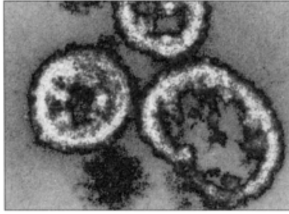
CHAPTER 1



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Changing pattern of infectious diseases

The incidence of infection is an ever-changing pattern, which is one reason why the study of infectious diseases is so interesting. While better sanitation, clean food and water supplies, good housing, personal hygiene, vaccines and drugs have controlled some diseases, new diseases emerge and other diseases are newly recognized to be infections. In the resource-poor developing countries infectious diseases continue to cause significant morbidity and mortality. In the developed countries, the picture of infectious disease at the beginning of the 21st century can be summarized as follows.

- There is one disease, smallpox, that has been eradicated from the world, although there is a potential threat of its deliberate release
- A second disease, poliomyelitis, is close to global eradication, having been absent from the Americas and Europe for over 3 years
- Infections which have virtually disappeared as endemic disease: cholera, typhus, diphtheria
- Infections which have become much less common or less virulent: measles, mumps, rubella, whooping cough, tetanus, tuberculosis, *Haemophilus influenzae* type b diseases, scarlet fever
- Infections whose incidence has remained unchanged are: respiratory infections, chickenpox (except in countries practising universal childhood varicella vaccination, e.g. the USA) and herpes zoster, infantile gastroenteritis (much less severe), infections of the nervous system (except *Haemophilus* meningitis), neonatal infections, urinary infections
- Infections which have increased are: sexually transmitted infections, infections in immunocompromised, debilitated and intensive care unit patients, methicillin-resistant *Staphylococcus aureus* (MRSA) outbreaks of infection in hospitals, infections in intravenous drug users
- Infections that increased in between 1980 and 2000, but now show signs of being better controlled are: salmonella and listeria infections associated with food, *Clostridium difficile*
- Infection associated with the increasing travel to tropical countries for business and holidays are: malaria, enteric fever, amoebiasis, helminthiasis, exotic viral infections, traveller's diarrhoea
- New infection problems are: human immunodeficiency virus (HIV) infection, variant Creutzfeldt–Jakob disease, multidrug resistance in pneumococci, salmonellae, tuberculosis and staphylococci, severe acute respiratory distress syndrome (SARS).

In the last decade (up to 2003), five global factors have emerged as forces that could cause further changes:

1 Climate change, and specifically global warming, could extend the geographical range of infections like malaria.
2 Population increase, accompanied by environmental degradation, could result in inadequate supplies of safe food and water.
3 Large numbers of people migrating for safety or economic and social reasons may bring high rates of diseases like tuberculosis into cities in both the developing and the developed countries.
4 Xenotransplantation and genetic modification could, in theory, result in new human pathogens, despite the safeguards taken to prevent this.
5 Bioterrorism and other deliberate releases of biological agents may be perpetrated to extort money (see Table 1.1).

The major aetiological agents of infectious diseases identified between 1972 and 2003 are listed in Table 1.2.

Transmission of infection

Infection spreads by one of the following methods.

Airborne

Infection is exhaled from the case or carrier by coughing, sneezing or speaking, in invisible respiratory droplets of moisture which are inhaled by the new host. The microorganisms may adhere to dust or textiles, leaving infected dust which may still transmit infection. Skin scales are an important source of contaminated dust. Dust may be carried by air currents, but rarely for distances of more than a few metres.

Diseases spread by airborne routes include:

Exanthemata: measles, rubella, chickenpox, scarlet fever.

Mouth and throat infections: diphtheria, tonsillitis, mumps, herpes stomatitis.

Respiratory tract infections: whooping cough, influenza and other respiratory virus infections, pulmonary tuberculosis.

General: meningococcal and staphylococcal infection.

Intestinal

Infection present in the bowel excreta of a case or carrier is ingested by a fresh host. Transmission may be immediate and direct via infected fingers, eating utensils, clothing, toilets, etc., or indirect via food or water.

Diseases spread by the intestinal route include typhoid and paratyphoid, salmonellosis, dysentery, cholera, gastroenteritis, poliomyelitis and other enterovirus infections, and viral hepatitis A and E.

In another group of ingestion diseases, transmission is direct from contaminated food. This group includes brucellosis, Q fever,

Table 1.1 Infections that might be released deliberately as acts of terrorism.

Infection	Notes
Anthrax	Tested as a biological weapon, 1939–1944; thought to be stocked as a weapon, 1992; used in USA, 2001 (see p. 109)
Botulism	Risk of food or water contamination (see p. 85)
Plague	(see p. 110)
Smallpox	Considered as a biological weapon 1950–1989 (see p. 103)
Tularaemia	(see p. 111)
Viral haemorrhagic fevers	(see p. 228)

Sources for more information
www.hpa.org.uk/infections/topics_az/deliberate_release/menu.htm
www.who.int/csr/delibepidemics/en/
www.bt.cdc.gov/

