival in natural waters;
 - Decreased quality of drinking water;
 - Indirect effects due to increased exposure to water used in air conditioning e.g. *Legionella pneumophila*;
 - Algal blooms;
 - Increased leisure exposure to freshwaters and sea waters;
 - Effect of floods: increased risk of pathogens breaching the water treatment and sanitation safeguards.
- 2.23 Cases of food poisoning in the UK are linked to warm weather and have been increasing rapidly. This increase is likely to continue, and perhaps accelerate, as summer temperatures rise. An increase of about 10,000 cases each year by 2050 is estimated. This is clearly worrying even when seen against the background of the approximately 100,000 cases that currently occur each year. However such an increase is not inevitable, indeed, it may be largely preventable if effective measures are adopted. Early and appropriate action may mitigate many of the effects on health of climate change.

- 2.24 By 2050 the climate of the UK may be such that indigenous malaria could become re-established. Local outbreaks of malaria caused by *Plasmodium vivax* may occur in the UK and if this comes to pass precautions may need to be taken by those living in low lying salt-marsh districts to avoid mosquito bites. Significant changes in the global distribution of malaria caused by *Plasmodium falciparum* are likely to affect travellers returning from abroad. This particularly dangerous form of malaria is unlikely to become established in the UK owing to conditions being unsuitable for the breeding and survival of the particular species of mosquito that can act as its vector. However, more contact with ticks is likely in the Britain of the future which could increase the incidence of Lyme disease. The risk of tick-borne encephalitis, now significant in parts of Europe, is likely to decrease because drier weather conditions inhibit survival of these ticks.
- 2.25 The UK has an excellent reputation for providing safe drinking water and good sanitation. This record and the measures upon which it is based are likely to prevent a significant increase in water-borne diseases as the UK climate changes. Cholera and typhoid, for example, are most unlikely to become problems in the UK. Outbreaks of disease caused by the protozoal organisms of the cryptosporidium group occur now. Oocysts of these organisms can survive current methods of water treatment and this has been addressed in new Regulations. Algal growths and algal blooms may increase and closer monitoring of water used for recreational purposes may be necessary. The overall impact of such changes is likely to be small. Whilst drought may well continue to be a major problem in many parts of the world its effect on health in the UK is expected to be small. The use of alternative sources of water for drinking during periods of drought may present problems and increased monitoring and treatment of such supplies may be needed.

Microbial adaptation

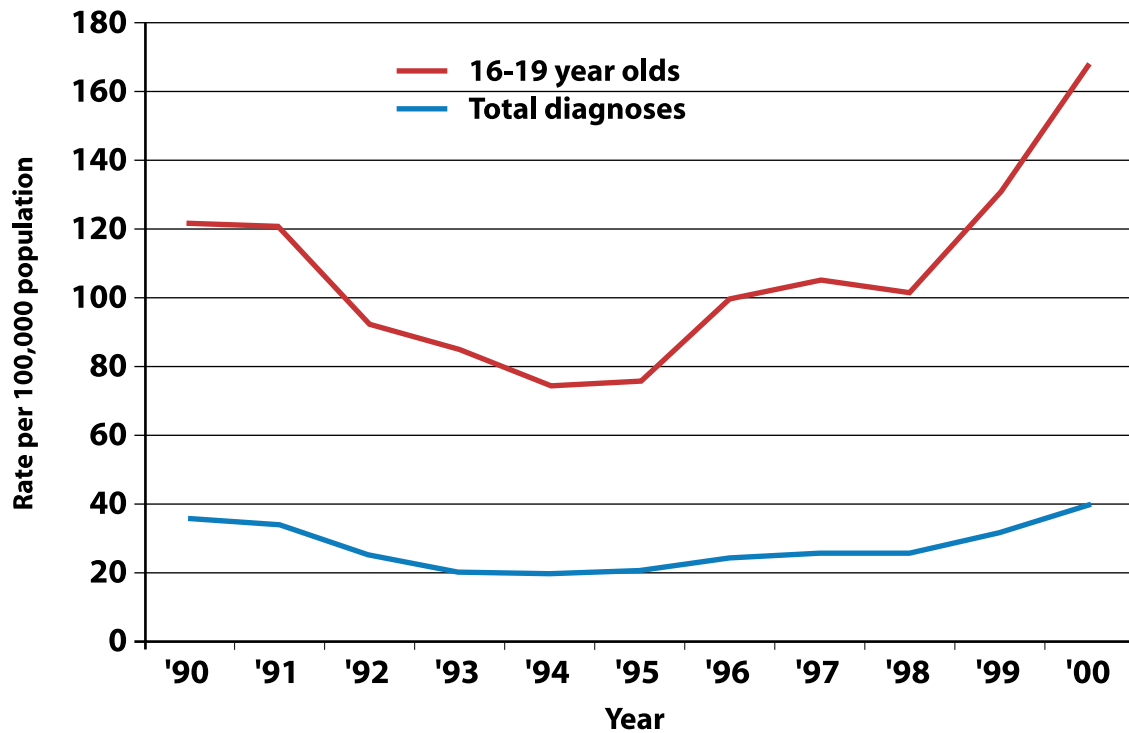
2.26 Microbes adapt to survive in the face of what are, for them, adverse conditions – for example antibiotic treatment. This occurs through modifications to their genetic composition. If the resulting change conveys some advantage, such as resistance to antimicrobial drugs, then this may favour the organisms' subsequent survival. In some instances, for example methicillin resistant *Staphylococcus aureus* (MRSA) strains evolve only rarely but they become important because of their ability to spread widely among patients. In other cases the resistance emerges readily and repeatedly, in yet others plasmids carrying resistant genes may spread widely causing the same pattern of antimicrobial resistance among a range of different bacterial species.

Positive blood cultures of methicillin resistant *Staphylococcus aureus* in England and Wales



* The data for the earlier years have been reconfigured to present the picture by current existing English regions

Rates of diagnoses of uncomplicated gonorrhoea seen in genitourinary medicine clinics in England



Human behaviour

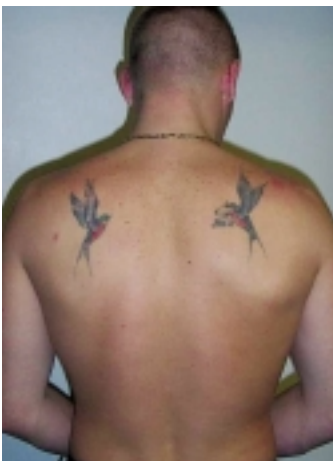
- 2.27 The UK has the highest rates of teenage pregnancy in Western Europe and we know that almost a third of our young people under the age of 16 years are having sex. During 1999, conception rates in England fell amongst both the under 16s and under 18s. However more recent data on levels of sexually transmitted infections show worrying increases particularly amongst young people.
- 2.28 Amongst gay men increases in the levels of sexually transmitted infections have also been observed which not only indicates unsafe sex but also sets markers for possible infection of HIV. For example, a recent outbreak of syphilis amongst gay men in Manchester produced 186 new cases of the disease between January 1999 and October 2001. Compared to previous outbreaks of syphilis in Bristol, Brighton and Peterborough, the Manchester outbreak remains the largest.

- 2.29 Syphilis has re-emerged in Manchester because of changes in the behaviour of gay men. A detailed study of sexual attitudes and practices in this population (see box) has shown a worrying level of co-infection with HIV. In the study group, knowledge of HIV status of sexual partners was low. However, some HIV negative men requested unprotected anal sex with full knowledge of their partner's HIV status. Condom use was not high and the majority of the gay men studied thought that unprotected oral sex carried little or no risk of infection.

Re-emergence of syphilis in Manchester - key facts from a study of gay men

- 30% of men with syphilis were also HIV positive;
- Men infected with syphilis only or syphilis and HIV had much higher numbers of partners than uninfected controls – average 30 in the previous year;
- 10% or less of men with syphilis or both infections knew the names of their partners;
- Men with syphilis failed to use condoms with 75% of their partners during anal sex;
- None of the men in the study used a condom for oral sex.

Source: P Clark, P Cook, P Wheeler, Q Syed, A Hoskins & Bellis M. *Re-emerging syphilis: a case control study based on the Manchester outbreak*. Liverpool: Liverpool John Moores University, August 2001.



- 2.30 The development of complacent attitudes and the lack of basic knowledge about risks are undoubtedly a cause of the re-emergence of syphilis in Manchester. The associated risks of HIV infection emphasise the seriousness of the situation and the need to intensify public health control measures.
- 2.31 Sharing of blood-contaminated needles and injecting equipment by drug misusers over the last few decades has resulted in the spread of blood-borne viruses such as HIV and hepatitis B and C. Currently injecting drug misuse is the major risk factor for new infections with hepatitis C in this country.
- 2.32 The increased popularity of body piercing and tattooing provides an opportunity for the spread of blood-borne viruses if proper hygienic precautions are not observed, and of localised wound infections where after care is not good.

Impaired immune systems

- 2.33 Advances in medical treatment, particularly in the fields of cancer therapy and transplantation, have resulted in increased numbers of people living with impaired immunity. The advent of AIDS and the more recent development of therapies that slow the progression to AIDS of HIV infected people has meant that there are more people living with impaired immunity. All these people are not only at increased risk of acquiring infection but also require more intensive management when they do acquire infection. Patients who have any form of weakened immune system are susceptible to infection by micro-organisms which cause disease but also those which are not very virulent and seldom cause infection in healthy people (these are called 'opportunistic' infections).
- 2.34 The most common way in which the immune system becomes compromised is through something very simple - a cut or wound in the skin, tissues or membranes. Thus, patients with surgical or traumatic wounds, those with catheters and those with tubes being ventilated are more likely than healthy people to get skin and soft tissue infection and infections of the blood, urinary or respiratory tract.
- 2.35 If a person with an impaired immune system remains in hospital for a long period of time the chance of such infection increases. So too does the risk of cross-infection from other patients, from the hospital environment or from health care staff. Such patients often have multiple or prolonged courses of antibiotics, increasing their susceptibility to infection with multiply antibiotic resistant bacteria.
- 2.36 Truly immunosuppressed patients usually have impairment of specific immunity, including those with congenital impairment of humoral immunity (complement, secretory antibodies), granulocyte neutropenia (e.g. people with leukaemia and transplant patients on immunosuppressive therapy) and defects of cellular immunity (HIV and AIDS, patients on immunosuppressive therapy, various granulomatous diseases).
- 2.37 Many other patients have less severe acquired impaired immunity as a result of their underlying disease or treatment. These include, for example, those with diabetes mellitus, liver failure, renal failure, chronic alcoholism, any form of tumour or cancer, and patients on steroids. Some groups appear to be at higher risk from infection, such as premature infants, and the elderly may have reduced immunity.
- 2.38 All these groups of people are more susceptible than healthy people to infection, but the type of infection they get depends on their type of immunosuppression.

Some important threats

2.39 Against this background of dynamic change, there are some clear ways in which micro-organisms could pose an increased threat to health.

Threat: Emerging and re-emerging infections

2.40 The threat of apparently new or previously unrecognised infections is ever present. Since the early 1970s at least 30 previously unknown infectious diseases have become prominent for which there is no fully effective treatment.

Newly identified infectious diseases and pathogens: some examples

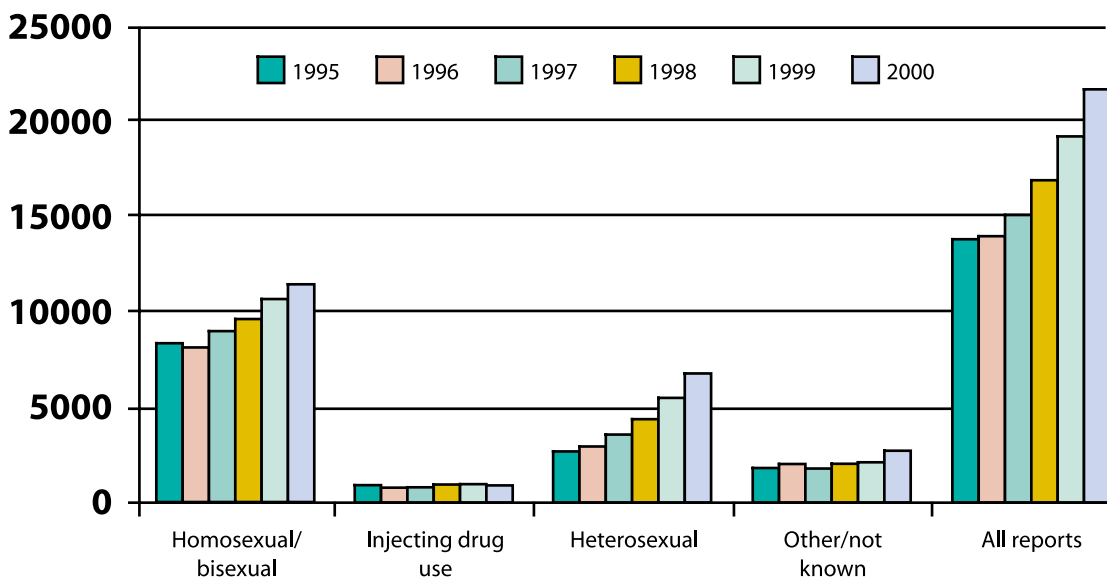
1999	Nipah virus
1997	H5N1 (avian flu)
1996	nvCJD Australian bat lyssavirus
1995	HHV8 (Kaposi sarcoma virus)
1994	Sabia virus Hendra virus
1993	Hantavirus pulmonary syndrome (Sin Nombre virus)
1992	<i>Vibrio cholerae</i> O139
1991	Guanarito virus
1989	Hepatitis C
1988	Hepatitis E Human herpesvirus 6
1983	HIV
1982	<i>Escherichia coli</i> O157:H7
1980	Human T-lymphotropic virus
1977	<i>Campylobacter jejuni</i>
1976	<i>Cryptosporidium parvum</i> Legionnaires' disease Ebola

Source: World Health Organisation 1999

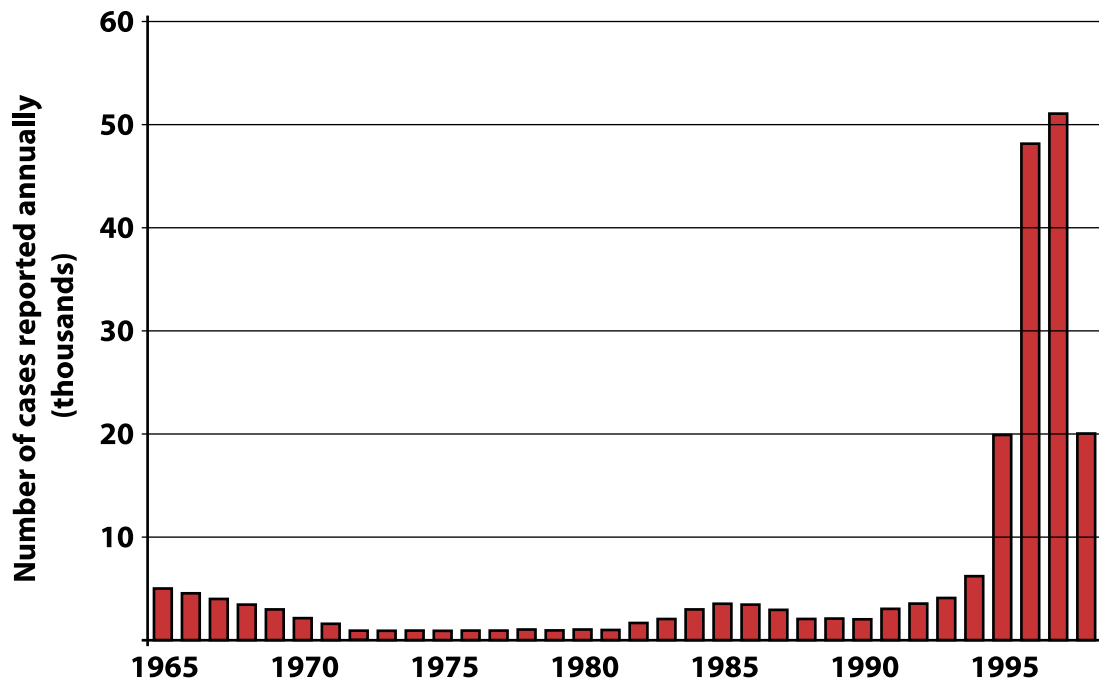
2.41 AIDS and HIV is the most spectacular recent example. In the late 1970s it was unknown and there were no recorded cases or deaths from the disease. By the beginning of the 21st century it was estimated that there had been 22 million HIV related deaths world wide, and that there were 36 million people living with HIV infection. In the UK it is estimated that there have been nearly 15,000 deaths, and that the number of people living with diagnosed infection, currently around 25,000, is rising at around 12% per annum. Although this increase is partly the result of improved survival due to more effective treatment and encouraging people who may have been infected for some years to be tested, the transmission of HIV infection in the UK continues. Rises in the incidence of other sexually transmitted diseases suggest that sexual behaviour which carries the risk of HIV transmission is increasing (as described earlier in this chapter).

2.42 Diseases which had become relatively insignificant threats to human health can re-emerge either because the organisms concerned develop resistance to antimicrobial treatments or because of a breakdown in or laxity of public health control measures. This has been seen in countries of the former Soviet Bloc.

Trends in prevalent diagnosed HIV infections seen for care in England, Wales & N Ireland by probable exposure category



Diphtheria in the Russian Federation and Newly Independent States

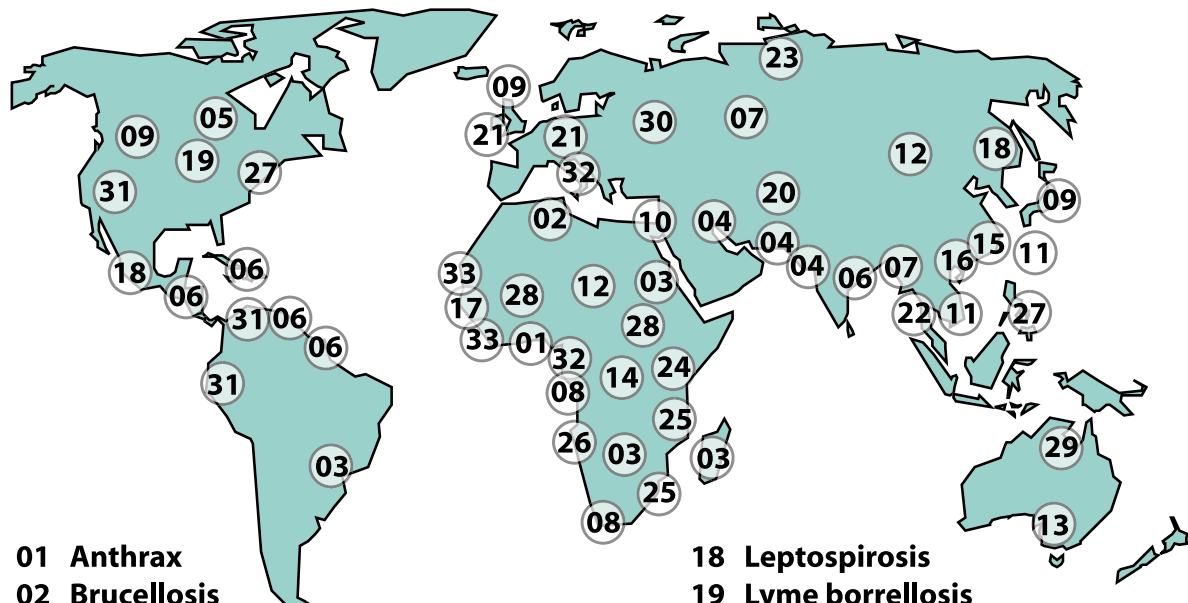


Source: World Health Organisation 1999

Factors likely to trigger resurgence of infectious diseases that were in abeyance

- Multi-drug resistant organisms;
- Poverty, population displacements, urban overcrowding;
- Collapse of public health infrastructure due to natural disaster or conflict;
- Under-investment in or complacent attitudes to public health control measures;
- Poor standards of hygiene.

Some of the hundreds of infectious disease outbreaks of international public health importance identified by the World Health Organisation since 1994



- | | |
|-------------------------------------|-----------------------------------|
| 01 Anthrax | 18 Leptospirosis |
| 02 Brucellosis | 19 Lyme borrellosis |
| 03 Cholera | 20 Malaria |
| 04 Crimean-Congo haemorrhagic fever | 21 Variant CJD |
| 05 Cryptosporidiosis | 22 Nipah |
| 06 Dengue haemorrhagic fever | 23 Omsk haemorrhagic fever |
| 07 Diphtheria | 24 O'nyong-nyong fever |
| 08 Ebola haemorrhagic fever | 25 Plague |
| 09 E.coli O157 | 26 Poliomyelitis |
| 10 Echinococcosis | 27 Reston virus |
| 11 Enterovirus 71 | 28 Rift Valley fever |
| 12 Epidemic meningitis | 29 Ross River virus |
| 13 Hendra | 30 Typhoid |
| 14 Human monkeypox | 31 Venezuelan equine encephalitis |
| 15 Influenza A [H5N1] | 32 West Nile fever |
| 16 Influenza A [H9N2] | 33 Yellow fever |
| 17 Lassa fever | |

Source: WHO

- 2.43 Infectious diseases of public health importance that have been rising in recent years and that at the same time have been associated with increasing levels of antimicrobial resistance include gonorrhoea, tuberculosis and invasive *Staphylococcus aureus* infection (including methicillin resistant *Staphylococcus aureus*).
- 2.44 Interruption of effective vaccination programmes has been associated with significant re-emergence of vaccine-preventable disease. A recent review found that the incidence of whooping cough was 10 to 100 times lower in countries where high vaccine coverage was maintained than in countries where immunisation programmes were compromised by anti-vaccine movements.

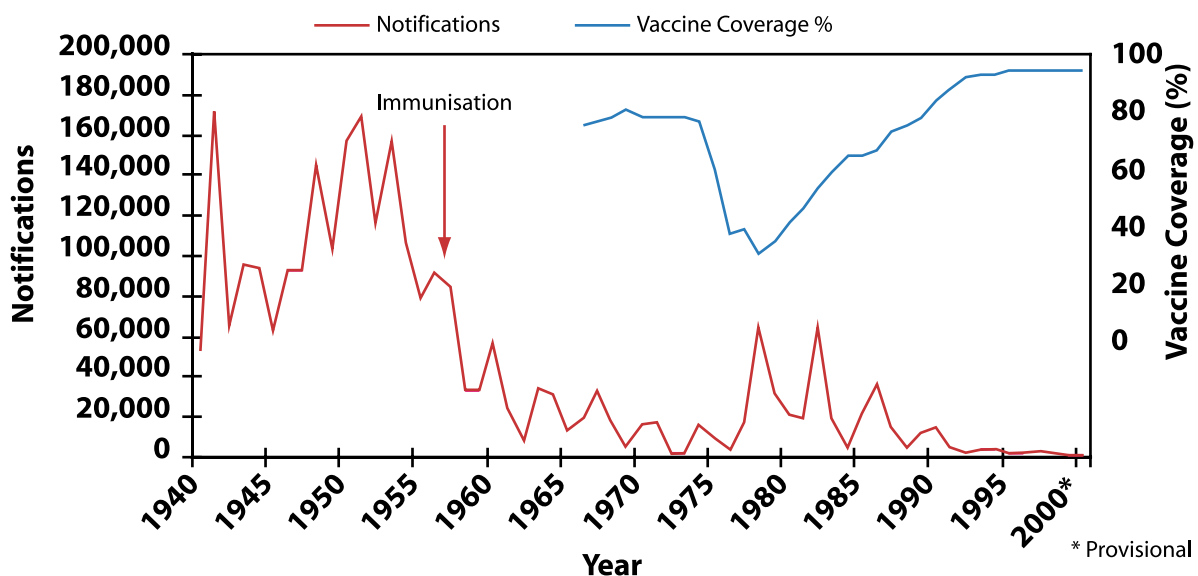
Whooping cough vaccine scare

After a 1974 report, ascribing 36 neurological reactions to whole-cell pertussis (whooping cough) vaccine, persistent television and press coverage interrupted a successful vaccination programme. Although health authorities resisted pressure to withdraw the vaccine, an alternative vaccine without pertussis was offered and there was a loss of confidence in pertussis vaccine safety with a sharp reduction in coverage. Pertussis epidemics followed. Eventually confidence was restored after many efforts directed at health workers and parents, including publication of a national reassessment of vaccine efficacy that showed “outstanding value in preventing serious disease”. Disease incidence declined dramatically following the recovery in vaccine uptake, and has since been low.

