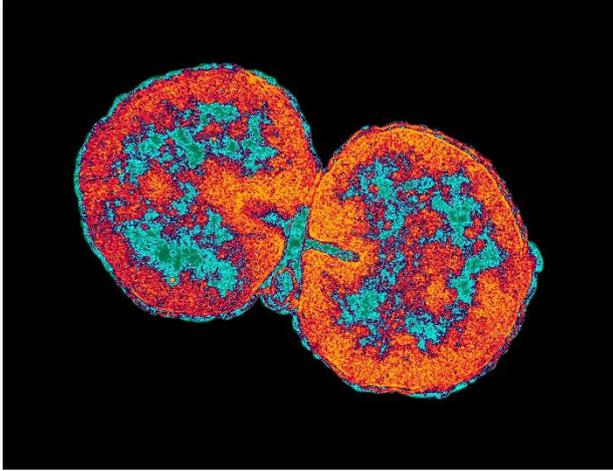


UK Trends in Infectious Disease



Infectious diseases can be transmitted from animals to people, or from one person to another. They can be mild and self-resolve, or develop into more serious illnesses that if left untreated lead to serious illness, long-term consequences or death. This note looks at UK trends in infectious disease.

Background

Vaccination, antimicrobial drugs and improved hygiene mean that infectious disease has been overtaken by non-communicable disease (cancer, cardiovascular disease and diabetes) as the main cause of death globally and in the UK.¹ However infections are still a significant health and economic burden to the UK.² This POSTnote describes recent trends in infections of particular concern in the UK. It outlines the trends that largely result from the capacity of infectious pathogens (disease causing agents) to develop resistance to existing drugs, the emergence of new infections and the re-emergence of infections linked to health inequalities or other factors. Infections are caused by viruses, bacteria, fungi, protozoa, parasites or prions. The epidemiology (causes, patterns and effects) of infectious disease are determined by the interplay of numerous factors: the individual (sex, age [see Box 1], health status, immunity and behaviour), the pathogen (its pathogenicity and ability to mutate) and the environment (climate, air quality and socio-economic factors such as income, quality of nutrition and housing).

Impact of Infectious Disease in the UK

There is no recent single analysis of the overall health burden of infectious disease in the UK, but data on individual infections are available from various sources. The Chief Medical Officer (CMO) has estimated that, in 2010, infectious diseases accounted for 7% of all deaths, 4% of all

Overview

- Infectious diseases are a significant health and economic burden in the UK, accounting for 7% of deaths and annual costs of £30bn.
- The national immunisation programme is widely considered to be the most effective public health intervention in the UK.
- There are a number of infections of particular public health concern for the UK for which there are vaccines in the early phases of development.
- Another area of policy interest is antimicrobial resistance. Few of the most needed new drugs are currently in development.
- Health inequalities continue to be a significant contributory factor in poor health outcomes for those people in the lowest socio-economic groups.

potential life years lost and 8% of hospital bed days. Infections are responsible for a large proportion of sickness absence from work. For example, minor illnesses such as respiratory or gastro-intestinal infections are the most common reason for work absence, accounting for 27.4m days lost in 2013.³ The total economic burden from infectious diseases in England is estimated at £30bn annually (this includes costs to the health service, the labour market and to individuals).²

Surveillance of Infectious Disease

Public Health England (PHE) is responsible for detecting outbreaks of disease and epidemics, with equivalent counterparts in the devolved administrations.^{4,5,6} National and international approaches to monitoring and surveillance have been described in detail in a previous [POSTnote](#).⁷

Preventing Infectious Disease

The National Institute for Health and Care Excellence (NICE) provides advice on cost-effective healthcare. NICE guidelines outline evidence-based best practice for infection control in community and hospital care settings.^{8,9} There is detailed advice on hand washing, managing the use of antimicrobial drugs (discussed later), organisational responsibilities (such as co-ordinating infection control strategies), education of health care workers and for the management of specific interventions where infections are common, notably catheters or devices inserted into veins.

