

# **THE CONTROL OF TUBERCULOSIS IN SCOTLAND**

**The Scottish Office Department of Health, 1998**



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## FOREWORD

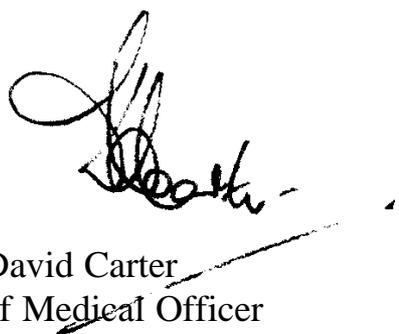
In past centuries tuberculosis was a major cause of morbidity and mortality in the United Kingdom. In the 17<sup>th</sup> century John Bunyan termed the disease ‘captain of all the men of death’; in the middle of the 19<sup>th</sup> century tuberculosis accounted for approximately one in eight of all deaths in this country. The relatively recent decline in the number of cases and of deaths represents a major public health achievement.

Although there were only 509 notifications of tuberculosis in Scotland in 1996, the infection remains a major and escalating problem in the developing world. In many countries (and in parts of the United Kingdom) associations between tuberculosis and HIV infection, and between tuberculosis and homelessness, are leading to increasing numbers of cases. Sub-optimal treatment and management of cases has contributed to the development of strains of *Mycobacterium tuberculosis* which are resistant to a number of antibiotics. For this reason, great emphasis is placed on the importance of prescribing, and ensuring compliance with, an appropriate drug regimen.

Scotland, unlike other countries, has not experienced a recent increase in numbers of cases of tuberculosis, but the downward trend of recent years has halted. In addition, the proportion of cases in Scotland which exhibit multi-drug resistance, although small, is increasing. We must therefore guard against any degree of complacency and ensure that all aspects of the control and management of tuberculosis conform to the highest standards.

In 1994 increasing concern about the global situation with respect to tuberculosis led to the establishment of an Interdepartmental Working Group on Tuberculosis to review the current situation in the United Kingdom and to consider what, if any, further measures were required for the control of tuberculosis. Four sub-groups were established to consider the prevention and control of tuberculosis at local level; tuberculosis and homeless people; the implications of multi-drug resistant tuberculosis and HIV-related tuberculosis; and tuberculosis surveillance systems.

*The Control of Tuberculosis in Scotland* guidelines are based on the findings and recommendations of the Interdepartmental Working Group sub-committees and take account of the latest British Thoracic Society Code of Practice for the prevention and control of tuberculosis in the United Kingdom. The guidelines consider the control of tuberculosis in the wider public health policy context in a way that is appropriate for the practical arrangements in place in Scotland. The Scottish guidelines update the 1993 guidance on the control tuberculosis in Scotland and cover all aspects of surveillance, diagnosis, prevention and management. If appropriately implemented, they will play a major part in Scotland’s response to what remains a serious threat to the public health.



Sir David Carter  
Chief Medical Officer

## SUMMARY

*The control of tuberculosis in Scotland* brings together the various current expert professional guidelines on tuberculosis, and seeks to ensure a consistency of approach in the detection, control and treatment of this disease. The original need for this document was created by the distinct differences in practical arrangements that exist between Scotland and the rest of the UK, but this also presented the opportunity to harmonise existing multiple sources of guidance, and to suggest new approaches to issues where there is currently no agreed policy.

The document falls into five sections:

- A **Background information** on the need for these Scottish guidelines and on the national and international evolution of the tuberculosis epidemic
- B **Surveillance mechanisms**, including the current arrangements for statutory notification of cases, laboratory reporting and submission of samples, national surveillance, and the communications network essential for effective public health action
- C **Prevention, diagnosis and management** of cases; this section deals with the practical issues encompassing screening tests, vaccination, laboratory diagnosis, notification of cases, antibiotic treatment (including management of multi-drug resistant strains), tracing and management of contacts of cases, and management of outbreaks and major incidents
- D **Special situations** where particular groups of people require a more specialised approach, namely children, the homeless, HIV-infected persons, immigrants and emigrants; those in institutional and similar settings (including prisons, hospitals, nursing/residential homes and the workplace); those with occupational risks (including healthcare staff and those in contact with animals)
- E **Other aspects** of importance in the fight against tuberculosis, namely education and training of healthcare staff, audit of clinical and epidemiological protocols and practice, the need for ongoing research, and the necessity of ensuring that local and national services are adequately resourced to maximise health gain.

In addition, a number of appendices are supplied, including form letters for contacts of cases and self-reporting diagrams for skin test subjects.

It is intended that these guidelines should be regularly reviewed, and the physical format of this document is designed to allow substitution with updated sections and also permits inclusion of other relevant local or national documents within the one cover.

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The Group is grateful to medical, nursing and veterinary colleagues for assistance with specialised areas of the Guidelines, and in particular to Sir John Crofton and Dr Peter Ormerod for their helpful comments on the final draft of the document. Our thanks also to Mark Getty at SCIEH for his work on graphics and layout.

### **Dr Gordon Leitch**

Dr Gordon Leitch tragically died in a swimming accident while on holiday in Cyprus. His contribution to the epidemiology, prevention and management of tuberculosis in Scotland and beyond was remarkable, and he leaves a large gap in the fabric that will not easily be filled.

His substantial contribution to these Guidelines represents one of his final major projects in the field of tuberculosis. He would have much enjoyed being part of the new developments in tuberculosis control and management, an area which he made peculiarly his own in his native Scotland.

**ABBREVIATIONS**

<b>AIDS</b>	Acquired Immune Deficiency Syndrome
<b>BCG</b>	Bacillus Calmette-Guerin
<b>BTS</b>	British Thoracic Society
<b>CAMO</b>	Chief Administrative Medical Officer
<b>CPHM (CD &amp; EH)</b>	Consultant in Public Health Medicine (Communicable Disease & Environmental Health)
<b>DVM</b>	Divisional Veterinary Manager
<b>EMAS</b>	Employment Medical Advisory Service
<b>ESMI</b>	Enhanced Surveillance of Mycobacterial Infections
<b>HIV</b>	Human Immunodeficiency Virus
<b>HCU</b>	Health Control Unit (Port Health)
<b>ICT</b>	Incident Control Team
<b>ISD</b>	Information & Statistics Division (Common Services Agency)
<b>MDRTB</b>	Multi Drug Resistant Tuberculosis
<b>MOEH</b>	Medical Officer for Environmental Health
<b>PPD</b>	Purified Protein Derivative
<b>SCIEH</b>	Scottish Centre for Infection and Environmental Health
<b>SMRL</b>	Scottish Mycobacteria Reference Laboratory
<b>SODoH</b>	Scottish Office Department of Health
<b>WHO</b>	World Health Organization

# NATIONAL GUIDELINES FOR THE CONTROL OF TUBERCULOSIS IN SCOTLAND

## A. BACKGROUND

### 1 Aims of the Guidelines

The remit of the Working Group was:

*“to produce a revised set of the Scottish Guidelines on control of tuberculosis, encompassing prevention, surveillance, diagnosis and management of tuberculosis with a view to encouraging best practice by Public Health Physicians, clinicians, laboratories, contact tracers and other interested agencies”*

The need for a revision was agreed in the light of a number of policy documents and guidelines being issued, which have appeared since the publication of *The Control of Tuberculosis in Scotland - Public Health Aspects* by the Scottish Consultants in Public Health Medicine (CD & EH) in 1993<sup>1</sup>, notably the British Thoracic Society Code of Practice<sup>2</sup> and a series of reports from the UK Inter-Departmental Working Group on Tuberculosis<sup>3,4,5</sup>.

It is intended that the present Guidelines should bring together in one document the philosophies and best practices expressed in all these documents, and provide practical assistance in the surveillance, diagnosis and control of tuberculosis in Scotland. While principally aimed at the public health aspects of the disease, it is hoped that these Guidelines may also be useful in encouraging uniformity in clinical practice and in encouraging communication and cooperation between the various professional groups involved.

This document does not seek to re-examine the scientific basis for current expert recommendations made elsewhere, and new material or philosophies have been added only where these were absent or where there was a conflict between existing guidelines. Having said that, the Working Group fully appreciates that the evidence base in many areas of practice is slim, and would benefit from a fundamental review of the available supporting data and additional research.

### 2 Epidemiological background

#### 2.1 Definition of tuberculosis

Tuberculosis is defined as disease caused in man by infection with the *Mycobacterium tuberculosis* complex of organisms (*M. tuberculosis*, *M. bovis* and *M. africanum*), which may cause pulmonary and/or non-pulmonary disease. Such disease may be confirmed in life by bacteriological or pathological examination of tissues or specimens; alternatively the diagnosis may be based on clinical and radiological features of disease. A diagnosis may also be made at post-mortem examination.

It is generally held that **around 10% of those infected actually develop the disease, half within one year of infection and half over the following 60 years or so**<sup>6</sup>. This proportion varies with the intensity and duration of exposure, and is greater in immunocompromised patients. Suggested definitions of terms are shown in Table 1.

#### 2.2 Epidemiology of tuberculosis in Scotland

In the 1850s tuberculosis was one of the most common causes of death in Scotland with a recorded mortality rate of about 400 per 100,000 in 1850. Notification of tuberculosis became statutory in 1914 and, as with mortality rates, notification rates fell progressively apart from documented increased rates as a result of both world wars. The early 1950s saw the establishment of effective chemotherapy for tuberculosis and an acceleration of the rate of decline of mortality and notifications from tuberculosis in Scotland. Mortality and notification rate trends since 1914 are illustrated in Figures 1 and 2.

The decline of notification rates for tuberculosis in Scotland continued until the mid 1980s when the annual number of notifications of disease in Scotland appeared to plateau, a situation which has persisted up to 1996 (Figure 2). Plateauing in notifications in Scotland over the last ten years mirrors similar trends seen in other European countries including England and Wales. In some of these countries, e.g. Switzerland and Holland, an increase in total number of notifications of tuberculosis reflects an increasing contribution from immigrant and refugee populations in these nations. In some countries a significant contribution to annual tuberculosis

notifications is made by individuals with HIV infection. Scotland has a low immigrant population (less than 1% of the population are from the Indian sub-continent) and few refugees. HIV co-infection contributes less than 2% to tuberculosis notifications in Scotland (1993 Tuberculosis Survey)<sup>7</sup>. There is no consistent trend in any individual age group since 1987 (Figure 3), but these figures confirm the higher rates of tuberculosis (mainly reactivation disease) in the elderly.

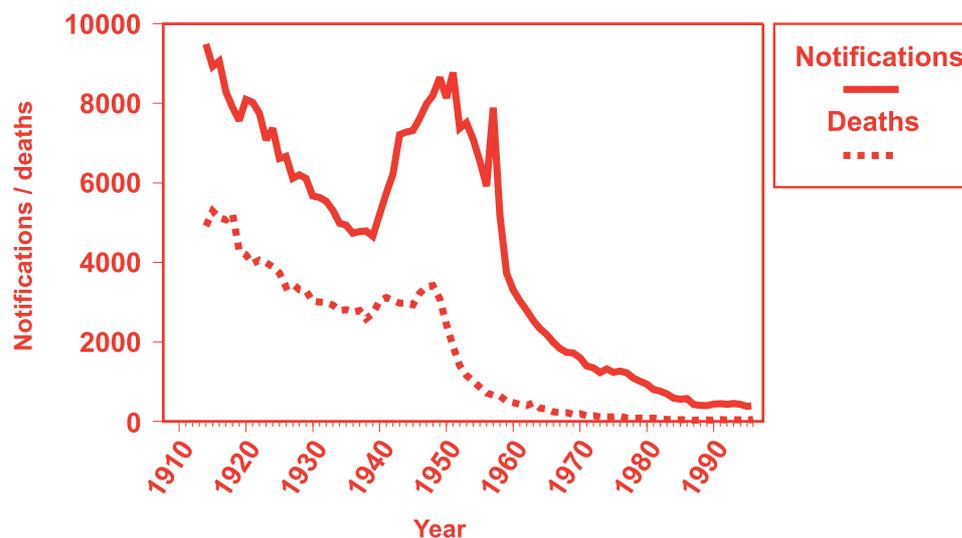
### 2.3 Epidemiology of tuberculosis in the rest of the UK and worldwide

In England and Wales tuberculosis notifications have also ceased declining in the last ten years and have possibly risen slightly. England and Wales differ from Scotland in having a relatively higher immigrant and refugee population and this is reflected in the breakdown of notification figures in England and Wales (e.g. in the 1993 Tuberculosis Survey, over half the notifications of tuberculosis were in non-white groups<sup>8</sup>). As was the case in the parallel 1993 survey in Scotland, tuberculosis in HIV infected individuals did not make a significant contribution to the total numbers of tuberculosis notifications. Despite the predominance of reactivation as a cause of disease, recent American studies have shown that 30-40% of ascertained cases in New York and San Francisco may be recently acquired<sup>9,10</sup>: this was partly related to the well-recognised influence of HIV/AIDS in these cities, but further emphasises the importance of contact tracing in tuberculosis control.

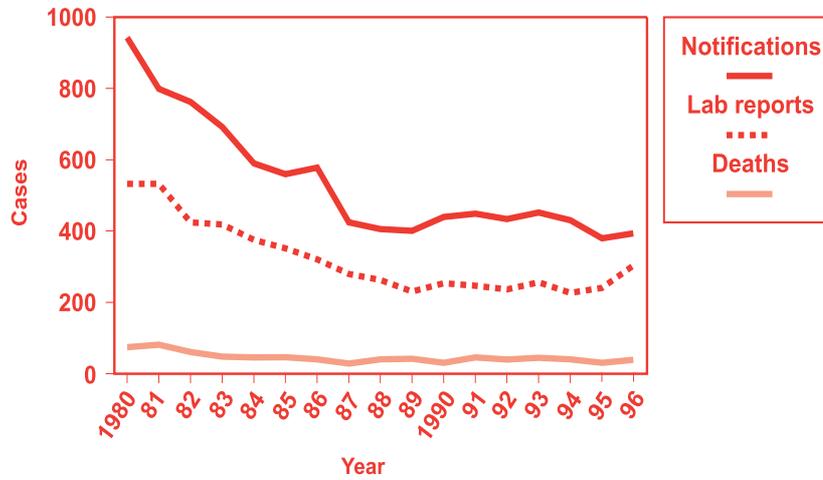
Tuberculosis has been declared a global emergency by the World Health Organization. The state of emergency reflects the dramatically rising reporting rates in certain non-European countries particularly in sub-Saharan Africa, Asia and in Southern America. In Africa and Asia where the majority of the population have previously been infected with tuberculosis and disease rates were previously high the advent of immunodeficiency induced by HIV infection has led to a logarithmic acceleration of tuberculosis rates. For example in Tanzania, a country which is generally accepted to have the most effective national tuberculosis programme in the developing world with an 80% effective cure rate, tuberculosis rates have risen progressively in the last ten years in spite of the effect of therapeutic intervention for identified cases (see Figure 4 for a comparison of notification rates in Tanzania and Scotland). This is largely attributable to HIV infection, with at least 30% (possibly 50%) of cases of tuberculosis in Tanzania being HIV positive.

These world-wide epidemiological changes have national implications. Residents from high prevalence areas moving to Scotland may develop tuberculosis during their stay in Scotland, for example foreign students studying at University; in addition, UK nationals returning from high-prevalence areas are at increased risk (see Section 14 for further details).