In total it took some 15 years for pertussis coverage to return to its pre-scare level. Yet, in retrospect, a significant risk of brain damage due to the vaccine was never demonstrated. Long after the real harm was done, with collapse of pertussis coverage and the return of death and disability due to the resurgence of disease, legal cases finally received a high court decision in 1988. The judge, in concluding the case said, “I have now come to the clear conclusion, that the plaintiff fails to satisfy me on the balance of probability that pertussis vaccine can cause permanent brain damage”.

Source: Derived from Gangarosa EJ et al. **Impact of anti-vaccine movements on pertussis control: the untold story.** *Lancet* 1998; 351: 356-61.

Whooping cough cases and vaccine coverage
England and Wales 1940–2000*



- 2.45 Infectious diseases continue to take us by surprise. In the late 1990s the population of the East Coast of the United States of America was threatened by a potentially fatal virus which had never been seen inside its borders. The story of West Nile Fever (see box) is only one of many ways in which infection can emerge unexpectedly and unpredictably and pose a new threat to the health of a population.**

West Nile Fever in North America

An unexpected number of dead crows in the City of New York in the summer of 1999 was the first sinister sign that a potentially fatal infectious organism previously unknown in the western hemisphere was attacking residents.

Human cases of viral encephalitis began to be seen in August 1999 in New York City and later in neighbouring counties in New York State. By October 1999, seven people had died and a total of 31 confirmed and 25 probable human cases had been reported. The infection was first thought to be due to St Louis encephalitis (SLE), a virus transmitted by mosquitoes which occurs in the south eastern states of America but not usually in New York.

Zoo birds as well as crows had been dying before and during the outbreak. A virus similar to SLE was found in tissues from the birds, but the virus more closely resembled one called West Nile Virus (WNV). This virus is known to have caused epidemics affecting people in Israel, Europe and South Africa since the early 1950s but not in the western hemisphere. New tests on the patients' samples confirmed the virus was the same. The link between the birds and the human cases was made.

City wide pest control measures in New York to eradicate any infected mosquitoes, together with the onset of cooler autumn weather, are thought to have brought the 1999 outbreak to an end.

Although this was a small-scale outbreak, it could easily have been much larger. It is still not known how the virus was introduced to North America: an infected traveller or imported birds may have played a role.

Due to WNV surviving within the mosquito population over the winter periods, the disease has reappeared in New York each subsequent summer. In the year 2000, 21 human cases and two fatalities were recorded, with the disease spreading to New Jersey and Connecticut. Up to the end of September 2001, surveillance for WNV in the USA revealed more human cases in six states

including one death. The disease has also been detected in wild birds in twenty-three states. Last year, the virus spread to Ontario, Canada where it had been detected in wild birds. The continued spread of West Nile Virus in North America indicates that it is permanently established in the Western Hemisphere. Subsequently the viral infection has spread in birds and mosquitoes through the eastern United States and down into the Caribbean.

- 2.46** Some of the commonest infections have a particular ability to change, influenza viruses being the chameleons of the microbial world. Gradual year on year changes enable influenza viruses to cause annual cycles of infection. On top of this, from time to time a more dramatic change occurs when one strain of the virus incorporates genetic material from another, creating a 'new' strain with the potential to cause widespread illness in an unprepared population. Worldwide epidemics ('pandemics') of influenza occurred three times during the last century: in 1918-19, 1957-58 and 1968-69. The worst of these, the 1918-19 'Spanish' flu, killed more people than died during the whole of the First World War.
- 2.47** Most influenza experts believe that it is a matter of when, not whether, another influenza pandemic strikes. Such a catastrophe may have been averted in the case of the Hong Kong 'bird flu' in 1997, when a strain of influenza that had not previously been seen in humans was identified as the cause of an outbreak in Hong Kong (see box). Hong Kong is a densely populated island at the intersection between east and west with very large numbers of international travellers. Had an epidemic of human influenza been underway at the same time then the two sorts of influenza virus could have exchanged genetic material. The chicken virus could then have developed the property of easy transmissibility that the human virus has. It is exactly the kind of catastrophic scenario which could be the origins of the next influenza pandemic.



Hong Kong ‘bird flu’: how a new influenza pandemic might start

In late 1997 an outbreak of influenza occurred in Hong Kong due to a new sub-type of the influenza A virus (H5N1). The virus had previously been shown to cause illness in fowl, and had been identified as a cause of illness in chickens in Hong Kong at that time, but had not previously been observed to cause human disease.

In the light of the possibility that this might lead to a global influenza pandemic, a major response was mounted in Hong Kong including increased surveillance and the slaughter of all chickens. The UK, in common with other countries, began preliminary activities as part of planned action in response to the threat of a pandemic.

Ultimately only eighteen cases were confirmed in Hong Kong, and none elsewhere. It appeared, fortunately, that the virus which was of bird origin was inefficient at spreading in the human population, but given different circumstances an event like this could have been the spark which ignited a new influenza pandemic.

Threat:

400 diseases can transmit from animals to people

2.48 We share our environment with many other species, and it has long been recognised that some infections (zoonoses) pass from animals to people. The potential scale and importance of the link is sometimes underestimated. Zoonotic infections transmitted through food or water have caused outbreaks affecting very large numbers of people. The largest outbreak of Vero cytotoxin-producing *Escherichia coli* O157 (VTEC O157), a leading cause of acute renal failure in children, in the world occurred in Japan in 1996, affecting over 7,000 school children. Contaminated bean sprouts distributed to schools across Sakai City were thought to be the cause. In Canada around 2000 people were infected with VTEC O157 through contaminated drinking water. Closer to home the largest VTEC O157 outbreak to date in the UK occurred in Central Scotland, affecting 512 people and claiming 17 lives.

- 2.49** Many major foodborne pathogens originate in animals. Since its discovery in 1977, campylobacter has become the most frequently identified cause of foodborne illness in the developed world. Recent figures show that, on average, 50% of chicken on retail sale in the UK is affected by campylobacter. VTEC O157, a leading cause of acute renal failure in children, first appeared on the world stage in 1982. The United Kingdom is at the bottom of the European league table. The personal cost to affected families is substantial and, in recognition of this, the courts recently awarded £2.6 million to a child who suffered permanent brain damage as a result of VTEC O157 infection.
- 2.50** An epidemic of *Salmonella typhimurium* DT104 in livestock (particularly cattle) and people started in the late 1980s, reached a peak in the mid-1990s and is now in decline. There was evidence that consumption of unpasteurised dairy products and contact with livestock were risk factors for human infection; a link between beef and beef products was not established. The rise and fall of human cases occurred over a similar time scale to that in cattle. Similar epidemics of other phage types of *Salmonella typhimurium* have occurred previously (e.g. *Salmonella typhimurium* DT104C in the 1970s and 80s and *Salmonella typhimurium* DT 193 starting in the 1970s).
- 2.51** Numerous other infections, from amoebiasis and anthrax to yaws and yersinia are passed from animals to people. Many other new or emerging diseases of recent years, such as Hendra disease in Australia and Nipah virus infection in Malaysia, have also been zoonotic in origin.

Hendra and Nipah viruses

In 1994 and 1995, a new viral zoonotic disease known as Hendra disease was identified in Queensland, Australia, killing two people and 15 horses in two separate outbreaks. In the first outbreak, a trainer and a stablehand suffered respiratory disease. The stablehand recovered slowly, but the trainer died, despite medical care. The second outbreak involved a farmer who died after experiencing prolonged neurological symptoms. The Hendra virus occurs naturally in northern and eastern Australia amongst fruit bats and it is presumed that a horse bitten by such a bat is the way this new disease emerged as a threat to human health.

In 1998 and 1999, an outbreak of a previously unrecorded viral disease killed over 100 people and thousands of pigs in

Malaysia. The causal agent, known as Nipah virus, has been shown to be related to the Hendra agent. Both viruses are carried by bats (genus *Pteropus*) which were considered to be the source of the outbreaks. As a result of these incidents, new measures have been adopted by the European Commission, imposing restrictions on the import of certain animals from Malaysia and Australia.

Threat: Infection and the consumer

- 2.52 Eating habits change. People are increasingly eating foods prepared outside the home - cook-chill foods from supermarkets, food from fast-food chains or in restaurants, for example - and are eating more foods imported from abroad.
- 2.53 Mass food production requires the introduction of new technologies, with attendant risks. Large-scale food manufacture, for example, requires a large-scale clean environment, large supplies of safe water, and appropriate storage for raw ingredients and for the product from the point of manufacture to the point of sale. Cross-contamination or inadequate storage or cooking of food may lead to food poisoning affecting very large numbers of people.



Selected large outbreaks of foodborne disease, in England and Wales

Year	Organism	Number affected	Food handling fault identified by investigators
1992	S. Wangata	210	Cross contamination
1995	S. Typhimurium DT141	224	Cross contamination and inappropriate storage
1995	S. Typhimurium DT104	200	Infected food handler and cross contamination
1996	S. Enteritidis PT4	190	Cross contamination
1996	S. Enteritidis PT4	179	Inadequate heat treatment
1996	S. Indiana	120	Inadequate heat treatment
1998	S. Enteritidis PT4	179	None stated
1999	S. Typhimurium DT120	193	Cross contamination
1999	VTEC O157	114	Inadequate heat treatment

Source: GSURV Database, PHLS CDSC

2.54 New food production methods have included changes in agricultural practice. Intensive rearing of food animals means that infection, once introduced, has the potential to spread rapidly between animals. The increased centralisation of slaughterhouses provides further opportunities for cross contamination during transport and at the slaughterhouse.

2.55 The complexity of the task of eradicating these problems is illustrated by the successful reduction of the rate of salmonella in chickens but the remaining serious problem of infection with another organism – campylobacter.

Salmonella drops to all time low in chickens, but campylobacter continues to be a problem

Percentage of chickens/chicken portions on sale testing positive for:

	Salmonella	Campylobacter
England	5.6%	46%
Wales	3.6%	42%
Scotland	8.9%	75%
Northern Ireland	5.4%	77%
UK average	5.8%	50%

Source: Food Standards Agency Press Release, 16 August 2001. Number 2001/0140.

- 2.56 Some members of the population are especially vulnerable to the effects of food poisoning, particularly the very young and the very old. A national alert was issued in the summer of 2001 when a five month old child was admitted to hospital with the rare but serious infection, botulism. The cause was discovered to be an infected brand-named infant formula milk powder which contained spores of the botulism organism. The occurrence of this case revealed the fact that the manufacturer of infant foods does not generally include a step that would inactivate spores. As a result , the Food Standards Agency has initiated discussion with the manufacturers of baby food (see box).**

A case of infant botulism

In the Summer of 2001, a 5 month old baby who was being weaned developed symptoms typical of infant botulism. The Public Health Laboratory Service detected the presence of botulinum neurotoxin type B in a rectal washout sample of the infant. An investigation was undertaken by a communicable disease team which visited the home of the family involved, to take specimens of various food products for analysis. Botulinum neurotoxin type B was found in an opened can of SMA Gold infant milk formula. Further tests on unopened cans of the same batch also contained botulinum neurotoxin type B. It is likely the spores of the bacterium *Clostridium botulinum* type B were introduced through the raw ingredients and as a result the company recalled certain batches of powdered infant formula.

Infant botulism produces paralysis which affects otherwise healthy infants less than 12 months old. It is caused by the spores of the bacterium *Clostridium botulinum*, which are a risk to infants whose immature gut may allow the spores to germinate and produce toxins which are absorbed and lead to paralysis.

There have been no other reported cases of infant botulism since 1994 and it is extremely rare; there have only been six cases ever reported in the UK.

Following this incident the Food Standards Agency met with the baby food industry to discuss their approaches to hazard identification and hazard management. The Agency is seeking assurances from industry that they have adequate checks in place to ensure that *C. botulinum* does not get into baby food.

Examples of outbreaks of cryptosporidiosis in drinking water in England

Year	Place (NHS Region)	Type of Water Supply	Number affected
1995	South West	Public	575
1996	Northern and Yorkshire	Public	126
1996	North West	Public	107
1997	North Thames	Public	345
1997	North West	Public	290
1998	North West	Public	62
1999	North West	Public	87

Source: GSURV database, PHLS CDSC

- 2.57** We expect our water to be safe, but contamination of the water supply does occur from time to time, and can affect large numbers of people. Cryptosporidiosis is one cause of gastrointestinal disease which may be transmitted through water. Most people either do not know they have been infected or only suffer mild illness, but some, especially infants and people with poor immune defences, can be severely ill.

Threat: Lapses in control measures

- 2.58** Complacency leads to lapses in standards and lapses in standards can lead to avoidable illness and deaths. Many examples are given in this and other chapters. Lapses in food hygiene; in hospital infection control; in management of water services to control legionella in, for example, cooling towers: all these have been documented as causes of outbreaks of infectious disease.

An unexpected outbreak of malaria

In March 1999, a 91 year old woman developed an unexplained fever while she was a patient in an infectious disease ward in England. Investigation revealed she had malaria, although she had not travelled abroad. Two further patients, neither of whom had recently travelled abroad, were subsequently found to have contracted malaria during their period on the same ward. One died. The infection was matched to that of a fourth patient who had been admitted for treatment of malaria at the same time. The infection was traced to a breakdown in infection control procedures: one bottle of saline had been used to flush through several patients' intravenous drips.

Threat: The spectre of terrorism

2.59 The deliberate release of infectious agents to cause harm to a population or to the troops of a military opponent has been the subject of extensive discussion, analysis and scientific papers over several decades. A report by The Royal Society published in July 2000 identified 25 micro-organisms or bacterial toxins that had been identified as those which potentially could be used in a deliberate release.

Natural biological agents capable of being used through deliberate release			
Bacteria	Viruses	Toxins	Rickettsia
<i>Bacillus anthracis</i>	Venezuelan equine encephalitis	Botulinum	<i>Coxiella burnetii</i>
<i>Yersinia pestis</i>	Tick borne encephalitis	Ricin	(Q fever)
<i>Francisella tularensis</i>	Russian Spring /Summer encephalitis	<i>Clostridium perfringens</i>	<i>Rickettsia prowazekii</i>
<i>Brucella species</i>	Congo Crimea haemorrhagic fever	Staphylococcus enterotoxin B	
<i>Vibrio cholerae</i>	Ebola	Some mycotoxins	
<i>Burkholderia pseudomallei</i>	Marburg		
<i>Burkholderia mallei</i>	Smallpox		
<i>Salmonella typhi</i>	Influenza		
	Yellow fever		

Source: Measures for controlling the threat from biological weapons. London: The Royal Society, July 2000.

2.60 Over the years the agents that have been most extensively studied and used in scenario plans are those that cause anthrax, botulism, bubonic plague, smallpox and tularaemia. These agents together with those responsible for the viral haemorrhagic fevers are considered to be the highest priority group because: either they can easily be disseminated or transmitted from person to person; or they cause high mortality; or have potential for major public health impact; or they might cause public panic and social disruption and they require special action for public health preparedness.

2.61 Expert analysis has suggested in the past that the manufacture of such agents is straightforward but that producing them in a form which would harm large numbers of people would be technically more difficult.

2.62 This earlier contingency planning against the risk of deliberate release of a biological agent had been carried out in the United Kingdom, the United States of America and other countries of the world without attracting a great deal of public interest. Planning of measures to protect the public health against a deliberate release of a biological agent had been combined with similar planning on the implications of a chemical attack.

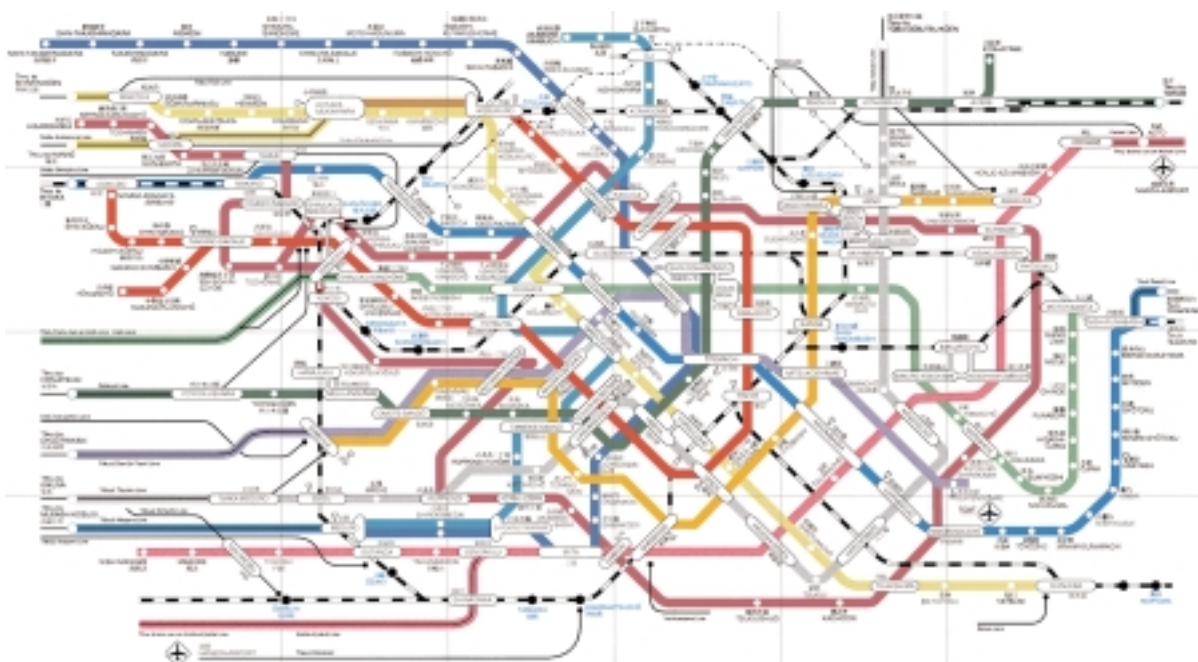
2.63 The latter possibility had attracted particular attention amongst public health authorities after the attack on the Tokyo underground on 20th March 1995 by the cult Aum Shinrikyo with sarin (a nerve gas) which killed 11 people and injured more than 5,500 others. Further less serious incidents occurred later.

2.64 It is less well known that investigators found a research laboratory for bioterrorism weapons in the cult's compound. They had made unsuccessful attempts to harm people with deliberate releases of anthrax and botulinum toxin, but were apparently planning an even more serious attack with devices which could pump biological and chemical agents into the streets of Tokyo.

By the middle of 2001, most planning to protect the public health against the deliberate release of biological or chemical agents or radioactivity had:

- Included consideration of the use of such agents in warfare which could affect both troops and civilians;

Tokyo Subway



- Assessed the challenge of creating an infectious agent for deliberate release as an aerosol as technically very difficult;
- Acknowledged the possibility of an attempt to infect or poison large numbers of people by the deliberate release of such agents but considered it unlikely to be successful.

2.66 The terrorist attacks on the World Trade Centre in New York City and the Pentagon in Washington DC on September 11th 2001 and the cases of anthrax amongst office and postal workers in the USA during the autumn of 2001 have led to revisiting of these assumptions.

2.67 The possibility of a much more extensive terrorist operation, the absence of a specific warning, the deployment of terrorists who have no fear for their personal safety or survival, and the use of multiple simultaneous points of attack must now form part of the planning for countermeasures to protect the health of the population against deliberate release.

2.68 This planning is taking place and will need to become increasingly sophisticated as vulnerabilities are identified and countermeasures designed.

Chapter 3:

Key Priorities

3.1 An effective strategy for combating infectious diseases, chemicals and radiation will ensure that we have the capacity to deal with the wide range of health threats outlined in these chapters. However, certain areas require focussed attention because of the seriousness of the illness, changing disease patterns, new interventions, or the need to keep a close watch on developments. This chapter identifies current priorities, but these should be reassessed on a regular basis.

New and emerging infections

3.2 A key component of any infectious diseases strategy must address the ever-present threat arising from new diseases, newly discovered diseases or old diseases posing a new or different threat. A priority for the strategy must be to create a strong capacity to deal with this problem.

3.3 Experience over the last 20 years has shown that some of the major health concerns of modern times can develop from the emergence of micro-organisms that: were previously unknown or unrecognised, had been believed to cause infection only in animals and not in people, had evolved to produce a new more virulent strain, or reflected the resurgence of an infection previously well controlled.

3.4 Examples described in more detail elsewhere in this strategy include: HIV and AIDS, BSE and vCJD, as well as the ever present risk of the influenza virus emerging in a form with the potential to cause a pandemic with high fatality rates.

3.5 To successfully combat the threat posed by new and emerging infectious diseases, the key is a strong surveillance system underpinned by good clinical reporting and specialist laboratory facilities. Clusters of unusual illness will come to light quickly, new organisms can be recognised early, new strains of existing organisms identified and the re-emergence of disease detected. With some new diseases effort and expertise need to be mobilised to design effective control measures, including new drugs and vaccines (see box).

New and emerging infections – action required

- ▶ Ensuring that surveillance systems provide the comprehensive coverage necessary to detect new or unusual disease presentations or changes in the occurrence or profile of particular micro-organisms;
- ▶ Strengthening clinical reporting of unusual symptoms and disease presentations;
- ▶ Using surveillance data, especially information on gaps in the immunity of the population, to anticipate outbreaks or epidemics so that preventive action can be taken, before cases occur;
- ▶ Co-ordinating specialist laboratory facilities to enable micro-organisms to be assessed and profiled in a standardised way;
- ▶ Maintaining strong international links with agencies in other countries with responsibility for infectious disease surveillance and control policies;
- ▶ Establishing a national source of expertise in assessing the threat from new and emerging infections;
- ▶ Creating a mechanism to rapidly produce a specification for new control measures (e.g. drugs, vaccines) when new infectious disease problems emerge.

Tuberculosis

- 3.6 Tuberculosis (TB) is a massive international health problem. In 1993 the World Health Organisation declared tuberculosis to be a global emergency. The spread of HIV infection, and, in some areas, the growth of multidrug resistant strains, have helped to increase its hold on Sub-Saharan Africa, the Indian subcontinent, South East Asia, Russia, some Latin American countries and to a lesser extent other countries of the world. HIV infection (especially in Africa) and failing public health programmes have fuelled the resurgence of tuberculosis, while drug resistance – notably in Russia (in their prisons in particular) – further threatens control.**

Examples of high tuberculosis case notification rates per 100,000 people in populations around the world deliberate release

Place	Case notification rate per 100,000
Botswana	513
Zimbabwe	435
South Africa	323
Papua New Guinea	278
Philippines	196
Peru	160
Iraq	142
India	123
Newham, London UK	123
Romania	117

Source:
Global Tuberculosis Control, WHO Report 2001 and CDSC North Thames. Data relate to 1999 for countries and to 2000 for Newham.