Box 1. Infections and the Connection to Life Stages

The Chief Medical Officer's 2011 report on infectious disease highlighted the connection between infections and life stages²:

- **Perinatal Infections** - babies' immature immune systems are susceptible to infections. They can be contracted in the womb, during labour, or immediately after birth and are associated with increased mortality and illness.¹⁰ Perinatal infections cause an estimated 10% of stillbirths and can also cause premature birth (premature babies are also more likely to develop an infection).¹⁰ Mother-to-baby HIV transmission has reduced from 25.6% in 1993 when there were no interventions, to <0.5% now, through ante-natal screening and anti-retroviral drug therapy for HIV-positive pregnant women. Immunisation of newborn babies whose mothers have the blood-borne virus hepatitis B has reduced transmission by 95%, and prevented cases of liver disease, cirrhosis and cancer in children and young adults.
- **Infancy and Childhood** - children are prone to infections as the immune system develops, mainly through exposure to pathogens, via close contact with other children at nursery and school. The UK national immunisation programme¹¹ offers a course of vaccinations that protect children (and the wider population) from a range of potentially serious illnesses.
- **Adolescence and Adulthood** - behavioural factors are key contributors to the spread of infections at this life stage. For example the risk of contracting sexually transmitted infections is largely dependent on sexual behaviour. For some infections, drug use involving contaminated needles is also a risk.
- **Old Age** - immune system function declines with age, so the rising UK elderly population is more susceptible to infections. They may also be at greater risk of exposure to pathogens because of frequent interactions with healthcare, or by living in settings such as care homes that bring them into contact with other people.

Immunisation

Immunisation is the process by which people are made immune to an infectious pathogen. It is widely considered as the most effective public health intervention. When coverage is high enough, infections can be eliminated, such as with smallpox. Where coverage is insufficient, the risk of infection re-emerges, for example as seen in the 2013 measles outbreak in South Wales.¹² The NHS immunisation schedule provides vaccines to protect against infectious diseases, from the pre-natal period, through infancy, childhood, adolescence and into old age. The Government is advised on immunisation by the Joint Committee on Vaccination and Immunisation (JCVI). JCVI makes recommendations about whether it is cost-effective to add vaccines to the national programme and proposes changes to the existing schedule. These recommendations are made in response to changes in the epidemiology of disease and the availability of new vaccines.¹³ For example, immunisation against meningitis B is now available for infants who are most at risk from the infection.^{14,15} Other recent additions to the national programme include vaccines against pertussis (whooping cough) and rotavirus, both of which have led to fewer cases and reduced mortality rates.^{16,17,18,19,20} Monitoring levels of immunisation is needed to identify where coverage is inadequate. For example trends in coverage of the measles, mumps and rubella (MMR) vaccine for children aged two are shown in Figure 1. Coverage was 91.9% by 2015,²¹ and has increased steadily since 2009, but is still below the World Health Organisation target of at least 95%.

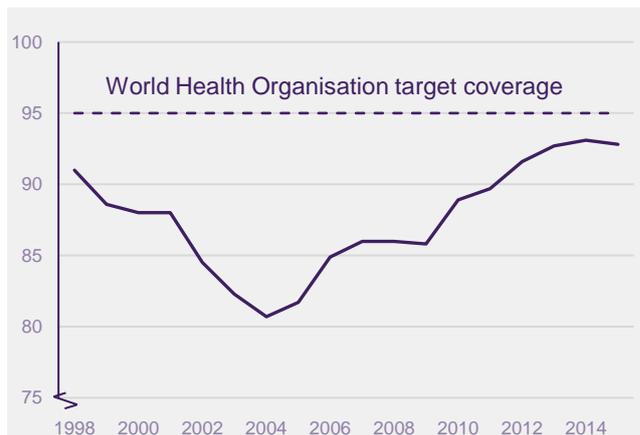


Figure 1. Trends in % coverage with MMR immunisation at 24 months old, England and Wales, 1998–2015

Priorities for Immunisation and Vaccine Development

JCVI priorities for future vaccine programmes are Group B Streptococcus and respiratory syncytial virus (RSV). Group A and B streptococci mainly cause minor infections, but babies are at particular risk from serious Group B infections. RSV is a common cause of serious respiratory infections in infants and the elderly. Vaccines are in clinical trials for common healthcare-acquired infections (*S. aureus*, *C. difficile* and *Pseudomonas aeruginosa*), hepatitis C, RSV, Group B streptococcus, norovirus, Lyme disease and cytomegalovirus (CMV).²² JCVI is also interested in vaccine development for norovirus, methicillin resistant *S. Aureus* (MRSA), CMV, hepatitis C and typhoid.^{23,24}