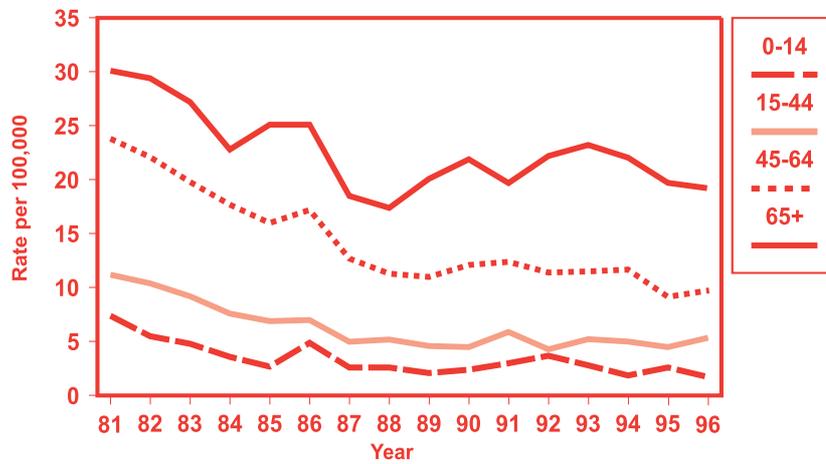
**FIGURE 1:** Respiratory tuberculosis notifications and deaths, Scotland 1914-1996



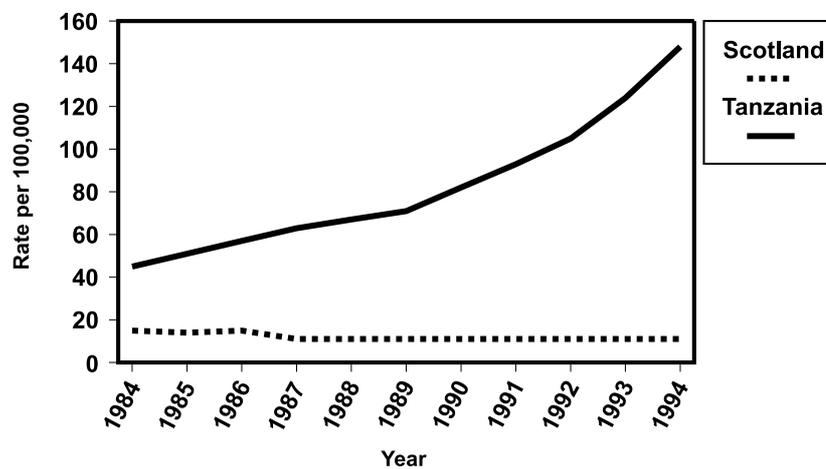
**FIGURE 2:** Respiratory tuberculosis notifications, deaths and laboratory confirmed cases, Scotland 1980-1996



**FIGURE 3:** Age-specific respiratory tuberculosis notification rates per 100,000 population, Scotland 1981-96 [Source: ISD]



**FIGURE 4:** Respiratory tuberculosis notifications per 100,000 population, Scotland and Tanzania 1984-94



**TABLE 1:** Definitions

<p><b>Case</b></p>	<p><b>A case of tuberculosis is defined as one of the following:</b></p> <p><b>Confirmed:</b> culture confirmed disease due to <i>Mycobacterium tuberculosis</i>, <i>M. bovis</i> or <i>M. africanum</i>.</p> <p><b>Probable:</b> in the absence of culture confirmation,</p> <ul style="list-style-type: none"> <li>• signs and/or symptoms compatible with tuberculosis <b>and</b></li> <li>• treatment with two or more anti-tuberculous drugs <b>and</b></li> <li>• <b>either</b> microscopic / histological evidence of mycobacterial infection <b>or</b> a positive tuberculin test result.</li> </ul> <p><b>Possible:</b> in the absence of culture confirmation,</p> <ul style="list-style-type: none"> <li>• microscopic / histological evidence of mycobacterial infection or positive tuberculin test results, or signs and/or symptoms compatible with tuberculosis <b>and</b></li> <li>• treatment with two or more anti-tuberculous drugs</li> </ul> <p>Culture confirmed cases of active tuberculosis diagnosed at post mortem should be classified as <b>confirmed</b>. Active cases identified at post mortem on the basis of histopathological findings, in the absence of culture confirmation, should be classified as <b>probable</b>.</p>
<p><b>Chemoprophylaxis</b></p>	<p>Administration of antituberculous drugs to prevent the development of infection, or to prevent the progression of infection to manifest disease, usually on the basis of a positive tuberculin reaction without symptoms or radiological changes. Chemoprophylaxis patients should <b>not</b> be statutorily notified as cases of tuberculosis.</p>
<p><b>Contact</b></p>	<p>A person who has been in association with an infected person or animal or contaminated environment (eg laboratory) which might provide a significant opportunity to acquire infection with <i>M. tuberculosis</i>, <i>M. bovis</i> or <i>M. africanum</i>.</p>
<p><b>Non-pulmonary tuberculosis</b></p>	<p>Tuberculosis affecting any part of the body apart from the lung.</p>
<p><b>Pulmonary tuberculosis</b></p>	<p>Tuberculosis in which the disease involves the lung parenchyma or tracheobronchial tree (excluding the pleura). For contact tracing purposes, pulmonary tuberculosis is divided into:</p> <ul style="list-style-type: none"> <li>• <b>Smear positive</b>, where mycobacteria can be seen on direct staining of a film of sputum derived from coughing or sputum induction. Does not include bronchial aspiration/lavage or other specimens obtained by instrumentation. (Gastric washings in children may have to serve as a proxy for smear status).</li> <li>• <b>Smear negative</b>, where no mycobacteria can be found on staining of three samples <math>\geq 24</math> hours apart. However, mycobacteria may be cultured, or there may be other clinical/pathological evidence of pulmonary tuberculosis (e.g. bronchial aspiration/lavage, biopsy).</li> </ul>
<p><b>Respiratory tuberculosis</b></p>	<p>Tuberculosis in which the principal site of infection is the lung parenchyma, tracheobronchial tree, larynx, upper respiratory tract or pleura; statutory notification currently refers to “respiratory” tuberculosis.</p>

## B. SURVEILLANCE

### 3 Surveillance mechanisms

Surveillance consists of the continuing scrutiny of the occurrence and spread of a disease to enable and inform public health action which is appropriate, timely and effective.

At a local level, surveillance is important to identify potential sources and outbreaks of tuberculosis, and to allow adequate contact tracing. It is also valuable in establishing the level of immunity and BCG vaccine uptake in a community. In addition, good surveillance allows valuable resources to be coordinated properly.

At a national level, surveillance is particularly important in identifying trends which are not obvious in smaller populations. Problems can be identified in particular subgroups of the population, such as the elderly or particular ethnic groups. The emergence of antibiotic-resistant tuberculosis strains can also be monitored. Surveillance data are also important in formulating national policies.

#### 3.1 Notifications

Both respiratory and non-respiratory tuberculosis are statutorily notifiable, the legislation requiring the attending physician to notify the Chief Administrative Medical Officer (CAMO) in the local Health Board area. Cases may also come to the attention of Departments of Public Health Medicine via informal reports from clinicians, laboratories, or other sources, in which case the CAMO or nominated Consultant in Public Health Medicine with responsibility for Communicable Diseases and Environmental Health (CPHM (CD&EH)) becomes responsible for notification and for denotification of cases subsequently found to be due to mycobacteria other than *M. tuberculosis* complex. **Suspected cases must be notified early on the basis of clinical suspicion rather than waiting for laboratory confirmation**, and in any case within three days of the decision to treat. Further information on notification is given in section 7.

#### 3.2 Laboratory reporting

At present, only 50-60% of notified cases are confirmed bacteriologically, often because no samples (or inappropriate samples) are submitted to the laboratory. It is important that as many cases as possible are confirmed bacteriologically, and that clinicians are encouraged to send fresh samples of tissue, body fluids etc, even if the clinical index of suspicion is low. Clinicians should liaise closely with their local laboratory.

In Scotland, the vast majority of laboratory diagnosed cases of tuberculosis are diagnosed by local laboratories on the basis of microscopy and/or culture. Cultures should then be sent on to the Scottish Mycobacteria Reference Laboratory (SMRL) for identification and sensitivity testing.

All patients locally diagnosed by microscopy or culture should be provisionally reported to the local CPHM. When identification results are received from SMRL these too should be reported as above.

#### 3.3 The Scottish Mycobacteria Reference Laboratory

The SMRL undertakes the identification (including molecular characterisation) and susceptibility testing of all mycobacterial isolates in Scotland, both for clinical management and for epidemiological purposes. The laboratory reports all identification results weekly to the Scottish Centre for Infection & Environmental Health (SCIEH), and provides regular epidemiological information as requested, and in the SMRL Annual Report. By means of a confidential reporting scheme, the laboratory is able to keep statistics of HIV-associated mycobacterial infections.

Cultures sent to the laboratory for testing should be accompanied by the relevant form, duly completed (see Appendix 1). As much information as possible should be given, and is welcomed. SMRL must be informed by fax or telephone before cultures or specimens are sent.

The SMRL is able to provide a laboratory resource for joint clinical/laboratory and epidemiological studies, and provides advice on the laboratory diagnosis and antimicrobial therapy of tuberculosis (see Section 8). Advice is always available on Control of Infection aspects of tuberculosis.

### **3.4 Enhanced Surveillance of Mycobacterial Infections (ESMI) in Scotland**

A major development in surveillance of tuberculosis will be the establishment of an Enhanced Surveillance of Mycobacterial Infections (ESMI) Scheme. This will incorporate the proposed European minimum data set, and will provide feedback to the various agencies involved in diagnosis, treatment and control of tuberculosis. ESMI will be administered by SCIEH under strict confidentiality conditions.

A new record in ESMI will be opened on receipt of information on a case of suspected or confirmed mycobacterial infection (including atypical mycobacteria), whether ascertained via laboratory report, statutory notification or other sources.

Further detailed information on individual cases will be collected by three months and at one year after diagnosis on special forms for incorporation into ESMI. These minimum data sets will comprise data on patient demographic characteristics, site of disease, smear status (positive/negative), treatment, culture results, drug sensitivities, and diagnostic status (confirmed, probable or possible case). Copies of the enhanced surveillance forms are reproduced as Appendix 2. These forms will be completed at local health board level prior to forwarding to SCIEH for incorporation into ESMI; thus, a full local dataset can be established while contributing to the national dataset.

SCIEH will undertake to produce an annual report on tuberculosis in Scotland utilising ESMI data, which will be circulated to CPHMs, clinicians and laboratories contributing to the scheme in addition to The Scottish Office Department of Health and other appropriate agencies. Data held in ESMI will be available to participating agencies at all times for ad hoc enquiries.

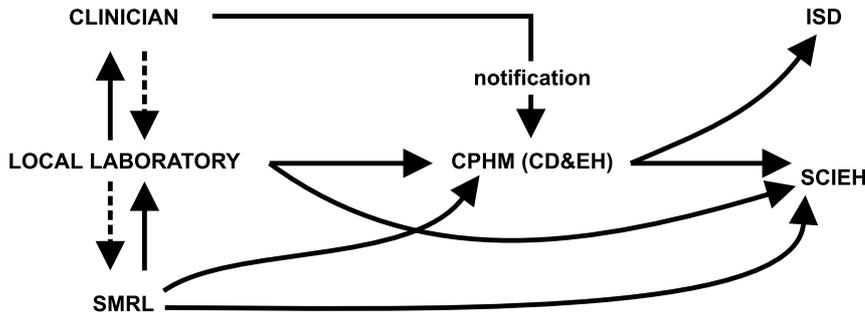
The flow of information envisaged for ESMI is shown in Figure 5.

### **3.5 Dissemination of information for action**

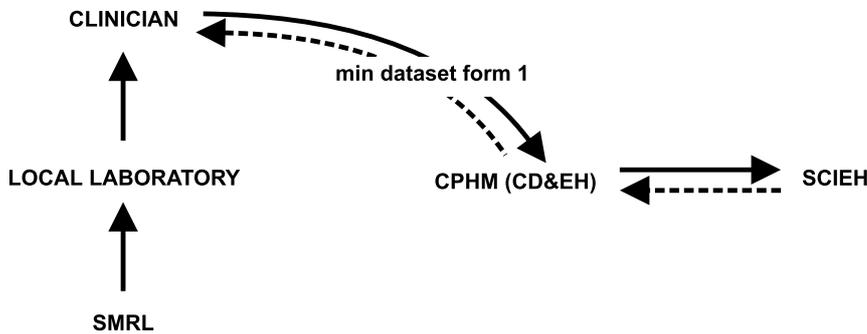
A single case of tuberculosis requires rapid public health action, in liaison with clinicians and laboratories, which is consistent with best practice; national surveillance of tuberculosis informs the strategic approach to the problem, identifies important trends in patterns of infection in the community, and allows tracking of cases across health board boundaries. There is a need for a clear and consistent flow of timely information between the key players to ensure that opportunities for health gain at local and national level are not lost.

**FIGURE 5:** Information flow for local and national surveillance of tuberculosis and other mycobacterial infection

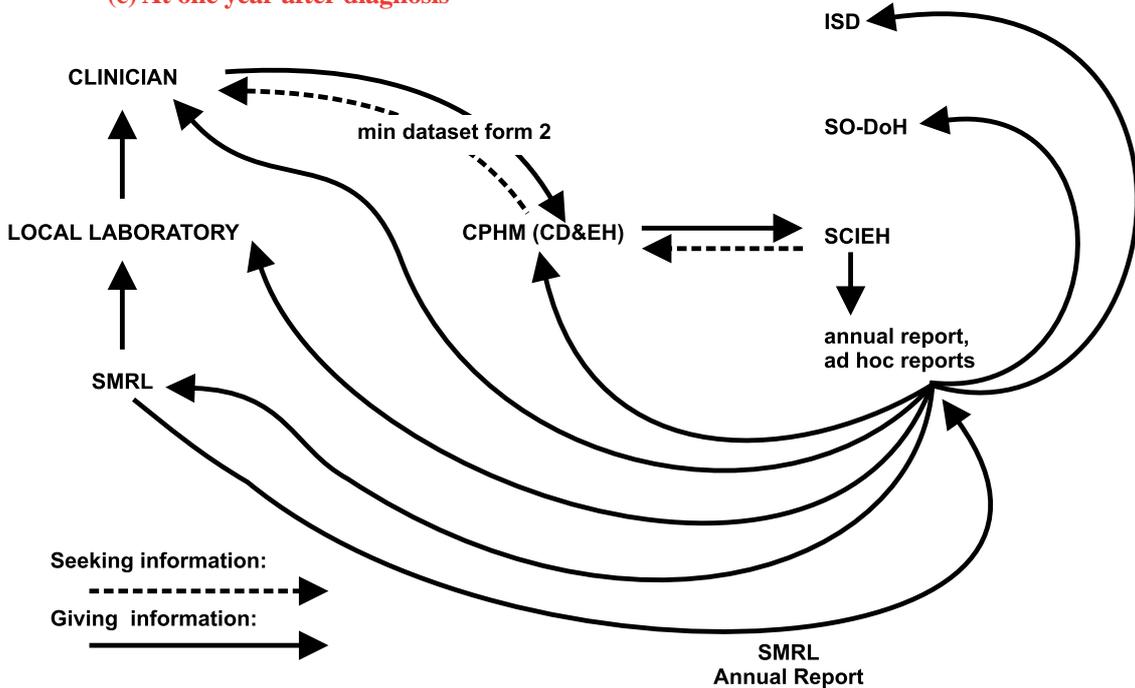
**(a) Immediately on discovering a case**



**(b) By three months after first diagnosis**



**(c) At one year after diagnosis**



## C. PREVENTION, DIAGNOSIS AND MANAGEMENT

### 4 Tuberculin testing & screening

#### 4.1 The rationale behind tuberculin testing

After first infection with tubercle bacilli, the body's responses include development of hypersensitivity (allergy) to tuberculo-proteins and also specific cell-mediated immunity. Subsequent contacts with tubercle bacilli incite a rapid response from primed lymphocytes. These collect around the site of invasion and produce tissue changes which inhibit the growth and dissemination of bacilli, and also destroy them.

While allergy and immunity develop together they are separate entities. The allergic element is demonstrable by the tuberculin test which indicates whether or not the subject is hypersensitive. A patient not infected by tubercle bacilli in the past gives a negative response, or at most a trivial non-specific one. With certain provisos (detailed below) an individual previously infected gives a positive result. **The degree of hypersensitivity does not necessarily correlate with the extent of the subject's immunity.**

The tuberculin test can be of great value not only in diagnosis but also in epidemiological work, including selection of subjects for BCG vaccination.

A tuberculin skin test must be carried out before BCG vaccination. The only exception to this rule is infants up to three months old who may be vaccinated without a prior test. The test assesses the individuals' sensitivity to tuberculin protein; a positive test implies past infection or past successful immunisation and such people should not be given BCG. Those with strongly positive tests may have active disease and must be referred to a chest clinic or other specialist facility for consideration of further investigation and treatment.

#### 4.2 Types of tuberculin tests

There are a number of techniques for tuberculin skin testing but **only** the Heaf test and the Mantoux test are recommended for general use. The Tine test is not recommended for use because of the well-documented evidence that its use can result in a considerable percentage of false negative reactions. Also, the Heaf gun with the disposable head is a more than adequate substitute. To ensure standardisation, and therefore correct interpretation, it is essential that the correct method is used, irrespective of whether Heaf or Mantoux is employed. **Testing procedures may appear simple but are often performed badly; in addition, mistakes can be made in interpreting results. This is particularly true of the Mantoux test, which is technically more difficult in administration and reading than the Heaf test and requires special expertise. The Mantoux may be more sensitive, but the Heaf is recommended for general use.**

Both Heaf and Mantoux tests use Purified Protein Derivative (PPD) which is obtained free of charge from Health Boards. This is a heat treated product derived from mycobacteria. **Care must be taken to ensure that the dilution of PPD used is that specified for the particular technique and careful attention must be given to the precautions described for each test to prevent any risk of cross-infection.**

#### 4.3 Storage and use of Purified Protein Derivative (PPD)

All tuberculin PPD must be stored between 2°C and 8°C (never frozen) and protected from light. Once an ampoule is opened, its contents should be used within one hour and not retained beyond that session. PPD tends to adsorb onto syringe surfaces and should therefore be used within 30 minutes after the syringe is filled. PPD may persist on the surface of any non-disposable syringe and on the endplate and needles of the standard Heaf gun, both of which need careful cleaning subsequently. The various strengths and uses of PPD are shown in Table 2.

**TABLE 2:** Tuberculin (PPD) units and usage

Strength units/ml	Dilution of PPD	Units of Dose of 0.1ml	Main use
100,000	standard	10,000	Heaf (multiple puncture test only)
1,000	1 in 100	100	For special diagnostic purposes only
100	1 in 1,000	10	Mantoux test (routine)
10	1 in 10,000	1	Mantoux test (special)

## 4.4 The Heaf test

This test was conventionally performed with a reusable Heaf multiple puncture apparatus (commonly known as a Heaf gun) which requires disinfection between subjects. Concern that blood borne infections such as hepatitis B and HIV might be transferred via this apparatus, should the recommended disinfection procedure not be strictly adhered to, has led to the development of a disposable head apparatus. **The disposable head Heaf apparatus is now recommended as the only method of Heaf testing which should be used and is the only method described.** It is particularly suitable for the schools BCG programme when multiple tests are performed in one session.

The present apparatus should not be confused with the earlier alternative version of the Heaf gun which had a magnetic head which held a replaceable six point steel plate. Studies showed a high false negative rate for use of this instrument, and the magnetic head itself could become contaminated with body fluids.

Concentrated PPD 100,000 units/ml is used for the Heaf test. This strength is only used for Heaf testing. It is supplied in packs of five ampoules of 1.0ml, each ampoule normally being sufficient for up to 50 tests.

### 4.4.1 The disposable head apparatus.

This equipment avoids the need for the disinfection, cleansing and maintenance required for the standard Heaf apparatus. It therefore ensures that no cross infection can occur between subjects and also avoids the possibility of needles becoming blunt and tuberculin building up on needles which are reused.

The disposable heads attach by a magnet to a handle. Six standard steel needles are retained in a plastic base which is enclosed in an outer plastic case with holes corresponding to the needles. The needles protrude only after actuation and then remain protruding so that it is easy to detect and discard ones which have been fired. The heads are prepacked and sterile.

There are three versions of the disposable head:

- White** this is the standard version for tuberculin testing in adults and children two years and over. The needles protrude 2mm on firing.
- Blue** for tuberculin testing children under two years. Needles protrude 1mm.
- Red** this version contains 18 needles for giving BCG by the percutaneous multiple puncture technique and must never be used for Heaf testing.