“An ancient disease is killing more people today than ever before. Tuberculosis - which many of us believed would disappear in our lifetime - has staged a frightening comeback.”

Dr Gro Harlem Brundtland
Director-General, World Health Organisation

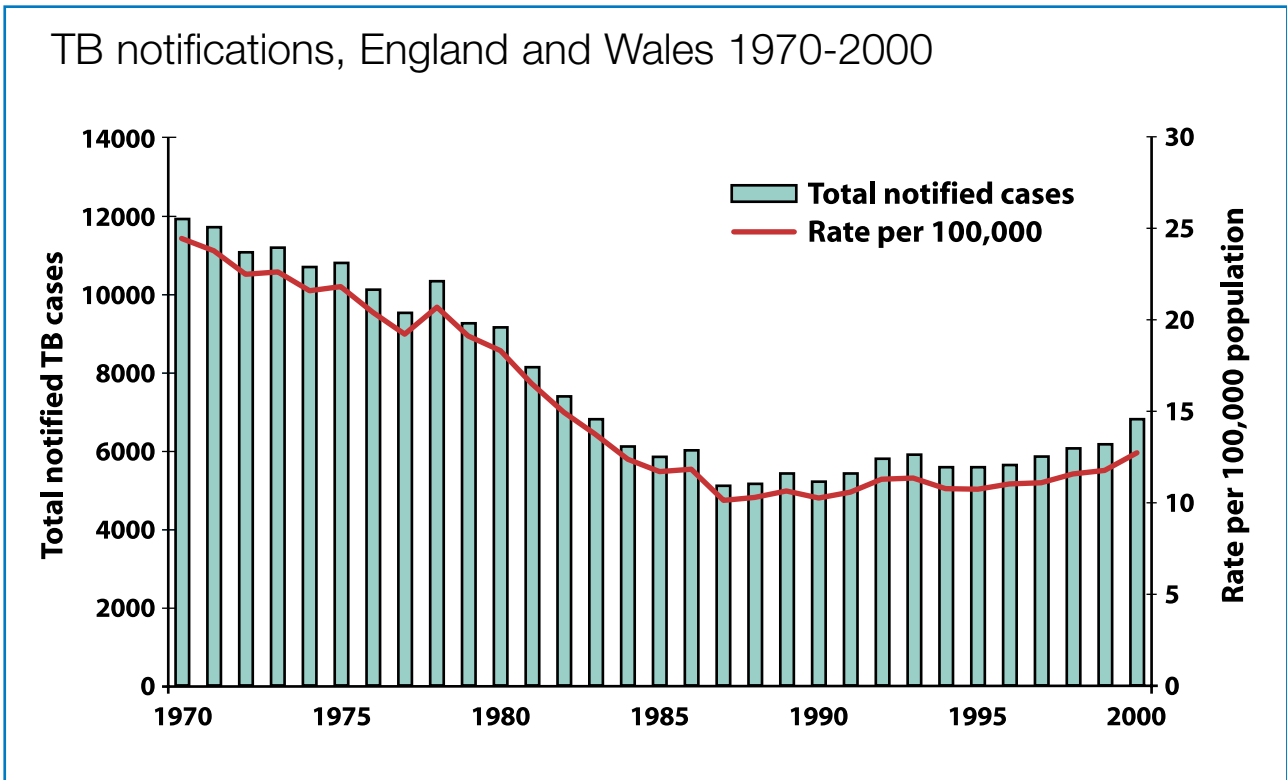
- 3.7 More people are dying of tuberculosis in the world today than at any other time in history - approximately three million deaths each year. Effective treatment programmes exist but only an estimated 15% of people ill with tuberculosis are receiving care in such a programme.**

Tuberculosis amongst prisoners in Russia

Speaking of the 50,000 inmates with tuberculosis in 45 penal colonies in Russia, the Director of the Varnavino camp, Vladimir Khrenov described the camp as “the last stop before the afterworld”.

Mark Franchetti interviewing Vladimir Khrenov.
Sunday Times, 28 September 1997.

- 3.8 In England, deaths from tuberculosis were at their peak in the mid 19th century when no effective treatment existed. People were sent to sanatoria. Many did not return.**



3.9 Both cases and deaths from tuberculosis in England and Wales steadily and dramatically declined until the last two decades of the last century, with notifications reaching an all time low of 5,087 in 1987. However, since the early 1990s this trend has been reversed. There were around 6,500 notified cases in 2000, and the increase of 11% from 1999 to 2000 was the biggest year on year increase in recent times.

3.10 Behind the national trend is a more complex regional and local picture, for example:

- London has a major problem, with a highly mobile population, many different ethnic minority groups, the largest proportion of HIV-related tuberculosis and the highest rates of drug resistant strains;
- In Birmingham, a significant proportion is amongst younger Afro-Caribbeans;
- In Bradford molecular testing has shown that cases are less often linked to people living in the same neighbourhood and more often associated across families linked to their ancestral towns and villages;
- Prolonged outbreaks can occur amongst drug misusers, prisoners and ex-prisoners.

3.11 The steady decline in tuberculosis in the first half of the 20th century has been attributed largely to better housing and nutrition. Throughout the second half of the 20th century to the present day prevention and control of tuberculosis in England has rested on the following public health measures:

- Identifying people with the disease, especially those potentially infectious to other people;
- Treating them effectively so that they are no longer infectious and to cure them of their disease;
- Tracing and examining their close contacts: one may have undiagnosed tuberculosis and been the source of their infection; others may, in their turn, have caught the infection from them;
- Treating those at the earliest stages of infection (i.e. giving them preventive chemotherapy), to stop them developing overt disease in the future;
- BCG immunisation: for those at high risk and as part of an overall national prevention programme.

In 1987 people with tuberculosis in London accounted for 14% of all tuberculosis in the country. By the year 2000, cases in London accounted for 50% of the whole country's tuberculosis.

**Source: R Iskander, T Wass, J Jones, H Maguire.
TB control in London: Next Steps. London: March 2001.**

3.12 These control measures have failed to keep pace with changing trends in the disease. London has borne the brunt of the increase in tuberculosis, with numbers nearly doubling since 1988, a 17% rise in cases reported in 2000 compared with 1999 and a total of nearly 3000 cases reported in the year 2000.

3.13 In 2001 two major outbreaks occurred in England. In Leicestershire, 67 children in one school developed the disease; a further 246 students were found to have early signs of the infection and were given treatment. In an extensive outbreak in North London, the first cases of which were traced back to 1995, 60 young adults have so far been found to be infected with a strain of tuberculosis resistant to one of the antibiotics most commonly used to treat the disease. Seven additional linked cases were identified in people living outside London. Sixteen of the cases had a link with a London prison, and nine of these were thought to

have acquired their infection in prison. This outbreak resulted in over 400 contacts of the cases being traced and offered screening for tuberculosis. This outbreak also demonstrated the usefulness of new molecular typing techniques in linking cases which were apparently separate geographically and in time.

3.14 This resurgence of tuberculosis appears to have occurred because of an increase in the number of infections and in particular:

- An increase in the number of infections among people who were born, or lived, in parts of the world where the disease is more common and the risk of infection therefore higher: over 50% of tuberculosis in this country now occurs in people born abroad, (the majority of whom have arrived within the last 10 years);
- The HIV epidemic which has led to tuberculosis in people co-infected with HIV;
- An ageing population which has meant that disease reactivates in older people who were exposed to tuberculosis when they were younger;
- A complex pattern of disease affecting communities in different ways;
- A lack of awareness amongst communities and professionals leading to delayed diagnosis and poorer control;
- In some areas, inadequate resources; tuberculosis is still underestimated by many, considered to be yesterday's problem.

3.15 Successes are now being achieved with a tuberculosis containment strategy called DOTS based on best practice, research evidence and experience over several decades.

Key elements of the DOTS programme

- Government commitment
- Microbiological diagnosis
- Standardised, supervised treatment
- An assured supply of quality drugs
- Monitoring of the programme, most crucially by outcome of treatment of cases

- 3.16 Programmes of tuberculosis control which do not detect people in the population with the disease, which treat the infection inadequately and where people on treatment do not satisfactorily complete their course of treatment will fail. Failure means a rising problem of tuberculosis, with in particular more multi-drug resistant strains of the disease.**
- 3.17 To bring the disease under control will require high level commitment throughout the country and active and rigorous application of known and effective control measures (see box).**

Regaining control over tuberculosis – action required

- ▶ Achieving high awareness of the disease among health professionals, teachers and others who work with high risk groups, so that the disease is recognised early;
- ▶ Ensuring that services have adequate resources and an appropriately skilled workforce (e.g. specialist nurses and outreach workers);
- ▶ Designing services to be more patient-centred and more accessible and adapted to the needs of those population groups at highest risk, particularly those for whom English is not their first language;
- ▶ Maintaining effective screening and case finding amongst new entrants to the country, especially in the big cities;
- ▶ Rapid identification and management of outbreaks;
- ▶ Offering an HIV test to those presenting with tuberculosis;
- ▶ Achieving high levels of successful outcomes of treatment and ensuring that people with infection comply with their treatment regime;
- ▶ Developing enhanced surveillance of the disease at population level including use of techniques such as DNA ‘fingerprinting’ of the tuberculosis bacterium to detect changes in trends and risk groups and to track multi-resistant strains of tuberculosis;
- ▶ Promoting research into better drugs, diagnostics and vaccines;
- ▶ Contributing to the international effort towards the global control of tuberculosis through effective programmes.

Health care associated infection

- 3.18 In the 19th century hospitals were hazardous environments. Until the latter part of that century there was no understanding of the mode of transmission of infectious diseases. So there was little application of the principles of hygiene to prevent patients acquiring infection during surgery or childbirth. As a result in-hospital mortality rates were high. The situation improved dramatically with increased understanding of the link between basic hygiene and infection. Further improvements came about with the discovery of the value of antiseptics during surgery.
- 3.19 Hospital acquired infection made a resurgence during the last three decades of the 20th century and is now a major problem for the NHS.
- 3.20 The factors which appear to have led to this situation are:
- Many more seriously ill patients who are more susceptible to infection (because of immunosuppression or general age or frailty);
 - A growth in invasive procedures and diagnostic tests which increases the likelihood of infection being introduced;
 - Mixing of patient populations as hospitals take in from wider catchment areas and pressure on beds leads to higher levels of in-hospital patient movements;
 - The growth of antimicrobial resistant organisms;
 - Weaker standards of cleanliness and hygiene;
 - A lack of awareness of, and senior management attention given to, hospital acquired infection.
- 3.21 The term 'health care associated' infection increasingly needs to replace the more traditional term 'hospital acquired' infection. Although many infections transmitted to patients during their care occur in hospitals, more care and procedures associated with it now take place in a primary care setting. Moreover, some such infections are transmitted to the patient but others arise from organisms in the patient's own body which become invasive as their immune systems are impaired. Infection control is therefore an important issue whichever the NHS setting.

Health care associated infection: key facts

- 15-30% of hospital acquired infection could be prevented by better application of knowledge and implementation of realistic infection control policies;
- Hand hygiene is possibly the most important factor in preventing hospital acquired infection but compliance is poor;
- Around 9% of hospital in-patients acquire an infection while in hospital;
- There are at least 100,000 hospital infections a year;
- Around 5,000 deaths each year might be primarily attributable to hospital acquired infection and in a further 15,000 cases it might be a substantial contributor;
- They impact on the quality of care; can cause a deterioration in a patient's condition; and sometimes contribute to or cause a patient's death;
- Between 50 and 70% of surgical wound infections occur after discharge from hospital.

Sources: House of Commons. Committee of Public Accounts. *Forty-second report: the management and control of hospital acquired infection in acute NHS trusts in England, together with the proceedings of the Committee relating to the report, the minutes of evidence and appendices. Session 1999-2000.* London: The Stationery Office, 2000. Chairman: David Davis. (HC 306). The National Audit Office.

3.22 Policy on infection control arrangements in acute NHS Trusts was comprehensively reviewed in the late 1990s and the issue was the subject of major reports from the National Audit Office in February 2000 and Public Accounts Committee in November the same year. Their recommendations are being addressed. The NHS must adopt a philosophy that the prevention of health care associated infection requires commitment from everyone, not just specialists in infection control. Better strategic management, leadership and accountability, education and training, monitoring of performance and progress are all crucial to in bringing about these changes. Improved surveillance of health care associated infection is also essential. A total of £261 million is being spent to clean up hospitals and improve sterilisation and decontamination arrangements for medical and surgical equipment. The issue of a national NHS standard for infection control against which performance can be measured will also bring benefits.

Health care associated infection – action required

- ▶ Leadership and commitment from the top of all local NHS organisations to ensure that infection control in their institutions is a core component of clinical governance and patient safety;
- ▶ Full implementation of the controls assurance standard for hospital acquired infection and its extension into primary care services;
- ▶ Ensuring that sterilising equipment as well as practices to reduce cross-infection from medical and surgical procedures and devices meet best practice standards;
- ▶ Further developing surveillance systems to monitor the pattern of, and trends in, health care associated infections and rapid feedback of comparative information to NHS organisations;
- ▶ Making strong control of infection policies and teams a focal point for action in every local NHS organisation.

Antimicrobial resistance

- 3.23** Antibiotics and other antimicrobial drugs have revolutionised the treatment of infection since sulphonamides were first introduced in the 1930s, but our ability to treat infection is threatened by the spread of organisms resistant to their effects. It is already becoming more difficult to treat many infections, especially where multiple resistance makes drug choices limited and expensive. Some drugs which were once life-saving in serious infections are now completely ineffective.
- 3.24** Antimicrobial resistance is as old as antimicrobial drugs themselves. When penicillin, the first true antibiotic, was introduced in 1946, 5% of staphylococcal infections were resistant to it. By 1952, this had risen to 85%. However, over the next 30 years there was intensive activity by the major pharmaceutical companies to develop drugs to fight infection. New classes of antibiotics were developed and the choice of drugs to successfully treat infection was broad. The 1980s was a golden era for therapy in this field of medicine – most infection was treatable, optimism was high.
- 3.25** Today there are resistant strains of almost all organisms ranging from *Staphylococcus aureus*, which can be carried

harmlessly in the nose and on the skin but which can cause infection, to salmonella (a common cause of food poisoning), to tuberculosis, malaria and many more serious diseases. In 1999, the first staphylococci partially resistant to vancomycin, the drug usually kept in reserve for treating highly resistant strains, were reported from Japan and then America. This is a worrying occurrence, since other available treatments are currently very limited indeed.

“Resistance to antibiotics... constitutes a major threat to public health and ought to be recognised as such more widely than at present”

Source: House of Lords Select Committee on Science and Technology. 7th Report. London: The Stationery Office, 1998.

- 3.26 The development of resistance is a natural phenomenon. It is the micro-organism’s way of surviving in a world in which antimicrobial drugs are designed to kill them. The organisms which are genetically susceptible die. The surviving organisms replicate and copy their resistance gene to millions of other organisms so that resistance spreads widely and quickly.

“Bacteria have evolved very sophisticated means of exchanging DNA, both within their own genus and species and across them. The widespread use of antibiotics will tilt the delicate balance between us and the bacteria”.

Source: Wise R et al. Antimicrobial resistance. BMJ 1998; 317: 609-610.

- 3.27 Antimicrobial resistance is more common in many other countries than it is in the UK but this is little comfort since resistance can spread internationally through travellers who have acquired their infection abroad. Control of antimicrobial resistance is now an international priority for action.
- 3.28 An example of a problem antibiotic resistant organism mentioned previously is methicillin-resistant *Staphylococcus aureus* (MRSA). *Staphylococcus aureus* is normally susceptible to methicillin and several other antibiotics. It is a common cause of skin, wound and (most seriously) blood stream infection, and although now usually resistant to penicillin, as noted above, it is usually treatable by other agents. MRSA, on the other hand, is resistant to methicillin and also to many other anti-staphylococcal antibiotics. MRSA would be better called ‘multi resistant *Staphylococcus aureus*’ since it is its multiple antibiotic resistance that makes it so difficult to treat.

- 3.29 Although MRSA had been known since the 1960s, it was a less serious problem in this country until an outbreak with a particularly epidemic strain began in Kettering Hospital in 1990. From there, this and other epidemic strains spread across the whole country during the 1990s so that now most hospitals are affected. This epidemic prompted the publication of new guidelines for the control of MRSA. Despite these efforts at control MRSA infections have continued to spread. Reports to the Central Public Health Laboratory have shown that MRSA as a proportion of all *Staphylococcus aureus* causing blood stream infections has risen from about 2% in 1990 to more than 40% in 2000.
- 3.30 In the Nosocomial National Surveillance Scheme (NINSS) report for 1997-1999 which covered 96 English hospitals, 47% of organisms causing surgical site (wound) infection were staphylococci, of which 81% were *Staphylococcus aureus* and 61% of these were MRSA. MRSA infections are a problem in Europe also, although the Netherlands and Scandinavia have so far been spared. Multiple antibiotic resistance helps organisms to defeat routine therapy and survive in hospitals, and this is one of the reasons why MRSA has spread so extensively throughout hospitals in this country. Other probable reasons include the existence of very contagious strains of MRSA, increasing movement of patients between wards and hospitals, lack of isolation facilities and increasing workload, and lapses in hygienic procedures such as handwashing.
- 3.31 MRSA are not the only multiply antibiotic resistant organisms causing problems in UK hospitals. The appearance of vancomycin (or glycopeptide) -resistant enterococci (VRE or GRE) in Dulwich hospital in the mid 1980s produced, for the first time since the beginning of the antibiotic era, some strains of clinically important bacteria that are resistant to all available antimicrobials. VRE are still not very common in the UK, but have been seen with increasing frequency both here and throughout the world. VRE were unknown in the UK before 1985, but by 1995 about 60 hospitals had been affected and the figure is certainly higher today. Since this vancomycin resistance can potentially transfer to staphylococci, the future emergence of untreatable *Staphylococcus aureus* infection remains a serious threat. Gram-negative bacteria have also re-emerged as a serious problem of multiply resistant hospital infection. New multiresistant enterobacteria, dominated by *Klebsiella* species, can cause large hospital outbreaks, sometimes with dissemination between hospitals. They have been seen throughout the world and there are many accounts of international transmission (often carried by patients transferred between hospitals). Outbreaks have been reported in several UK hospitals.

3.32 The seriousness of this threat of antibiotic resistance was emphasised in a report from the House of Lords Science and Technology Committee in 1998, in a report from the Standing Medical Advisory Committee called *The Path of Least Resistance* in the same year, and in a 1999 opinion of the European Commission Scientific Steering Committee on Antimicrobial Resistance. All these reports emphasised:

- The global threat posed by antimicrobial resistance;
- The risks to patients and the public;
- The breadth of factors involved in the causation of antimicrobial resistance;
- The need for commitment, from government to local level, if the problem is ever to be contained.

3.33 The factors which contribute to antimicrobial resistance include the inappropriate use of antibiotics, both in medicine and in agriculture. Half of the inappropriate use of antibiotics is in the field of animal husbandry and food production. Antibiotics indiscriminately used to treat sick animals, the use of such drugs to act as growth promoters and achieve higher productivity in plant and animal rearing and the elimination of unwanted bacteria during food processing have all played their part in generating micro-organisms which are multiply resistant. It may seem surprising or shocking to many people that this dependency on antibiotics has led in some countries for example to the long term spraying of fruit trees with them and in some cases to the addition of 50 kilograms of antimicrobial to each acre of salmon farms. In medicine the widespread use of antibiotics in situations where they are unnecessary, (e.g. in treating viral sore throats against which such drugs do not work), the failure to tailor antibiotic treatment to the infection concerned, and large numbers of patients taking their treatment erratically are also major factors.

3.34 In June 2000, the Government set out the first three years of its strategy for tackling antimicrobial resistance. Much has been achieved, and antimicrobial prescribing in primary care has fallen by 23% between 1996 and 2000. The strategy will continue to be reviewed and in particular will be revised in the light of advice from the new Specialist Advisory Committee on Antimicrobial Resistance (SACAR).

Use of antibiotics		
Where antibiotics are used	Types of use	Questionable use
Human use (50%)	20% hospital 80% community	20-50% unnecessary
Agricultural use (50%)	20% therapeutic 80% prophylactic/growth promotion	40-80% highly questionable

Source: R Wise at al.
Antimicrobial resistance.
BMJ 1998; 317: 609-610.

Antimicrobial resistance: further action required

- International co-operation through the World Health Organisation, the European Union and other bodies to contain the growth of antimicrobial resistance;
- Strategies targeted at influencing, educating and gaining the support of: doctors who prescribe antibiotics, nurses, pharmacists, veterinarians, the agricultural community, professional bodies, the pharmaceutical industry, food manufacturers and processors;
- Enhanced national and local surveillance of antimicrobial resistance;
- Public education to enhance their role in containing resistance;
- Extending policy on containing resistance from antibiotics to antiviral and other antimicrobial agents;
- Clear guidelines on the treatment of infection;
- Development of new drugs and vaccines to combat and prevent infection;
- Constraining the use of growth promoters in food producing animals;
- Establishing the annual usage of antimicrobials in animals and enhancing the consideration of resistance in the authorisation process;
- Encourage the development of strategies to minimise the use of antimicrobials;
- Improve understanding of incidence and development of resistance in bacteria isolated from food producing animals.

Infectious diseases in children

- 3.35 Infectious diseases and infection are an important cause of illness, hospital admission and death amongst children in this country. Some studies have suggested that as many as 48% of child hospital admissions are associated with infection, whilst another study showed that the average number of infective events recorded in children by the age of 18 months was eight.
- 3.36 There are a number of special issues to be considered when planning the approach to tackling infectious diseases in childhood:
- The positive impact of breastfeeding;
 - Immunisation programmes;
 - The prevention and management of infection transmitted from mother to child (e.g. HIV infection, rubella, hepatitis B) or acquired in the newborn period (e.g. Group B streptococcal infection);
 - The management of serious rare infections (e.g. meningococcal or pneumococcal septicaemia, osteomyelitis, acute malaria);
 - The care of children with impaired immune systems (e.g. those undergoing transplantation or cancer chemotherapy);
 - The appropriate use of antibiotics in children.
- 3.37 Newborn infants are particularly susceptible to infection because of immaturity of their immune systems. One of the most important bacteria infecting such infants is the Group B streptococcus which is often acquired from the mother's genital tract. Other infections transmitted from mother to child (i.e. vertically) include HIV, cytomegalovirus, toxoplasmosis and herpes simplex. Newborn babies, especially those who are premature or low birth weight and admitted to neonatal intensive care, are particularly vulnerable to infection.
- 3.38 A number of rarer infections in childhood can be very serious and require highly specialist expertise to manage them, for example: meningococcal septicaemia, tuberculous meningitis, HIV infection and tropical diseases like malaria. For example, the value of such specialist expertise is being shown by the major breakthrough in the survival of children with severe meningitis because of improvements in initial management of patients with meningococcal disease at referring hospitals, use of a mobile intensive care service, and centralisation of care in a specialist unit.

Improved survival amongst children admitted to St Mary's Hospital with severe meningococcal disease

Year	Number of children	Case fatality%
1992/93	44	25%
1994	39	13%
1995	64	12%
1996	73	11%
1997	111	2%

Source: Booy R et al
Arch Dis Child 2001;
85: 386-390.