Healthcare-Acquired Infections

Healthcare Acquired Infections (HCAIs) are common, and may result in illness, prolonged hospital stays or death. There is mandatory surveillance of the bacteria responsible for the bloodstream infections caused by MRSA, *C. difficile* and *E. coli*. Table 1 summarises data on reported cases of each. A recent 6% rise in *C. difficile* cases was the first annual increase since 2007. Mandatory surveillance of *E. coli* infections began in 2012/13, and have risen by 10.4% since. The rate of infections per 100,000 population is a useful comparator: in 2015/16 it was 70.1 for *E. coli*, much higher than the 1.5 for MRSA.²⁵

	<i>C. difficile</i>	<i>E. coli</i>	MRSA
2007/08	55,498	No data	4,451
2008/09	36,095	No data	2,935
2009/10	25,604	No data	1,898
2010/11	21,707	No data	1,481
2011/12	18,022	No data	1,116
2012/13	14,694	32,309	924
2013/14	13,362	34,275	862
2014/15	14,192	35,764	800
2015/16	14,139	38,132	819

Table 1. Cases of healthcare-acquired infections²⁵

Interventions such as hygiene measures (behaviour change such as hand-washing and cleaning protocols, and design of hospitals and equipment), improved antibiotic prescribing and changes to some surgical techniques, have reduced the burden of HCAIs. One focus is to take a preventative approach to bacteria such as *E. coli*, *Pseudomonas* and *Klebsiella* which are harder to treat, becoming more prevalent and cause urinary tract and bloodstream

infections and life-threatening pneumonias. Another is on infection control in settings outside hospitals, such as care homes and in communities.

Hepatitis C

Hepatitis C is a treatable but chronic blood-borne infection that affects liver cells. There is no vaccine. The number of confirmed cases of hepatitis C infection has risen more than five-fold in England since the 1990s, with 1,836 new cases per year between 2011–2015.²⁶ An estimated 200,000 people have the infection in the UK, half of whom are undiagnosed. Left untreated, serious liver disease and cancer can occur, with a transplant the only option.

Admissions to hospital rose from 611 in 1998 to 2,658 in 2012, with a similar increase in mortality, rising from 98 in 1996 to 457 in 2014.²⁷ The number of liver transplants in the UK as a consequence of the infection has also risen from 45 in 1996 to 175 in 2014 (17% of all liver transplants).²⁷

One of the biggest risk factors for contracting hepatitis C is injected drug use: anonymised surveys show that of people who inject drugs, 50% in England, 23% in Northern Ireland and 57% in Scotland have the infection. These rates have been stable for the last decade. The rate in Wales has risen from 19% in 2003 to 47% in 2014.²⁷ Policy approaches focus on preventing new infections, raising awareness of the virus, improving and increasing diagnoses, and treatment with anti-viral drugs. It is expected that new direct acting antiviral drugs for hepatitis C will improve health outcomes; a reported 11% decreased in mortality in 2015 is attributed to them.²⁶ Testing those most at risk continues to be a priority, including former and current injecting drug users.

Sexually Transmitted Infections

Sexually transmitted infections (STIs) almost always occur via unprotected sex. There were 435,000 diagnoses of STIs in England in 2015.²⁸ Chlamydia is the most common STI (200,228 diagnoses in 2015), with many people unaware of their infection. If left untreated, it can cause long-term health problems, including infertility. Other common STIs in 2015 were genital warts (68,310 diagnoses), gonorrhoea (41,193 diagnoses) and genital herpes (33,218 diagnoses).²⁹ In 2015, heterosexual men and women accounted for 92% of diagnoses of genital warts, 92% of genital herpes and 85% of chlamydia diagnoses, while men who have sex with men (MSM) accounted for 79% of syphilis and 54% of gonorrhoea diagnoses.²⁸ Overall, new diagnoses of STIs fell by 3% between 2014- 2015. This fall is thought to be associated with fewer heterosexuals testing for chlamydia, and fewer cases of genital warts in 15-19 year old females as a consequence of the human papilloma virus (HPV) immunisation programme. A continued trend is increased rates of syphilis and gonorrhoea (rises of 76% and 53% respectively since 2012), particularly in men.²⁸ It is likely that risky sexual behaviour accounts for these trends, although gonorrhoea detection has also improved. The groups at greatest risk of contracting infections are heterosexuals aged under 25 and MSM, see Figure 2 for recent trends for this group.