## 4.4.2 Performing the Heaf test

The recommended site for testing is on the flexor surface of the left forearm at the junction of the upper third with the lower two thirds, avoiding any eczematous areas. Cleansing the skin is only necessary if it is visibly dirty, in which case spirit should be used but must be allowed to dry completely before the test.

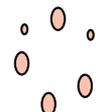
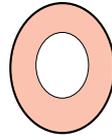
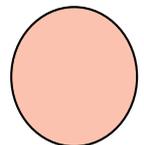
Tuberculin 100,000 units/ml should be withdrawn from the ampoule by needle and syringe and after detaching the needle a small quantity of solution should be dropped directly from the syringe onto the skin at the standard test site. Ensure that the correct head is being used and that there is sufficient tuberculin on the skin. The head of the apparatus should be used to disperse the tuberculin over an area of skin just greater than the head's diameter. The endplate should then be applied firmly and evenly to the area of skin covered by the tuberculin and pressure applied to the handle until the clicking firing mechanism operates. Do not apply further pressure after this, and withdraw the apparatus. Remove the tuberculin head from the handle by holding the outer rim and discard the head into a sharps bin.

Wipe off any excess tuberculin from the skin and observe the presence of six puncture marks. If these are not present the test has not been adequately applied, and should be repeated at a site slightly lower down the arm. Advise the patient that the arm may be wetted and washed normally but perfumes and other cosmetics should not be applied. Instructions should be given to the patient to return to have the test read.

## 4.4.3 Interpretation of the Heaf test

**The reaction is ideally assessed at seven days after administration**, although readings between three and ten days of administration may be acceptable. The reaction is graded 0-4 according to the degree of induration produced (erythema alone should be ignored) as shown in Table 3. The results should be recorded as a number and not merely as positive or negative. Self reporting cards for Heaf testing have been developed<sup>11</sup> (see Appendix 3).

**TABLE 3:** Interpretation of Heaf test results at seven days post administration

Heaf Grade	Result	Appearance
0	No induration at the puncture sites Erythema only is present. Discrete induration of three or fewer needle sites is acceptable. <b>Negative</b>	
1	Discrete induration at four or more needle sites. <b>Negative</b>	
2	Induration around each needle site merging with the next, forming a ring of induration but with a clear centre. <b>Positive</b>	
3	The centre of the reaction becomes indurated to form one uniform circle 5 - 10 mm wide. <b>Strong positive</b>	
4	Solid induration over 10 mm wide. Vesiculation or ulceration may also occur. <b>Strong positive</b>	

**Guidance on interpretation of Heaf and Mantoux reactions is as follows.**

- Heaf grades 0 and 1 (or Mantoux induration < 5mm diameter) are regarded as negative. Individuals who have not previously received BCG vaccination may be offered vaccination in the absence of contraindications. **Those who give a history of previous BCG should only be re-vaccinated if there is no evidence of a characteristic pale, flat, circular scar at any site.**
- Those with a grade 2 Heaf reaction (or Mantoux induration 5-14mm diameter) are positive. They are hypersensitive to tuberculin protein and should not be given BCG vaccine. When the vaccination is performed as part of a routine health prevention programme such as the schools programme, **no further action is required** (see Section 12). In other circumstances (eg immigrants, contacts of tuberculosis etc) subjects under 16 years old with a grade 2 reaction who have not previously had BCG vaccination should be referred to a chest physician or other specialist (see also Section 14 and Figures 6-8). Vaccination with BCG usually results in grade 1 or 2 Heaf test reactions.
- A more strongly positive reaction to tuberculin (Heaf grade 3 or 4, Mantoux induration of at least 15mm diameter) usually indicates prior **infection** with *M. tuberculosis*, but does not necessarily indicate active **disease**. A negative tuberculin test is commonly found in the presence of severe and disseminated tuberculosis. All those who show a strongly positive reaction to tuberculin, including those previously given BCG, should be referred for further investigation and supervision (which may include prophylactic chemotherapy). It is important to remember that BCG vaccination does not protect against infection with *M. tuberculosis*, but provides a degree of protection against subsequent development of clinical disease.

## 4.5 The Mantoux test

The PPD preparation for routine use in the Mantoux test (dilution 100 units/ml) is supplied in ampoules containing 1.0 ml. The contents of an ampoule will therefore be sufficient for five or six tests. For tests in patients in whom tuberculosis is suspected, or who are known to be hypersensitive to tuberculin, a dilution of 10 units/ml should be used (see Section 5.9 for details of suppliers).

The Mantoux test is performed using a 1ml syringe and a short bevel 25 gauge (0.5 x 10mm) or 26 gauge (0.45 x 10mm) needle. A separate syringe and needle must be used for each subject to prevent cross infection.

The test should be performed on the upper third of the flexor surface of the forearm. The site is cleaned if necessary with spirit and allowed to dry. 0.1ml of tuberculin PPD dilution 100 units/ml is injected **intradermally** so that a bleb is produced typically of 7mm diameter. **The results should be read 48 to 72 hours later**, but a valid reading can usually be obtained up to 96 hours. A positive result consists of transverse **induration** (not erythema) of at least 5mm diameter following injection of 0.1ml PPD 100 units/ml (see Table 4).

**TABLE 4:** Interpretation of Mantoux test results at 48-72 hours

Extent of Induration	Result	Heaf Test Equivalent
0-4mm	Negative	0 - 1
5-14mm	Positive	2
>15mm	Strongly positive	3 - 4

## 4.6 Factors affecting the tuberculin test

The reaction to tuberculin protein may be suppressed by many factors, including the following:

- glandular fever;
- viral infections in general, including those of the upper respiratory tract;
- live viral vaccines;
- Hodgkin's disease;
- sarcoidosis;
- pregnancy;
- systemic corticosteroid and other immunosuppressive therapy;
- immunosuppressing diseases, including HIV infection;
- severe disseminated tuberculosis.

Patients who have a negative test but who have had a significant upper respiratory tract or other viral infection (excluding the common cold) at the time of testing should be re-tested 2-3 weeks after clinical recovery before being given BCG. **Tuberculin testing should not be carried out within three weeks of receiving a live viral vaccine**; vaccination programmes should be arranged so that tuberculin testing is carried out before live viral vaccines are given.

The following factors may also affect the consistency of tuberculin testing or add to its variability:

- **Tester/reader variation** - Even in the best controlled trials there can be a difference of up to 16% between the results of one tester or reader against another. It is essential therefore to minimise these differences by strictly adhering to the techniques described.
- **Skin type** - Skin thickness and reactivity vary in different areas of the body. The tests should therefore always be given at the recommended site.
- **Time of response** - There is some variability in the time at which a test develops its maximum response. For a given test the majority of subjects will be positive at a given time. A few however may have their maximum response just before or after the standard time and their tuberculin reaction could be misinterpreted if read only at the standard time interval. If there is any doubt, the observations of the patient may be valuable.
- **Tuberculin adsorption** - Tuberculin can adsorb onto materials. Once it has been drawn into a syringe it should be used within 30 minutes otherwise there may be a deterioration in the tuberculin.
- **Age** - There is a tendency for the tuberculin response to diminish with increasing age of the subject. Negative tests in those over 50 years may not be true negatives; repeat testing several weeks later may yield a positive result - an apparent skin conversion - which is due to boosting of pre-existing low level skin test reactivity (a lymphocyte function) by the first skin test. A positive second skin test may therefore be taken as a true positive tuberculin response.

## 4.7 Screening of schoolchildren

In the schools BCG programme there is probably no value in performing skin tests on children who are known to have had BCG **as proved by the presence of the characteristic pale, flat, circular scar**, usually on the upper arm or lateral aspect of the thigh. Documentary evidence of previous BCG administration is inadequate as proof of vaccination; recording may be faulty, or the vaccine may have been given wrongly and thereby less likely to lead to immunisation. **However, percutaneous neonatal BCG administered with a modified Heaf apparatus will normally leave no scar** (see Section 5.1), and in these circumstances (mostly applying to children of high prevalence ethnic groups) one may have to rely on documentary evidence. Further information on the schools BCG programme is given in Section 12.

## 5 Vaccination

### 5.1 Bacillus Calmette-Guerin (BCG) vaccine

BCG vaccine contains a live attenuated strain derived from *Mycobacterium bovis*. The vaccine gives good protection against *M. tuberculosis*: in British children, efficacy has been shown to be greater than 70%, protection lasting at least 15 years with little attrition of effectiveness. BCG vaccine was introduced for general use in Scotland in 1953. A national vaccination programme was then started with the aim of immunising all children at age 13 before they left school. By 1958, 35% of children in this age cohort had been vaccinated and by 1962, 60%. In recent years over 90% of the target group have been vaccinated each year. A further 5-7% were already tuberculin positive from either previous immunisation or natural infection and therefore exempt from vaccination.

Adverse reactions to BCG vaccine are rare if attention is paid to proper selection of subjects and to the techniques for both tuberculin testing and BCG vaccination. All personnel performing these tests must be properly instructed and observed to be using the correct techniques. It is recommended that BCG vaccine be administered intradermally using a separate tuberculin syringe and needle for each subject. **Jet injectors should not be used. The percutaneous route (using a modified Heaf gun) is an acceptable alternative to the intradermal method for neonates, infants and children under five only. It is not recommended for older children, teenagers and adults.** A gun head with 18-20 needles and special BCG vaccine are required for this latter method (see Section 5.9 for details of suppliers). A practical problem with the percutaneous technique is that the characteristic BCG scar may not form, and documentary evidence of vaccination will be required.

### 5.2 Recommendations for vaccination with BCG

#### 5.2.1 Criteria for proceeding with vaccination:

- **Successful BCG immunisation has not previously been carried out:** patients should **only** be re-vaccinated if there is no characteristic pale, flat, circular scar, usually on the upper arm or lateral aspect of the thigh or documentary evidence of percutaneous vaccination. **There is no place for re-vaccination**<sup>12</sup> except in high-risk occupational groups where there is an unsatisfactory reaction to BCG (see Section 17.1)
- **The tuberculin skin test is negative:** babies up to three months of age may be vaccinated without prior skin testing, but care should be taken in coordinating the times and sites of other injections (see Section 5.7)
- **Absence of other contraindications:** see Section 5.8

#### 5.2.2 Groups recommended for vaccination

- Those at normal risk
  - school children between the ages of 10 and 14 years;
  - babies under three months old, children or adults where the parents or the individuals themselves request BCG vaccination.
- Those at occupational risk (see Section 17)
- Contacts of cases known to be suffering from active pulmonary tuberculosis (for definition of “cases” and “contacts” see Table 1 and Section 10.3).

Contacts of a sputum smear positive index case may have a negative tuberculin skin test but be in the early stages of infection because tuberculin sensitivity has not yet developed. Vaccination will do no harm, but if possible should be delayed and the skin test repeated six weeks later (this delay is not necessary if more than six weeks have elapsed since the last exposure to an infectious case). Vaccination is then offered only if this second test is negative. If the second skin test is positive, the patient has become tuberculin positive, and must be referred for consideration

of prophylactic chemotherapy. However, it may be better in some circumstances to vaccinate after the first test if administration of a second test is impractical or unlikely.

HIV positive contacts of a smear positive case should be referred for consideration of chemoprophylaxis, **and should not be vaccinated** (see Section 20).

Children under two years of age who are close contacts of a smear positive case (including neonates born to smear-positive mothers) should have prophylactic isoniazid chemotherapy and the tuberculin test repeated after six weeks. If positive, chemotherapy is continued; if negative, BCG vaccine is given provided they are no longer in contact with infectious tuberculosis<sup>2</sup>. Newly born contacts of sputum negative cases should be vaccinated with BCG immediately. Further information on chemoprophylaxis is given in Section 10.5

- Immigrants from countries with a higher prevalence of tuberculosis, their children and infants wherever born (see Appendix 4).

New entrants to the United Kingdom from countries where tuberculosis is of high prevalence (eg Asia, Africa, South & Central America (including the Caribbean), Eastern Europe and the former Soviet Union: see Appendix 4), and who have no BCG scar, should be tuberculin skin tested as part of the initial screening procedures for immigrants and those intending to stay for at least six months, and offered BCG if negative; this also applies to all refugees. Further details are given in Section 14.

- Those intending to stay in high prevalence countries for more than a month:

#### **No evidence of previous BCG (scar absent) :**

- Skin test negative: Arrange BCG vaccination
- Skin test positive or strongly positive: Arrange chest X-ray if symptomatic or there is the possibility of recent contact with an infectious case. If the chest X-ray is normal, but the person has had recent possible exposure to a case of tuberculosis, referral to a chest physician or other specialist should be considered. If the chest X-ray is abnormal, the person should be referred. Further details are given in Section 14.

#### **Previous BCG (scar present)**

- Skin testing is unnecessary, and repeat BCG should **not** be given.

## 5.3 Preparation of vaccine

The freeze dried vaccine should be protected from light, stored between 2°C and 8°C and never frozen. It has a shelf life of 12 to 18 months and should not be used after the expiry date stated on the label.

The multidose vial of vaccine should be diluted as instructed on the package insert using aseptic precautions, a syringe and suitable large needle. Do not shake it to mix (the vaccine will froth). The needle may be left in situ for subsequent withdrawal of vaccine. Once made up the vaccine should be used within four hours. Any unused reconstituted vaccine should be discarded at the end of the session.

## 5.4 Vaccination technique

The recommended site for giving the vaccine is at the insertion of the deltoid muscle near the middle of the left upper arm. Sites higher on the arm, the tip of the shoulder particularly, are more likely to lead to keloid formation. In females, for cosmetic reasons, the upper and lateral surface of the thigh may be preferred.

The vaccine must be given strictly intradermally with a fresh needle and syringe for each subject. The dose is 0.1ml (0.05ml for infants under three months). This should be drawn into a tuberculin syringe and a 3/8" 25 gauge (0.5 x 10mm) or 26g (0.45 x 10mm) short bevelled needle attached to give the injection. The needle must be attached firmly with the bevel uppermost.

The upper arm must be held at approximately 45° to the body. This can be achieved if the hand is placed on the hip with the arm abducted. If the skin is dirty it should be swabbed with spirit and allowed to dry. The operator stretches the skin between the thumb and forefinger of one hand and with the other slowly inserts the needle, with the bevel upwards, for about 2mm into the superficial layers of the dermis almost parallel with the surface. The needle can usually be seen through the epidermis. A correctly given intradermal injection results in a tense blanched raised bleb and considerable resistance is felt when the fluid is being injected. A bleb typically of 7mm diameter follows 0.1ml injection. If little resistance is felt when injecting and a diffuse swelling occurs as opposed to a tense blanched bleb, the needle is too deep. The needle should be removed and reinserted elsewhere before more vaccine is given.

The patient must always be advised of the normal reaction to the injection (see below).

BCG vaccination by intradermal injection, using a separate needle and syringe for every subject, is the only recommended method for older children, teenagers and adults. However, this technique can be difficult in infants and very young children, and **percutaneous BCG vaccination by multiple puncture** technique is an acceptable alternative **in these latter groups only**. The site of injection is over the insertion of the deltoid muscle as previously described, using 18-20 needle punctures with 2mm skin penetration. One drawback of this technique is the failure to produce the characteristic BCG scar, and good documentary evidence of vaccination may be important in these cases. Only percutaneous BCG vaccine, which has 50-250x10<sup>6</sup> colony forming units per vial, should be used (see Section 5.9 for supply details).

## 5.5 Vaccination reaction

A local reaction normally develops at the vaccination site within two to six weeks, beginning as a small papule which increases in size for a few weeks, widening into a circular area up to 7mm in diameter with scaling, crusting and occasional bruising. Occasionally a shallow ulcer up to 10mm in diameter develops. It is not necessary to protect the site from becoming wet during washing and bathing, but should any oozing occur, a temporary dry dressing may be used until a scab forms. It is essential that air should not be excluded. If absolutely essential (for example, to permit swimming) an impervious dressing may be applied, but only for a short period as it may delay healing and cause a larger scar. The lesion slowly subsides over several months and eventually heals leaving a scar, at which point the foregoing precautions can be abandoned.

After vaccination with BCG vaccine there is a high tuberculin conversion rate and further observation of those at normal risk is not necessary, nor is further tuberculin testing recommended.

After vaccination of those at higher risk, subsequent inspection of the site is a matter for clinical discretion, **except for health care staff judged to be at high risk** (see Section 17), in whom the site of vaccination should be inspected six weeks later to confirm that a satisfactory reaction has occurred. Reactions should be recorded by measuring the transverse diameter in millimetres; a scar of 4mm or more is satisfactory. Only those who show no reaction to BCG require a post-BCG tuberculin test, after which anyone who is still tuberculin negative should be re-vaccinated. If after re-vaccination there is still no evidence of a satisfactory reaction or of conversion to a positive tuberculin test, consideration should be given to moving the subject to work not involving exposure to patients with tuberculosis or to tuberculous material.

## 5.6 Adverse reactions to BCG

Severe injection site reactions, large ulcers and abscesses are most commonly caused by faulty injection technique where part or all of the dose is administered too deeply (subcutaneously instead of intradermally). The vaccination of individuals who are tuberculin positive may also give rise to such reactions. To avoid these, doctors and nurses who carry out tuberculin skin tests and administer BCG vaccine must be trained in the interpretation of the results of tuberculin tests as well as in the technique of intradermal injection with syringe and needle.

Keloid formation at the injection site is a not uncommon, but largely avoidable, complication of BCG vaccination. Some sites are more prone to keloid formation than others, and those immunising should adhere to use of the two sites recommended in this chapter (the mid upper arm or the thigh). Most experience has been gained in the use of the upper arm and it is known that the risk of keloid formation is greatly increased when the injection is given at a site higher than the insertion of the deltoid muscle near the middle of the upper arm.