- 3.39 More children are receiving organ transplants or surviving longer with cancer. These children also need the input of a physician with specialist experience in paediatric infectious diseases. The intensive chemotherapy they receive increases their vulnerability, including susceptibility to infections to unusual or highly resistant organisms, and serious infection can develop with terrifying speed.
- 3.40 Whilst many minor infections in childhood are successfully managed in primary care, assessing and treating children with serious infection is a highly skilled endeavour requiring the involvement of many disciplines working together.
- 3.41 It is important that training programmes recognise the need for these specialist skills if standards in the care of seriously ill children are to be maintained and keep pace with the best in the world.
- 3.42 It is important that the National Service Framework (NSF) for Children currently under development recognises this issue and ensures that sufficient centres of excellence are available in regions to provide multidisciplinary specialist care. Dealing with children with serious infection primarily in adult infectious disease units is not an acceptable model of care for the future.
- 3.43 The burden of infectious diseases in childhood can be reduced by prevention - the two most important measures being effective immunisation programmes (see later in this chapter) and promoting breastfeeding.

Infection in childhood: further action required

Prevention

- higher levels of breast feeding;
- high coverage of safe, effective vaccination programmes;
- empowering parents and children: through education on personal and food hygiene, vaccine programmes and recognition of important infections.

Effective management of day to day infections

- good programmes of education and training of health professionals who encounter children in primary and secondary care;
- high quality prescribing of antibiotics.

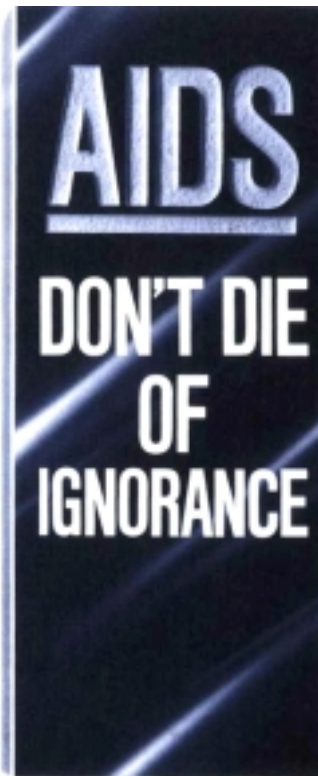
High quality management of special groups and serious infections

- effective organisation of specialist facilities to deal with infection in newborn babies;
- effective organisation of specialist facilities and centres of excellence to manage serious infection in childhood.

Research

- into new vaccines and potentially vaccine preventable diseases.

- 3.44** The benefits of breastfeeding to the developing infant are well established and yet a recent national survey of infant feeding showed that only 70% of babies are breastfed at birth in England and Wales. Research has shown that breastfeeding is an effective method of reducing the risk of common childhood illnesses, especially gastrointestinal and ear infections. Any strategy to address infectious diseases should therefore also take account of the role of breastfeeding in reducing the burden of childhood infections.



Blood-borne and sexually transmitted viruses

- 3.45 The UK had an estimated 33,200 HIV-infected living adults by the end of 1999. Our country has been less badly affected by the HIV epidemic than many of our European neighbours. The early responses of the gay community followed by wide ranging health promotion initiatives – most memorably the “AIDS : Don’t Die of Ignorance” campaign – were major factors.
- 3.46 A person with HIV infection can appear perfectly healthy for many years following exposure to the virus and during this time can infect other people. The principal ways in which HIV can be transmitted are through sexual intercourse with an infected person without a condom, sharing of drug injecting equipment and from an HIV-infected mother to her child around the time of birth. Around one in three people with HIV infection in this country do not know they are infected.
- 3.47 There is currently no cure for HIV infection nor any vaccine that can protect against it. Treatment with anti-HIV drugs is allowing people with HIV infection to live longer, healthier lives and has reduced dramatically the number of deaths from HIV infection from a peak of around 1700 cases each year to 400. However, the number of cases of HIV being diagnosed each year is rising and exceeded 3,500 in 2000. Coupled with improved life expectancy, this means the number of people living with HIV infection is growing.

Continuing to contain the threat of HIV and AIDS – action required

- ▶ Implementing the National Strategy for Sexual Health and HIV (published in July 2001), to modernise sexual health and HIV services over the next 10 years. It particularly targets newly acquired HIV infections and the number of undiagnosed infections;
- ▶ High quality multidisciplinary care to diagnose, treat and support people with HIV infection and AIDS;
- ▶ Raising and maintaining public awareness of how HIV is transmitted through provision of relevant information and health promotion;
- ▶ Targeted health promotion in high risk groups;
- ▶ Overcoming prejudice through education to promote voluntary counselling and testing for HIV infection;
- ▶ Continued impetus to further reduce mother-to-child transmission;
- ▶ Promoting research into new drug treatments which overcome side effects and resistance to current anti-HIV therapies;
- ▶ Supporting the international effort to develop a safe, effective and affordable HIV vaccine.

3.48 Whilst HIV is the most serious of the blood-borne viruses that cause infection world-wide, blood-borne hepatitis viruses are more common:

- **Chronic hepatitis B infection is estimated to affect 300 million people world-wide and about 0.3% (180,000) of the UK population;**
- **Around 170 million people world-wide are estimated to be chronic carriers of hepatitis C, including an estimated 0.4% (250,000) of the UK population;**
- **Chronic carriers of either virus may develop chronic liver damage, cirrhosis or liver cancer;**
- **The viruses are transmitted by direct blood-to-blood and body fluid contact (e.g. contaminated needles, unprotected sexual intercourse, medical and surgical procedures if hygienic precautions are not observed).**

- 3.49** Hepatitis B and C differ from one another somewhat in their epidemiology and thus the approaches required to control them, but they also have features in common. Like HIV, both are transmitted by direct blood-to-blood and body fluid contact, e.g. use of contaminated needles, sexual practices, medical and surgical procedures. Both can cause major long term sequelae following infection, including chronic liver damage, cirrhosis and liver cancer.
- 3.50** Although some measures are in place to reduce the impact of these diseases, based around blood screening, selective immunisation (for hepatitis B) and awareness raising to change behaviours in order to reduce opportunities for transmission, the burden of illness for both has steadily increased and is projected to increase further. A good illustration is given by the model for hepatitis C developed in Bristol. Based on a given prevalence (in this case 0.5%), the burden of disease can be estimated.

Projected burden of disease from a one year cohort with hepatitis C infection: example based on the population of the City of Bristol

Base population

Total population of city	500,000
Prevalence of hepatitis C (0.5%)	2,500

Initial disease burden state

Of the 2500 people with hepatitis C infection:

will resolve spontaneously	375	(15%)
will already have compensated cirrhosis	213	(10%)
will have mild chronic hepatitis	1466	(69%)
will have moderate to severe disease	464	(21%)

Disease progression of those chronically infected;

10 years later:

will still have mild disease	648	(30%)
will have severe disease	582	(27%)
will have developed compensated cirrhosis	895	(42%)

Source: Barry R. Hepatitis C disease progression model. Bristol: Directorate of Medicine, United Bristol Healthcare NHS Trust, 2001.

- 3.51** The costs of treating chronic hepatitis C may be considerable. Whilst the costs of not treating are low initially, as the disease progresses many more people move to decompensated cirrhosis where the treatment costs, which may include liver transplantation, increase enormously.

Hepatitis B and C: further action required

Improved information, through improved surveillance and special studies:

- ▶ better understanding of the true incidence, prevalence, epidemiology and natural history of both diseases, but particularly hepatitis C;
- ▶ greater understanding of the causes of chronic liver disease, the relative role of viruses, and the contribution of hepatitis C infection to primary liver cancer.

Improved primary prevention to reduce the risk of infection, through:

- ▶ routes associated with drug misuse;
- ▶ sexual practices;
- ▶ greater uptake of hepatitis B immunisation among risk groups, including all prisoners, on reception and those at high risk of sexual transmission:
 - by the end of 2003, all gay and bisexual men attending genitourinary clinics should be offered hepatitis B immunisation at their first visit;
 - expected uptake of the first dose of vaccine, in those not previously immunised should reach 80% by the end of 2004;
 - expected uptake of the three doses of vaccine in those not previously immunised, within one of the recommended regimens to reach 50% by the end of 2004 and 70% by the end of 2006.

Improved secondary prevention through:

- ▶ voluntary testing and counselling of high risk groups;
- ▶ effective contact tracing services;
- ▶ increased coverage of hepatitis B testing during antenatal care and immunisation of all babies born to positive mothers.

Improved treatment and care, through managed clinical networks.

- 3.52 In recognition of its public health importance, a specific strategy for hepatitis C is being developed that will be published in 2002. The strategy will bring together integrated actions that need to be taken to improve prevention and control and treatment and care. Already identified are improvements needed in surveillance of hepatitis C in particular of chronic disease and raising awareness in both the general public and in health professions.

Chronic diseases

- 3.53 In 1969 there were 16,680 operations in this country, to try to cure peptic (duodenal or stomach) ulcer. This was major surgery and it was not always successful. By 1999 the number of such operations had fallen to 52. This remarkable transformation was brought about by a new generation of drugs, the histamine H₂ antagonists, which by blocking histamine receptors convert the gastric parietal cells to a resting state and stop the production of acid. In the 1990's the next generation anti-ulcer drugs emerged (the proton pump inhibitors). They became the predominant ulcer healing drugs arguably producing faster healing rates and greater acid suppression.
- 3.54 But the story of duodenal stomach ulcer was not over. In 1982 a link was discovered between a bacterium *Helicobacter pylori* and peptic ulcer disease. It is now believed that 90% of such ulcers are caused by this infectious agent. A high proportion can now be cured with a course of antibiotics.
- 3.55 Increasingly the basis of some diseases - previously believed to be the product of lifestyle, environment or genetic inheritance - is being rethought as infectious causations are uncovered. The list of such diseases is growing. It is important that research is carried out to establish and validate such links. It is also important that guidelines are produced to treat them effectively especially because many of these problems will be unfamiliar to clinicians. The health service implications will also need to be taken into account.

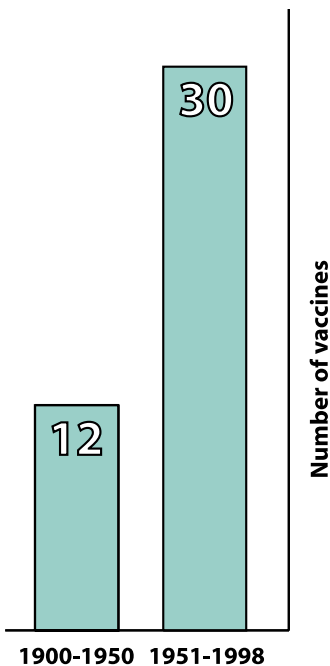
Links between infectious agents and chronic diseases

Micro-organism or infection	Chronic disease
Established links	
<i>Helicobacter pylori</i>	duodenal ulcer and gastric mucosa associated lymphoid tissue (MALT) lymphoma
HPV	cervical carcinoma
<i>Streptococcus mutans</i>	dental caries
<i>E Coli</i> O157	Haemolytic Uraemic Syndrome and Chronic renal failure
HBV/HCV	liver cancer and cirrhosis
Epstein-Barr virus	Burkitts lymphoma and nasopharyngeal carcinoma
JC virus	progressive multi-focal leucoencephalopathy
Human herpes virus type 8 (HHV8)	Kaposi's sarcoma
HTLV1	adult T cell leukaemia and Tropical Spastic Paraparesis
<i>Clonorchis sinensis</i>	cholangiocarcinoma
<i>Schistosoma haematobium</i>	squamous cell carcinoma of the bladder
Possible links	
<i>Chlamydia pneumoniae</i> , <i>Helicobacter pylori</i> , Herpes simplex virus 2, Epstein-Barr virus and chronic periodontal infections	coronary heart disease
<i>Mycobacterium avium</i> subsp. <i>Paratuberculosis</i>	Crohn's disease
<i>Propionibacterium acnes</i>	sciatica
<i>Yersinia</i> spp., <i>Salmonella</i> spp., <i>Campylobacter</i> spp and <i>Chlamydia trachomatis</i>	reactive arthritis
<i>Klebsiella pneumoniae</i>	ankylosing spondylitis
<i>Proteus mirabilis</i>	rheumatoid arthritis
Mycobacteria	sarcoidosis
Carious dental infection	endocarditis
HPV	squamous cell carcinoma of the skin in immunosuppressed patients
Anaerobic bacterial metabolites	cancer of the bowel
<i>Schistosoma</i> spp	carcinoma of the prostate
Bacterial vaginosis	birth prematurity
Hypothesised on the basis of epidemiology or infection triggers	
Viruses	Juvenile diabetes
Infectious triggers	Rheumatoid Arthritis
Infection	Multiple Sclerosis
Childhood or adolescent infection	Schizophrenia
Infection	Childhood leukaemia
Viral infections	Chronic Fatigue Syndrome

Chronic Disease caused by infection: further action required

- ▶ A research strategy aimed at establishing causal associations between infectious agents and chronic diseases;
- ▶ Increasing clinical awareness and professional education where there is an established link;
- ▶ Establishing evidence-based guidance in treatment of chronic illness with antimicrobial drugs.

Vaccines
licensed
since 1900



Source: World Health Organisation 1999

New vaccines

3.56 Fifty years ago, in this country, there were measles epidemics every other year. Hundreds of thousands of children were affected. Even in the second half of the twentieth century, there were more than 100 deaths associated with many such epidemics. Epidemics of paralytic poliomyelitis affected thousands of individuals before the development of safe and effective vaccines. Parents of today's children have never seen a child crippled with polio and wearing calipers. Many of the young general practitioners of today may never have seen a case of measles. Epiglottitis (acute and life-threatening blockage of the airway from *haemophilus influenzae b*) is no longer feared by paediatricians and anaesthetists. These gains have come from safe and effective vaccines, made available to all children, irrespective of their background or social circumstances.

3.57 In its 1993 report 'Investing in Health', the World Bank identified childhood vaccination as one of the most cost-effective health strategies; furthermore, new vaccines were recognised as one of the most valuable areas for investment in health research.

3.58 Over the next decade it is highly probable that research and development will produce new generations of vaccines. Indeed, as the benefits of new genetic technologies are increasingly successfully applied, the pace of emergence of new vaccines may well accelerate. Not only will there be new vaccines, but many will be combined. Harnessing this change will require a carefully managed relationship with the research community and the vaccine industry.

3.59 In the short term the major developments could be:

- More vaccines combined into new ‘multivaccines’ to reduce the number of injections or clinic visits;
- Introduction of new conjugate pneumococcal vaccines to protect young children and the elderly from pneumococcal septicaemia, meningitis, pneumonia and ear infections, with the potential to reduce the annual toll of 22,000 hospital admissions and 3000 deaths caused by pneumococcal infection;
- A move to injectable rather than oral polio vaccine as paralytic poliomyelitis is eradicated world-wide and the risk of importation of wild poliovirus disappears. This change will maintain protection against poliomyelitis but avoid the risk of vaccine associated cases that can follow the use of oral polio vaccine;
- More widespread use of existing vaccines to protect against chickenpox and hepatitis B.

3.60 Over the next decade the research and development breakthroughs are likely to be:

- A vaccine against Group B meningococcal infection;
- A vaccine against rotavirus gastroenteritis – the commonest cause of diarrhoea in children;
- A more effective vaccine against tuberculosis;
- A vaccine against HIV infection;
- A vaccine against respiratory syncytial virus which is a significant cause of morbidity and mortality in adults as well as children;
- The development of safe and effective vaccination against malaria.

- 3.61** The United Kingdom already has world-leading levels of computerisation of our immunisation information systems. These now need to be brought up to the sophistication of information management that is the norm in industry and commerce. For example, each individual dose of vaccine could be bar-coded and then tracked from manufacture to use, with telemetered information on its progress. This would be linked with the computerised individual health record allowing identification of immunisation status (and lack of immunisation), tracking of coverage and suspected adverse event monitoring, payment of providers, and ordering of next doses of vaccines and scheduling of appointments.
- 3.62** As parents have fewer experiences of previously common infectious diseases, so their perception of their seriousness diminishes and fears about diseases are replaced with fears about vaccine safety. These societal changes, along with the increasing access to the internet with its information without quality control, mean that paternalistic recommendations will no longer serve an increasingly questioning population. Along with high quality vaccines there will need to be high quality information materials that are easily found, comprehensible to all readerships, engaging and truthful.
- 3.63** For both new vaccines and new vaccinations, the UK is already foremost in the world with a dedicated Vaccine Evaluation Consortium. The benefits from such a consortium were clearly demonstrated by the rapid development and introduction of meningococcal C vaccine. Similarly, the UK has world-leading research/monitoring of parental knowledge and attitudes about immunisations and vaccine preventable diseases. This tracking is given high priority in the designing of communication materials and promotion of immunisation, being sensitive to parental opinions rather than preconceptions or prejudices of health communicators. Linking these two topics is the need to actively research any new safety concerns. The new techniques of record linkage are particularly important in demonstrating whether there is significant risk that can be attributed to vaccinations.
- 3.64** It is important that clear plans are in place for people of this country to achieve the potential benefits of vaccination to eradicate some infectious diseases entirely, to reduce illness caused by infections and to save lives from infectious diseases that currently kill. As part of this infectious diseases strategy, vaccine policy is one of the priorities for action.

Continuing to secure the benefits of safe, effective vaccines in the future – action required

- ▶ Extending the use of existing vaccines to larger numbers of people – in particular influenza vaccine and pneumococcal vaccine;
- ▶ Continuing to maintain high levels of coverage in the childhood immunisation programmes;
- ▶ Switching from oral polio immunisation to the injected form when global progress on polio eradication is at an appropriate point;
- ▶ Introducing available and soon to be available vaccines according to epidemiological needs and cost effectiveness, e.g. varicella vaccine, pneumococcal conjugate vaccine;
- ▶ Stepping up research and investment to bring forward new vaccines to prevent large or serious infectious disease problems, in particular meningococcal Group B vaccine, a vaccine against respiratory syncytial virus (one of the commonest causes of chest infection and hospital admission) and rotavirus gastroenteritis;
- ▶ Contributing to international research to develop a vaccine against HIV infection;
- ▶ Establishing a system to track vaccines using new technologies such as bar-coding;
- ▶ Designing new materials for the public and parents on vaccines which will address their needs for information and will be made as widely accessible as possible through opportunities such as the internet.

Terrorism

- 3.65** In March 2000, the Department of Health issued planning guidance to health authorities to ensure that they started to make plans to respond to the deliberate release of biological and chemical agents. Earlier comprehensive guidance on the response to radiation/nuclear incidents was published with the 1998 guidance for major incidents.
- 3.66** Since 11 September 2001, planning has been intensified within the Department of Health and across government (through COBRA, the government's emergency planning committee). During September and October 2001, further action has been taken in relation to health protection in the light of a possible terrorist attack using these agents:
- Further planning guidance through regional directors of public health to the local NHS and public health services;
 - Clinical guidance to all doctors through the Public Health Laboratory Service on anthrax, smallpox, botulinum, tularaemia and a wide range of chemical hazards;
 - Securing drugs and other supplies and the logistics for delivering them to where they might be needed in an emergency;
 - A joint collaboration agreement signed with the United States of America and joint work with European countries and Canada.
- 3.67** This work needs to be extended and further developed over time by planning, surveillance and research to find the best ways of reducing the adverse consequences of deliberate release of biological (and chemical) agents.

Deliberate release of biological agents: further action required

- ▶ Strong health protection contingency and emergency response plans to reduce vulnerability to deliberate releases; these should be regularly reviewed and strengthened;
- ▶ Ensuring that health protection plans are well co-ordinated with other contingency and emergency plans at national, regional and local level;
- ▶ High clinical awareness of and professional education on symptoms, signs and illness presentations which might indicate a deliberate release;
- ▶ Establishing appropriate stores and supplies of drugs, vaccines and equipment to respond to an emergency;
- ▶ Good scenario planning and research;
- ▶ Strong security and effective regulation of laboratories dealing with micro-organisms;
- ▶ Good surveillance;
- ▶ Forward thinking and innovation in identifying and protecting against vulnerability.

Chapter 4:

Some Success Stories

- 4.1 The analysis in the previous three chapters has shown infectious diseases are a real and present danger to global health. This does not mean that the problems they cause are insurmountable. On the contrary looking across the countries of the world, including our own, over the last few years reveals a catalogue of success stories. There are instances where small communities or whole countries have turned the tide on particular infectious disease problems which had previously caused serious illness or death.
- 4.2 In this chapter examples are given of where striking progress has been made in the battle against infectious diseases.

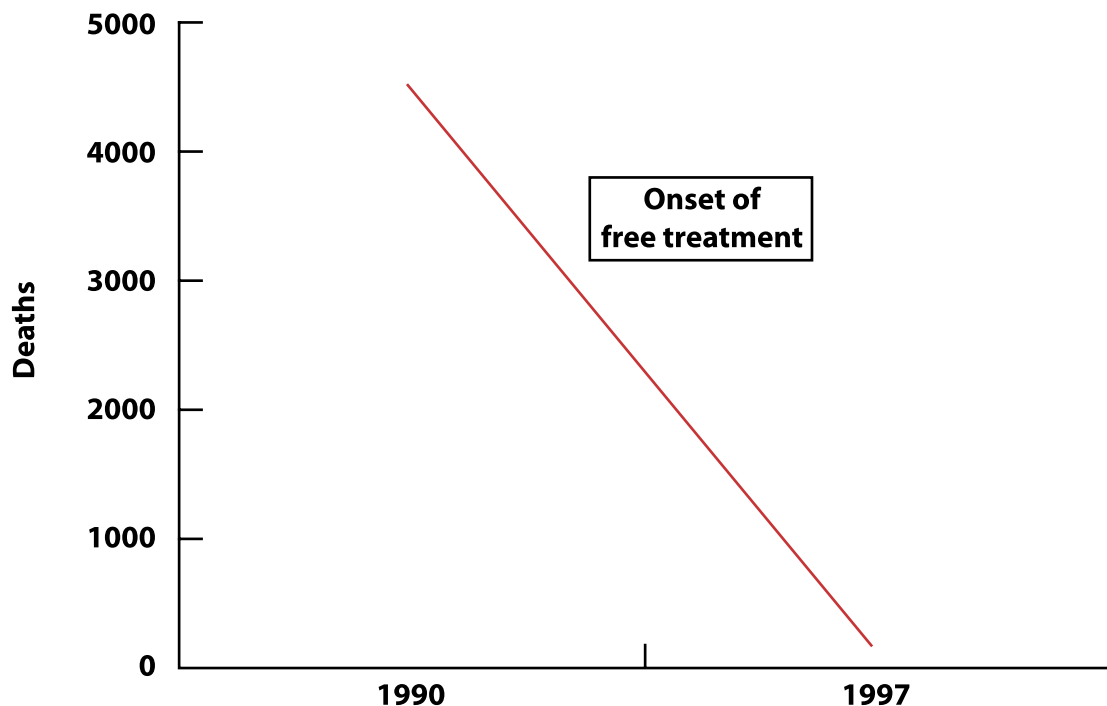
“Three continents of the world are now polio-free with no transmission of indigenous polioviruses: the Americas were certified polio-free in 1994; the Western Pacific Region which includes China will be certified this year. Europe has been polio free for over a year. Had this eradication effort not been launched, three million children who today can walk and play might otherwise have been crippled with polio.”

Dr Gro Harlem Brundtland, World Health Organisation, speaking in New Delhi, India. 6 January 2000.

Reduction in malaria deaths in Vietnam

- 4.3 At the beginning of the 1990s nearly 5000 people a year died from malaria in Vietnam. Many more were made very ill with this serious disease which causes at least 300 million acute illnesses and over 1 million deaths worldwide.
- 4.4 In Vietnam a four year campaign between 1992 and 1998 reduced deaths from malaria by over 90%.
- 4.5 This dramatic success was achieved by government commitment, additional funding, low cost interventions (e.g. house spraying and insecticide-impregnated bed nets) and the hard efforts of local health workers.

Free treatment reduces malaria deaths in Vietnam



Source: Removing obstacles to healthy development. Geneva: WHO, 1999.

