NHS

Tuberculosis factsheet

immunisation

the safest way to protect your health

TB (tuberculosis) is an infectious disease that usually affects the lungs, although it can affect almost any part of the body.

About 150 years ago, it caused about one in eight of all deaths in the UK. But by the 1980s, through a combination of better housing and nutrition, the early detection and isolation of cases, and effective treatments it had become uncommon in this country.

However, TB had not been wiped out completely. In fact, TB is one of the major infectious disease problems the world faces today. Last year, more deaths occurred from TB than at any time in history – approximately 8000 per day.

Over the last 20 years, TB has been slowly increasing in the UK. About 7000 cases are now newly diagnosed each year – just over one person in every 10,000 of the population.

This factsheet describes the disease, its diagnostic features, control and treatment, and provides a picture of its incidence both in the UK and around the world. It takes into account the new, more targeted recommendations for BCG immunisation in the UK, and it also includes references, a glossary and useful websites.

The disease, its prevention and treatment

What is TB?

Tuberculosis (TB) is a serious, but curable, infectious disease caused by a bacterium called *Mycobacterium tuberculosis* (*M. tuberculosis or M. Tb* for short). It usually affects the lungs (called pulmonary TB) but it can affect other parts of the body such as the lymph glands, bones, joints and kidneys. It can also cause a serious form of meningitis.

A closely related bacterium (*M. bovis*) causes tuberculosis in animals, mostly in cattle (bovine TB). *M. bovis* can also infect people and was a common cause of TB before the introduction of milk pasteurisation and TB testing of cattle.

What are the symptoms of TB?

Because TB can affect almost any part of the body, the symptoms are varied.

The most common form of TB is pulmonary (lung) TB. A person with TB of the lung will usually:

- lose their appetite and lose weight
- have a persistent cough, which gets progressively worse over several weeks or months
- bring up phlegm; they may also cough up blood if a blood vessel becomes damaged
- be unusually tired
- have a fever – most often at night, that can result in heavy night sweats.

How is TB spread?

TB can only be spread by people with infectious TB in the lungs or voice box (pulmonary TB). The bacteria are present in the droplets they cough or sneeze into the air. However, people with TB in the lungs are not always infectious.

How difficult is it to catch TB?

TB is quite difficult to catch and usually requires prolonged or repeated contact with a person with infectious TB, such as living in the same household. Even then, not everyone who is infected with the bacteria causing TB will develop TB disease. The majority (about nine out of ten) of otherwise healthy TB contacts who have been infected with the TB bacteria will completely eliminate or contain the bacteria and will not develop disease. The remaining 10% of infected TB contacts will develop TB disease, not necessarily immediately, but at some time in their life, sometimes decades later (Comstock, 1982).

This is because the bacteria that cause TB are capable of surviving in the body for many years in an inactive state without causing disease. They can become active and cause TB later in life, particularly if a person's immune system becomes weakened, for example by old age, certain medical treatments, serious illness such as HIV or through generally poor living conditions.

For the 10% of infected people who go on to develop TB disease, the risk is greatest within the first two years following infection.

Between 1 and 5% of infected people develop TB disease soon after infection (Styblo *et al.*, 1969; Sutherland *et al.*, 1976; 1982). This is called primary disease, and is more common in children. Primary TB usually passes unnoticed and resolves without treatment but can reactivate later in life. It can leave a small scar on the lung and affects surrounding lymph nodes that can only be seen by chest x-ray.

What is the difference between TB infection and TB disease?

For most people who become infected with TB, the immune system is able to fight the bacteria and eliminate them or stop them growing. In this case, the bacteria become inactive, but remain alive in the body and can become active later. This is called latent TB infection.

People with latent TB infection:

- have no symptoms
- do not feel unwell
- cannot spread TB to other people
- usually have a positive tuberculin skin test reaction
- can develop TB disease later in life.

People with TB disease ('active TB') have symptoms or signs of the disease as described on page 4.

How serious is TB?

Untreated, TB in most healthy adults is a slowly progressive disease, which may be fatal. Some forms, such as TB meningitis, are more serious than others. One of the most severe complications of pulmonary TB, if left untreated, is haemorrhage (bleeding) from the lungs. TB can be more serious if it becomes resistant to the main drugs used to treat it, as it can then be very difficult to treat.

In the UK, TB is the cause of or contributes to about 350 deaths each year, mainly in the elderly but also in a significant number of young people (HPA1). Worldwide, where living conditions and health care are poor, the death rate is higher.

How is TB treated?

In almost every case TB can be cured, but only if the full course of treatment is taken as prescribed for a minimum of six months. People with TB rarely go into hospital for treatment although they may be admitted very briefly to confirm the diagnosis and start their treatment.