Apart from these injection site reactions, other complications following BCG vaccination are rare and mostly consist of adenitis with or without suppuration and discharge. A minor degree of adenitis may occur in the weeks following vaccination and should not be regarded as a complication. Very rarely a lupoid type of oral lesion has been reported. A few cases of widespread, and potentially dangerous, dissemination of injected organisms have occurred, virtually all in immunocompromised individuals. Very occasionally, anaphylactic reactions can also occur.

It is important that all complications should be recorded and reported to the appropriate clinician. Serious or unusual complications (including abscess and keloid scarring) should be reported to the Committee on Safety of Medicines using the yellow card system, and techniques reviewed. **Every effort should be made to recover and identify the causative organism from any lesion constituting a serious complication.**

## 5.7 Contraindications to BCG vaccination

BCG vaccine should **NOT** be given to patients:

- receiving **systemic** corticosteroid or other immunosuppressive treatment, including extensive radiotherapy (each case to be judged on its merits);
- suffering from a malignant condition such as lymphoma, leukaemia, Hodgkin's disease, or other tumour of the reticuloendothelial system;
- in whom the normal immunological mechanism may be impaired;
- who are HIV positive. In areas where the population prevalence of tuberculosis is low, such as the United Kingdom, it is recommended that BCG is withheld from all subjects known or suspected to be HIV positive, including infants born to HIV positive mothers.
- who are pregnant. Although no harmful effects on the fetus have been observed from BCG vaccination during pregnancy, it is wise to avoid vaccination in the early stages and if possible to delay until after delivery;
- with positive sensitivity tests to tuberculin protein (Heaf grade 2 or greater, Mantoux 5mm or greater);
- with pyrexia;
- with generalised septic skin conditions. If eczema exists, a vaccination site should be chosen that is free from skin lesions.

BCG vaccine may be given concurrently with another live vaccine. If they are not given at the same time, an interval of at least three weeks should be allowed between such vaccines. No further vaccination should be given for at least three months in the arm used for BCG vaccination because of the risk of regional lymphadenitis. When BCG is given to infants, there is no need to delay the primary vaccinations.

## 5.8 Record keeping and surveillance

**It is important that information should be recorded and records maintained** to show the result of tuberculin skin testing, whether the subject had previously received BCG (scar present or absent), and whether or not BCG was subsequently given. **These records should show who administered the skin test or vaccine, the batch number of the vaccine, and who recorded the result or lesion.** Particular attention should be paid to unusual or severe reactions. Such records should be kept for at least ten years. The results of tuberculin skin tests and of BCG vaccination of hospital staff (including students) should be recorded on appropriate records. It may be appropriate for staff and for those going abroad for long periods to hold a copy of their own records.

## 5.9 Supplies of BCG vaccine, tuberculin PPD, Heaf apparatus and videos

Health Boards order BCG vaccine and Tuberculin PPD from:

AAH Hospital Services, 204 Polmadie Road, Glasgow G42 0PH, tel 0141 423 4555, fax 0141 423 7662  
*or*  
Unichem plc, Grange Road, Houston Industrial Estate, Livingston, West Lothian EH54 5DE, tel 01506 434211, fax 01506 430596

Heaf testing and multiple puncture equipment is available from:

Bignell Surgical Instruments, 18 River Road, Littlehampton, West Sussex. BN17 5BN, tel 01903 715751, fax 01903 731242.

A video entitled *Heaf Testing and BCG Vaccination: A Practical Guide* (UK6257) can be purchased for £19.90 inc. VAT (1998 price, cheques payable to *CFL Vision*) from:

CFL Vision, PO Box 35, Wetherby, Yorkshire LS23 7EX, tel 01937 541010, fax 01937 541083.

## 6 Diagnosis and laboratory facilities

### 6.1 Clinical diagnosis

The key step in the clinical diagnosis of tuberculosis is for the clinician to be aware of and consider this possibility. As a result of the substantial decline in tuberculosis over several decades, doctors have become less experienced with this disease. Most cases of tuberculosis present with respiratory disease, but clinicians need to be alert to atypical presentations in certain ethnic groups, and particularly in the young, the elderly and the immunosuppressed.

The diagnosis may be suggested by persistent cough, purulent sputum production, haemoptysis, weight loss, fever or night sweats. **The early identification and treatment of smear positive cases is the most important single measure in controlling tuberculosis.** Therefore, the clinical suspicion of pulmonary tuberculosis should be immediately followed by the following appropriate investigations :

- Chest radiology. The presence of typical apical cavitating lesions will certainly support the clinical diagnosis. Clinicians need to be alert to the more unusual radiological presentations, such as diffuse infiltration, miliary disease, and pleuropericardial disease.
- Sputum examination. At least three good sputum samples (not saliva) collected on consecutive days should be submitted to the bacteriology laboratory with the appropriate clinical information.

Normally, only those who are sputum smear positive and those patients with discharging tuberculous sinuses (the latter very rare now) are likely to be infectious. For immunocompromised patients and contacts, where the situation is different, see Section 20.

Between 1982 and 1991 in Scotland, 5.6% of close contacts of smear positive disease were found to have active tuberculosis. Very low rates were found in contacts of sputum smear negative and non respiratory disease. Because of the high incidence of active tuberculosis in close contacts of those with smear positive disease, it is imperative that contacts are promptly identified and appropriately followed up. **Notification should be made and contact tracing initiated on the basis of a smear positive result, and not delayed until the laboratory has confirmed the diagnosis by culture.** Approximately 30-40% of cases of pulmonary tuberculosis can be expected to be smear positive. The diagnosis can be confirmed by culture in a substantial proportion of the remainder; if a rapid diagnosis is required, see Section 6.2. It should be remembered that a person identified as a contact may in fact be the original source of infection.

Examination of bronchial lavage fluid, obtained at bronchoscopy, or induced sputum, may provide an earlier diagnosis. Some initially smear negative patients become smear positive following bronchoscopy, but contact tracing for the period prior to bronchoscopy in these cases is unnecessary. Adequate precautions to prevent nosocomial spread should however be in place (see Section 18).

### 6.2 Laboratory diagnosis

Laboratory diagnosis is predominantly by local bacteriology laboratories on the basis of microscopy and culture on solid media. The Scottish Mycobacteria Reference Laboratory (SMRL) provides an identification and sensitivity testing service for all mycobacteria isolates in Scotland. Complex samples, or samples requiring specialised tests, can be sent to SMRL (e.g. culture, including blood cultures, on rapid systems which give results in 10-14 days instead of several weeks using conventional procedures). Where there is urgency (e.g. for infection control purposes), rapid tests using molecular technology can also be provided by arrangement with SMRL.

All smear-positive or culture-positive cases must be assumed to be tuberculosis and reported accordingly by the laboratory to the local Department of Public Health Medicine and SCIEH (see section 3.2). Provisional results can be amended if necessary when identification results are available (usually within 2-3 weeks of receipt of cultures by SMRL).

SMRL is able to undertake molecular epidemiological typing of all Scottish isolates of *M.tuberculosis* and to provide a rapid typing service for the investigation of suspected outbreaks.

## 7 Notification

Both respiratory and non-respiratory tuberculosis are statutorily notifiable, the legislation requiring an “attending physician” to notify the CAMO in the local Health Board area. Cases may also come to the attention of Departments of Public Health Medicine via informal reports from clinicians, laboratories, or other sources, in which case the CAMO or nominated CPHM (CD & EH) becomes responsible for notification. Information from the following sources should be directed, both informally and formally, to Departments of Public Health Medicine without delay so that appropriate action can be taken:

- **Clinicians:** where a hospital clinician or GP suspects tuberculosis, even if not confirmed bacteriologically, this information should be passed immediately to the local Department of Public Health Medicine. He/she is statutorily required to complete an official notification form, but should also furnish further information (see Section 3.4).
- **Hospital Bacteriologists:** as soon as mycobacterial infection is suspected, sufficient information should be imparted immediately (preferably by telephone, and via the statutory notification form) to the local Department of Public Health Medicine so that further details of the patient’s clinical condition and whereabouts can be obtained. This is particularly important when organisms can be seen on direct staining of a sputum sample (positive sputum smear).
- **Hospital Pathologists:** where a Pathologist suspects active tuberculosis, either from clinical or post mortem specimens, this information should be passed without delay to the local Department of Public Health Medicine (preferably by telephone, and via the statutory notification form).

For statutory notification purposes “Respiratory” tuberculosis refers to disease involving the lung parenchyma, tracheo-bronchial tree or pleura, larynx or upper respiratory tract; “Non-Respiratory” includes any other body site.

The local Department of Public Health Medicine should notify all known and suspected cases of tuberculosis to the Common Services Agency at the end of every week. Where further evidence (e.g. from bacteriology or post mortem samples) suggests that the diagnosis has been erroneous or that the infection has been caused by an atypical mycobacterium, then this information should be passed on so that the records can be corrected centrally. **It is much better to notify a case of tuberculosis and subsequently denotify it, than not to notify a case which is clinically likely to be tuberculosis.**

**Patients given chemoprophylaxis should NOT be notified via the statutory scheme.** This rule applies where chemoprophylaxis is given either for protection (as in the case of children), or where a strongly positive tuberculin reaction suggests infection in the absence of clinical illness or radiological changes. A record should be kept, however, by the prescribing clinician and the local Department of Public Health Medicine informed for case finding purposes. A clinical decision to **treat** a patient (as opposed to chemoprophylaxis) requires that the patient be notified. Recurrence of active disease following an apparently successful course of treatment should be re-notified as a fresh contact-tracing exercise may be required.

## 8 Treatment and compliance

### 8.1 Treatment

Hospital admission is often not necessary but may be indicated for medical or social reasons. All cases should be supervised until treatment has been completed, by (or in collaboration with) a consultant with experience in the management of tuberculosis. Most often this will be a consultant respiratory physician, but it may be an infectious disease physician or paediatrician or, occasionally, another physician with appropriate expertise. Health Boards may consider it appropriate to formally identify physicians with appropriate expertise. Protocols may have to be drawn up for shared care between specialties. GPs may wish to have a role in follow up, but this must only be as part of a shared care programme in collaboration with the designated physician, who remains in overall charge. Much of the day to day supervision may be carried out by a tuberculosis liaison nurse or similar.

If smear-positive patients are being managed in hospitals or other institutions, a minimum of two weeks in isolation with appropriate therapy is desirable prior to de-isolation or discharge. Patients with fully-sensitive pulmonary tuberculosis are usually deemed non-infectious thereafter, even if they remain smear positive, but the evidence for this assumption is limited<sup>24</sup>. Different conditions apply for multi-drug resistant cases and for HIV positive patients (see Sections 9.4 and 20.3 respectively). Infection control issues for hospitals (including hazards to visitors, staff and other patients) are dealt with in Section 18.

Treatment of tuberculosis requires at least six months of combination chemotherapy, administered daily or two to three times weekly (see below). Chemotherapy regimens are internationally agreed and are based on the results of a series of large controlled studies, often under the auspices of the British Thoracic Society<sup>13,14</sup>. A revised set of BTS chemotherapy guidelines is expected in 1998. The currently recommended standard regimen is two months of rifampicin, isoniazid and pyrazinamide (plus ethambutol, if isoniazid resistance is suspected), followed by rifampicin plus isoniazid for a further four months. For pulmonary tuberculosis, this six-month regimen has been shown to be highly effective; it is also appropriate for many non-pulmonary forms of tuberculosis. At least 12 months' therapy is recommended for tuberculous meningitis.

Occasionally second line drugs (including ciprofloxacin, streptomycin, capreomycin, prothionamide, amikacin, rifabutin or clofazimine) may be required in the presence of primary or acquired drug resistance (see Section 9) or if there is patient intolerance.

The currently available antituberculous drugs, either alone or in combination, have potentially serious toxicity. Fatal hepatotoxicity is clearly associated with antituberculous therapy<sup>13,15</sup>. Treatment failure, and the development of drug resistance, result from non-compliance, incorrect drug doses and inadequate duration of therapy. Prolonged treatment with potentially toxic drug regimens requires close supervision and specialist expertise, and it is strongly recommended that antituberculous therapy be supervised by a clinician with specialist expertise in tuberculosis.

The BTS also offers guidance on management complicated by diabetes, pregnancy, liver disease, renal disease and corticosteroid therapy<sup>13</sup>.

### 8.2 Non-compliance with treatment

It is important to reiterate that non-compliance is the major cause of treatment failure and the development of drug resistance. Spot checks of compliance (eg. by pill counts, urine tests, prescription checks) should be done as a routine. Robust arrangements will be required for the detection and follow-up of those who default from clinic attendance.

Non-compliant patients and those who are likely to become non-compliant should, in the first instance, be offered supervised (directly observed) therapy. Clinically effective therapy can be given in a supervised setting on a twice or thrice weekly basis<sup>13</sup>. This can be administered by a responsible person in a variety of settings, including hospital outpatient departments, GP surgeries, day centres and hostels. Adequate supervision requires effective liaison with other agencies, including tuberculosis health visitors, district nurses, GPs, social workers and voluntary sector workers. Supervised therapy allows immediate detection of non-compliance; compliance may be encouraged by incentives such as provision of hot meals.

In circumstances where supervised therapy is proving ineffective, it may be possible to arrange for the compulsory detention of a patient in hospital. Where such action is considered it is of course prudent to seek legal advice. Section 54 of the Public Health (Scotland) Act 1897 provides that a person may be compulsorily removed to hospital and detained there, on application of the local authority and the order of the Sheriff or Justice of the Peace. The Designated Medical Officer is required to certify that the accommodation occupied by the person concerned is such that “proper precautions cannot be taken for preventing the spread of disease”: the person may be detained in hospital “so long as he continues in an infected condition”. Removal to hospital is to be carried out by the police or officers of the local authority. Section 55 of the 1897 Act provides that, where the Sheriff or Justice of the Peace is satisfied, on the application of the local authority, that an infected person already in hospital, who would not on leaving hospital be provided with accommodation in which “proper precautions could be taken to prevent the spreading of the disease by such person” may direct that he be detained in hospital. These provisions for detention do not of course imply that treatment may be administered compulsorily.

### **8.3 Chemoprophylaxis**

This issue is dealt with in Section 10.5.

## 9 Multi-drug resistant tuberculosis

The term multi-drug resistant tuberculosis (MDRTB) is generally applied to strains which are resistant to both rifampicin and isoniazid, but many strains are also resistant to other anti-mycobacterial agents. Drug-resistant tuberculosis strains usually arise originally from poor clinical management and/or non-compliance with standard treatment regimens. They can then be passed from patient to patient or to healthcare workers so that, although the original strain resulted from poor clinical management, subsequent infections simply reflect the mechanism of spread of tuberculosis.

Guidance on the management of HIV-associated and multi-drug resistant tuberculosis is being developed by the Interdepartmental Working Group<sup>5</sup> and should be added to the current document for reference as Appendix 5.

### 9.1 Epidemiology

MDRTB is presently uncommon in the UK. However, recent hospital outbreaks of MDRTB in England and various anecdotal accounts of individual cases, coupled with outbreaks reported in European cities, indicate the serious potential threat of MDRTB.

Most outbreaks, especially those seen in the USA, arise in the setting of HIV co-infection although infection in HIV-negative patients accounts for almost all Scottish MDRTB cases to date. The English outbreaks also involved HIV-seropositive patients. It may be that HIV seropositive individuals (patients, visitors and healthcare workers) are more susceptible to MDRTB, but it is dangerously complacent to assume that MDRTB is less virulent or less infectious than fully-sensitive strains. The risk of MDRTB to HIV seronegative patients and healthcare workers should also be borne in mind. It should not be assumed that patients who have again become smear-positive while on treatment for tuberculosis have become infected with *Mycobacterium avium*; it may be that they have an MDRTB superinfection on top of a fully sensitive infection (as happened with the index case in a recent English hospital MDRTB outbreak).

### 9.2 Specialised management facilities and infection control

Nosocomial transmission of MDRTB has been documented in healthcare settings in which immunocompromised patients are treated. Contributory factors have included lapses in respiratory isolation procedures, inadequate ventilation in isolation rooms, and prolonged infection (due to delay in diagnosis, in establishing drug sensitivity patterns, and in starting treatment). The greatest danger arises when a patient with unrecognised tuberculosis is nursed or subjected to cough-inducing procedures on an open ward.

**Treatment of patients with infectious MDRTB should be carried out only in hospitals with adequate isolation facilities, and therapy must be undertaken only by specialist physicians with relevant clinical experience,** working in close liaison with SMRL. If management facilities are inadequate the patient must be transferred, and procedures for this eventuality must be in place. All hospitals treating MDRTB, particularly those caring for a significant number of immunocompromised patients, should carry out systematic assessments of the potential risk of nosocomial transmission of MDRTB in all patient areas, including operating theatres and post mortem rooms. Specialist engineering advice is needed to assess the efficacy of mechanical ventilation and air filtration systems in all patient care areas.

All such specialised hospitals should have access to an adequate number of respiratory isolation rooms with appropriate negative pressure ventilation as defined in Appendix 5. In addition, an ante-room should be incorporated where possible to reduce escape of infectious droplet nuclei during opening and closing of the isolation room door. The use of ultraviolet germicidal irradiation may be considered for both duct and upper-room irradiation.

Aerosol-generating procedures (e.g. nebulised therapy, physiotherapy, sputum induction and bronchoscopy) require appropriate enclosing devices, or to be conducted in specially adapted respiratory isolation rooms with sufficient local exhaust and air changes per hour to ensure removal of virtually all airborne particles between each patient use (see Appendix 5).

All hospital workers who may be exposed to MDRTB should have been adequately immunised previously (see Section 17). Exposure of healthcare workers to infection risk should be minimised; appropriate systems of nursing (e.g. named-nurse system, primary nursing) can significantly reduce the number of nurses and other healthcare workers involved in the direct care of individual patients. Face masks which offer a high degree of barrier function while being easy to wear should be worn at least by those at high risk of infection

(e.g. physiotherapists, staff involved in sputum induction, primary nurses). Use of a face mask by the patient may be appropriate on occasion, e.g. to reduce the risk to others while in transit. While the patient is infectious, visitors should be restricted to those who have already been in close contact with the patient prior to diagnosis, and kept to a minimum; use of face masks by these visitors should be encouraged, particularly if the patient is judged to be highly infectious. The physician in charge should make an individual assessment for risks to immunocompromised visitors.