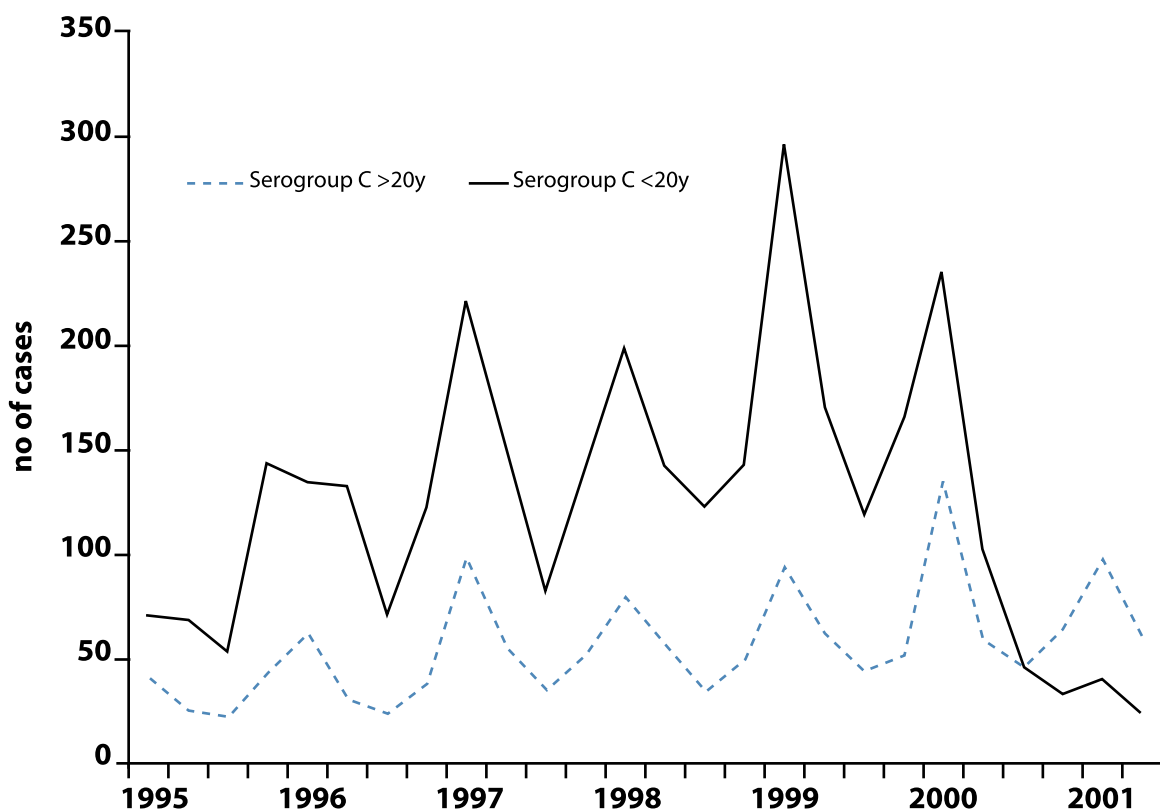


Meningococcal C disease in children dramatically reduced in England

- 4.6 In the winters of 1998 and 1999, the newspapers in Britain were full of stories of children and teenagers who had died tragically from meningitis or septicaemia (blood poisoning) caused by the bacterium *Meningococcus C*.
- 4.7 In the years 1997, 1998 and 1999 approximately 930, 970 and 1200 young people a year respectively fell ill with the disease, many very seriously and around 10% died each year. Meningococcal infection was the commonest cause of death in children aged 1 to 5 years and the commonest infectious disease cause of death in children and young people.
- 4.8 Although there was a vaccine it gave only limited protection and this waned after a few years. In under 2s, those most at risk from Group C meningococcal infection, the vaccine did not work at all.

- 4.9 From the mid-1990s, the UK saw a rise in cases of meningococcal disease and an increase in the proportion due to Group C infection. After identifying that the vaccine manufacturers could develop new conjugate Group C meningococcal vaccines that might give long term protection and work for all ages, the UK moved to invest in trials of candidate vaccines. The result was an acceleration in the availability of these vaccines. By 1999 the UK was the first country in the world to launch a conjugate meningococcal Group C vaccine.
- 4.10 The immunisation campaign launch in November 1999 aimed to offer the vaccine to everyone under the age of 18 years by the end of the year 2000 and was the largest immunisation programme since the introduction of polio vaccine some 40 years earlier. Vaccine was delivered to the NHS immediately as it came in from the manufacturers to allow a phased campaign to be run, picking off those most at risk by age, as sufficient vaccine became available.
- 4.11 By the end of 2000 everyone in England under 18 years had had the chance to be immunised. The result has been a dramatic reduction in the disease.

Laboratory Confirmed Cases of Meningococcal Disease (by quarter) England & Wales Serogroup C By Age Group



- 4.12 The vaccine appears to be very effective. After 18 million doses had been distributed, there had been only 18 vaccine failures. This suggests a vaccine efficacy of 92 – 97% depending on the age of the recipient: coverage for babies has been above 90%; the campaign coverage overall was in excess of 80%.
- 4.13 The number of confirmed group C cases in England and Wales in 1998/9 before the campaign and in 2000/01 after the campaign has been compared.

Laboratory Confirmed Reports of Group C Meningococcal Disease England & Wales in <20 year olds, 1999 (weeks 1-43) compared to 2001 (weeks 1-43)			
Age Group (years)	1999	2001*	% Reduction
<1y	81	18	78%
1-2y	100	22	78%
3-4y	79	7	91%
5-9y	91	4	95%
10-14y	76	8	89%
15-19y	172	23	87%
Total	599	82	86%

*2001 data are provisional
Source: PHLS CDSC
& Meningococcal
Reference Unit

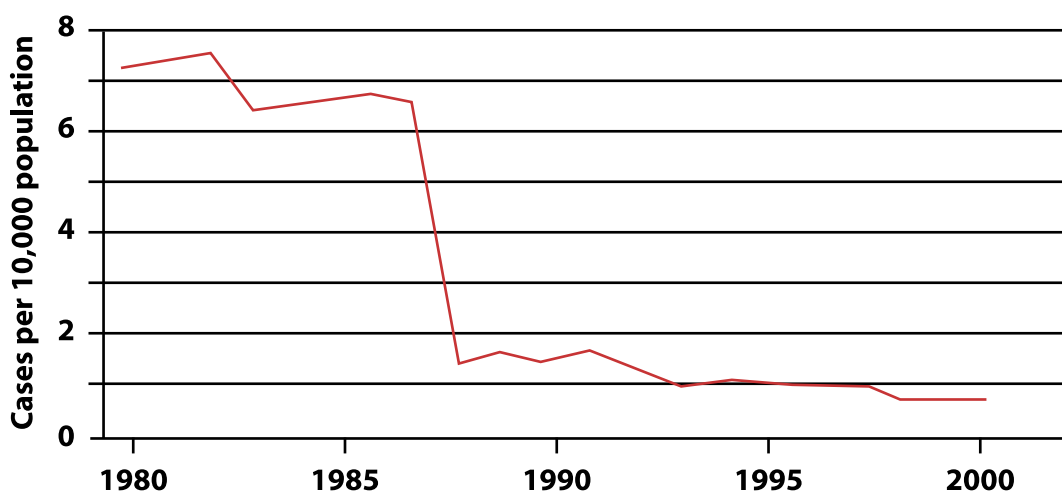
- 4.14 The first quarter of each year is usually the time when the most meningococcal cases occur. In the first quarter of 1999, before the campaign started, there were 40 deaths in people less than 20 years. In the same period in 2001, there were only four deaths. Over the same periods, deaths in those over 20 years rose from 24 to 32.

Breakthrough in the control of leprosy in Sri Lanka

- 4.15 Leprosy is a disease documented since biblical times. Images from history of a leper ringing a bell to warn of their impending arrival and the existence of leper colonies until the beginning of the 20th century show that the disease was a source of fear and disgust.

- 4.16 The bacterium *Mycobacterium leprae* that causes leprosy belongs to the same family as the tuberculosis bacterium. Leprosy affects the peripheral nerves and causes deformity of the limbs and loss of tissue and severe disfigurement. There are two broad types determined by the host immune response – the greater the host response the greater the severity of the accompanying nerve damage. Person to person spread is thought to occur, especially from those with lepromatous leprosy where the host response is less marked but the infectious burden is much higher. The precise route of transmission is unknown. There have been no indigenous cases of leprosy in the UK in the last several decades, although imported cases occur infrequently.
- 4.17 The disease was curable from the early 1950s when drug therapy became available. It continued in pockets around the world and as drug-resistant organisms emerged it could not be eradicated in some countries where it remained a serious health problem.
- 4.18 In Sri Lanka, an anti-leprosy programme was started in 1954. It had an early positive impact but progress was slow and over several decades drug-resistant strains of the bacterium emerged. In 1990, with the disease still prevalent in the population a campaign was launched by the Sri Lankan ministry of health together with charities. The campaign was broad based and aimed to change the public image of leprosy so that people would not be fearful of identifying or coming forward with the disease. This campaign was implemented through mass media advertising, TV soap operas, training of opinion leaders, teachers and village women and education for school children. Treatment was made available close to local centres of population and attention was given to treatment regimes and ensuring compliance with therapy. New generations of leprosy treatment made effective treatment possible.
- 4.19 The results of the programme were spectacular. In less than a year case detection rates had increased by 150%. In the year prior to the campaign only 9% of new cases were self-reported, whilst a year into the campaign this figure had jumped to 50%. With higher levels of self-reporting, reduction of the stigma associated with the disease and well-organised diagnostic, treatment and follow-up services, Sri Lanka was able to clear the backlog of cases and reduce the pool of infection to a prevalence rate of 1 per 100,000 population (a figure which meets the WHO definition for the elimination of leprosy as a public health problem).

Prevalence rate of leprosy in Sri Lanka from 1980 to 2000

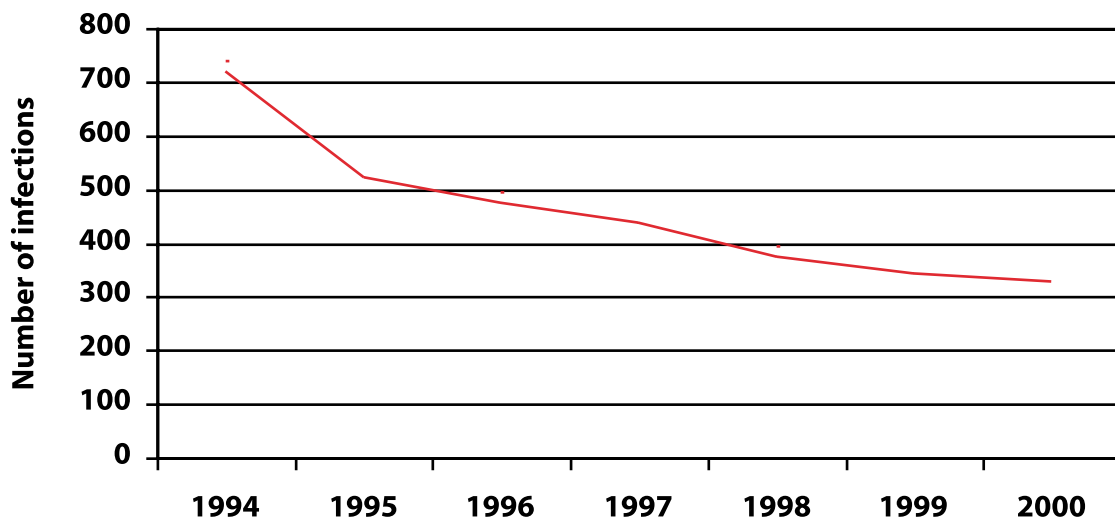


Source: Leprosy: Learning from success. Geneva: WHO, 2001.

Confronting AIDS in the Caribbean

- 4.20 Amongst countries in the Caribbean, the Bahamas has been particularly badly affected by HIV and AIDS throughout the history of the world-wide epidemic. The epidemic in the Bahamas was fuelled by migration from Haiti which was another Caribbean country very seriously affected though by the mid-1980s immigration was not a major factor in sustaining the epidemic.
- 4.21 Between 1989 and 1996 AIDS moved to become the third highest cause of death in infants.
- 4.22 Over the period 1994 to the present the Bahamas government has embarked on a programme of prevention and care for HIV/AIDS which involves mass communication and education, promotion of voluntary counselling and testing, stronger management of sexually transmitted diseases, active interventions to reduce mother to child transmission, modern approaches to diagnosis and therapy, and widespread engagement of community-based stakeholder organisations.
- 4.23 As a result the programme has had a major impact:
- Mother to child transmission of HIV reduced by 57%;
 - A 55% reduction in the number of new reported HIV cases;
 - Increase in condom sales of 33%;
 - Child mortality rate more than halved;
 - Deaths from AIDS reduced by 64%.

Declining new HIV infections reported annually in the Bahamas, 1994-2000

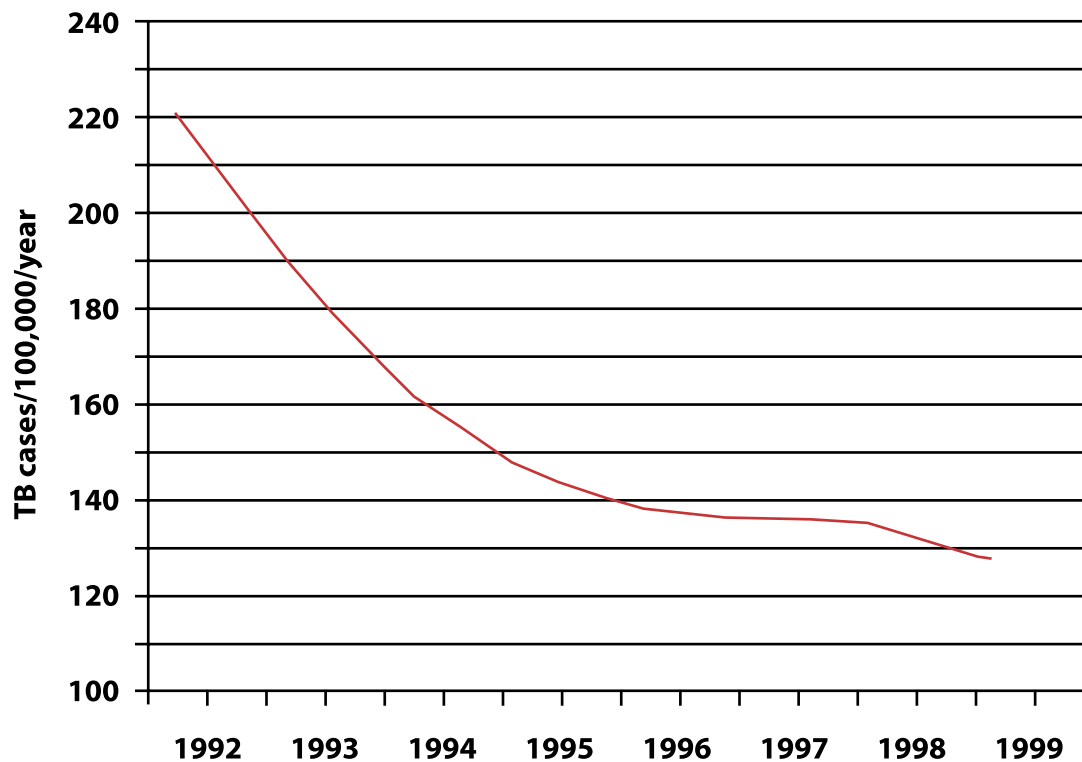


Source: National HIV/AIDS Surveillance Report 2000, Ministry of Health, Bahamas.

Peru set to halve new tuberculosis cases every ten years

- 4.24 Peru is a country with one of the highest tuberculosis incidence rates in the Americas. The World Health Organisation puts it amongst the 22 countries in the world accounting for 80% of all new cases of tuberculosis. Before 1990 only half the people in Peru diagnosed with tuberculosis were able to get treatment and of those only half were treated successfully. There were shortages of drugs, records were poorly organised, health workers were overburdened and the country's infrastructure had been destroyed by guerrilla war.
- 4.25 From 1990 the government of Peru gave a high level political commitment to turning back the tide on tuberculosis. Extra investment was made, the DOTS control programme was chosen as the main vehicle to tackle tuberculosis and out-reach services and supplies were given particularly to remote areas.
- 4.26 By 1997 the whole population was enrolled in the DOTS programme and by 1998, over 90% of cases were detected. Peru has brought about a systematic decline in tuberculosis and is one of the first countries in the world with a high burden from this disease to begin to reverse the trend.

The DOTS control programme reduces pulmonary tuberculosis cases in Peru



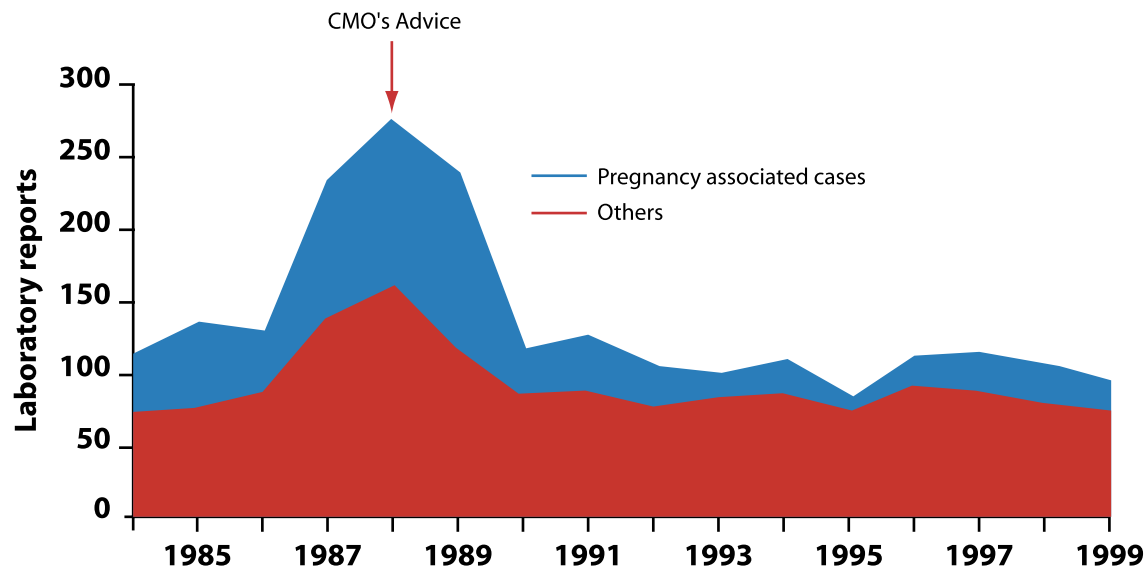
Source: WHO/CDS

Note: DOTS is a strategy for TB control (see para 3.15)

Listeriosis in pregnancy falls in the United Kingdom

- 4.27 The bacteria which cause listeriosis, *Listeria monocytogenes*, are commonly found in the environment and in food producing animals. They cause disease in people with pregnant women, neonates, the elderly and the immunocompromised recognised as being high risk groups. *Listeria monocytogenes* infection in healthy adults is usually a mild illness however, infection in neonates, pregnant women, the elderly and immunocompromised patients can be severe resulting in meningitis or blood poisoning. In pregnancy infection may lead to loss of the baby or to severe infection in the newborn child. The death rate in listeriosis cases is high ranging from 20-40%.
- 4.28 An unusual feature of *Listeria monocytogenes* is that it can survive and grow at refrigeration temperatures. The foods associated with listeriosis generally have extended refrigerated shelf lives and are often eaten without further cooking.
- 4.29 The number of cases of listeriosis in this country started to rise in the late 1980s affecting all vulnerable groups, but especially pregnant women.

Listeriosis in England and Wales fell after public health action



Source: PHLS CDSC & FSML

- 4.30 Intensive investigations showed that the increase was largely due to contaminated imported pâté, which was withdrawn. The Department of Health issued advice to pregnant women and the immunocompromised to avoid eating soft cheeses and pâtés, and to reheat certain chilled foods. The advice to pregnant women was subsequently reiterated in a booklet. The food industry also responded promptly to the problems uncovered during these, and other, investigations. Cases of listeriosis fell and have remained low ever since.
- 4.31 The control of listeriosis in pregnant women in the UK has been a success and holds an important lesson. People were given appropriate, accessible advice and, armed with this information, were empowered to make informed choices about their eating patterns.

Chapter 5:

A modern system to combat the infectious disease and wider health protection threat

5.1 The broad functions which are necessary to provide an effective response to the challenge posed by the many infectious diseases that potentially threaten human health are:

- Comprehensive preventive action including active public education and involvement, suitable professional education and training, immunisation programmes, technological measures, good hygiene practice;
- Early recognition, notification to the public health authorities and accurate clinical and laboratory diagnosis of infection;
- Treatment and care for people with infection and for any long term consequences of their infection;
- A strong system of surveillance supported by fully accredited diagnostic and reference microbiology services;
- Clear public health control measures tailored to each major infectious disease problem;
- Rapid expert response to investigate and control epidemics, incidents and outbreaks;
- Effective links with other national and international bodies;
- Good communication with the public;
- Ongoing research and development programmes to improve all aspects of infectious disease control.

5.2 In this chapter the main components of a system to carry out these functions are set out with an analysis of present weaknesses and discussion of how they should be strengthened.

World class surveillance

- 5.3 The bedrock of infectious disease prevention and control is high quality clinical expertise, microbiology and surveillance which allows outbreaks or epidemics to be anticipated and prevented, disease trends to be tracked, new and emerging diseases to be spotted, epidemics and outbreaks to be identified, and the impact of control measures to be evaluated.
- 5.4 A distinction is often made between ‘passive’ and ‘active’ surveillance and ‘sentinel’ reporting of infectious disease events. Passive surveillance is where data are gathered from a variety of clinical and laboratory sources to provide information on the occurrence of the particular infection. A list of ‘reportable’ diseases is created and a requirement is laid on health professionals and laboratories to accurately report cases that they encounter. Active surveillance involves searching for evidence of particular infectious diseases. This method of surveillance is particularly used during a campaign or programme with particular targets to reduce or eliminate a disease (e.g. during an intensive vaccination programme).
- 5.5 Sentinel reporting relies on reports from a representative sample of authorities, clinicians or laboratories or from a particular group of specialists. Where the specialists are in a field of care where they are likely to see a high proportion of the people with the disease concerned, reporting will be almost complete. By gathering data specifically from such care providers it is possible to track the occurrence of a disease quite reliably. One example is genitourinary medicine (GUM) clinics which see the majority of people with major sexually transmitted diseases and a second example is that of consultant neurologists who see clinically and are asked to report cases of Creutzfeldt-Jakob disease (CJD).
- 5.6 A diversity of surveillance systems currently exists, the main components of which are:
- Data derived from the reporting of certain statutorily notifiable diseases by doctors through local authorities or through other arrangements such as those for which the Health and Safety Executive is responsible;
 - Data derived from laboratories which have undertaken diagnostic or reference tests of samples to detect the presence of micro-organisms or toxins;
 - Clinical reporting from particular areas of care e.g. the Royal College of General Practitioners weekly returns of conditions seen in general practice;

- Reports from certain national infection reporting systems focusing on particular diseases or problems e.g. the HIV/AIDS clinician and laboratory reporting system, statistical returns from genitourinary medicine clinics;
- Data from special surveys, such as the unlinked anonymous surveys of HIV and hepatitis infection, and seroprevalence surveys to assess population immunity to diphtheria or tetanus;
- Reports of rare diseases, as undertaken by the British Paediatric Surveillance Unit;
- Information on hospital admissions and other administrative data;
- Mortality statistics from the Office for National Statistics.