The standard treatment for TB is a combination of three or four antibiotics for a period of two months and then two antibiotics for a further four months. The four main antibiotics for treating TB are called isoniazid, rifampicin, pyrazinamide and ethambutol. They are always prescribed in combination to reduce the risk of the bacteria becoming resistant to one or more of the drugs. Once treatment has started, people normally become non-infectious after about two weeks and begin to feel better after two to four weeks, but at least six months' drug treatment is required to cure the disease Failure to complete the prescribed course of drug treatment can lead to drug resistant or multi-drug resistant TB or MDR-TB (Conaty *et al.*, 2004).

Sometimes longer courses of treatment are needed, for example for TB meningitis, or if the bacteria are resistant to one or more of the usual antibiotics and different drugs need to be used.

What is BCG vaccine?

Bacillus Calmette-Guèrin (BCG) vaccine is used to help protect against TB. It is a modified strain of *Mycobacterium bovis*, the bacterium that causes TB in cattle. The bacteria in the vaccine are alive but have been modified so that they do not cause disease (except on occasion in people with lowered immunity, for example due to HIV infection).

BCG is given only once as a single injection into the skin with a fine needle.

Can TB be prevented by BCG vaccination?

BCG does not prevent TB in all cases. It works best against the most severe forms of disease in children, such as TB meningitis (Rodrigues *et al.*, 1993).

Why has the UK's BCG vaccination programme been changed?

- BCG vaccination was introduced in the UK in 1953 at a time when TB affected all parts of the UK population. It was given at the then school-leaving age (14 years) because the greatest risk for developing TB was when young people joined the workforce. Since the 1960s, in addition to the schools' programme, BCG has been offered to UK infants at higher risk of TB, as soon as possible.
- Since the 1950s, TB rates have declined in the indigenous UK population to very low levels indeed. TB has also changed from a disease affecting the general population to one affecting particular groups.
- The total number of TB cases has increased slightly in recent years, but this increase is confined to specific populations in major cities. Today, over most of the country, the risk from TB is very low and in most places declining. So, rather than having a universal vaccination programme, it is now more appropriate to have a selective programme that immunises children at an early age to ensure they are protected as soon as possible.

Who is offered BCG vaccination?

BCG vaccine is offered to:

- infants under 12 months of age born or living in areas where the incidence of TB is 40/100,000 of the population or greater
- children under 16 years of age whose parents or grandparents were born in or come from a country with a TB incidence of 40/100,000 of the population or greater
- previously unvaccinated new immigrants from high prevalence TB countries.

Countries with rates of TB over 40/100,000 are listed at www.hpa.org.uk/infections/topics_az/tb/epidemiology/who_table1.htm.

Do you need a BCG immunisation if you are travelling abroad?

BCG immunisation is recommended for those under 35 years of age, not previously vaccinated, who are going to visit, live or work for more than one month in a country with high rates of TB (www.dh.gov.uk, enter 'Green Book' in search box, click on Immunisation against infectious disease and go to Ch33 Tuberculosis).

Why do some people have a skin test before the BCG vaccine?

Some individuals will have a skin test before the BCG vaccine (see below). This is performed to determine if the immune system already recognises TB. It involves injecting a small amount of tuberculin – a solution of purified proteins from *M. tuberculosis* – into the skin. The injection site is inspected two to three days later.

The test is positive when there is a raised red reaction at the needle site. In this case, BCG vaccine should not be given as the person has already come into contact with TB or other similar bacteria and their immune system has already responded. If the test is strongly positive then further investigation may be necessary as the person may be infected with TB or have TB disease.

Who needs a skin test?

A tuberculin skin test is necessary prior to BCG vaccination for:

- all individuals six years and over
- infants and children under six years of age with a history of residence or prolonged stay (more than one month) in a country with an annual TB incidence of 40/100,000 or greater
- those who have had close contact with a person with known tuberculosis.

What should be done if someone has been in contact with a person with TB?

When someone is diagnosed with TB, the local chest clinic staff will assess the risk posed to other people. If a person is infectious, or if a child has developed TB and the source of the infection is unknown, then close contacts will be invited for screening. Close contacts are people living in the same household and close family members. Sometimes casual contacts, e.g. work colleagues and friends, may be invited for screening but this is often not necessary.

It is extremely rare for children with TB disease to be infectious because they don't tend to get infectious TB of the lungs but are affected by TB in other parts of the body – but their TB suggests there is an infectious adult in their vicinity.