## 9.3 Laboratory diagnosis

Present methods for laboratory diagnosis of drug resistance at SMRL imply a delay of some days. Although molecular methods are being developed, these are not yet routinely available. Radiometric methods should give preliminary indications of drug susceptibility or resistance within 10-14 days. It will also be possible to perform molecular typing of any isolate to allow comparison with the archive of resistant strains. **When MDRTB is suspected, clinical specimens should where possible be submitted directly to SMRL from smear positive patients** (in addition to subsequent isolates) to allow faster detection of resistance.

## 9.4 Treatment

The choice of drugs for treating MDRTB will depend on susceptibility testing carried out by SMRL, and close liaison with the Reference Laboratory is essential. Such cases should be treated with a combination of at least three drugs to which the organism is susceptible. It may be that a wide range of agents has to be considered and tested, and drugs which appear inactive in isolation can have a synergistic interaction in combination.

Each case must be judged on its merits. In general, treatment of MDRTB may take up to 18 months, and should continue for a minimum of nine months after becoming culture-negative (three samples taken 4-8 weeks apart). Directly observed therapy is recommended, and follow-up should include regular sputum examination and annual radiography for up to five years thereafter (lifelong follow-up in the case of HIV-infected patients). Follow-up arrangements must also include advice from an experienced specialist physician. Further guidance on HIV-infected and immunocompromised patients is given in Section 20.

There is no consensus on chemoprophylaxis regimens for contacts of infectious MDRTB cases, and expert advice should be sought from SMRL.

## 9.5 Respiratory isolation

Cases should be kept in negative-pressure isolation until the following criteria are met:

- At least three smear negative sputum samples are obtained over a 14-day period
- Significant clinical improvement (including complete resolution of cough), following at least 14 days' treatment
- There is compliance with, and tolerance to, the drug regimen

Patients exiting respiratory isolation should **not** be managed thereafter in close proximity to immunocompromised patients. The exact duration of respiratory isolation should be discussed on the merits of each situation by the clinician in charge and the Infection Control Team, and the desirability of culture-negative status may be a factor.

## 9.6 Surveillance

Drug susceptibility can only be monitored if all isolates and specimens are processed by SMRL. Data on resistance will be collected by the ESMI scheme (see Section 3.4), but the local laboratory should inform the CPHM (CD&EH) immediately by telephone on discovery of a case of MDRTB. The CPHM should thereafter inform the Scottish Office Department of Health and SCIEH. For patients first diagnosed outwith Scotland, the person who establishes first medical contact with the patient should inform the other appropriate agencies, especially the SMRL.

## 10 Contact tracing and management

Several recent studies have shown that up to 10% of tuberculosis cases are diagnosed by contact tracing and that disease occurs in about 1% of all contacts. Disease found by contact tracing is usually found at the first clinic visit in non-BCG vaccinated close contacts of smear positive disease. Children are particularly at risk, especially for tuberculous meningitis and miliary disease. Contact tracing in schools is fully dealt with in detail in Section 12.

### 10.1 Procedure for tracing contacts

Contact tracing includes registering the index case and details of the illness, particularly the duration and degree of infectivity. Those at risk must then be contacted, the need for attendance must be explained and possible fears and anxieties explored. Follow up must be made as easy as possible, to ensure attendance not only at the first follow up but also subsequently if necessary. Contact tracing, therefore, also includes monitoring attendance so that appropriate action may be taken if a contact fails to attend. Accurate and up to date records must be kept for all cases and contacts to enable monitoring of cases, contacts and the general pattern of infection.

The tracer should compile a list of contacts to be screened for each index case. These contacts should then be informed of the fact that they had been in contact with an infective case of tuberculosis and that screening and follow up may be necessary. A suggested letter for casual contacts (see Section 10.3 for definitions) is given at Appendix 6. Emphasis should be laid upon the fact that the follow up process is to ensure that the contact has **not** acquired the infection rather than to allow them to feel they are almost inevitably infected. It may, however, be more successful to use the latter tactic with some people.

Results of the screening should be noted in the contact's record. The completed list should be sent to the local Department of Public Health Medicine to maintain an overview of the position. If an active case of tuberculosis is identified as a result of contact tracing, a second wave of contact tracing should be undertaken for that new index case as appropriate.

### 10.2 Who should perform contact tracing?

The person who is in charge of contact tracing should ideally have a knowledge and understanding about tuberculosis which has been acquired from basic professional training, specialist reading and teaching from health service staff involved in the care of people with tuberculosis. This person also requires expertise in working with individuals in their own homes or in community settings, experience which is gained from a training such as that for a health visitor, district nurse or trained community worker. An understanding of the epidemiology of infection, mechanics of transmission and the implication of the infection for a population is also useful, so some background in a public health department would be valuable. Because contacts are usually healthy members of the public who are at work or pursuing their normal lives, flexible hours are essential to enable evening or weekend visiting if necessary. Administrative experience is valuable in order to maintain the surveillance system and record keeping.

The ideal solution is a dedicated tuberculosis liaison nurse or Health Visitor. Where the workload does not justify even a half-time tuberculosis liaison nurse, the optimal solution would be to identify and train specific named health visitors or other community health staff on a geographical basis who would take responsibility for the completion of contact tracing of index cases identified within their locality. The follow up of immigrants would also form a suitable part of the job, as many of the requirements are very similar (see Section 14).

## 10.3 Close and casual contacts

The infection is usually spread by the excretion of live bacilli in the sputum of patients with pulmonary disease. A patient's infectivity depends on the frequency and intensity of sputum droplet dispersal (by coughing, sneezing, speaking, singing or laughing), and the number of bacteria in their sputum. A contact who will be at risk, therefore, is someone who has been physically close for enough time to an infective index case for likely transmission to have occurred. Contacts of cases of pulmonary tuberculosis should be classified into **close contacts** and **casual contacts**.

- **Close contacts:** those, particularly small children, sharing a house with someone who has smear positive disease are most at risk. Household contacts of someone with smear negative disease run a lower risk but should be examined once in case they prove to be a source case. A contact in the work environment or in a hospital ward may be close enough to be equivalent to a household contact if there is substantial exposure at conversational distance, or if there is re-breathing of shared air in a confined space or via an air circulation system. This may also apply to a long haul flight of over eight hours' duration<sup>16,17</sup>. Each situation should be judged on its merits, but in general at least four hours' cumulative contact at conversational distance may be taken as indicative of "close contact". Individual cases vary in their infectiousness, however<sup>24</sup>; **if the index case is thought to be highly infectious as evidenced by transmission to more than 10% of close contacts**, this suggested threshold for "close contact" should be revised downwards and relevant "casual contacts" duly reassigned as "close".
- **Casual contacts:** these include most occupational contacts. If the index case is smear negative, casual contacts do not need to be examined. If the index case is smear positive, casual contacts need only be examined if they are unusually susceptible (e.g. young children or immunocompromised individuals), or if the index case is thought to be highly infectious.

Contacts of patients with non-pulmonary disease do not usually need to be examined. If the index case with non-pulmonary disease is considered to have been recently infected (e.g. a child) contact tracing may identify a source or other related cases and is therefore recommended.

## 10.4 Examination of contacts

Investigation of contacts may include establishing BCG vaccination status (i.e. presence or absence of the characteristic scar), Heaf/Mantoux testing and chest radiography. The flow diagram illustrating the procedure for examination of close contacts of pulmonary tuberculosis is shown in Figure 6. If the index case is smear positive, contacts who have not had BCG vaccination and who have a negative (Grade 0 or 1) Heaf reaction should ideally be retested six weeks after the last contact to allow for tuberculin conversion. **If retesting is not practicable**, BCG vaccination should be given after the first negative Heaf test; chemoprophylaxis may also be given to children under two years of age.

## 10.5 Vaccination and chemoprophylaxis

Previously unvaccinated children and young adult contacts who are persistently tuberculin negative (Heaf Grade 0 or 1) may be offered BCG vaccination.

Chemoprophylaxis may be given to contacts with strongly positive Heaf test reactions but with no clinical or radiological evidence of tuberculous disease. Chemoprophylaxis regimes consisting of isoniazid alone for six months, or rifampicin plus isoniazid for three months, are recommended by the British Thoracic Society<sup>13</sup> for both children and adults.

The risk of developing disease after infection depends on age, BCG status and whether infection is recent, but is 5-10% overall. Chemoprophylaxis should therefore be given to contacts under the age of 16 years who have not had BCG vaccination and who have positive Heaf reactions (Grades 2-4), and to all those in whom recent tuberculin conversion has been noted. All unvaccinated children under two years old who are close contacts of smear positive cases (including babies born to smear-positive mothers) should receive chemoprophylaxis for six weeks, and BCG should be given if tuberculin negative at that point; if tuberculin positive, chemoprophylaxis should be continued<sup>2</sup> (see Section 12 for further guidance on management of paediatric contacts). Expert advice should be sought concerning management of contacts of multi-drug resistant tuberculosis (MDRTB), a situation where there is no current consensus on chemoprophylaxis (see also Section 9).

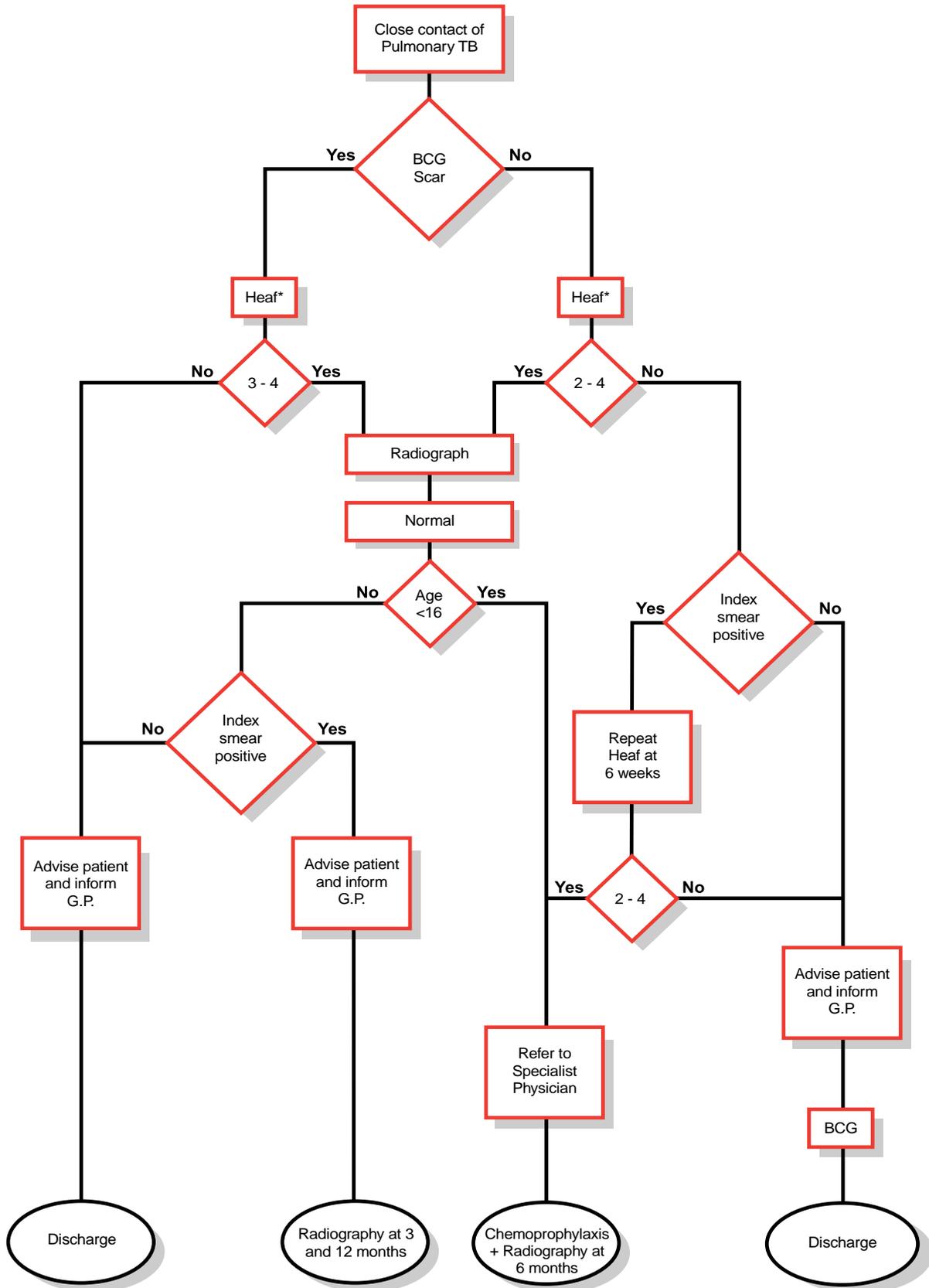
## 10.6 Follow-up and compliance

Most disease in contacts is found at initial examination. Those without findings of disease on initial screening should be advised to report suspicious symptoms occurring within the next year to their GP, who should also be informed by the contact tracer of the history of contact with tuberculosis. Routine radiographic follow-up at three and twelve months is recommended for asymptomatic patients **who were eligible for but did not receive chemoprophylaxis**<sup>2</sup>, and for those with strongly positive Heaf tests (Grade 3-4, or Grade 2 with no previous BCG vaccination) after close contact with smear positive cases. The yield from radiographic follow-up is small and varies between districts; in some areas, local audit may show that it is unnecessary. There is evidence from an audit in Edinburgh that radiographic screening beyond six months is unhelpful<sup>14</sup>.

If a contact fails to attend for follow-up within one month of the initial approach, he or she should be sent a reminder. If the contact fails to attend a second time, he or she should be visited in an attempt to elucidate any difficulties or worries. If, in spite of this visit, the contact fails to attend, a letter should be sent to the GP informing him or her that the patient has been a close contact of tuberculosis but has failed to attend to follow-up and that the GP may need to bear this in mind if the patient presents at a later stage with ill health. A young adult who refused screening recently in Scotland subsequently died of acute fulminant tuberculosis.

It is the responsibility of the contact tracer to monitor attendance, to identify those who fail to attend and to inform the CPHM (CD&EH) of repeated failures to attend in order that he/she may contact the GP.

**FIGURE 6:** Protocol for screening of close contacts. Note that special conditions apply to children < 2 years old (see Section 10.5); BCG scar may be absent in cases of vaccination with Heaf gun multiple puncture technique.



**\* Should be repeated at least six weeks after last contact if negative and first test was within six weeks of last contact.**

## 11 Incident and outbreak control & planning

The investigation of an outbreak of tuberculosis involves a description of the situation, its nature and timing, where and from whom the cases might have acquired the disease, and the characteristics of the affected people. Information about source and spread may allow instigation of prompt and effective investigation and management.

A single case of particular importance (e.g. a multi-drug resistant infection) may justify the convening of an Incident Control Team, but in general two or more apparently related cases constitute an outbreak until proved otherwise; in the current Section, major outbreaks and “incidents” require similar or identical actions. Further issues relating specifically to hospitals and residential homes are dealt with in more detail in Sections 18 & 19.

### 11.1 Objectives & guiding principles

- To recognise a major incident.
- To define its important epidemiological characteristics and aetiology.
- To prevent its further spread and recurrence.
- To maintain satisfactory communications with appropriate external agencies and the general public.

For effective and efficient management of an incident, a plan should be based on the following principles:-

- The Director of Public Health, or nominated deputy, has overall responsibility for the investigation and control of a communicable disease outbreak. The nominated deputy will usually be the CPHM (CD&EH) who is also Designated Medical Officer to the Local Authority.
- The CPHM (CD&EH) assumes the role of Major Outbreak Control Coordinator and has the overall responsibility to institute the major outbreak / incident plan and manage the outbreak/incident.
- Individual members of any Major Outbreak / Incident Control Team should have personal responsibility for managing clearly defined aspects of the outbreak.
- Suitably developed plans should be agreed by Health Boards, their constituent Trusts, and Control of Infection committees.

A schematic diagram of the process necessary in investigating outbreaks of tuberculosis is given at Figure 7.

### 11.2 Initial investigation

Cases of tuberculosis may come to the attention of any of the following:

- General Practitioners
- Hospital Clinicians
- Environmental Health Officers
- Microbiologists or other laboratory staff

Under the Public Health (Notifications of Infectious Diseases) (Scotland) Regulations 1988 every doctor is required to notify the Chief Administrative Medical Officer (CAMO) as soon as he/she becomes aware or suspects that a person is suffering from tuberculosis. The CPHM should also be informed by the local laboratory (see Section 3.2).

If an outbreak occurs in a residential or day care facility the officer in charge should inform the resident’s/client’s GP and the responsible manager in the Social Work Department. It is the duty of the GP attending the patient(s) to notify the case(s) to the duty CPHM. Local mechanisms should be in place easily identifying how the duty CPHM can be contacted.

The CPHM (CD&EH) maintains routine surveillance of infectious diseases in the community and will make the necessary preliminary investigations and consultations to determine whether or not there is an outbreak, the extent of any such outbreak, and the urgency with which any subsequent investigation is carried out.

## 11.3 Incident control

### 11.3.1 Institution of the Incident Control Plan

The CPHM (CD&EH) will have discretion as to whether or not to institute any Incident Control Plan depending on the number, type and timing of cases. The CPHM (CD&EH) should inform the Director of Public Health and the Health Board General Manager as well as the Health Board Press Officer if any Major Outbreak Control Plan is to be implemented.