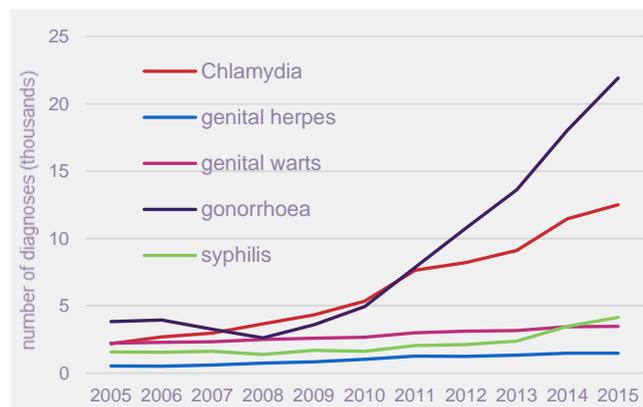


Figure 2. Trends in sexually transmitted infections in Men who have Sex with Men, 2005-15³⁰

HIV

There is no vaccine or cure for HIV, but prompt diagnosis and antiretroviral drug treatment allows people a normal life expectancy. Figure 3 shows the trend in new diagnoses of HIV and AIDS and in mortality.³¹ The latest data from 2015 reported that 101,200 people in the UK have HIV, with an estimated 13% unaware of their infection.³¹ Late diagnosis (after the immune system has been damaged) has serious health effects, with half of heterosexuals (men: 55%, women: 49%) receiving a late diagnosis in 2015. New HIV diagnoses in heterosexual men and women have declined since 2004 with the overall prevalence in the population in 2015 being 1.0 per 1,000.³⁰ However this is higher in heterosexual black Africans (men: 22.2 per 1,000, women: 42.6 per 1,000) and MSM (58.7 per 1,000).³¹ Rates of transmission remain high among MSM, with modelling indicating that incidence could be increasing. There were 3,320 new diagnoses in MSM in 2014 (up from 2,860 in 2010), accounting for more than half of all new HIV diagnoses. However the proportion diagnosed late has decreased (43% in 2004 to 30% in 2015). Continuing the downward trend in HIV transmission depends on a combination of increasing testing availability and take up, treatment and behaviour change (safer sex practices).³² Tailored prevention strategies and programmes are thought to be particularly important for some at-risk groups.

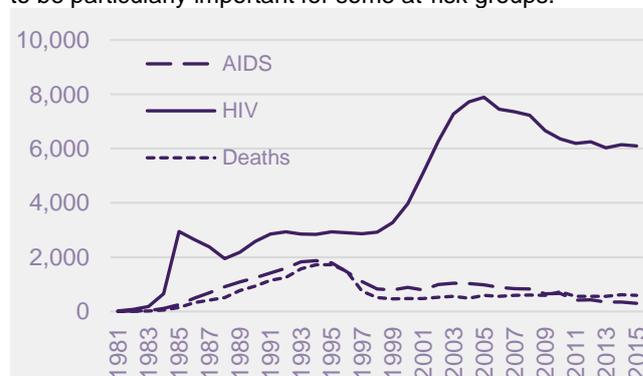


Figure 3. Annual new HIV diagnoses, first AIDS diagnoses and deaths in the UK, 1981–2015³¹

Emerging Infections

The emergence of new infections and the re-emergence of others are inevitable. They are a consequence of several, often interacting factors:

- **ecological and environmental factors** - changes in land use, water ecosystems and climate change (which may affect the distribution of vector-borne diseases³³)
- **human behaviour** - travel, and the lack of or the breakdown of public health measures
- **agricultural practices** - intensive farming, animal husbandry practices, unregulated use of antimicrobials and international trade
- **microbial evolution.**