Screening of contacts is done to identify people who may have been infected with TB or who have active disease. Screening will involve a skin test and in some cases a chest x-ray. In the UK, people's skin tests will often be mildly positive (a raised red reaction at the needle site) as a result of their having had a BCG vaccination. If the skin test is strongly positive a chest x-ray will be taken to look for signs of TB disease. If signs of infection or disease are identified, the person will be referred to a specialist doctor and may be treated with a course of anti-TB drugs.

The UK picture

Isn't TB a disease of the past?

No. TB steadily declined during most of the last century, up until 1987, but the disease never went away – there were still over 5000 cases a year in the UK in the late 1980s when TB was at its lowest (HPA2).

Throughout the nineteenth and early twentieth century, TB ('consumption') was common in the cities of Europe and North America. London was one of the worst affected areas. TB once caused about one in eight of all deaths in the UK (Charlton and Murphy, 1997; Office for National Statistics). The decline was achieved through a combination of better housing and nutrition; isolation of infectious cases; pasteurisation of milk; antibiotics against TB; early detection through mass chest x-ray programmes and BCG immunisation.

How common is TB in the UK today?

Cases of TB in the UK fell from 50,000 a year in 1950 to 5745 in 1987, the lowest recorded level. Since then, the numbers in the UK have been rising again and have increased by 27% to 7300 a year (Figure 1). In London, the numbers have doubled; they now account for almost 40% (3000) of the national total.

Each year about 350 people in Britain die from TB (HPA1).

Why is the number of cases of TB increasing in the UK?

Like most countries, the UK is affected by the worldwide resurgence of TB. As an airborne infectious disease that travels with affected individuals, no part of the world can be isolated. Case numbers in the UK have begun to rise due to a combination of factors. These include increased migration of people from areas of the world where TB is more common than in the UK and the increased mobility of the UK population. An ageing population and the emergence of HIV, have also added to this increase.

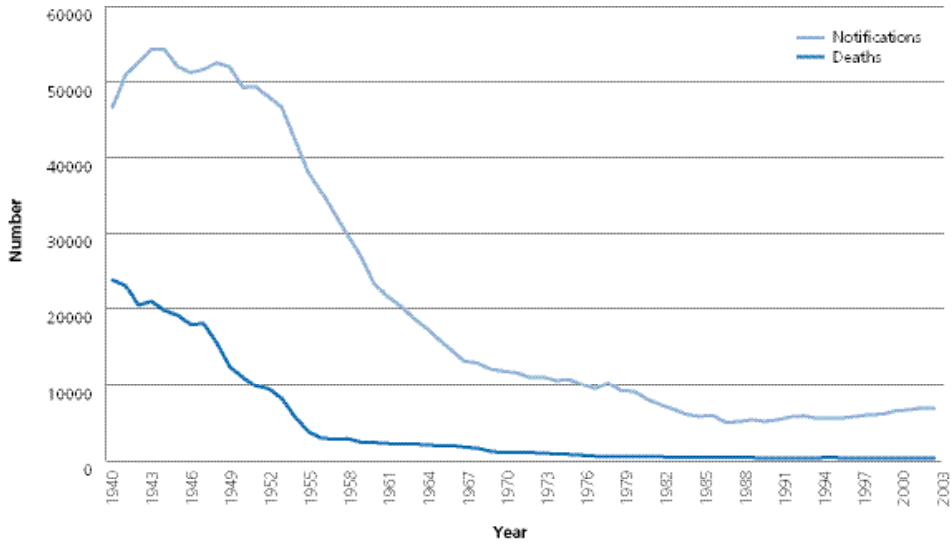
Who is most at risk from TB?

Anyone can get TB but some people are more at risk.

Although TB is increasing in the UK, it remains quite rare and is found mainly in London and the other major cities where the risk factors tend to be concentrated.

In the UK, those who are at most risk of developing TB disease are people who:

- are close contacts of a person with infectious TB
- have visited, lived or worked for a long time in countries with a high rate of TB
- are the children of parents whose country of origin has a high rate of TB
- have a weakened immune system due to disease or treatment (HIV is a particular risk factor)



* For 2002 and 2003 the NOIDS (notifications) figures have been estimated using the Enhanced figures for 2002 and 2003

Figure 1 TB notifications and deaths in England and Wales, 1940–2003
Health Protection Agency, Centre for Infection (Sources: Statutory Notifications of Infectious Diseases (NOIDs), HPA Centre For Infections. Office for National Statistics (notifications of infectious disease deaths))

- are homeless or living in poor or overcrowded conditions or undernourished
- may have been exposed to TB in their youth when the disease was more common in this country
- have been in prison
- are addicted to drugs or misuse alcohol.