### 11.3.2 Incident Control team.

Normally the CPHM (CD&EH) will fulfil the role of Coordinator in suspected outbreaks, and adequate secretarial/administrative support should be identified. It is also important to involve clinicians and microbiologists at the earliest opportunity. Core membership of the Incident Control Team (ICT) should be:

- CPHM (CD&EH) or deputy (Chairperson)
- appropriate physicians (specialist respiratory/ID, general, GPs or paediatricians)
- Consultant Medical Microbiologist
- tuberculosis Liaison Nurse
- representative of Health Board and/or Trust General Management (as necessary)
- Infection Control Nurse

Other organisations or individuals who may be invited as appropriate to attend the ICT include:

- School Health Services
- Environmental Health Departments
- Scottish Centre for Infection and Environmental Health (SCIEH)
- Scottish Mycobacteria Reference Laboratory
- Emergency Planning Officers
- Health Board / Trust Press Officers
- NHS Trusts within the health board area
- Divisional Veterinary Manager
- The Scottish Office Department of Health
- Infection Control Adviser for the Community.
- Other Health Boards in incidents which cross boundaries

### 11.3.3 Procedure for Incident Control Team (ICT) meetings

The Chair is usually taken by the CPHM, but in outbreaks affecting more than one health board area it is appropriate to invite a representative of SCIEH to chair the ICT. Secretarial support should be provided by health board management if required.

Objectives:

- To investigate the source and cause of the outbreak
- To agree on the implementation of any measures necessary to control the outbreak
- To monitor the effectiveness of the control measures
- To provide information to General Practitioners, patients, patients' contacts, the general public, the media and appropriate staff
- To liaise with appropriate health bodies, local authority and statutory services
- To evaluate the overall work of controlling the outbreak, co-ordinate the investigation and implement the lessons learnt

Checklist of matters to be considered:

- Medical/Nursing care of patients:
  - Advice to general practitioners, district nurses, health visitors and other primary health care staff

- Liaison, via NHS Trust Medical Directors, with hospital clinicians who may be involved in outpatient or inpatient investigation and treatment of cases
  - Need for additional medical and nursing staff
  - Availability of supplies, including Heaf guns, PPD, disposables, drugs, laundry.
- Investigation of the source of the outbreak: epidemiological study, including
    - formulation of a hypothesis to explain the most likely source, site and time of infection.
    - case definition
    - case finding - identifying the number of people affected or exposed to tuberculosis.

Methods will vary according to numbers involved and the setting in which the outbreak has occurred. For example, case finding in community based outbreaks may be more difficult than in those occurring in hospital. Molecular typing may be of assistance, and the advice of SMRL should be sought.

### 11.3.4 Control measures

- Isolate and treat identified cases
- Identify high-risk groups, e.g. work, schools, nurseries
- Arrange screening of contacts, estimating potential resource implications
- Arrange for other measures as appropriate, e.g. chemoprophylaxis or referral.

### 11.3.5 Monitoring

Organise and collate the data from ill and well persons exposed to the index case. Plot the epidemic curve, determining the predominant clinical signs and symptoms and estimating the possible incubation period. Continue surveillance in order to calculate incidence rates using a clearly defined denominator, noting variations in time, place and person.

### 11.3.6 Communications

Communications are often identified as a problem area in outbreak investigation and management. Apart from professional communications, media communications can be an asset in reducing public anxiety or tracing contacts. Management of outbreaks may be hampered by negative and defensive responses to the Press from Incident Control Teams.

- Consider setting up a helpline to give specific advice and information to patients, patients' relatives and friends, the general public; continually update that information. The NHS Helpline may assist, or a locally-based helpline can be staffed by appropriately trained personnel, e.g. community nurses.
- Consider informing, and regularly updating, relevant GPs by secure fax communication.
- All communications with the media should be issued and approved by the ICT and coordinated centrally (e.g. by the health board Press Officer).
- Using fax, telephone or electronic communication (as appropriate) liaise with other agencies; the Scottish Centre for Infection and Environmental Health, Scottish Office Department of Health, SMRL, adjacent health boards and other relevant bodies. Within the health board, the Board General Manager and appropriate others should be kept informed of developments.

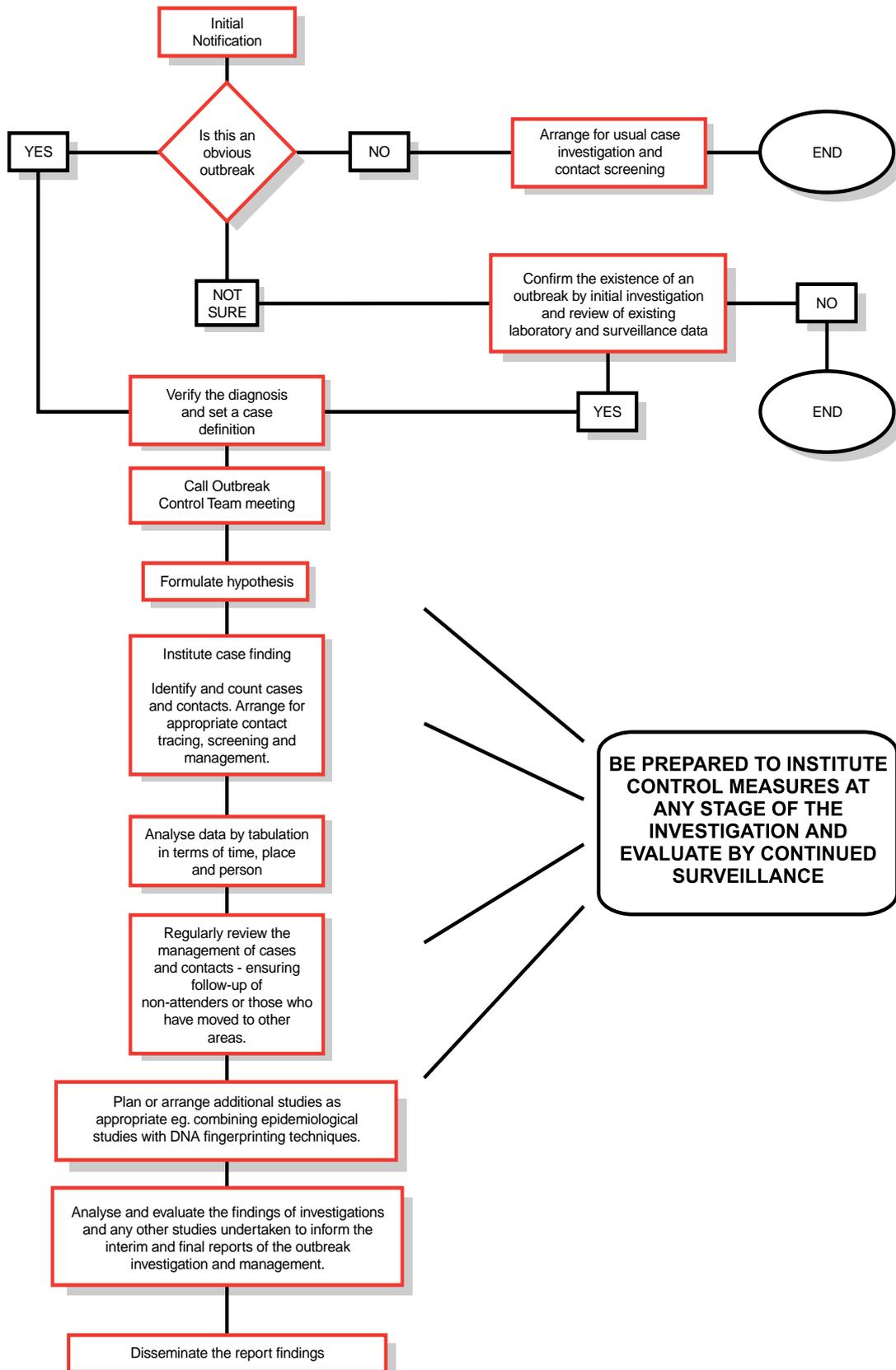
### 11.3.7 Completion

After the outbreak has been controlled, a final meeting of the Incident Control Team should be held with the following objectives:-

- To review the experiences of all participants involved in the management of the incident.
- To identify shortfalls and particular operational difficulties encountered.
- To revise the major outbreak plan if necessary
- To recommend appropriate actions required to prevent a further outbreak.

The CPHM (CD&EH) should be responsible for producing any interim reports required by the Board and a final report at the conclusion of the incident. The findings and recommendations for future action should be disseminated to all parties involved in the management of the incident.

**FIGURE 7:** Protocol for investigation of an outbreak of tuberculosis



Adapted from:  
Goodman RA, Buehler JW, Koplaan JP<sup>25</sup>

## D. SPECIAL SITUATIONS

### 12 Infants, children and schools

#### 12.1 Screening & vaccination

BCG should be routinely offered to:

- babies where there is a history of tuberculosis in a close family member within the past two years
- babies who may live or have a prolonged stay (over 1 month) in a part of the world where there is a high incidence of tuberculosis, e.g. Asia, especially Indian subcontinent, Africa, Central & South America, Eastern Europe and the former Soviet Union. (see Appendix 4)
- babies whose parents, or relatives in close contact, come from areas where there is a high incidence of tuberculosis
- schoolchildren 10 to 13 years: in Scotland this is the normal age for screening and vaccination.

**N.B. HIV positive children or babies born to HIV positive mothers should not be offered BCG vaccination.**

Maternal immunity is not passed to the newborn baby, and skin testing prior to BCG is not normally required before three months of age. Older infants and children should be tuberculin tested in the first instance. BCG does not interfere with the normal primary vaccination schedule, but BCG should be given concurrently with other live vaccines or with an interval of three weeks between administration of BCG and of the other live injected vaccine(s). No further vaccination should be given for at least three months in the arm used for BCG vaccination because of the risk of regional lymphadenitis.

Babies born to smear-positive mothers, and contacts less than two years old of smear-positive cases, should receive chemoprophylaxis for six weeks and then be tuberculin tested; if negative, BCG should be given, otherwise chemoprophylaxis should be continued<sup>2</sup>.

In the schools BCG programme there is no value in performing skin tests on children who are known to have had BCG, as evidenced by the characteristic pale, flat, circular scar (usually on the upper arm or lateral aspect of the thigh).

If a schoolchild is reported as having a strongly positive skin test (Heaf grade 3 or 4, Mantoux > 14mm), he or she should be asked about symptoms suggestive of tuberculosis (eg., a persistent cough, persistent fever or weight loss), and whether they have been in contact with anyone who might be suffering from tuberculosis. A chest X-ray should also be performed. If they are asymptomatic, if there has been no likely contact with tuberculosis, and if the chest X-ray is clear, no further action is needed apart from informing the GP. Details of interpretation of tuberculin tests and the actions required in the schools BCG programme are given in Table 5. Management of suspected cases should be referred to a specialist paediatrician or other physician with appropriate expertise.

**TABLE 5:** Interpretation of Heaf/Mantoux test and action required (schools BCG programme) for children with no BCG scar

Observation	Result	Action
No reaction, or Heaf Grade 1, or Mantoux less than 5mm induration	Negative	Give BCG
Heaf Grade 2 or Mantoux of 5mm to 14mm induration	Positive	Record in notes Do not give BCG
Heaf grade 3 or 4, or Mantoux greater than 14mm induration	Strongly positive	Refer for investigation of active tuberculosis. Do not give BCG

## 12.2 Contact tracing in schools.

The following actions are as suggested by the BTS Guidelines<sup>2</sup>. In the school situation it should be borne in mind that tuberculosis in adults is probably more infectious than in children.

### The index case is on the school staff:

- if the index case is smear negative and culture negative, no action is normally necessary.
- if an index case with smear positive pulmonary tuberculosis is a primary teacher, children in the relevant teaching or games group and staff considered to be close contacts should be screened.
- if an index case with smear positive pulmonary tuberculosis is a secondary teacher, pupils with prolonged contact with the teacher should be screened. Staff considered to be close contacts should also be screened (Figure 6).
- as extra caution is appropriate, the above measures should also be applied for index cases who are culture positive but smear negative; each situation must, however, be judged on its merits particularly with regard to the perceived infectiousness of the index case and the duration/closeness of contact.

### The index case is a pupil:

- if the child index case is smear negative, further action within the school is not normally required.
- if the index case is smear positive (or diagnosed from gastric washings), all children in the same class(es) should be screened as for close contacts (Figure 6). A second tuberculin test should be administered six weeks after the last known exposure to the index case where appropriate (especially in primary schools), but if there are practical difficulties a single later test may be the better option.
- if further cases are identified, teaching and other staff should also be screened.
- if no further cases are identified, further action is unnecessary.

### In either situation:

Child contacts with Heaf Grade 2-4 reactions and no previous BCG (scar absent) should be referred for clinical examination and chest radiography, and should be given chemoprophylaxis if there is no evidence of disease. Child contacts who have had previous BCG (scar present) with Heaf Grade 3-4 reactions should be referred for radiography. A clear chest X-ray should be followed up by repeat radiography at six months. Tuberculin converters (Heaf 0-1 to Heaf 2-4, with at least an increase of two Grades) should receive chemoprophylaxis.

## 13 Homeless persons & travelling people

### 13.1 People of no fixed abode

Tuberculosis is a well-established and important health problem for those who are homeless and those living in hostels, night shelters and similar accommodation, this group having a much higher incidence of tuberculosis than the general population. For example, the mean annual rate of infection in the Glasgow homeless for the five year period 1990 to 1994 was 179 per 100,000 compared with 14.4 per 100,000 for the total population. Despite this very high rate, however, these homeless cases accounted for only 3% of the total for the health board area. Recent studies in London and the USA confirm the high risk of infection in the homeless and signal that this is an increasing problem. Since the mid-1980s the number of homeless people (especially young adults and children) has increased. Factors which may increase these individuals' likelihood of infection include poor nutrition, alcohol and substance abuse, and locally high prevalence of infection in overcrowded conditions. Access to and use of healthcare facilities is poor, and late diagnosis (with attendant increases in morbidity and mortality rates) can be a problem.

The Royal College of Physicians<sup>18</sup> has identified three broad groups of homeless people:

- **Group I** - statutorily homeless households (accepted as homeless or potentially homeless by local authorities)
- **Group II** - rough sleepers, night shelter and direct access hostel users, and self or agency (not local authority) referrals to bed & breakfast hotels
- **Group III** - other groups with "inadequate" housing.

Group II homeless persons are most likely to be at risk of tuberculosis, though it should be remembered that there is an overlap with Group I, and some rough sleepers alternate periods of rough sleeping with stays with family and friends, thus possibly spreading TB to the general population. While this group in the past largely consisted of middle-aged and elderly males, often with alcohol problems, there are now increasing numbers of younger men, women, substance misusers and those suffering from mental illness in this category.

A difficulty with some of Group I, as well as Group II, is that homeless people may move frequently between different forms of temporary accommodation including friends' floors, and sometimes geographical areas, which can make keeping in touch with them and ensuring compliance with treatment, and tracing contacts, particularly difficult. This difficulty may be reduced if homeless people, including rough sleepers, have access to GP services (and if possible are registered with a GP), or other outreach health services. The Code of Guidance on Homelessness issued by The Scottish Office Development Department in 1997<sup>26</sup> reiterates existing policy that inpatients should never be discharged to homelessness services but to appropriate care accommodation and with support. It also reinforces the duty on health boards to consider the health needs of the homeless and to prepare strategies for meeting those needs. Implementation of local initiatives to address tuberculosis in the homeless will depend on the size and nature of the local problem.

### 13.2 Travelling people

The high mobility of many in this group can make treatment particularly problematic. Educational intervention and explaining the importance of contact tracing and treatment may be effective, and liaison between health boards is essential where patients move on during the therapeutic period.

### 13.3 Hostels and equivalent establishments

**Residents:** Ideally, all long-term residents should have a chest X-ray annually, but consideration may be given to other active screening methods such as a simple health questionnaire for newcomers or tuberculin skin testing programmes. Because of the higher incidence of tuberculosis in hostel residents, the diagnosis should always be borne in mind when a resident develops, or has a change in, respiratory symptoms. Staff should be aware of likely signs, symptoms and presentations of tuberculosis, and should be aware of the appropriate points of contact (clinical and public health) for action. When a case in a resident is identified, the following criteria for assessing contacts are appropriate:

- **Single room setting:** no action is necessary as far as the mass of other residents is concerned, unless there has been exceptional prolonged contact at conversational distance with another resident.
- **Dormitory setting:** the occupants of the two adjacent beds should be treated as close household contacts with skin testing and chest X-ray as appropriate (see Figure 6).

- **Social contacts** should be treated as casual contacts.

In practice, the co-operation achieved might amount only to a chest X-ray two months after exposure ceases.

**Staff:** All staff should be BCG vaccinated if necessary as a routine occupational health measure on taking up the post (see Section 17). Where staff have been in contact with a smear positive case, they should be assessed for degree of exposure (see Section 10.3) and thereafter managed as in Figure 6 (Section 10).

## 14 Immigrants and emigrants

### 14.1 Immigrants

The incidence of tuberculosis in many immigrant groups in the UK is high, and the highest rates of disease occur within five years of first entry to the UK. As with all infectious diseases, the incidence may vary even within a high-prevalence country, and some developed countries may have a higher incidence of drug resistant strains or different age-sex distribution of cases: monitoring and surveillance are therefore important. Countries considered to be high prevalence are detailed in Appendix 4. Although Scotland receives only small numbers of immigrants in comparison with other areas of the UK, the numbers are nonetheless significant; this is particularly so in areas within the central belt and those with major academic centres.

All immigrants (or other entrants planning to stay in the country for six months or more, including students), refugees and asylum seekers from countries where there is a high incidence of disease should be screened. Screening may be best managed at local health board level, and could be addressed independently of arrangements for immigration health checks at port of entry. This would ensure a uniform approach, can be combined with other health promotion measures, and simplifies follow-up arrangements. When potential cases have been identified at port of entry, forms are issued to the destination health board by the Port Health Control Unit; the current criteria for completion of the various forms are given in Table 6. It should be noted that chest radiography alone is an insensitive screening method, and a normal clear radiograph presented by an immigrant may not be recent, or may even belong to someone else altogether.

Until the arrangements at ports for informing health boards of new arrivals can be improved, additional methods for identifying those at risk may be required, e.g. through primary care registers, school registers, universities & colleges, refugee hostels and community groups. CsPHM should be aware of the addresses of any refugee hostels or groups in their health board area and establish links with community and voluntary services for ethnic minorities.