5.7 The flow of information varies. Statutory notifications go to the local 'proper officer' (normally now the Consultant in Communicable Disease Control), who forwards aggregate data to the Public Health Laboratory Service Communicable Diseases Surveillance Centre for national collation, analysis and dissemination. Laboratory reports are sent voluntarily from diagnostic and specialist reference laboratories usually in parallel to the local Consultant in Communicable Disease Control and to the Communicable Diseases Surveillance Centre. Clinical reports are sent to the organisation running the particular surveillance scheme, and then by agreement to the Communicable Diseases Surveillance Centre.

5.8 Without surveillance and specialist laboratory diagnostics it would not have been possible to have tracked the epidemic of HIV or AIDS, nor to have identified the first cases of variant Creutzfeldt-Jakob disease (vCJD) nor could the annual preparation of an adequate vaccine to prevent influenza take place, nor could the threat from bioterrorism be addressed.

5.9 Yet surveillance is often taken for granted, assumed to be present, a function almost taking care of itself. Although the system of infectious disease surveillance in the United Kingdom is much stronger than in many other countries it has not had particularly high attention and investment in the past. Just a few examples emphasise the gaps in surveillance coverage of infectious disease problems:

- It is incomplete – there is no compulsion to report aside from the statutorily notifiable diseases and even these are under-reported;
- There is no comprehensive surveillance of antibiotic resistant organisms (despite their being one of the most worrying health problems in the world);
- The true burden of chronic liver disease resulting from viral hepatitis is unknown;
- Meaningful information on rates of all health care associated infections is not available;
- Much reporting is still paper based, although gradually more laboratory and clinical data are being gathered electronically;
- No single body is charged with responsibility for all surveillance;
- There is limited linkage of surveillance of human infections to food, veterinary or environmental surveillance or to clinical surveillance systems (e.g. antibiotic prescribing or numbers of immunosuppressed patients). An infection of *E coli* O157 acquired by a child on a farm visit is arguably not notifiable;
- Feedback of relevant information to those who report it is not as strong as it could be and does not help clinicians feel part of the public health protection system.

- 5.11** The first step in the chain of surveillance is at the clinical level. It is vital to ensure that when a patient is seen by a health professional there is awareness that their illness may be caused by infection and that as accurate a diagnosis as possible is made. At present this only occurs in a proportion of cases. Thereafter, there are numerous links in the chain, which may affect the validity of surveillance, for example: the decision by the clinician whether a test should be done to confirm the diagnosis, whether a specimen of sufficient quality is taken, stored and transported adequately; quality of the initial microbiological test; whether the laboratory undertaking the test decides to refer it to a specialist laboratory; and the extent to which information is properly collated, analysed, interpreted and reported.
- 5.12** While diversity is unavoidable, it is important that surveillance fulfils two broad purposes. Firstly, to provide up-to-date, useful and accurate information to those responsible for the prevention and control of infectious diseases at local level. Secondly, to provide similarly high quality information at regional and national levels to enable infectious disease trends, patterns, epidemics and outbreaks to be identified as well as to provide the basis for policy to be formulated and control programmes to be designed and evaluated. It follows that surveillance must also evolve to answer the relevant questions of the day.
- 5.13** The current surveillance function fulfils these purposes partly. Although outbreaks and new incidents are generally recognised quickly, allowing a rapid and appropriate response, ongoing comprehensive, co-ordinated surveillance information is not always available in a timely way at local or national levels.
- 5.14** Little clinical information is linked to antimicrobial susceptibility reporting, so that the clinical consequences of antimicrobial resistance are largely unknown. Primary care surveillance is largely separately run. Close links and better alignment of objectives and methodologies are only now beginning in many areas, to assess the links between animal and human infections including those resistant to antimicrobials.

- 5.15** An important part of the process of surveillance involves the use of data to identify and solve problems at local level. A weakness in the past has been that local public health professionals have not always had up-to-date information tailored to their needs. It is almost inevitable given the size of the country that a purely national to local flow of information will not be fit for purpose. The regional public health observatories established in the year 2000 are already playing a vital role in relation to other aspects of health surveillance. There would be major advantages in them being linked in to the use of surveillance data on infections.
- 5.16** There is thus considerable opportunity to modernise the surveillance system making use particularly of modern electronic means of data entry, capture and analysis.
- 5.17** A major improvement in the quality and comprehensiveness of information for surveillance of infectious diseases would occur if:
- It is uniformly recognised that contributing to surveillance is an integral part of clinical care and public health protection;
 - There is a high level of awareness amongst patients and health professionals that an illness might be caused by infection and that it was very important that it was accurately diagnosed;
 - A more consistent approach is taken to sampling for certain specific infections;
 - Diagnostic microbiology laboratories give equal emphasis to their public health protection role as to their clinical diagnostic role;
 - Clinical and laboratory reporting of infection are linked and made mandatory;
 - Reporting is made easier, for instance through greater use of compatible electronic information systems;
 - The surveillance of infectious disease was linked to regional public health observatories;
 - Ways are found to gather information on the occurrence of infection directly from the public;
 - There is greater alignment of national and European surveillance.

Organisation of services

5.18 The responsibility for the prevention, control and treatment of infectious diseases in England currently is split between the Department of Health, the NHS, and local government authorities including those responsible for port health. Support is provided for the diagnosis of infection and surveillance of infectious diseases at a population level by the Public Health Laboratory Service, its Communicable Disease Surveillance Centre and certain other national bodies.

Department of Health

5.19 As a department of national government the Department of Health has a key role to protect the public health and in particular, in relation to infectious diseases in England:

- Setting strategy and policy for the prevention, treatment and control of infectious diseases;
- Working with other government departments on issues relevant to infectious disease control;
- Ensuring policy is backed by appropriate legislation and regulation;
- Ensuring that effective arrangements are in place within the NHS and local government for the prevention, treatment and control of infections;
- Assuring through the NHS management system that high quality performance is attained in relation to all aspects of infectious disease prevention, control and treatment;
- Horizon scanning and maintaining an overview of infectious disease trends and patterns and strengthening policy and action where necessary;
- Taking charge when a number of agencies are involved, or national controls are required;
- Agreeing work programmes and providing resources for the Public Health Laboratory Service and certain other national bodies;
- Contributing to an effective international collaboration on infectious disease prevention and control, including surveillance, international regulation of travel and traveller's health.

- 5.20 In the case of local authorities and port health authorities, the Department of Health is responsible for the legislation which sets out the authorities' role in relation to infectious disease in people, but funding is provided as part of the local government settlement on which the Department for Transport, Local Government and the Regions has the lead.
- 5.21 The Department of Health delivers these functions under the overall leadership of the Chief Medical Officer who is responsible for advising Health Ministers. A Division whose functions include infectious disease and wider health protection policy provides support. Eight regional directors of public health currently operate from the Department's NHS regional offices.

Local authorities

- 5.22 Local authorities play an important role in infection control. Public health legislation, in particular the Public Health (Control of Disease) Act 1984, places some responsibilities and powers for infection control on local authorities. Each local authority is required to appoint a Proper Officer. The Act gives local authorities discretion as to who this should be, but guidance from central government has long been that this should be the local Consultant in Communicable Disease Control. Some diseases must be notified to the Proper Officer and Proper Officers are given various powers of investigation and control but only in regard to those specified diseases.
- 5.23 In practice, the main work of local authorities in infection control relates to those infections which are environmental in origin (food, vector or water-borne). The investigation of outbreaks, for example, of food poisoning and the prevention of spread of diseases in the community is carried out by Environmental Health Officers (EHOs) working with the Proper Officer and laboratories.
- 5.24 There has been a lack of clarity about the roles and responsibilities in infection control between local authorities and health authorities although this is tempered by practical working arrangements. In the main, these problems derive from the rigidity of the legislation which has not been reviewed for many years and especially in the light of NHS changes.
- 5.25 The 1984 Act does not codify the responsibilities of the different organisations. Rather, it confers certain reserve powers (these issues are discussed in more detail later in this chapter). Certain diseases are not properly covered or investigative roles made clear e.g. E coli O157 acquired from animals, or tuberculosis which may be infectious and carried by someone in the community and difficult to track or trace.

5.26 Many of the activities of local authorities for example planning and building controls over drainage and design of buildings and their waste management functions have in their historic origins the control of the spread of infection through hygienic design and management.

The NHS

5.27 The NHS has responsibility for diagnosing, treating and caring for people with infectious diseases. The majority of these services are in primary care, with others in clinics, such as genitourinary or HIV and AIDS services. These are backed up by specialist infectious diseases units with special isolation facilities, including two high security isolation units for the management of patients with highly infectious dangerous pathogens.

5.28 The NHS also has responsibility for improving and protecting the health of populations. One strand of this population health (or public health) function relates to infectious diseases. Essentially the NHS is responsible for:

- Local surveillance of infectious diseases;
- Organising effective programmes to prevent the transmission of infectious diseases (e.g. implementing national policies such as immunisation programmes);
- Working with local authorities and other government agencies to manage local outbreaks to establish their cause, to reduce their impact and further spread of the disease;
- Reducing the risk to patients from infectious diseases in health care premises and associated with health care interventions;
- Providing medical support to local authorities to enable them to discharge their responsibilities under public health legislation;
- Ensuring proper diagnostic and treatment facilities for people with infections (including isolation facilities for those with highly infectious diseases).

5.29 Until now, accountability for these functions has rested with health authorities. In practice, day-to-day management responsibility rests with a team led by a Consultant in Communicable Disease Control based within the director of public health's department in the health authority. In hospitals, the primary responsibility for infection control rests with the Infection Control Team.

5.30 In July 2001, plans (Shifting the Balance of Power within the NHS: Securing Delivery, London: Department of Health, 2001) were published to restructure the NHS at regional and local level. More responsibility will be given to primary care trusts, the number of health authorities will be reduced from 95 at present to around 30, and regional offices of the NHS Executive will be abolished. These changes have an important bearing on the public health functions, including infectious disease control. A regional director of public health will be present in every regional office of government making up the Department of Health public health function. The regional director of public health will, amongst other responsibilities, be accountable for the protection of health (including against infectious diseases and environmental hazards) across the region. The document makes clear that there will be an effective public health function at local level delivered to the primary care trusts and involving strategic health authorities and public health networks. Networks are necessary for proper delivery of specialist areas of public health which cannot be present in every primary care trust. The detailed design of these health protection functions is covered in the proposals set out in chapter six.

Public Health Laboratory Service

- 5.31** The Public Health Laboratory Service (PHLS) is a non-departmental public body established in 1947, under the legislation which created the NHS. It has its origins in an Emergency Public Health Laboratory Service established at the beginning of the Second World War to combat the potential threat of bacteriological warfare.
- 5.32** At the end of the war, it continued to function but in a wider role undertaking microbiological laboratory work and related field investigations required for the diagnosis, prevention and control of infectious diseases.
- 5.33** Today the PHLS comprises:
- A network of eight groups of public health laboratories – made up of 46 local laboratories in total (including some specialist and reference laboratories);
 - The Central Public Health Laboratory (CPHL), at Colindale in London which undertakes specialist and reference work in relation to the diagnosis of infection and characterisation of the organisms involved;

- Other special laboratories located at the London School of Hygiene and Tropical Medicine and University College Hospital, London;
 - The Communicable Diseases Surveillance Centre (CDSC), at Colindale with its 8 regional offices in England;
 - A management headquarters at Colindale.
- 5.34 The PHLS serves health ministers in England and Wales. It also has collaborative agreements with the Scottish Centre for Infection and Environmental Health (SCIEH), the CDSC has regional units in Northern Ireland, and CPHL provides some reference microbiology functions for Scotland and Northern Ireland within a Service Level Agreement.
- 5.35 The PHLS is organisationally complex. It is managed as a single executive body from the headquarters and essentially runs in three distinct but intertwined entities:
- The eight groups of laboratories, providing diagnostic, outbreak investigation support services and advice to the NHS and local authorities. The laboratories also test food and water samples;
 - The reference laboratories (mainly at the CPHL), providing specialist diagnosis, testing and advice, and outbreak investigation support; and
 - CDSC, providing national and regional surveillance and operational support for management of outbreaks.
- 5.36 The PHLS is managed by a board, consisting of a chair, deputy chair, and 15 non-executive directors appointed by the Secretary of State for Health. The PHLS has a director and two deputy directors (one of them medical and the other in charge of corporate planning and resources).
- 5.37 The CDSC was established in 1977 and is administered by the PHLS Board with the remit of providing “a co-ordinated and expanded information centre to exercise responsibility on behalf of the Chief Medical Officer for those duties relating to surveillance and advice on the control of outbreaks”.

5.38 Over the last 20 years, the role of the CDSC, and of microbiology, has greatly expanded in response to the growing importance and changing nature of infectious diseases and has encompassed:

- New areas of infectious disease e.g. HIV/AIDS, *Helicobacter pylori*, as they have arisen as well as enhanced surveillance of existing diseases as they have grown in importance (e.g. hepatitis, meningococcal disease);
- Surveillance in certain specialist fields in collaboration with other agencies (e.g. water-borne infections with the Drinking Water Inspectorate and blood-borne infections with the National Blood Authority);
- Enhanced roles in relation to immunisation and vaccination including monitoring new vaccines, vaccine uptake levels, evaluating vaccine effectiveness, confirmation of apparent vaccine failure, and investigating vaccine safety issues;
- Assisting in the development of policy on infectious diseases;
- Greater operational support to the NHS in the prevention and control of infection and outbreak investigation;
- International surveillance;
- Teaching, training, research and development;
- Communication with the public.

5.39 Since 1996, a regional epidemiology function has been established by CDSC and is located in each current NHS regional office accountable to the regional director of public health. The key responsibility is that of leading the co-ordination of communicable disease prevention and control activities that cross local boundaries. The main elements of the service, delivered by regional epidemiologists, are:

- Surveillance: all eight regional units collect and analyse data from laboratory and notification sources as well as carry out specialised surveillance in support of local and national initiatives. Certain regional units carry responsibilities for national surveillance.
- Advice and support to NHS regional offices and health authorities in England. This has included working in conjunction with regional offices to support implementation of initiatives such as those on hospital acquired infection and antimicrobial resistance;

- Advice to professionals on communicable disease control matters, including operational support in outbreaks, especially those involving more than one district or one region;
- Promotion of professional standards including teaching, training and audit.

Other national bodies concerned with infectious disease control

- 5.40 There are a number of government departments with an interest in infectious disease control and other aspects of health protection – the Department for the Environment, Food and Rural Affairs (including the Drinking Water Inspectorate), the Environment Agency, the Health and Safety Executive, the Department of Transport, Local Government and the Regions, and the Food Standards Agency.
- 5.41 **The Department for the Environment, Food and Rural Affairs (DEFRA)** has the overall aim of promoting sustainable development and a better environment. A key objective within that is the protection of public health in relation to food and animal diseases which can be transmitted to humans. It is responsible for controlling and monitoring animal health, and for assessing the risks of transmission of disease between animals and humans in conjunction with the Department of Health.
- 5.42 **The Drinking Water Inspectorate (DWI)**, now part of DEFRA, is responsible for assuring the safety and integrity of public water supplies, and auditing the performance of water companies.
- 5.43 **The Environment Agency (EA)** is the main “competent authority” under the European Waste Framework Directive, and is responsible for assessing, monitoring and reporting the impact of waste disposal by incineration or landfill, to ensure that it does not harm human health or the environment.

- 5.44 **The Health and Safety Executive (HSE)** is an agency set up at 'arm's-length' from Government to improve health and safety at work and help reduce risks to workers and the public from injuries and ill health caused by work activities. It does not have a primary role in infectious disease control, though there are occasions when the HSE would become involved in such matters for example in legionnaires' disease. It is responsible for the enforcement of provisions in the Control of Substances Hazardous to Health Regulations and the Genetically Modified Organisms (Controlled Use) Regulations relating to the containment and handling of certain biological agents in the workplace. It also addresses infectious disease risks in the laboratory or other workplaces.
- 5.45 **The Food Standards Agency (FSA)** was established in April 2000 under the Food Standards Act 1999. Its establishment came in the wake of public concern about the handling of the BSE epidemic. Its fundamental role is to protect the public from risks which may arise in connection with the consumption of food, and otherwise to protect the interests of consumers in relation to food. It operates under three guiding principles: putting the consumer first; being open and accessible; and being an independent voice. It was created as an organisation at arms length from Ministers and is headed by a Board to which its staff are accountable. The FSA is responsible for providing the central government response to outbreaks of foodborne disease and operating the food hazard warning system. It is also responsible for developing and implementing policies to address all microbial hazards associated with food and has set, as a key objective, a target of reducing foodborne disease by 20% by April 2006.
- 5.46 **The National Institute for Biological Standards and Control (NIBSC)** is responsible for providing reference standards to control and standardise the quality and safety of vaccines and other biological medicines, testing samples of batches if required and re-testing any samples that may have been associated with suspected adverse events. It also undertakes research into vaccine safety. It contributes nationally and internationally to surveillance of poliomyelitis and influenza.
- 5.47 **The National Institute for Medical Research (NIMR)** is part of a World Health Organisation network that works on early identification of influenza viruses so that new vaccines can be made each year in advance of the influenza season.
- 5.48 **The Centre for Applied Microbiology and Research (CAMR)** is the executive arm of the Microbiological Research Authority, a special health authority established in 1994 to conduct research on microbiological hazards associated with health care, and to develop and manufacture diagnostic,

prophylactic and therapeutic products. Increasingly CAMR is fulfilling a wider public health role in supporting the management of new and emerging infections (e.g. diagnostic testing).

- 5.49 **The United Kingdom Xenotransplantation Interim Regulatory Authority (UKXIRA)** role is to advise the Secretaries of State for Health, Northern Ireland, Scotland and Wales on the action necessary to regulate xenotransplantation. It proposes the overall approach and principles, and provide guidance for monitoring and surveillance of potential infections which may be associated with xenotransplantation.
- 5.50 **Committees** also give advice to the government on infectious diseases issues and help with the development of policy. They include for example: the Spongiform Encephalopathy Advisory Committee (SEAC) which advises on the risks and control of transmissible spongiform encephalopathies and has been very active during the BSE and vCJD epidemics.

National bodies which advise the government on infectious diseases

- Public Health Laboratory Service (PHLS)
- National Institute for Biological Standards and Control (NIBSC)
- Centre for Applied Microbiology and Research (CAMR)
- Advisory Committee on Dangerous Pathogens (ACDP)
- Advisory Group on Hepatitis (AGH)
- Expert Advisory Group on AIDS (EAGA)
- Joint Committee on Vaccination and Immunisation (JCVI)
- Specialist Advisory Committee on Antimicrobial Resistance (SACAR)
- Spongiform Encephalopathy Advisory Committee (SEAC) and its sub-committees
- UK Advisory Panel for Health Care Workers Infected with Blood-borne Viruses (UKAP)
- Advisory Committee on the Microbiological Safety of Food (ACMSF)
- Committee for the Microbiological Safety of Blood and Tissues
- UK Zoonoses Group
- The United Kingdom Xenotransplantation Interim Regulatory Authority (UKXIRA)

Diagnostic and reference microbiology laboratories

5.51 The accurate diagnosis of infection is essential to effective treatment, to high quality surveillance, to the control of outbreaks and epidemics and to the successful prevention of infectious diseases. The definitive diagnosis of infection is made through laboratory testing of samples from patients.

Local laboratories

5.52 There are over 330 clinical laboratories in England undertaking microbiological tests. Predominantly based within NHS hospitals they provide diagnoses for patients being cared for as hospital inpatients or outpatients, with a focus on bacteriological analyses. Most also provide a diagnostic service for local general practitioners. Some local hospital microbiology services are provided, under contract, by one of the Public Health Laboratory Service laboratories, and a very small number are run by independent sector companies on a contractual basis.

5.53 Virus testing and similarly more specialised microbiological testing is undertaken mostly in the microbiology departments of larger teaching hospitals, Public Health Laboratories, including some PHLS reference laboratories, and university departments of microbiology. Newer technology is allowing more virus testing to be carried out by local level laboratories. Further development of molecular diagnostics combined with reduced numbers of virologists may reverse this trend.

5.54 There are four main public health functions of microbiology laboratories. These are the provision of appropriate specimens to reference laboratories, the provision of data to public health departments as well as assisting in the management of incidents and the development of local policy. Most local NHS laboratories provide information for public health purposes and therefore contribute to population level surveillance of infectious diseases locally and nationally but this is an informal arrangement. Variation exists in the contribution of laboratories to the investigation of incidents of infectious disease. There is a need to bring consistency to the delivery of the public health functions of laboratories and standardise on current good practices.

Public health laboratories

5.55 Public health laboratories are run by the Public Health Laboratory Service. There are 46 of them in eight groups in England and Wales. They undertake microbiological testing of food, water and environmental samples, as well as testing of samples from patients and so contribute to clinical diagnosis and national surveillance. PHLS laboratories including reference laboratories conform to agreed service specifications including accreditation and participation in quality assurance programmes. All public health laboratories provide the required public health functions. Some private laboratories also offer food, water and environmental microbiological services.

Specialist and reference laboratories

5.56 Reference laboratories undertake either detailed testing of common micro-organisms to characterise and fingerprint them or specialist testing for rare or unusual infections. They also provide a national microbiological support and expert advisory service. Many of them are World Health Organisation Reference and Collaborating Centres.

5.57 Reference microbiology has several important functions: detailed identification and typing of micro-organisms for studying the distribution of organisms and particularly for the detection and monitoring of outbreak investigations; confirming antimicrobial resistance and determining novel mechanisms of resistance for bacteria and viruses; and supporting control and prevention of health care associated infections.

5.58 Reference laboratories provide data on seroepidemiology and seroprevalence, which can be used to inform and advise national policy on infectious diseases. These and other laboratories carry out research and development, including kit evaluation, assessment of new technology, recognition of pathogenicity and virulence factors, and development of diagnostics. Reference laboratories are also centres for teaching and training.

- 5.59 Within the PHLS the majority of national reference microbiology services are located at the PHLS Central Public Health Laboratory, Colindale and are under single management. The remainder are provided by public health laboratories. Malaria and parasitology are provided on behalf of the PHLS by the London School of Hygiene and Tropical Medicine, and University College Hospital, London respectively. Anthrax, some haemorrhagic fever viruses, arboviruses and Q fever reference services are provided by the Centre for Applied Microbiological Research (CAMR). The PHLS and the Veterinary Laboratory Agency have reciprocal arrangements for brucella, botulinum toxin and rabies reference work to avoid duplication.
- 5.60 There are multiple lines of accountability for reference and specialist microbiology provision. Better co-ordination and improved support for surveillance and epidemiology could be achieved by a single point of management.
- 5.61 The PHLS reference laboratories organise national and international quality assessment schemes for food, water and clinical microbiology, which include over 220 NHS laboratories as well as the 46 public health laboratories in England and Wales. They also participate in, and in many instances lead, pathogen-specific international reference schemes.

Standardisation of testing

- 5.62 Laboratory methods differ. Accreditation procedures require laboratories to document and update their own methods. The Public Health Laboratory Service has a system of Standard Operating Procedures (SOPs) for use within its own laboratories, in order to provide a greater uniformity of approach. These include detailed specifications and guidance notes. They have been made available to other laboratories, although there is no requirement for them to be used.
- 5.63 Detailed information about an infectious organism is derived from laboratory testing. This testing occurs with different levels of detail and specialism. A detailed profile ('DNA fingerprint') of a bacterium taken from different sites where people have developed the symptoms and signs of food poisoning can establish whether there is a link between cases. This can be crucial in deciding whether an outbreak has occurred, identifying its source and taking action to prevent spread and protect further people from becoming ill.
- 5.64 Somewhat surprisingly different methods of characterising or profiling the same micro-organism may be used by veterinary reference and clinical reference laboratories.