Young children and very elderly people are more susceptible to TB.

What is being done to control TB in the UK?

The Chief Medical Officer published a National TB Action Plan *Stopping Tuberculosis in England* in October 2004, which sets out the steps needed to reverse the rise in TB in England (Department of Health, 2004).

TB can be controlled by:

- promptly recognising and treating people with the disease
- ensuring that people with the disease complete their treatment (not fully completing the prescribed course of treatment not only fails to control the disease but contributes to the growth of drug resistance)
- protection through BCG immunisation of those at high risk of infection
- health promotion, education and raising awareness
- concentrating these activities on those most at risk from TB.

The global picture

TB caused 100 million deaths in the last century and was declared a Global Health Emergency by The World Health Organization in 1993 (WHO 1). It is estimated that a third of the world's population is infected and there are almost nine million new cases every year (see WHO 2 for map). Someone is newly infected with TB every second.

Most people's immune systems are able to keep the infection under control so they do not go on to develop active TB. Even so, TB is the cause of around two million deaths worldwide every year, one every 15 seconds (WHO 3). Of these deaths, 98% occur in the developing world and particularly in South Asia and sub-Saharan Africa (WHO 2).

TB is the leading killer of women and it creates more orphans than any other infectious disease.

What is being done to tackle TB globally?

TB can only be tackled by global effort. Control of TB in any one area of the world depends on it being controlled elsewhere.

The World Health Organization promotes a global strategy called DOTS (Directly Observed Treatment – Shortcourse) to tackle TB (WHO 4). This is a five-point strategy dependent on:

1. sustained political commitment
2. access to quality-assured TB sputum (phlegm) microscopy for accurate diagnosis
3. standardised short-course (six months) *chemotherapy* for all cases of TB, under proper case-management conditions
4. uninterrupted supply of quality-assured drugs
5. recording and reporting systems that enable treatment outcomes to be monitored.

Which countries have high rates of TB?

Countries that have high rates of TB over 40/100,000 of the population are listed at www.hpa.org.uk/infections/topics_az/tb/epidemiology/who_table1.htm

Glossary

antibiotics – special medicines used to treat infections that work either by killing bacteria or by stopping them multiplying

bacterium/bacteria – single cell micro-organisms (germs), some of which cause disease. Others are essential for our bodies to work properly.

BCG – Bacillus Calmette-Guèrin – the vaccine that helps protect against TB, named after the two scientists who developed it. Although it does not work in all cases, it is most effective against the more severe forms of disease in children such as TB meningitis.

chemotherapy – the use of particularly strong drugs over a period of time to cure a disease – in the case of TB the drugs used are special antibiotics.

clinical isolation – people being treated in hospital for TB need to stay in a special room on their own while they are infectious so they do not infect other people.

DOTS strategy – 'Directly Observed Therapy Short course', or DOTS for short, is the name given to the World Health Organization's strategy to get TB under control worldwide. At its core is recognition of the need to supervise every patient with TB until they have completed their treatment.

drug-resistant TB – TB due to strains of *Mycobacterium tuberculosis* (the germ that causes TB) that are resistant to one of the usual TB antibiotics; different types of treatment may be needed. Multidrug-resistant (MDR) TB is resistant to several TB antibiotics and is particularly difficult to treat

haemorrhage – a discharge of blood from a blood vessel.

Mantoux skin tests – tests carried out to help diagnose TB or before immunisation to see if someone is already immune to TB and therefore does not need a BCG injection.

immune system – the body's system for fighting infectious disease.

inactive state – some bacteria can live in the body in an inactive state for many years without causing any disease (latent infection). They may later become active and cause the disease.

lymph nodes – parts of the lymph system of the body that collect lymphatic fluid, filter it and return it to the blood stream. They also contain special types of white blood cells that destroy bacteria and viruses.

Mycobacterium tuberculosis (M Tb) – the bacterium (germ) that causes TB.

pasteurisation – the sterilisation of milk by heating to kill the *Mycobacterium bovis* bacteria that cause TB in cattle (bovine TB) but can also affect man.

primary disease – the first TB infection in an individual. It usually passes unnoticed, and clears up without treatment. However, some people, especially children, develop TB within months or even weeks of being exposed to the bacteria.

pulmonary TB – TB affecting the lungs. People with pulmonary TB are infectious if the TB bacteria can be seen in their sputum (phlegm) when it is examined under a microscope.

screening – a process where people are checked to see if they are already infected with TB. This can consist of a tuberculin skin test, and/or a chest x-ray. In the future a blood test may be used.

TB meningitis – swelling of the lining of the brain caused by TB infection.