CsPHM should ensure that the full protocol has been applied if not carried out at the port of entry. The British Thoracic Society immigrant screening protocol (Figure 8) should be followed and BCG vaccination offered to those who are tuberculin negative. All children subsequently born in this country to families originating from high incidence areas should be offered neonatal vaccination. If this is not done, BCG can conveniently be given at two months of age at the same time as the first dose of the routine childhood vaccines, and in any case up to three months old without skin testing if there is no known contact with tuberculosis.

### 14.2 Travellers & settlers (including temporary residents)

UK residents intending to stay for an extended period (over 4 weeks) in countries of high incidence such as Asia, especially the Indian subcontinent, Africa, Central & South America, Eastern Europe and the former Soviet Union (see Appendix 4 for full list), should be assessed for presence of the characteristic pale, flat circular BCG scar before departure. If there is no evidence of a BCG scar and the skin test is negative they should be offered BCG. If the skin test is strongly positive, or positive without scar evidence of previous BCG, they should have a chest X-ray; otherwise, no action is needed. Travellers abroad should be advised in general of the need to report suspicious symptoms on their return in conjunction with their travel history. The World Health Organization has stated that **there is no role for repeating BCG vaccination in those who are known to have received it in the past**<sup>12</sup>.

Long haul flights of greater than eight hours' duration in proximity to a smear positive case of tuberculosis may constitute exposure equivalent to close household contact due to closeness of contact and/or recirculation of air<sup>17</sup> (see Section 10.3) and should be managed accordingly. Contact tracing exercises may be required in the event of such cases being diagnosed on long haul flights and long train journeys or similar opportunities for spread, but experience suggests that the return on investment of substantial investigative resources is often small.

**TABLE 6:** Port health forms issued following referral for medical examination by the Immigration Service\*

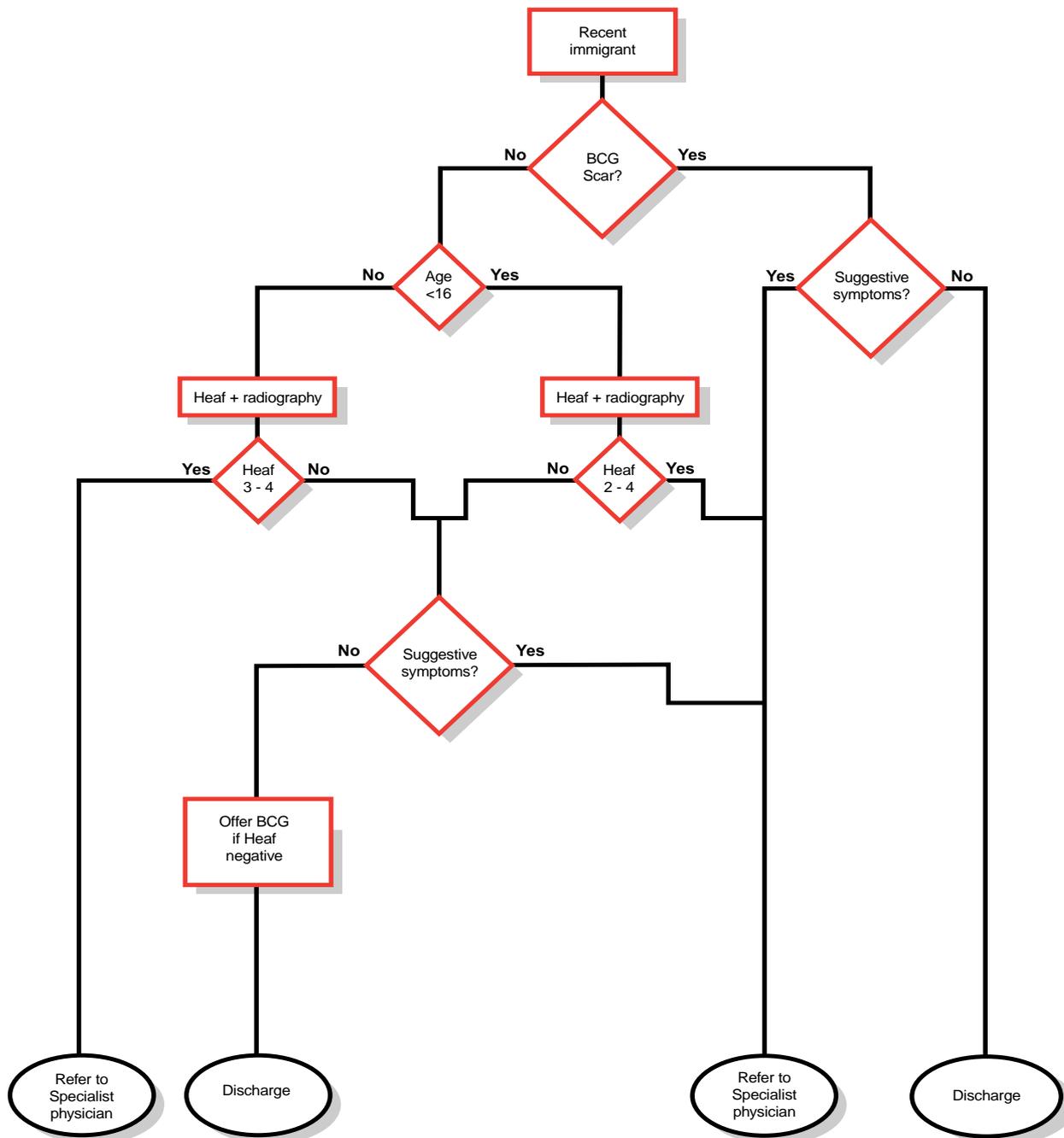
**Form Port 101** (white) is used where the entrant appears to be in satisfactory health and where medical examination and chest X-ray have been completed either at the Port Health Control Unit or in the country of origin under Entry Clearance arrangements. In the latter case, the form will show the Medical Referee's health assessment (extracted from Form XY). The chest X-ray taken at the HCU is available on request or will be enclosed routinely if this has been arranged. It should be attached to the subject's medical record or returned to the HCU. Further investigation will depend upon ethnic susceptibility to diseases such as tuberculosis (tuberculin skin-testing and BCG vaccination should be offered through a chest clinic). Those eligible should be helped to register with a general practitioner.

**Form Port 102** (blue) is used when the medical examination is incomplete (usually because chest X-ray has not been performed), or is inconclusive in providing evidence of satisfactory health. The Medical Officer for Environmental Health (MOEH), should contact the entrant **as soon as possible** to ensure completion of the examination plus other arrangements as above.

**Port Form 103** (yellow) is used when the medical examination points to significant disease that may endanger the public health. Where appropriate the chest X-ray will be enclosed. The entrant will have undertaken to report to the MOEH on arrival (and is **required** to do so under the Immigration Act 1971). New entrants may have difficulty in satisfying this requirement and may not fully appreciate the urgency of doing so, therefore the MOEH should arrange a visit **as a priority matter**. Follow-up will be monitored and the MOEH is asked to return Part C of the form to the Department of Health within the time stated.

\*(English form: The CPHM (CD+EH) fulfils the role of MOEH in Scotland).

**FIGURE 8:** Protocol for screening of immigrants from high-risk areas



**Consider chemoprophylaxis if Heaf >2 in cases aged <16 or young adult with Heaf 3-4.**

## 15 Institutions

### 15.1 Prisons

Tuberculosis is not a common diagnosis in HM Prisons. Even with inmates who are illegal immigrants, homeless or HIV infected, there have been virtually no cases of tuberculosis in Scottish prisons for many years, nor any episodes of tuberculosis transmission recorded within UK prisons. Most prisoners are aged under 50 years, and they and most prison officers should have been protected by BCG vaccination. New staff should be screened as for at-risk healthcare workers (Figure 10, Section 17) and offered BCG if tuberculin negative.

All prisoners should, ideally, be screened by clinical examination on admission. A high index of suspicion for tuberculosis should be maintained in all prisons; early bacteriological and radiological investigation should be followed if appropriate by directly observed chemotherapy supervised by a chest physician or other appropriate specialist. Smear positive prisoners should be segregated as with smear positive hospital inpatients (see Section 8). Notification of cases is essential to enable contact tracing. Prison officers and other staff in close contact with smear positive prisoners will be screened as part of the routine contact tracing procedures. Routine radiological screening of prison populations is unnecessary. Management and contact tracing may be complicated by short stays and by the high mobility of inmates within the prison system, but every effort should be made.

### 15.2 Colleges and universities etc.

It has become acceptable at some colleges and universities to insist on chest radiographic examination (or evidence of a recent normal chest X-ray) for staff and pre-matriculation students coming from countries with a high prevalence of tuberculosis (i.e. > 40 cases per 100,000 population per annum). These high prevalence areas include Africa, Asia, Central & South America, Eastern Europe and the former Soviet Union (see Appendix 4 for a detailed list). The screening protocol for immigrants should be followed where possible in preference to routine chest radiography (Figure 8, Section 14).

### 15.3 Factories and other work settings

Generally, the delivery of an advisory letter and contact card (Appendix 6 & 7) to each individual is sufficient following discovery of a case. Only with exceptional "conversation contact" (e.g. sharing a small office or a closed small volume circulating air system) need the standard contact screening procedures (Figure 6, Section 10) be followed; recent cumulative close exposure of less than four hours is unlikely to constitute a risk. If a high number of close contacts are found to have been infected (>10%), screening should be extended to those judged to be at the next level of risk.

### 15.4 Armed services

New recruits are subject to medical examination at enlistment, but the potential for spread within the barracks environment and the opportunities for acquiring tuberculosis while abroad in high-incidence countries should be borne in mind.

## 16 Animal tuberculosis

### 16.1 *Mycobacterium bovis* infection in humans

Human infection with *M. bovis* is uncommon. Since 1986 this organism has comprised only 2% of all tuberculosis notifications in Scotland. None of the cases was reported as directly attributable to an animal source, most representing reactivation of existing infections.

### 16.2 *M. bovis* infection in cattle

Since 1986 there has been a continuing low level of disease in cattle. Udder infection is now rare and spread between cattle is usually by the respiratory route. Cattle herds are tested routinely every four years, although in high risk groups the testing may be more frequent. Animals giving a positive reaction to the comparative tuberculin test (“reactors”) are slaughtered and a post mortem examination carried out. In all cases the origin of infection is investigated and the movements of potentially infected cattle on or off the farm are traced. On rare occasions the origin of infection has been attributed to humans. There is no evidence that badgers represent a significant source of infection in Scotland.

### 16.3 *M. bovis* infection in deer

In recent years *M. bovis* has been confirmed in farmed (mainly Red) deer in the United Kingdom. Unlike cattle, there is no compulsory testing regime for farmed deer. However, tuberculosis is a notifiable disease in all deer (including farmed, park and wild).

### 16.4 Liaison between medical, veterinary and other agencies

The Working Instructions to veterinary staff investigating tuberculosis state “*where human infection is suspected as an origin or consequence the Consultant in Public Health Medicine (CPHM) must always be informed*”. In practice the Divisional Veterinary Manager (DVM) will liaise with the CPHM when tuberculosis is suspected. Notification in advance of laboratory confirmation would not be expected in the case of a single reactor (given the large number of reactors with no visible lesions). However, the DVM should notify the CPHM when there are several reactors or when there are visible lesions at post-mortem examination.

Similar arrangements apply to animals with lesions, suspicious of tuberculosis, detected at routine meat inspection in the abattoir.

With a case of human infection with *M. bovis* a small but real risk of associated animal infection exists, either as a result of or as the source of human infection. The DVM should be advised of human cases of *M. bovis* with any agricultural connection as a matter of routine and as quickly as is practicable.

Humans infected with *M. tuberculosis* do not normally pose a risk of infection to cattle. However, such an exposure may result in non-specific reaction to the tuberculin test in cattle and in some instances it would be of value to the veterinary authorities to be informed of human cases of *M. tuberculosis* with an agricultural connection. Ethical considerations would in most cases outweigh such advantage and routine reporting would be inappropriate. There is no justification for routine notification to the veterinary authorities of human infections with other mycobacteria.

Where any human case has possible occupational origins the employer has a responsibility to notify the Employment Medical Advisory Service (EMAS). It would be helpful if the CPHM could inform employers of their obligation and also advise EMAS informally about the case.

While the responsibility to deal with milk from any infected dairy herd lies with the local authority, the CPHM should confirm with the Director of Environmental Health that arrangements for heat treatment of the milk are satisfactory.

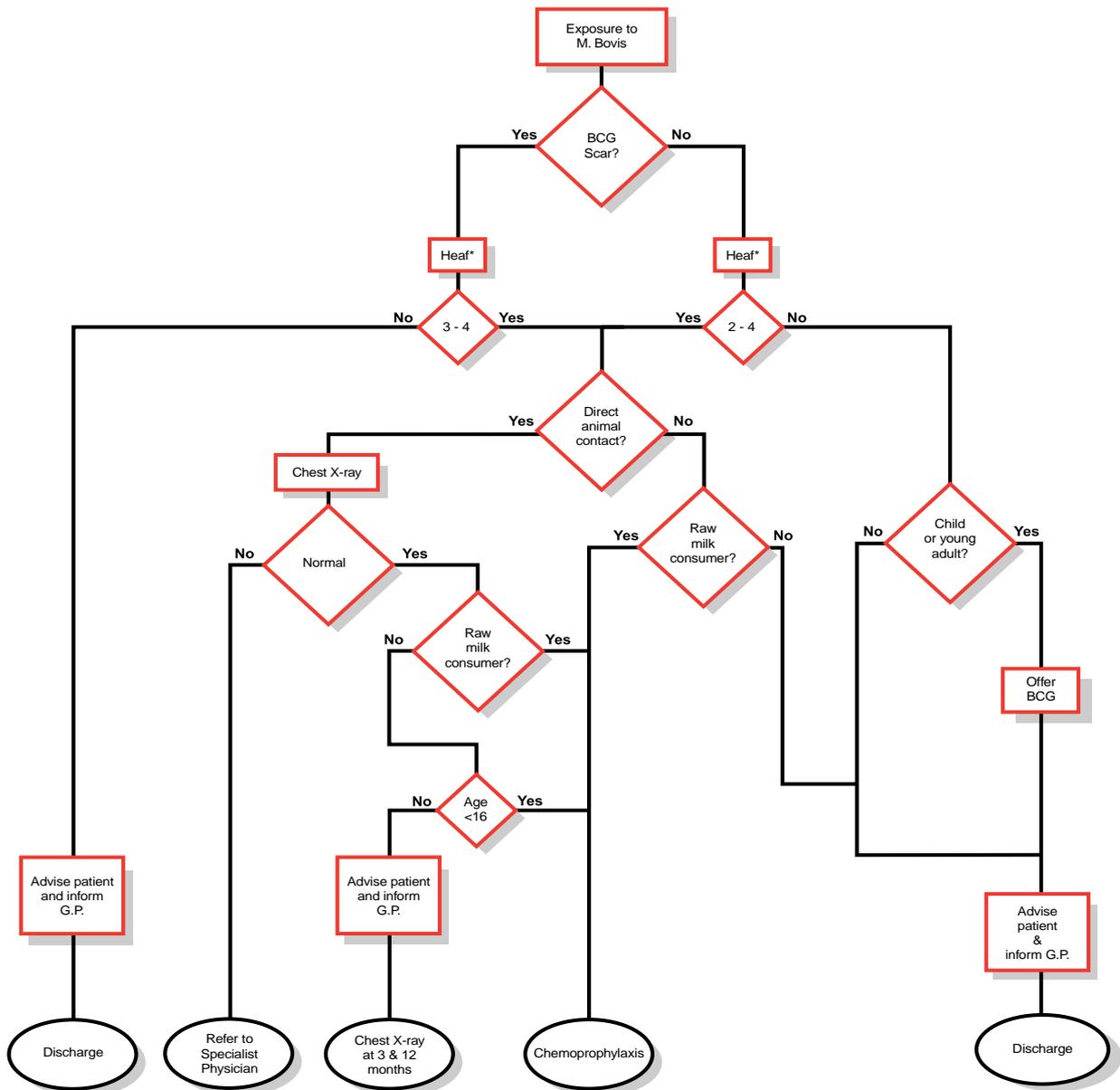
### 16.5 Guidelines for screening humans

Only those who have had direct contact with infected cattle or consumed raw milk from infected herds should be considered for screening. Consumers of pasteurised milk do not need to be screened, and judgement may be necessary to avoid screening those persons unlikely to have had any significant exposure. The public health actions required are detailed in Table 7, and the screening protocol for exposed persons is shown in Figure 9.

**TABLE 7:** Investigation of human contacts of *M.bovis* infected cattle

<b>Animal Reactor Type</b>	<b>Action by CPHM</b>
Reactors with no visible lesions and culture negative	No screening required
All other reactors i.e. culture positive (uncommon) and/or those with visible lesions	Screen those in contact with animals. Screen staff, other relevant persons living on the farm
Reactors with proven or possible udder infection	Screen those who may have consumed raw milk.
Abattoir cases with visible lesions	Discuss with DVM to assess risk.

**FIGURE 9:** Screening protocol for persons exposed to *M.bovis*



**\* Should be repeated at least six weeks after last contact if negative and first test was within six weeks of last contact.**

## 17 Occupational risk

Where there is a known occupational risk, such as in the Health Service or in teaching, the Control of Substances Hazardous to Health Regulations 1994 (COSHH) require potential occupational exposures to be assessed and controlled, and where necessary the introduction of health surveillance for exposed workers. There is also a duty on employers to provide information and training to their staff to reduce the risk. If an employee contracts tuberculosis as a result of his or her occupation, then the employer has a duty to report this under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR). It is also considered to be a Prescribed Disease if contracted in the work setting.

Spillages of tuberculous material in Containment Level 3 laboratories should be reported to the Health & Safety Executive (HSE). All laboratories must have explicit procedures for dealing with such accidents.