As multiple new fingerprinting and typing methods become available it is important for there to be standardisation for micro-organisms that cause zoonotic infections.

- 5.65 Most, but not all reference microbiology laboratories work to a common service specification and are accredited.
- 5.66 Clinical diagnostic microbiology laboratories are usually managed within NHS pathology services, with little managerial separation at the local operational level. The consultant microbiologist provides clinical oversight and advice, and as the infection control doctor advice, and support to infection control staff.
- 5.67 The Pathology Modernisation Programme, set up in 1998 by the Department of Health, is encouraging rationalisation of NHS pathology services. The vision is of services serving larger populations rather than individual hospitals. The reasons for this change of emphasis are better use of scarce human resources, development of subspecialty diagnostics, efficient use of expensive sophisticated equipment, introduction of new technologies and the development of information technology. The Pathology Modernisation Programme will facilitate improvement in standardisation of testing.
- 5.68 Much clinical microbiology is labour intensive and part of the work can be carried out at a centre away from the hospital site but emergency analyses are time critical. These need rapid turn around times. Such issues are being examined in the Pathology Modernisation Programme.
- 5.69 Accreditation of NHS pathology laboratories apart from those providing cervical cytology is voluntary. Of these 52% are accredited and a further 22% have conditional approval. Steps for achieving 100% accreditation of all NHS pathology laboratories, including microbiology, (of which 53% are accredited) in the regional plans for pathology are due in June 2002. New quality standards are being introduced by CPA UK Ltd from 2003.
- 5.70 All PHLS and National Blood Service laboratories providing clinical microbiological testing to the NHS are CPA accredited. Of the independent sector laboratories 34% have CPA accreditation and 65% are registered.
- 5.71 Accreditation and universal adoption of evidence based standard operating procedures are the bedrock of continuous quality improvement in diagnostic laboratories as 60% of diagnoses in the NHS depend on diagnostic pathology universal accreditation. This will be supported by central advice in the pathology planning guidance currently being developed.

Opportunities for Improvements in Microbiological Services

Primary diagnostic microbiology

- Improvements in participation in quality assessment schemes
- Adoption of standard operating procedures
- Formation of a comprehensive network of accredited laboratories
- Improved and integrated clinical and laboratory reporting of test results and infection locally and nationally through information technology developments
- Establishment of a co-ordinated system for evaluation and managed introduction of new technology
- Further integration of testing between disciplines within pathology

Reference and specialist microbiology

- Adoption of a common service specification
- All reference laboratories to be accredited
- Improvements in co-ordination of the national reference microbiology function by adoption of a single point of management
- Clinical and veterinary laboratories adopting common methods of typing for micro-organisms causing zoonoses.

Public health legislation

- 5.72 Responsibilities for infectious disease are discharged under two very different pieces of legislation.**
- 5.73 The NHS Act provides the basis for important activities which the NHS does in relation to infectious disease. The advantages of this Act are that its purposes are broad and it provides the Secretary of State with wide powers of direction over NHS bodies. This power means that requirements can, where necessary, be spelt out – and kept up to date - in secondary legislation.**

5.74 Local authority responsibilities are set out in the Public Health (Control of Disease) Act 1984. This gives the Secretary of State a power to make regulations, but he does not have a wide power of direction of the kind that the NHS Act provides. Detailed provisions on infectious diseases are written into the Act itself. Although passed in 1984, the Act consolidated earlier legislation, much of it pre-dating the creation of the NHS and some of it even going back to Victorian times. Legislation which fully reflected advances in our understanding of how infectious diseases can best be controlled could make rather different provisions.

5.75 The main provisions are:

- a requirement for any **registered medical practitioner** to notify the local authority if s/he becomes aware of any case of food poisoning or of certain diseases. Some diseases are identified as notifiable in the Act itself; others are identified in regulations made under the Act;
- powers for **the local authority** and its officers to take certain action in order to control outbreaks of disease, including:
 - environmental control measures (such as arranging for the disinfection/destruction of material exposed to notifiable disease);
 - powers to require certain actions of individuals. For example, a person responsible for the care of a child who has or has been exposed to a notifiable disease can be ordered by the local authority's proper officer not to allow the child to go to school;
 - powers to apply to a Justice of the Peace for an order requiring a person thought to have a notifiable disease to be medically examined, or removed to hospital, or detained there in certain circumstances;
- a duty on **members of the public** not to expose others to notifiable disease, for example by using public transport when they know themselves to have a notifiable disease.

- 5.76 In January 1988, a committee chaired by Sir Donald Acheson (then Chief Medical Officer) made as one of the recommendations in its final report the proposal that the 1984 Act should be revised with a view to producing more up-to-date and relevant legislative backing to communicable disease control.
- 5.77 There was a consultation exercise in 1989. Over 500 responses were received which gave a pretty consistent view of what reform of the 1984 Act was required:
- Establishing a statutory notification scheme for laboratories (to complement the current system of notification of diseases by medical practitioners);
 - Clarifying the responsibilities of health authorities and local authorities in the area of communicable disease control;
 - Modernising and simplifying the powers of investigation and those exercised as a last resort over people, premises and property in circumstances posing a risk to public health;
 - Providing the Secretary of State with better focused reserve (or default) powers that could be exercised in the extreme event that those responsible for administering the provision of the legislation fail to do so properly, or when an outbreak of communicable disease is (or is thought to be) being seriously mishandled.
- 5.78 No change to the law was ever made and the outstanding problems with the 1984 Act remain and have been compounded by developments since the early 1990s. It is inflexible and arguably has not adapted to the changing role of local authorities, the reorientation of health service bodies towards primary care and trends in clinical practice.
- 5.79 In most parts of the country, health authorities and local authorities have established effective working relationships which make the best use of their respective skills. In some, however, this has been more difficult to secure, despite the assistance of guidance. This difficulty may have been partly due to the lack of any clear understanding of the respective roles and responsibilities of the two or more authorities in this area. Where authorities do not have co-terminous boundaries the problems are exacerbated. More generally, the absence of a general duty to provide a service has tended to result in the development of a reactive, rather than a proactive approach.

- 5.80 The traditional split of responsibilities between health and local authorities tends to be based on the ‘focus’ of the infectious disease problem - environmental hazard (usually local authority), food (usually local authority), premises (usually local authority) and person-to-person spread (usually health authority). In the case of a carrier of tuberculosis the health authority may need extensive help to locate and track infected persons.
- 5.81 In practice, the two sectors work jointly and both are assisted by national agencies and sources of expertise such as the Public Health Laboratory Service. However, lead roles, particularly in emergencies involving hazards from micro-organisms, must be clear. Moreover, the Food Standards Agency is now responsible for food safety (working through local authorities) whilst health authorities will be abolished subject to legislation.
- 5.82 There is a need to review legislation on infectious disease surveillance, prevention, control and investigation with a view to modernising it.

The workforce dealing with treatment, prevention and control of infectious diseases

- 5.83 The range of health professional staff who are involved in the prevention, control and treatment of infectious diseases is broad.
- 5.84 All doctors, nurses and other health professional staff will regularly be responsible for the diagnosis and care of patients whose illness is infective in origin. All doctors, nurses and many other health professionals would be expected to understand the principles of diagnosis and treatment of infectious diseases as well as to have detailed knowledge of the symptoms and signs of many specific infectious diseases.
- 5.85 Around 80 hospital consultants specialise in the diagnosis and treatment of infectious diseases. They are based in NHS hospitals, regional specialist centres and in academic units. They mainly treat patients with the more serious, or highly contagious, infectious diseases, including tropical diseases, but offer specialist expertise on the management of all patients with infection. They also offer specialist support in outbreak investigations and are a key source of expert advice at the national level.

- 5.86 Consultant medical microbiologists are employed in NHS or PHLS posts attached to hospital-based, clinical diagnostic laboratories. There are small numbers working in reference laboratories or holding academic appointments in teaching hospitals. Typically, consultant medical microbiologists are the source of knowledge and advice on all matters related to the diagnosis, treatment and control of infection in a locality served by their hospital microbiology laboratory.
- 5.87 Their work includes: interpretation of laboratory tests, clinical liaison with hospital staff and general practitioners, hospital and community infection control, teaching and training health care workers, laboratory management, advising and supporting the local public health function, undertaking surveillance of infection supporting outbreak investigations and research.
- 5.88 The modern consultant medical microbiologist applies and interprets the science of microbiology as a key member of multi-disciplinary teams managing infection problems in individual patients or communities – clinical teams, infection control teams and public health teams.
- 5.89 Specialist clinical virology services in the United Kingdom are provided by 44 consultant medical virologists and a dozen clinical scientists who carry out some clinical work as part of their duties.
- 5.90 In most district general hospitals, provision of virology advice again falls largely to consultant medical microbiologists, few of whom have received specialist training in this area, and amongst whom there is considerable demand for updates in both clinical and laboratory aspects of diagnostic virology.
- 5.91 The distribution of consultant clinical virologists today reflects past patterns of investment and current difficulties in filling posts, rather than current clinical need. The result is a specialty group most of whose practitioners are carrying very large clinical workloads, maldistributed geographically, and with a significant proportion of consultants practising in isolation.
- 5.92 Many infections fall to other clinical specialists to deal with. The expertise for treating tuberculosis rests largely with respiratory physicians, who work as part of a district team which includes specialist tuberculosis nurses as key members. There are some specialist areas of treatment such as genitourinary medicine that provide a unique approach with over 200 clinics throughout the country providing free, open access and confidential services.

- 5.93 Many routine practices to prevent infection are carried out as part of the day-to-day work of doctors, nurses and other professional health care staff. Every acute hospital has an infection control team which has the primary responsibility for all aspects of surveillance, prevention and control of infection in the hospital. The team is usually led by an infection control doctor and includes at least one infection control nurse. The infection control team reports to the Chief Executive through an Infection Control Committee.
- 5.94 Certain key groups of staff carry day-to-day responsibility for the prevention and control of infectious diseases at the level of local communities. Principal amongst them are Consultants in Communicable Disease Control (CsCDC). These posts (held by medically qualified staff with training in the infectious disease control side of public health) were first established in the late 1980s following a review of the public health function carried out by the then Chief Medical Officer, Sir Donald Acheson. Most are based within health authority local NHS departments of public health headed by a director of public health.
- 5.95 The current role of the CCDC has evolved from that described in 1988. Many have a more strategic role, with professionals such as specialist nurses leading on operational matters. Key responsibilities include:
- Strategic leadership and co-ordination of local programmes for communicable disease and infection control for a defined population;
 - Leadership for health protection activities which require multi-agency collaboration at local level;
 - Proper officer to one or more local authorities to discharge duties and exercise powers under the Public Health (Control of Disease) Act 1984 and the Public Health (Infectious Diseases) Regulations 1988;
 - In parts of the country with international ports and airports, additional responsibilities in relation to imported infection;
 - Investigation and management of communicable disease incidents and outbreaks;
 - Advice to those commissioning services for prevention and treatment of communicable diseases;
 - Development, co-ordination and monitoring of immunisation programmes;

- Investigation and management of the health aspects of non-infectious environmental hazards;
- Co-ordination of the local population health protection aspects of NHS emergency planning.

5.96 Current plans to restructure the NHS will necessitate changes to the way in which the functions of the current Consultants in Communicable Disease Control are delivered. Proposals for how this will take place are set out in Chapter 6.

Health protection

5.97 Infectious diseases are only one of the threats to health from the external environment – they represent the main biological threat. However, there are threats to health that arise regularly from the physical environment – for example chemical and radiation incidents.

5.98 A study in 1991 recommended that arrangements within the NHS for the investigation of acute incidents of exposure of the public to toxic substances should be developed and strengthened in England and Wales. It recommended that the service should have the capacity to perform surveillance, to provide an emergency response (entailing the provision of rapid epidemiological, laboratory and toxicological skills in the event of an acute incident) and to undertake relevant training and research. In 1993 the Department of Health issued guidance that made clear that responsibility for the co-ordination of the health response to chemical incidents rests with health authorities. Regional Service Provider Units (RSPUs) were established to provide expertise and support to health authorities in this area, as it was recognised that sufficient expertise to manage all the health aspects of such incidents is not always available locally. There are currently four such regional units in England and Wales, which offer a contractual service to health authorities for the provision of advice on managing chemical incidents.

5.99 In 1996 a study of activity on public health effects of environmental chemicals found that there was still a lack of clarity about the roles of the Department of Health and the NHS in dealing with chemical incidents. The Department of Health responded by establishing the National Focus for Chemical Incidents to co-ordinate work on chemical incidents. However, a review in 2000 of the National Focus' work concluded that there were still problems with the current system of chemical incident management. The current structure supporting the NHS was fragmented and there was inadequate central support in the event of a major incident. The review recommended that co-ordinated working would be best facilitated by a move away from the contractual system under which health authorities and RSPUs operate and that the arrangements for managing chemical incidents should be revisited.

Chemical incidents: an everyday problem

- Early in 2000, several families in Weston village, Runcorn, were permanently evacuated from their homes following the discovery that vapours from chemicals in an old industrial dump site nearby had permeated through sandstone into nearby houses.
- In May 2000, a large fire in a plastics factory in Portsmouth was declared a major incident by the emergency services. Twelve people received medical attention. A number of properties and nearby supermarkets were evacuated and people advised to stay indoors.
- Following an explosion and fire in a waste disposal plant in Sandhurst, Gloucestershire in October 2000, at least 169 residents were evacuated and 14 people decontaminated and taken to hospital.
- A leak of chlorine gas at a swimming pool in August 2001 during delivery of chemicals used in the water disinfection process resulted in 48 people requiring hospital treatment.

5.100 The National Focus based in Wales is a national co-ordinating unit providing support to the UK Health Departments and the NHS in the event of a major chemical incident.

The national focus for chemical incidents: role and functions

- A national co-ordinating unit providing advice and support to the UK health departments and the NHS on chemical hazards affecting the public health.
- Undertakes national surveillance of chemical incidents.
- Disseminates good practice and promotes training in dealing with chemical hazards and incidents.
- Provides support in the emergency response to chemical incidents which affect the public health.

5.101 The extent to which there can be major public concern about this source of threat to health and recriminations when it is believed that the public's health has not been protected is exemplified by the Lowermoor incident of 1988 (see box). This resulted in a series of detailed inquiries, litigation, and major changes to prevent any such incident in the future and to improve the responses of water companies and of the National Health Service to chemical incidents in general. The health of those affected has been investigated, and the results of the research published. This research and surveillance continues. Despite this, there are those who still feel that their concerns have not been addressed properly. Acknowledging this, Ministers have asked the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment to advise on whether the incident has resulted in delayed or persistent health effects, and on any need for additional monitoring and research.

5.102 The national Poisons Information Service (NPIS) is a UK-wide clinical toxicology service providing information and advice to health care professionals working in the NHS on the diagnosis, treatment and management of patients who may have been accidentally or deliberately poisoned. Following a major review, the NPIS has been reorganised on a regional basis with six UK centres (Belfast, Birmingham, Cardiff, Edinburgh, London and Newcastle) to provide stronger local links for the promotion of interaction with users of the service. The Department of Health leads the work of the NPIS Management Board which has responsibility for the policy and strategic management of the National Poisons Information Service (NPIS), in conjunction with the other UK health departments.

The Lowermoor incident

At South West Water's Lowermoor water treatment works near Camelford in North Cornwall in July 1988, a contractor's relief driver dumped 20 tonnes of aluminium sulphate into the wrong tank at the unmanned works, leading to contamination of the drinking water supplies to some 20000 people.

In the days, months and weeks afterwards local residents in a wide area complained about ill effects to their health. These included symptoms such as joint and muscle pains, general malaise, fatigue, memory problems, and loss of hair and nails.

The Lowermoor Incident Health Advisory Group (LIHAG) was formed at the request of the health authority, and concluded in July 1989 that the early symptoms such as nausea, vomiting, rashes and mouth ulcers were probably caused by the contamination, but that delayed or persistent effects were unlikely. LIHAG also noted the anger and mistrust in the community, and widespread concern about the possibility of long-term effects.

Suggestions that the levels of aluminium in the drinking-water were higher than had been thought, and scientific studies of the role of aluminium in Alzheimer's disease, heightened concern and led to a further investigation by LIHAG. The Group reported in November 1991 that it was not convinced that there had been harmful accumulation of aluminium, or more ill-health due to the toxic effects of the contaminated water, but it recognised that the incident and subsequent events had led to real suffering in the community. Given that the incident was unique, and that only time could tell whether there had in fact been long-term effects on health, LIHAG recommended further research and health surveillance, which is continuing.

Changes in the organisation and regulation of the water industry were already planned at the time of the incident. The incident itself led to at least three: immediate new procedures by water companies to prevent such an incident arising again; a new criminal offence of supplying water unfit for human consumption; and a statutory requirement for water companies to inform health authorities about incidents.

LIHAG made recommendations to improve the NHS handling of chemical incidents. Subsequent changes include the review and reorganisation of the National Poisons Information Service, and the creation of the National Focus for Chemical Incidents. There is now also a requirement on health authorities to contract with Regional Service Provider Units to provide them with a constant source of specialist advice and assistance on chemical incidents.

5.103 Another example of close interrelationship between agencies to provide health protection in the round are the arrangements in place for radiation incidents. A strict regulatory regime has been in place for decades to cover the safety of nuclear installation and users of radioactivity and these include inter-agency working in the preparation of emergency plans to deal with radiation accidents. These plans also have to be exercised on a regular basis. This ensures that the inter-relationships between organisations and their responsibilities continues to run smoothly. Key to the integration of these activities is the provision of robust and consistent radiation protection advice. This is provided both locally and at the national level by the National Radiological Protection Board (NRPB). NRPB also co-ordinates the activities of organisations undertaking radiation monitoring. Like the PHLS, the NRPB is a non-departmental public body. It was established in 1970 by the Radiological Protection Act. The NRPB has the capacity and expertise to monitor radiation levels, gather other relevant information on radiation exposure and its effects, by its own research and co-ordination both nationally and internationally in the field. It performs assessment of doses and risk and from those assessments provide advice to government and other agencies. During emergencies the involvement of the NRPB at all levels of response ensures that there is consistency of evidence-based advice across the board.

The National Radiological Board: role and functions

- An independent body set up by the Radiological Protection Act 1970.
- Give advice to individuals, organisations and government departments on the protection of the public health from radiation hazards.
- Provide technical services to those concerned with radiation hazards.
- Advance knowledge in the field of radiation protection.
- Provide an emergency response in the event of accidental or deliberate release of radioactive material.

5.104 The recent outbreak of foot and mouth disease (FMD), although an animal infection, raised issues of health protection of the public. The strategy for controlling the disease needed to build in an assessment of the environmental and consequent human health implications of large scale disposal of animal carcasses by burial or burning. Once a full risk assessment had been carried out and policy established, the process of implementation of the health protection measures was complex and required high level interagency co-ordination.

Foot and mouth disease: public health response

- Foot and mouth disease in the United Kingdom in the year 2001 led to the slaughter of almost four million animals (cattle, sheep, pigs).
- Disposal of carcasses became a major issue, with burial in landfill sites, high temperature incineration, rendering in plants, and burning on pyres all being options for disposal.
- The disposal policy needed to be guided by public health considerations, since there were potential risks to the public health from microbiological and prion contamination of private water supplies, increased levels of chemical pollutants in air and possible dioxin contamination of the food chain.
- The Department of Health working with scientific experts reviewed relevant evidence, including modelling, and advised on a hierarchy of disposal methods (with special reference to prion risks from older cattle), recommended distances of pyres from local communities and a monitoring programme to check air, food and water.
- Regional public health services played a major part in the management of this process: ensuring that public health guidance was followed, attending public meetings and providing regional feedback to the government co-ordination mechanism.

5.105 The foot and mouth epidemic emphasises the close interrelationship between infectious diseases in animals, infections in people and hazards in the environment. This strongly reinforces the perspective that health protection should be seen in the round and not in isolated strands of activity. Whilst the Department of Health led on the human health effects, it worked closely with the Ministry of Agriculture, Fisheries and Food (now the Department for Environment, Food and Rural Affairs), the Environment Agency, the Ministry of Defence, and the Cabinet Office. The Public Health Laboratory Service, the Environment Agency and the Food Standards Agency were involved in relevant environmental monitoring and surveillance whilst regional directors of public health and local Consultants in Communicable Disease Control implemented measures at local population level and worked closely with local authorities and military personnel. Based on the Department of Health's experience in designing and implementing mass vaccination campaigns, targeted at many millions of individuals over short periods of time, the Department of Health collaborated with MAFF in designing a cattle vaccination campaign should it be required.

Research, development and innovation

5.106 Good research and development is essential in underpinning the quality of the infectious disease prevention and control function as it is, indeed, for all aspects of health protection.

5.107 The contribution of research and development is specifically in:

- establishing the causation and pathogenesis of infection, the mode of action of particular micro-organisms and how the body's immune system responds;
- developing and evaluating effective diagnostic tests;
- understanding the epidemiology of infectious diseases, anticipating and recognising outbreaks;
- creating new safe and effective vaccines and refining existing ones;
- finding new treatments for infectious diseases;
- discovering new infectious agents;
- using existing knowledge to ensure that strategies for infectious disease control and treatment are up-to-date and evidence-based;

- supporting front line clinical and public health staff by providing ready access to knowledge.

- 5.108 In the United States research based pharmaceutical companies spent \$US 2,509 million in 1999 on drugs acting on infection and parasite diseases. This represented 14.2% of expenditure on all classes of drugs.
- 5.109 Research and development in the field of infectious diseases is commissioned and funded by a wide range of bodies including the NHS research and development programme, the research councils, charities and the pharmaceutical companies.
- 5.110 Major innovations in technology are on the horizon in the infectious disease field. These have been stimulated by rapid developments in the physical and biological sciences coupled with the needs of other agencies to rapidly detect micro-organisms using robust portable equipment. For example, the search for life in space and the need to detect and identify biological warfare agents.
- 5.111 Most of the new technological developments are making possible improvements in sensitivity, specificity and speed of result. For example, it is now possible to identify a pathogen directly in clinical material and to determine the likelihood of antibiotic resistance within a few hours.
- 5.112 Improvements in automation of existing and new diagnostic and investigative tests will improve the likelihood of adoption by primary diagnostic laboratories and will improve standardisation and quality. The full potential and value of automation will be realised where there is a high throughput of specimens. This may be aided by rationalisation of testing between disciplines in pathology such as serum samples for clinical chemistry and microbiology. These technological developments support rationalisation and are complementary to the Pathology Modernisation Programme. However, there is no mechanism for evaluation and national managed introduction of new technology.
- 5.113 To safeguard patients and public health, introduction of these new technologies must be supported by robust quality assessment schemes.
- 5.114 One of the major achievements has been the miniaturisation of diagnostic tests for infections. This is making possible near patient testing for many infections and the possibility of over the counter sales of such tests for home use. These tests may be of immense value in primary care and help to support rational antibiotic prescribing. It is also possible that their use will aggravate under-reporting for surveillance. Conversely, the availability of saliva based antibody tests

to confirm infections such as measles, mumps and rubella, has considerably increased the availability of data to confirm or refute clinical diagnoses.