Year	Agent	Disease
1972	Norwalk-like viruses	Diarrhoea outbreaks
1973	Rotaviruses	Major cause of infantile diarrhoea worldwide
1975	Astroviruses	Diarrhoea (outbreaks)
1975	Parvovirus B19	Fifth disease and aplastic crises in chronic haemolytic anaemia
1976	*Cryptosporidium parvum*	Diarrhoea
1977	Ebola virus	Ebola haemorrhagic fever
1977	*Legionella pneumophila*	Legionnaires' disease
1977	Hantaan virus	Haemorrhagic fever with renal syndrome
1977	*Campylobacter* spp.	Diarrhoea
1980	Human T-cell lymphotropic virus 1 (HTLV-1)	Adult T-cell leukaemia/lymphoma; tropical spastic paresis
1982	HTLV-2	Hairy cell leukaemia
1982	*Borrelia burgdorferi*	Lyme disease
1983	Human immunodeficiency viruses (HIV-1, HIV-2)	Acquired immunodeficiency syndrome and related illnesses
1983	*Escherichia coli* O157	Haemorrhagic colitis and haemolytic–uraemic syndrome
1983	*Helicobacter pylori*	Gastritis and gastric ulcers
1988	Human herpesvirus 6 (HHV-6)	Exanthema subitum (roseola infantum)
1989	*Erlichia* spp.	Human erlichiosis
1989	Hepatitis C virus (HCV)	Parenterally transmitted non-A non-B hepatitis
1990	Human herpesvirus 7 (HHV-7)	Pityriasis rosea
1990	Hepatitis E virus (HEV)	Enterically transmitted non-A non-B hepatitis
1991	Hepatitis F (HFV)	Severe non-A non-B hepatitis
1992	*Bartonella henselae*	Cat-scratch disease
1993	Sin nombre virus	Hantavirus pulmonary syndrome
1994	Sabia virus	Brazilian haemorrhagic fever
1994	Human herpesvirus 8 (HHV-8)	Kaposi's sarcoma
1995	Hendravirus	Meningitis, encephalitis
1996	Prion disease related to bovine spongiform encephalopathy	Variant Creutzfeldt–Jakob disease (vCJD)
1997	Enterovirus 71 (EV71)	Epidemic encephalitis
1998	Nipahvirus	Meningitis, encephalitis
1999	West Nile virus	Encephalitis (New York)
2003	New Coronavirus	Severe acute respiratory syndrome (SARS)

Table 1.2 Major aetiological agents of infectious diseases identified between 1972 and 2003.

salmonellosis, trichinellosis and other helminth infections.

Direct contact

Infection may be transmitted directly by local skin contact. This mostly involves cutaneous infections and includes impetigo and scabies.

Venereal route

Infection may be transmitted by sexual contact, including syphilis, gonorrhoea, lymphogranuloma venereum and herpes genitalis infection, HIV and hepatitis B infection.

Insect or animal bite

Infections transmitted by bites include malaria, leishmaniasis, trypanosomiasis, typhus, rabies and simian herpesvirus infection.

Blood-borne

Some infections are commonly transmitted via infected blood or blood products, e.g. hepatitis B, HIV, hepatitis C.

These do not cover all the complex routes by which disease spreads. For example, leptospirae excreted in rats' urine may contaminate stagnant water and later penetrate the intact skin of a human host bathing in the water, or tetanus spores from the faeces of herbivorous animals may contaminate pasture land and years later may enter a wound and cause human disease.

Other diseases may spread by two or more alternative routes. For example, tuberculosis commonly spreads by airborne infection, but may spread via milk by ingestion or even by direct skin contact.

Control measures

Notification

All countries have some system of reporting select infections for public health purposes: 'notification'. The list of diseases, the mechanism of reporting and the legal basis for the notifications vary from country to country. But they have in common that the public interest justifies giving medical information about a patient to a public health service, that there are control measures that can be taken to prevent further spread or that the disease is important enough to require surveillance. In the UK, the list of notifiable diseases specified by the Public Health (Infectious Diseases) Regulations 1988 is detailed in Table 1.3, and the notification is made to the Consultant in Communicable Disease Control (CCDC) for the district in which the patient is living.

Collecting data from clinical microbiologists on laboratory-proven infections also provides surveillance in most countries that have well-established microbiological services. Some countries have sentinel or 'spotter' general practitioners to consistently and quickly report conditions like influenza-like illnesses.

Communicable disease control

Outbreaks and serious cases of infectious disease are investigated by the public health specialists (CCDC and community infection control nurses in the UK) and environmental officers, in collaboration with microbiologists and infectious disease consultants. The source of infection, mode of spread, contacts and occupational circumstances are all investigated and appropriate measures carried out, including the isolation and treatment of patients and the immunization and control of carriers and contacts.

Table 1.3 Notifiable diseases.

Acute encephalitis	Paratyphoid fever
Acute poliomyelitis	Plague
Anthrax	Rabies
Cholera	Relapsing fever
Diphtheria	Rubella
Dysentery (amoebic or bacillary)	Scarlet fever
Food poisoning	Smallpox
Leprosy	Tetanus
Leptospirosis	Tuberculosis
Malaria	Typhoid fever
Measles	Typhus
Meningitis	Viral haemorrhagic fevers
Meningococcal septicaemia (without meningitis)	Viral hepatitis
Mumps	Whooping cough
Ophthalmia neonatorum	Yellow fever

International control measures

In cases of smallpox, cholera, plague and yellow fever (officially referred to as 'diseases subject to the regulations') the World Health Organization arranges an interchange of information to enable the necessary public health and preventive measures to be carried out. The World Health Organization also regularly exchanges information on a further group of infections which are kept under surveillance, and this includes poliomyelitis, epidemic influenza, louse-borne relapsing fever and louse-borne typhus fever.