TB sputum microscopy – examining someone's sputum (spit or phlegm) under a microscope to see if they have TB infection.

tuberculin – a solution of purified proteins from *M. tuberculosis* that is used in the Mantoux test. The tuberculin is injected into the arm to see if the body recognises the bacterium. A weak reaction in the form of a raised red area where the tuberculin was injected means the person may have been exposed to TB or similar germs in the past and immunisation against TB is not required. A strong reaction may mean the person has TB.

tuberculosis (TB) – a serious, but curable, infectious disease caused by the bacterium *Mycobacterium tuberculosis*. It usually affects the lungs but can affect other parts of the body such as the lymph glands, bones and kidneys. It can also cause meningitis.

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World Health Organization (2) http://www.who.int/tb/publications/global_report/2005/annexes_countrydata/en/index.html

World Health Organization (3) Tuberculosis: The worsening epidemic. http://w3.whosea.org/tb/pdf/kit/right7.pdf

World Health Organization (4) http://www.who.int/tb/dots/en/

For further information

Websites

To find out more about TB you can visit:

www.who.int

www.hpa.org.uk

www.tbalert.org

www.dh.gov.uk

www.immunisation.nhs.uk

The symptoms, diagnosis and complications of the more common types of TB – a guide for health professionals

Type of disease	Symptoms/signs	Diagnosis	Complications
TB in general	Fever (up to 80% patients), loss of appetite, weight loss, night sweats, lassitude	Tuberculin skin test (but may be negative early, in disseminated disease or if immunocompromised) Chest x-ray Microscopy, culture or histology of relevant tissue/body fluid	
Primary infection	Usually symptomless or mild illness resolving spontaneously Erythema nodosum	Tuberculin skin test Chest x-ray	Pressure on bronchi causing cough, wheeze, lung collapse Caseation/rupture of parabronchial or paratracheal nodes
Pulmonary (lung)	Cough, sputum (usually purulent, sometimes blood-streaked) Aching or pleuritic chest pain	Chest x-ray (abnormal in nearly all cases) Sputum microscopy/culture Pleural biopsy	Pleural effusion Haemorrhage from the lungs TB empyema or discharging sinus
Lymph nodes, e.g. neck, groin, mediastinum	Usually painless, slowly enlarging nodes, often bilateral Mediastinum: cough	Microscopy/culture of aspirated pus or biopsy material	Abscess, rupture with resulting discharging sinus Mediastinal nodes may erode trachea, bronchi or vena cava
Orthopaedic (bone/joint), most commonly spine (Pott's disease), also knee, ankle, hip, any other bone or multiple sites	Back pain, local tenderness, rarely radicular pain, kyphosis with or without paraparesis or paraplegia Pain in relevant bone/joint	Radiology Biopsy	Psoas abscess Abscess of long bones extending into joints Permanent damage to joints
Abdominal	Intestinal tract: diarrhoea, abdominal pain, rapid weight loss Peritoneal: chronic recurrent abdominal pain, bowel irregularity, abdominal swelling	Radiology Biopsy Peritoneal aspiration/biopsy	Bowel obstruction
Pericarditis ('dry' or with pericardial effusion)	Chest pain, shortness of breath, pericardial rub	Radiology, pericardial aspiration/biopsy	Heart failure
Genito-urinary (kidney, ureter, bladder)	Kidney may be symptomless for years; loin pain, back ache Frequency, dysuria, haematuria (usually microscopic though may be frank) Ureteric colic Haematuria/pyuria with sterile urine on routine culture	Radiology Microscopy/culture of early morning urine Cystoscopy and biopsy	Cold abscess Chronic renal insufficiency Hydronephrosis due to ureteric obstruction Ulceration/fibrosis and/or shrinkage of bladder
TB meningitis Tuberculoma	Headache, nausea and vomiting, drowsiness, irritability, behavioural change, epilepsy, altered consciousness	Radiology Microscopy/culture of CSF	Permanent neurological deficit
Disseminated (miliary)	Dry cough, breathlessness Choroidal tubercles	Chest x-ray (but may be normal) Microscopy/culture of sputum, urine, blood, pleural fluid etc Microscopy/culture/histology of biopsy material, e.g. liver, lymph node, bone marrow, bronchoscopic lung biopsy	Pleural effusion(s) Organ failure, death
Skin (lupus vulgaris)	Ulcerating granulomas of the skin, usually face	Microscopy/culture of discharge or biopsy material	
Larynx	Hoarseness of voice Pain Dysphagia	Sputum microscopy Laryngoscopy/biopsy	Usually associated with advanced pulmonary TB

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