- 5.115 A number of issues need careful consideration if the benefits of near patient tests are to be fully realised:
- Ensuring that information on type of a micro-organism circulating in the population is not compromised;
 - Formulating and disseminating guidance on performing and reading the tests;
 - Establishing effective quality control schemes.
- 5.116 The rapid advances in whole genome sequencing of micro-organisms have given an unparalleled opportunity to understand better the ways in which they cause disease. This coupled to improved ways of monitoring gene expression will allow a more rational approach to development of new antimicrobials and new vaccines.
- 5.117 Whole genome sequences are also invaluable to the development of new international typing schemes for micro-organisms.
- 5.118 New information technology developments are allowing better use to be made of the new molecular developments. In particular, the newly evolving field of bioinformatics is enabling molecular reference microbiology epidemiology to be established and made use of in support of surveillance.
- 5.119 The new field of bioinformatics and its application to public health needs support and established training programmes.
- 5.120 The pace of technological advancement is unlikely to slacken. There will be continued development in non-invasive tests for infections and the possibility of automatic transmission of the test result and even possibly automated guidance on treatment.
- 5.121 New technology has already had an impact on primary diagnostics in microbiology laboratories. Its impact on primary care is still to take place and the effects are less easy to predict. The establishment of primary care trusts should enable the beneficial introduction of new technology and managed evolution of the inevitable change in relationship with patients in primary care.

Communicating with the public

- 5.122 Many of the infectious disease problems covered in this strategy raise issues of risk, personal lifestyle and societal concern. There is a reasonable public expectation that information will be provided in a way that allows people to make choices based on the best available scientific evidence. There is also the expectation that the government will be open and honest and will be able to demonstrate how science is used in public policy making.
- 5.123 In the UK, the publication of Lord Justice Phillips' report of the BSE Inquiry in 2000 was particularly important in highlighting aspects of the handling of risk, uncertainty and openness that needed to be improved. A key message is that communication needs to be a continuous and integral part of the whole of risk analysis, from the early stages of identifying a hazard and assessing the risk through the consideration of risk management options to implementation of any necessary controls and monitoring and review.
- 5.124 This is a vital part of increasing the public understanding that risks sometimes have to be assessed when there is very limited scientific knowledge. For valid reasons, therefore, there can be considerable uncertainty associated with the process. For example, there might be a lack of basic epidemiological data for a newly recognised infectious agent, or an agent might be used in a novel way, such as in a deliberate release as a terrorist activity. Senior government professionals are working with independent experts and the media to help provide the public with accurate soundly based information, using language consistently and in a way that recognises the uncertainties and conveys a meaningful message.
- 5.125 The advances in recent years in information technology and electronic communications have removed some of the barriers to efficient and effective transfer of information. Strong scientific networks are developing internationally, and more robust risk assessments are possible. There are better means of communicating between experts and with the public. However, together with the benefits of increasing availability of good quality information comes the risk of overload with poorer quality and misleading information. A challenge for the future will be to make more progress in tackling this problem.

- 5.126** The effective control of infectious diseases in the population and the protection of the public from other hazards to health requires open, accurate and honest communication. whether the issue is an outbreak of tuberculosis in a local school, a report about apparent side effects of a vaccine, or a cluster of cases of cancer near to a factory the public will expect information to help them understand the risks and what it means for them and their families.
- 5.127** As the Phillips' report showed this has been a weak area of government and public health practice in the past and much work needs to be done to improve matters and ensure genuine public involvement in the whole area of information on risk assessment and decisions on risk management.

Chapter 6. The Strategy: Proposed Actions

Based on the analysis in this report and in particular the previous section, there are ten key changes that the proposals in this strategy seek to bring about:

- Higher levels of recognition and detection of infection;
- More accurate diagnosis of infection and a standardised approach to laboratory profiling of micro-organisms;
- Giving every microbiology laboratory a public health as well as a clinical diagnostic role and rationalising the management arrangements for such laboratories;
- Achieving higher levels of reporting of infectious diseases, closing serious gaps in the surveillance system and improving the comprehensiveness and quality of surveillance generally;
- Intensifying control measures to reduce illness and death from certain key infectious disease problems – tuberculosis, health care associated infection, antimicrobial resistant organisms, blood-borne and sexually transmitted infections;
- Eradicating more infectious diseases by developing more safe, effective vaccines;
- Being prepared to anticipate, respond swiftly and consistently to outbreaks and epidemics;
- Being much better prepared to recognise and take action to control new infectious disease threats: previously unrecognised infections, re-emergent problems and particularly bioterrorism;
- Promoting innovation in the prevention and control of infectious diseases and harnessing new technologies and new knowledge to bring about improvements;
- Creating a unified system of health protection from national to local level adding other aspects to infectious disease control.

A health protection service equipped for the future: some acid tests

A modernised service would be expected to protect our population against a wide range of eventualities. For example:

- A major community outbreak of gastrointestinal disease
- An urgent need to reduce incidence of a specific infection e.g. tuberculosis, genital chlamydia, meningococcal disease
- An outbreak of an unknown illness - could be biological, or the result of chemical or radiological exposure
- A breakdown of infection screening quality
- A large fire in a plastics factory
- The appearance of a previously unrecognised pathogen in the national blood supply
- Uncontrolled serious infection contracted in hospitals
- Chemical, biological or radiological contamination of a water supply
- A lost radiation source
- A local or national vaccine safety scare
- A hepatitis virus infected health care worker who has practised in many areas
- A serious imported infection affecting a number of hospitals
- The emergence of a new sexually transmitted infection or the re-emergence of a previously recognised sexually transmitted infection
- The next influenza pandemic
- A suspected deliberate or accidental release of a biological or chemical agent or radioactivity
- A major animal epidemic with implications for human health

Action Proposed

1. A new agency for infection control and health protection

A new national agency is proposed to act as a source of national expertise and to provide key services at national, regional and local level in a range of specified areas of health protection. The agency would take overall responsibility for the surveillance of infectious diseases, for commissioning and co-ordinating specialist and reference microbiology laboratories. It would also play a key role in the provision of a service for the prevention and control of infectious diseases, chemical and radiation hazards in the population.

These arrangements would reduce the current number of national bodies in this field from four to one. It is proposed that the new Agency would subsume the functions of the Public Health Laboratory Service, the Centre for Applied Microbiology and Research (CAMR), the National Radiological Protection Board (NRPB) and the National Focus for Chemical Incidents. The new agency would not have responsibility for food safety – this rests with the Food Standards Agency.

Some of the work undertaken at the National Institute for Biological Standards and Control (NIBSC) is already done in close collaboration with PHLS and CAMR, for example in vaccine and HIV related research. But other functions of NIBSC, such as the manufacturing of standards, are quite separate. It is therefore proposed that NIBSC should not come under the umbrella of the new Agency, but should be a partner, continuing to work closely as at present.

The existing bodies which we propose will be merged into the new Agency have enormous strengths. The aim of the reorganisation is to capture, preserve and develop those strengths under one organisational umbrella to create a cohesive health protection entity. The Communicable Disease Surveillance Centre at Colindale in particular has an international reputation for excellence and it is proposed that this function remains as a distinct entity within the new Agency. The NRPB holds a similar international status for radiological protection advice and this function would also remain a distinct entity within the Agency.

These new arrangements will address the growing concern that the control of infectious diseases is one part of a range of health protection functions which at the moment are fragmented.

In future there will be a clear line of sight from national to regional to local level for the health protection function. We envisage that the day-to-day provision of that function will be through a service delivered by a new unified National Infection Control and Health Protection Agency. This service will work with central government, the NHS and the local authorities for delivery of a high quality health protection service.

The main functions of the National Infection Control and Health Protection Agency would be:

- To provide information, expertise and advice on infectious diseases, chemical and radiation hazards;
- To co-ordinate all systems of surveillance relevant to the prevention and control of infectious diseases in England;
- To develop and maintain a system of surveillance to protect the public health against the risks from chemical and radiation hazards;
- To identify gaps in surveillance and develop information systems to close them;
- To set standards and guidelines for the notification and reporting of infection by health professionals and by laboratories;
- To recommend changes to the statutory list of notifiable diseases and institute modern criteria for case definitions;
- To work with the Commission for Health Improvement where there are serious deficiencies in standards of infection control in hospitals, primary care or other health service premises;
- To work with the NHS and local authorities to provide a health protection and infectious disease control service;
- With the NHS and local authorities to investigate and manage outbreaks of infectious diseases, and chemical and radiation incidents in liaison with the appropriate authorities;
- To respond to new or emerging threats, including terrorism;
- To advise on national and local policy in relation to the prevention and control of infectious diseases and the protection of the public health from chemical and radiation hazards;
- To commission microbiology laboratories to provide specialist public health or reference functions;
- To review the current arrangements for provision of advice on chemical toxicology issues relating to clinical poisoning and chemical incidents to provide a robust, efficient system which meets the needs of both central government and the NHS.
- To provide agreed technical services;

- To advise the NHS Director of Research and Development on the use of a new research and innovation fund.

The new National Infection Control and Health Protection Agency will have a board and be headed by a chief executive . The Agency will employ professional, scientific and managerial staff as well as field officers and their support teams.

The structure of the new Agency will be a matter for discussion with its chair and chief executive when appointed. However, it is envisaged that a number of management functions would be clearly designated: a communicable disease surveillance centre with a division of vaccines; a division of radiation protection; a division of chemical hazards protection; a division of field services; a division of specialist and reference laboratories services; an emergency response division (including dealing with the public health component of planning and countermeasures against possible threats from the deliberate release of biological, chemical or radiological agents).

Overall accountability of the new Agency will be from the board and chief executive to the Department of Health and the health departments for the United Kingdom devolved administrations where the new Agency will have a role (through the Chief Medical Officers). However, accountability for the delivery of its function to protect the health of local populations in England will be through health protection agreements made via each regional director of public health with the primary care trusts (and their directors of public health) and local authorities in the nine regions.

In England it is already decided that in each of the nine regional offices of government, a Department of Health public health function will be co-located with other government functions for the regions. The regional director of public health will lead this function and be accountable for it to the Chief Medical Officer. These arrangements create a stronger interface between the public health function and local authorities.

We envisage that in England they will also place clear and unambiguous responsibility on the regional directors of public health and their teams for ensuring that the whole health protection (and NHS emergency planning function) is securely in place, maintained and developed in every locality within the region.

The creation of the new Agency means that the specialist service will operate more effectively in every locality. However, it is the responsibility of the primary care trusts and their directors of public health to ensure that this happens. Infectious disease control and health protection will remain an integral part of general public health practice and training programmes. They are a basic competency for all public health specialists. Local public health practitioners will participate in on-call rotas along with the new Agency's field staff.

The new arrangements will allow secure arrangements for the provision of health protection functions in a highly devolved NHS. They will also allow flexibility in serving populations of various kinds (e.g. a primary care trust, a local neighbourhood, a city or a town) which at different times may require a particular focus or intensive effort to address a problem. For example, a virulent strain of an antibiotic resistant organism affecting several teaching hospitals in a region; an outbreak of tuberculosis affecting children in six different schools in an area; high levels of respiratory illness in communities downwind of a new factory; a tourist city with increasing levels of sexually transmitted diseases the occurrence of clusters of a rare form of cancer in several locations in an area (with high levels of public concern about an environmental causation).

These are just some of the kinds of problems faced by an infectious disease control and health protection service. Rigid geographical boundaries, expertise 'locked' into single organisations, the lack of a surge capacity in emergencies, poor connections between national expertise and local service needs are the serious disadvantages of the present system which will be addressed by the new proposals.

Precise local arrangements will be a matter for local determination with the regional director of public health overseeing and co-ordinating the health protection function in discussion with directors of public health of primary care trusts and with local authorities. The arrangements will be consistent with public health networks (part of the implementation of the NHS reorganisation set out in 'Shifting the Balance of Power within the NHS: Securing Delivery. London: Department of Health, 2001').

The new Agency's field officers will be in teams led by a specialist in infection control and health protection. It is envisaged that these staff will be drawn mainly from the existing Consultants in Communicable Disease Control and their teams.

Immunisation co-ordinators are presently either Consultants in Communicable Disease Control or others who are best able to implement and manage the immunisation programme at local level. They have contributed greatly to sustaining the routine programme and the implementation of new vaccination programmes. Whatever the arrangements and responsibilities for field officers, the functions of the immunisation co-ordinator must continue, with an identified individual responsible for the programme in each locality.

The Consultants in Communicable Disease Control have played a valuable role since the post was established in the late 1980s. The expanded health protection role for these staff under the new arrangements will be the bedrock on which the modernised health protection service will be built. They will continue to operate at local level, closely aligned to the general public health service in primary care trusts and part of the public health region. However, their employment by the new National Agency will provide an important opportunity for training, career development and the acquisition of special expertise in areas of health protection. It will also enable them to join in the important international work that the new Agency will continue to participate in.

2. A new mechanism to identify and assess the threat from new and emerging infectious diseases

A new national panel is proposed which would regularly review any new or emerging infectious diseases reported in this country or from elsewhere in the world. The panel will report to the Department of Health. It will assess the potential threat to the population of this country, and advise on any protection or control measures that should be initiated to reduce the potential threat to the population's health. The panel will subsume the work of the National Zoonoses Committee. The panel will make public all its assessments.

It is also proposed that the opportunity will be taken to streamline existing advisory committee structures for infectious diseases.

3. A strengthened and integrated system of infectious disease and health protection surveillance

It is proposed to examine the case for strengthening the surveillance system for infectious diseases by:

- Broadening the number of clinical staff required to report the occurrence of infectious diseases;
- Developing case definitions for reporting;
- Placing a duty of care on microbiology laboratories to report for public health surveillance purposes;
- Introducing a strand of direct public reporting of infectious diseases;
- Introducing new elements of surveillance to cover important infectious disease problems which are not well described currently;

- Harmonising with surveillance systems for chemical and radiation hazards;
- Creating a single point for co-ordination, analysis and reporting on all the different systems of infectious disease surveillance;
- Integrating information from other systems of data which are relevant to the prevention and control of human infectious diseases – for example, veterinary surveillance, environmental monitoring data, antimicrobial prescribing patterns and trends, patient care data;
- Mandating regional public health observatories to provide tailored information to match the needs of local public health services;
- Making use of modern technology to achieve greater and more accurate knowledge about infectious disease problems in the population, more effective analysis and more rapid feedback to front line staff;
- Strengthening interfaces with international surveillance systems.

4. Intensified action to reassert control over serious infectious disease problems – tuberculosis, health care associated infection, antimicrobial resistance, blood-borne and sexually transmitted viruses

It is proposed that strengthened or new control measures are introduced to reduce the relatively high levels of infection being produced by certain specific problems.

New updated plans will cover:

- Health care associated infection;
- Tuberculosis;
- Antimicrobial resistance;
- Blood-borne and sexually transmitted viruses (HIV/AIDS, hepatitis B, hepatitis C).

Each of these problems would have a targeted action plan in place by the end of 2002. In some cases they will update existing plans or highlight strands of existing strategies (e.g. the sexual health strategy).

5. Rationalisation and standards of microbiology laboratory services

It is proposed that the present fragmented system of microbiology laboratories which are under differing management arrangements be simplified with a clear categorisation of laboratories into those providing routine diagnostic microbiology work and those providing public health, specialist or reference functions.

In the future most microbiology laboratories providing routine clinical diagnostic work will be under the management of the NHS (or commissioned by the NHS) whilst all public health specialist or reference laboratories will be commissioned by the new National Infection Control and Health Protection Agency.

This will mean that the number of local PHLs laboratories doing a major part of their work for NHS diagnostic purposes will reduce. However, it is essential that major diagnostic laboratories are not decoupled from the public health laboratory function. A good public health laboratory function relies on specimens taken for diagnosis of patients with infection. Similarly the cadre of microbiologist undertaking specialist microbiology work for public health purposes must also have involvement and experience of routine clinical microbiology.

All clinical microbiology laboratories will be required to operate to common reference standards and standard operating procedures. All microbiology laboratories will be required to make mandatory reports of infection for surveillance purposes, to contribute to outbreak investigations and to recognise their public health as well as clinical responsibilities. Regional directors of public health will oversee the commissioning of the public health component of microbiology services within each region.

An Inspector of Microbiology post will be established to ensure that laboratories meet their public health requirements which are essential to protecting the health of the public in England. This post will also take responsibility for ensuring that all programmes of work are registered and that the opportunity for misuse of microbiological products are minimised.

There are some parallels between the proposed Inspector of Microbiology post and HM Inspector of Anatomy within the Department of Health. The Inspector of Anatomy post has been instrumental in ensuring that anatomy departments licensed under the Act maintain a rigorous approach to standards and safeguards, both for teaching and research. The Inspector of Microbiology will have six main functions:

- Ensuring that all NHS microbiology laboratories meet their responsibility for public health surveillance;

- Promoting and ensuring quality assurance in the operation of microbiology laboratories;
- Identifying significant gaps in specialist and reference diagnostic microbiological testing which are relevant to public health surveillance;
- Achieving adherence to standardised operating procedures in diagnostic microbiology;
- Registering all projects involving particularly hazardous micro-organisms and ensuring that there are protocols in place to reduce the risk of loss or misuse of microbiological agents;
- Establishing and ensuring compliance with security procedures in microbiology laboratories working co-operatively with the Health and Safety Executive (which has a statutory remit in this area).

6. A programme of new vaccine development to create opportunities to eradicate particular infectious diseases

With safe, effective vaccines, as experience has shown, lives will be saved, risks of serious illness will be reduced and it may be possible to eradicate some diseases altogether.

It is proposed that efforts to ensure high uptake of vaccines of proven effectiveness are maintained and research and development programmes are enhanced. Ensuring public and professional confidence will continue to be crucial to successful immunisation programmes. And gaining and maintaining this confidence will require new strategies which meet the new and developing concerns of parents, the public and health professionals. Key vaccine developments will be:

- Extending the use of existing vaccines to larger numbers of people - in particular influenza vaccine and pneumococcal vaccine;
- Switching from oral polio immunisation to the injected form when global progress on polio eradication is at an appropriate point;
- Identifying how best to use new varicella and pneumococcal conjugate vaccines;

- **Stepping up research and investment to bring forward new vaccines to prevent large or serious infectious disease problems, in particular meningococcal Group B vaccine, a vaccine against respiratory syncytial virus (one of the commonest causes of chest infection and hospital admission) and rotavirus gastroenteritis;**
- **Contributing to international research to develop a vaccine against HIV infection.**

7. Strengthened, integrated approach to infection in childhood

It is proposed that the special needs of children with serious infection and other aspects of the prevention and treatment of infection in childhood should be taken account of in the National Service Framework for Children which is currently being developed. It is also proposed that the infection control and prevention needs of older people and other groups where appropriate, should be taken into account when NSFs and other national programmes are being considered.

8. Clear and comprehensive contingency plans to reduce the impact of any future terrorist attack

Extensive planning had already been undertaken prior to the 11th September 2001 attacks on the World Trade Centre in New York City and the Pentagon in Washington DC to protect the public against the deliberate release of biological, chemical or radiological agents. Since 11th September 2001 further intensive planning has taken place. This has involved issuing detailed guidance to health and local authorities and emergency services, raising clinical awareness and producing for clinicians guidelines on the recognition of unusual clinical presentations, assembling strategic stockpiles of drugs and vaccines, signing an international agreement on emergency health planning with the government of the United States of America, and working with other countries and the European Union.

It is proposed that plans for responding to a terrorist attack should continue to be strengthened particularly through:

- **Enhanced surveillance and training of key personnel to identify new diseases or unusual patterns;**
- **Developing rapid diagnostic techniques;**
- **Identifying newly emergent pathogens;**

- Ensuring adequate specialist diagnostic and management support;
- Promoting research into antiviral drugs and vaccines;
- Continuous horizon scanning, scenario planning, risk assessment and research;
- Creating innovations in countermeasures.

9. A new capacity to provide the public with information about infectious diseases and the risks associated with them

Much more information will be made regularly available to the public on infectious disease problems and health protection issues. This will involve information on: patterns and trends in the incidence of particular infectious diseases, advice to travellers, assessments of risk of particular activities, new and existing vaccines, and new and emerging infections. This information will be compiled and made available by the Department of Health and the new National Infection Control and Health Protection Agency working jointly. Particular emphasis will be given to a role for NHS Direct and some of the interactive technologies that are being developed for informing the public.

10. Enhanced programmes of professional education and training in infectious diseases prevention, control and treatment

It is proposed that there is a review of the content of infectious diseases and health protection in the current education programmes with a view to strengthening it through NHS workforce and education confederations and educational providers. The control and prevention of infectious diseases is a responsibility of all healthcare professionals - not just the specialists.

11. A research and innovation programme

Research and development is a vital factor in making progress in combating infectious diseases and the other threats to the public health.

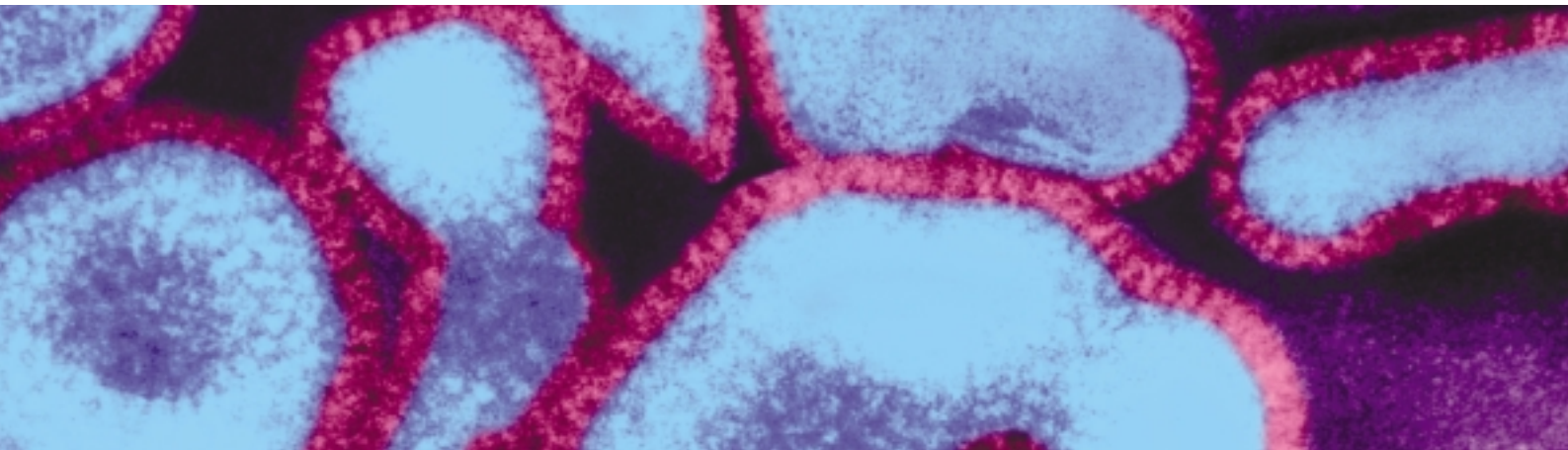
At present, research and development is fragmented and there is no strategy for research in this field. The existing bodies which it is proposed will form the new Agency currently have their own research and development funds (except for the National Focus which has no research funds of its own). This is a mixture of a direct grant from the Department of Health (approximately £18.5 million in total) and grants from other sources (including also from government) approximately £14 million in total.

It is proposed that all of these funds will pass to the NHS Director of Research and Development to create a research and innovation fund for health protection. The new Agency together with the Medical Research Council will advise the NHS Director of Research and Development on a strategy for deploying the funds to obtain maximum gain from research, knowledge and innovation in infectious disease control and other aspects of health protection.

12. Modernising Public Health Law

It is proposed to review the legislation to support the effective prevention, investigation and control of infectious diseases to modernise it, in particular addressing:

- The current requirements for reporting of infectious diseases for public health surveillance purposes;
- The need to ensure adequate data protection whilst meeting health protection imperatives;
- The need to remove old legislation of no current relevance.
- The roles and responsibilities of health bodies and local authorities.



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