An estimated two-thirds of emerging infectious diseases in the last 60 years were zoonotic (passed from animal to humans), with 70% coming from wild animals.³⁴ PHE monitors emerging patterns and assesses the possible significance for public health.³⁵ Monitoring includes infections that arise in the UK, the spread of existing infections into the UK or new infections that arise elsewhere. Some emerging infections arise in tropical settings (such as Ebola and Zika) whereas others arise elsewhere; recent outbreaks of SARS, influenza A (H5N1) and foodborne *E. coli* had non-tropical origins. Infections can have implications for the UK even if cases do not occur here. These include blood or tissue availability, extra demands on healthcare, or health screening on entry to the UK, as with the recent Ebola outbreak. Recent infections of concern include the viral Middle East Respiratory Syndrome and polio. Polio has been reported in Ukraine, which has low rates of vaccination (50% coverage of children in 2014).³⁶

Antimicrobial Resistance

Antimicrobial drugs, including antibiotics, anti-virals and anti-fungals are the main treatments for infections. Although there are many effective antimicrobials against both bacteria and viruses, drug resistance, largely driven by inappropriate prescribing, is a serious threat to public health.³⁷ A recent review raised concerns that deaths due to antimicrobial resistance could outweigh mortality from all other causes by 2050, if action is not taken (0.7m annual deaths worldwide, rising to a possible 10m annual deaths in 2050).³⁸

Drug resistance can be minimised by ensuring that drugs are used only when necessary. Resistance in bacteria which cause most hospital-acquired and community infections such as gonorrhoea³⁹, are a serious concern since there are limited treatment options and they are already resistant to drugs of last resort. Drug-resistant TB is an increasing problem in the UK, with some forms of the disease resistant to multiple treatments.⁴⁰ The Chief Medical Officer (CMO) has described antimicrobial resistance as “catastrophic”, and warned that if left untackled, could for example result in people dying after minor surgery.⁴¹ The Government’s five-year, cross-departmental antimicrobial resistance strategy outlines national and local objectives. The main aims are:

- improved knowledge of antimicrobial resistance
- better stewardship of existing drugs
- stimulating development of new diagnostics (to identify infections accurately) and drugs, particularly antibiotics.⁴²

Development of new antibiotics has declined in recent decades.^{43,44} This reflects the complexities of designing effective drugs, the significant rate of attrition as compounds are tested and rejected, and lower returns for pharmaceutical companies’ investment, compared with other medicines. The latter arises from the fact that new antibiotics are unlikely to be sold in volume: treatments are short-term (usually a few days) and likely to be held in reserve as a last resort. An estimated 40 new antibiotics are currently in development.⁴⁵ These are not of the kind most urgently needed; broad-spectrum agents (active against a range of microbes) and which are capable of overcoming multiple mechanisms of resistance. Improved diagnostics are also needed to identify pathogens in order to help doctors to prescribe the right drug.^{46,47}

Health Inequalities

UK health inequalities result from social inequalities⁴⁸ including differences in income, education, employment and living conditions. The CMO has identified infectious diseases which exemplify health inequalities in the UK.

- **Tuberculosis** is concentrated in the most deprived areas. In 2015 the rate of TB was 20.5 per 100,000 in the 10% of the population living in the most deprived areas and 3.6 per 100,000 in the 10% in the least deprived areas.⁴⁰ Those most at risk are those who are not UK-born, have a history of drug use, imprisonment or homelessness. Such groups are at highest risk of transmission and acquiring drug-resistant strains and least likely to complete treatment. They are also more likely to have other infections, such as hepatitis B or C.
- **STIs** are particularly concentrated in deprived urban areas. Diagnoses of gonorrhoea rose by 11% between 2014 and 2015, and are concentrated in the most deprived areas of London.⁴⁹ HIV rates are also highest in deprived areas, especially in London.

Immunisation and Inequalities

Inequalities are associated with low vaccine take up (Box 2).⁵⁰ Research suggests that interventions to improve vaccination take up at population level are unlikely to make a difference to some groups, for whom specific policies are needed. There is no government policy to reduce the influence of inequalities on the prevalence of infectious disease, or health more generally. However NHS England recognises the challenges⁵¹ and national public engagement work is underway.⁵²

Box 2. Factors Underlying Inequalities in Vaccine Take Up

Children most at risk of not being fully immunised are:

- those who missed previous vaccinations (whether as a result of parental choice or otherwise) or not registered with a GP
- those with physical or learning disabilities
- children of teenage or lone parents and looked after children
- younger children from large families
- children who are hospitalised or have a chronic illness
- children from some minority ethnic groups
- vulnerable children, such as those whose families are travellers, asylum seekers or are homeless.

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