### 17.1 Screening & vaccination

Individuals changing posts should be questioned on general health issues including previous tuberculosis screening and BCG vaccination. Healthcare workers appear to be at increased risk of infection<sup>19</sup>, and those in particularly high risk jobs, such as respiratory disease clinic workers and staff in pathology and bacteriology laboratories (including post mortem room workers) should have annual questionnaires to assess their health. Staff returning from third world attachments may also be subject to such general screening.

All workers at occupational risk should be advised of the importance of reporting symptoms suggestive of tuberculosis (e.g. a persistent cough lasting for longer than three weeks, persistent fever or weight loss) to their own GP and to the Occupational Health Service. Contact tracing may be indicated where there has been a known exposure to tuberculosis, at the discretion of the clinician and CPHM (CD&EH).

The following groups should be screened on taking up appointment or at commencement of training, following the protocol shown in Figure 10. The screening of workers who will be in contact with children is particularly important because of the potentially serious consequences of childhood tuberculosis.

**Healthcare Workers** - the following staff groups and students in these groups

- doctors
- nurses
- Professions Allied to Medicine (PAMs)
- others in direct regular contact with patients or specimens (e.g. laboratory staff, mortuary staff, porters, cleaners etc.)

N.B. this list includes part-time, externally contracted and non-NHS staff.

**Local Authority Workers**

- mortuary workers
- care staff in residential homes and in the community (including care of the homeless)
- social workers dealing with children and people with HIV infection.
- Environmental Health Officers with regular or prolonged patient contact

**Education Workers**

- teachers and students in nursery, primary, secondary and tertiary establishments
- teaching assistants
- matrons or similar posts in boarding schools

All candidates for teaching posts are expected to sign a declaration of health on taking up an appointment.

**Private Sector Workers**

- care staff in nursing homes and other residential establishments
- healthcare workers in private hospitals (as detailed above)

## Voluntary Sector Workers

- those working with people with HIV infection
- those working with children
- those working with prisoners
- those working with ethnic minority groups
- those working with people of no fixed abode.

## Others

Other workers not mentioned in the above categories may be at occupational risk of contracting tuberculosis; they include:

- veterinary surgeons
- veterinary nurses and other veterinary staff
- farmers
- agricultural workers
- agricultural students

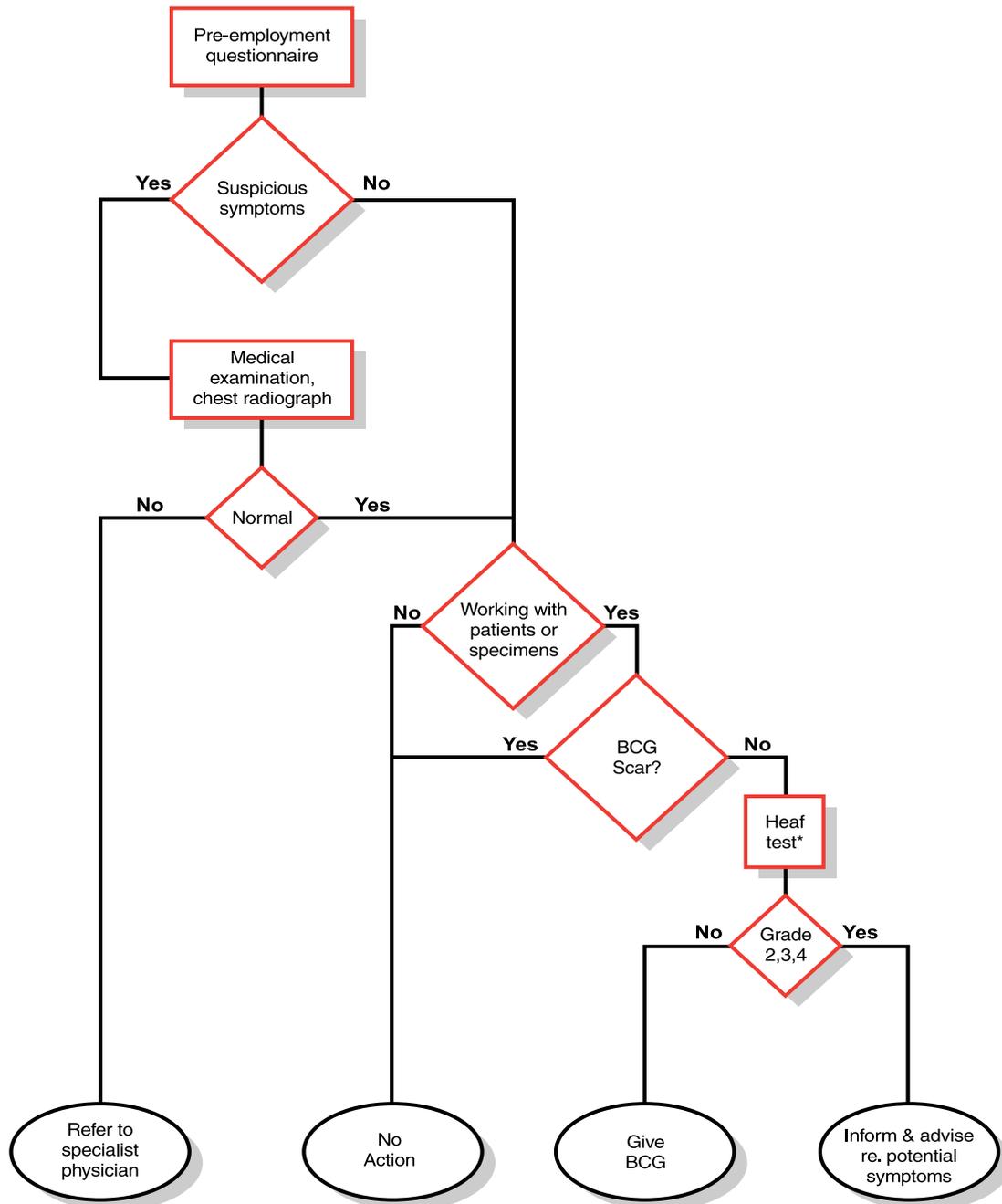
Staff should be screened according to the staff screening protocol (Figure 10) at the beginning of their employment or study period. All those at risk should be asked about any symptoms suggestive of tuberculosis (e.g. a persistent cough lasting for longer than three weeks, persistent fever or weight loss), assessed for the presence of the characteristic BCG scar, and given a tuberculin skin test (Heaf or Mantoux).

For healthcare workers judged to be at high risk of infection and given BCG, the site of vaccination should be inspected six weeks after administration of BCG to confirm that a satisfactory reaction has occurred. Reactions should be recorded by measuring the transverse diameter in millimetres; a scar of 4mm or more is satisfactory. **Only those who show no reaction to BCG require a post-BCG tuberculin test, after which anyone who is still tuberculin negative should be re-vaccinated.** If after re-vaccination there is still no evidence of a satisfactory reaction or of conversion to a positive tuberculin test, consideration should be given to moving the subject to work not involving exposure to patients with tuberculosis or with tuberculous material. There is no place for re-vaccination in any other circumstances<sup>12</sup>.

## 17.2 Contact tracing

Healthcare staff who have been in close contact with a smear positive case (particularly if undertaking mouth to mouth resuscitation, prolonged care of high-dependency patients or repeated chest physiotherapy) should be assessed for presence of a BCG scar and the contact screening protocol (Figure 6, Section 10) applied if BCG has not been given. If they are considered immune either from previous exposure or from BCG, they should be issued with a contact card (Appendix 7) to remind them of the risk and to report relevant symptoms. It is expected that staff working routinely with tuberculosis patients or specimens will have been given BCG preemptively.

**FIGURE 10:** Screening protocol for staff who may be at occupational risk of tuberculosis



\* The Heaf test may be repeated in older persons to detect a boosted reaction and avoid unnecessary BCG vaccination.

## 18. Control of Infection in hospitals

### 18.1 Advice and communication

Advice on day to day Control of Infection issues relating to individual patients with tuberculosis should be obtained from local Control of Infection Teams and can be supplemented by advice from the Scottish Mycobacteria Reference Laboratory. Normally, Control of Infection Teams liaise closely with local CsPHM's but this should not obviate the need for both Clinicians and laboratories to inform Departments of Public Health of known or suspected cases of tuberculosis at the earliest opportunity. Section 11 outlines procedures in the event of a tuberculosis outbreak or other significant incident.

### 18.2 Control of Infection policies

Health Boards should ensure that all hospitals in their area have Control of Infection policies appropriate for tuberculosis, including multi-drug resistant tuberculosis. Policies should include the following elements:

- advice on appropriate disinfection and sterilisation procedures (e.g. for endoscopes) and policies for changing of filters and/or tubing in anaesthetic or similar apparatus.
- guidance on the measures to be taken for patients with smear-positive pulmonary tuberculosis, stressing especially the following:
  - Staff, patients and visitors are all at risk of infection from smear-positive cases. **While the patient is still infectious, single-room isolation of the patient with restriction of visitors to those with prior substantial exposure during the period of infectiousness is strongly recommended. It should be borne in mind that patients in a ward setting frequently visit each other.** Risks to staff should be minimised where possible (see Section 17).
  - patients with clinical or radiological evidence suggestive of pulmonary tuberculosis should be regarded as infectious and isolated until shown to be smear negative (three consecutive negative smears over 14 days) **or** until two weeks of appropriate drug therapy have been administered (for fully sensitive infections).
  - smear positive patients if treated in hospital should be isolated for two weeks after commencement of therapy or, if multi-drug resistant tuberculosis (MDRTB) is suspected, thereafter until the strain is shown to be fully sensitive or if the patient becomes smear negative (see Section 9). Continued isolation may be deemed appropriate, however, if there are HIV-infected or other immunocompromised patients on the ward; the evidence for the effectiveness of two weeks' treatment in rendering sputum sterile is not robust<sup>24</sup>.
- guidance on measures to be taken for patients with known or suspected MDRTB (see Section 9).
- guidelines for immunocompromised (e.g. HIV-positive) patients with tuberculosis (see Section 20); also for immunocompromised staff or visitors.
- guidelines for Laboratory staff handling fluids or tissues known or likely to contain *M.tuberculosis*.
- guidelines for Contractors or Estates staff handling equipment known or suspected to have been contaminated by *M.tuberculosis*.

Further detailed information relevant to Control of Infection policies is available in a number of published documents<sup>2,5,20</sup>, including a new guidance document being produced by the Advisory Group on Infection<sup>21</sup>.

## 19 Elderly patients and nursing/residential homes

The Public Health Medicine Environmental Group (PHMEG) has recently produced a practical set of operational guidelines on the control of infection in residential homes<sup>22</sup>. The aim of this section is to ensure that all reasonable steps are taken to protect residents and staff from tuberculosis infections acquired or treated in residential and nursing homes; it should also be applicable to nursing homes in the community which provide primary rather than secondary care.

This section contains guidance on organisational and management issues which should be considered in prevention of further cases, and has been laid out with a view to circulation (with Section 17) of copies to managers of local nursing and residential homes.

### 19.1 Monitoring and reporting

A record (e.g. a log book) should be kept at the residential or nursing home to record information on residents with suspected and confirmed infections; arrangements for this must protect patient confidentiality. Prompt notification and reporting of tuberculosis cases enables investigation and control measures to be instituted rapidly, and is essential for the monitoring of infection. Cases must be notified by the attending physician (usually the GP) to the Chief Administrative Medical Officer (CAMO) of the local health board. A standard notification form and advice on local arrangements is available from the local Consultant in Public Health Medicine with responsibility for communicable diseases and environmental health (CPHM (CD&EH)). It is recommended that the person in charge of the home should also report such cases immediately to the CPHM (CD&EH) by telephone.

### 19.2 Control of outbreaks (see Section 11)

An outbreak may be defined as two or more cases of the same infection associated in time and place. As soon as an outbreak of tuberculosis is suspected within a home, the person in charge must immediately contact the CPHM (CD&EH) by telephone. The CPHM (CD&EH) will:

- decide whether there is a true outbreak and will initiate and co-ordinate any necessary action including the use of local outbreak control plans
- advise the person in charge of any immediate actions necessary to control the outbreak; these may include isolation of patients, and/or stopping admissions and transfers for a period of time.

### 19.3 Occupational Health

In the context of overall infection control, each home should have appropriate policies for the protection of staff through vaccination, training and compliance with health and safety legislation. Such policies should apply to all agency and locum staff, and to those on short-term contracts. Each new member of staff should complete a pre-employment health questionnaire and give information about previous illness and symptoms. Evidence of previous BCG immunisation (presence of the characteristic pale, flat circular BCG scar on the upper arm or thigh) should be sought. Those not previously vaccinated should have a skin test or chest X-ray as necessary, the results recorded and appropriate action taken (see Section 17 and Figure 10 for screening protocol).

Infection Control policies should be available to ensure that residents are protected from staff with tuberculosis. Such policies should clearly set out the responsibilities of staff members to report episodes of illness to their manager or matron. When necessary, staff may have to be excluded from work until they have recovered or results of specimens are available; as homes vary in terms of the vulnerability of their residents to infection, policies may differ between homes and advice should be sought from the home's occupational health advisor.

### 19.4 Last Offices for an infected person

The precautions used for handling infectious residents do not stop with the person's death. The body of a person who has been suffering from an infectious disease may remain infectious to those who handle it. Guidance should be given on:

- **laying out procedures:** these should be carried out by the carer/undertaker or relatives (under supervision) wearing gloves and aprons
- **“Danger of Infection” precautions:** the body should be placed in a shroud (or the person's own clothes)

and then in a secured body bag. The identity labels and “Notification of Death” labels should be attached in such a way that they may be read through the body bag. “Notification of Death” and “Danger of Infection” labels should be attached discreetly to the outside of the bag. Neither label should state the diagnosis (which is confidential information), only the type of precautions required. Once the body bag is sealed there is no further need for protective clothing for those handling the body.

- **viewing of the deceased by relatives and friends:** those who wish to view the body should do so as soon as possible after death. They should be told that there is a risk of infection and should be advised to refrain from kissing or hugging the body.

## 19.5 Control of Infection precautions

Tuberculosis in the elderly usually results from a reactivation of previously healed tuberculosis infection. The original infection might have occurred years before and passed unnoticed. New residents should have any past history of tuberculosis recorded, and symptoms suggestive of tuberculosis in any resident should be investigated promptly. All staff should be aware of the symptoms of tuberculosis (e.g. chronic cough, perhaps with bloodstained sputum, weight loss, night sweats) and immediately report suspicious symptoms in themselves or in residents. Table 8 illustrates the precautions required for control of tuberculosis infection in nursing and residential homes.

**TABLE 8:** Control of Infection precautions in residential & nursing homes for tuberculosis cases

Type of tuberculosis	Code	Duration of application of precautions
Respiratory (sputum smear positive)	3	Until two weeks of treatment are completed. Seek advice from CPHM (CD&EH) on management of contacts
Respiratory (sputum smear negative)	1	Nil required
Genito-urinary	2	Until recovered. Aprons & gloves must be worn when handling urine.
Abscess	2	Gloves or a no-touch technique must be used when dealing with secretions or discharges from the affected area.
Lymph nodes	2	Gloves or a no-touch technique must be used when dealing with secretions or discharges from the affected area.
Meningitis	-	Cases normally admitted to hospital. Seek advice from CPHM (CD&EH) on management of contacts
Other	2	Gloves or a no-touch technique must be used when dealing with secretions or discharges from the affected area.

Code 1: No extra precautions necessary

Code 2: Residents may mix freely but consider treating linen as infected

Code 3: Single room isolation; no social mixing with other residents; separate eating arrangements; treat linen as infected.

Homes need to be made aware of the physical, social and psychological effects of Code 3 isolation. There is a need for verbal and written information explaining the need for precautions being taken.

## 20 HIV-infected and immunocompromised patients

It is essential to be aware of the risk of tuberculosis for immunocompromised patients and in units where patients are likely to be immunocompromised. In such settings tuberculosis infection can progress rapidly to disease. Tuberculosis is an established AIDS indicator disease, and HIV infection is a recognised risk factor for tuberculosis. In the UK to date, however, overlap between the two diseases has been small.

Further technical details of requirements for hospitals dealing with HIV-infected patients with tuberculosis will be available in the proposed Interdepartmental Working Group document on HIV-related and drug-resistant tuberculosis<sup>5</sup>.

### 20.1 Screening

Screening for tuberculosis infection in HIV clinics should include chest radiography; **evidence of a BCG scar is not sufficient to discount active infection**. Notification rates for tuberculosis are consistently lower in HIV seropositive cases than in those known or thought to be HIV seronegative; **all suspected cases should be notified**, even if later de-notification is required (e.g. if the disease is found to be due to atypical mycobacteria). In contact tracing, the patient's consent to divulging the dual infection where appropriate should be sought, as the contacts may also be HIV seropositive.

### 20.2 Diagnosis

Diagnosis of tuberculosis in immunosuppressed patients may be difficult. Clinical presentation may be atypical and tuberculosis may mimic, or co-exist with, other opportunistic infections such as *Pneumocystis carinii* or atypical mycobacteria (usually *M.avium*). In this patient group a higher proportion of culture positive sputum samples are smear negative than in the general population<sup>23</sup>, there may be no reaction to tuberculin testing, and chest X-rays may have a non-characteristic appearance. Advice on molecular typing is available from the Scottish Mycobacteria Reference Laboratory (SMRL).

### 20.3 Specialised hospital management facilities and infection control

**It is particularly important that cases are managed by Physicians with the relevant expertise and experience. The minimum physical requirement for hospital management of a tuberculosis/HIV co-infected patient with pulmonary tuberculosis is single room accommodation, preferably air vented to the outside.** If other immunocompromised patients are accommodated in an adjacent area, a negative pressure room with full engineering controls is required (see Appendix 5 for details).

All hospitals caring for a significant number of immunocompromised patients should carry out systematic assessments of the potential risk of nosocomial transmission of tuberculosis in all patient areas, including operating theatres and post mortem rooms. Specialist engineering advice is recommended to assess the efficacy of mechanical ventilation and air filtration systems in all patient care areas.

All such hospitals should have access to an adequate number of respiratory isolation rooms with appropriate negative pressure ventilation. An ante-room is advisable where possible, to reduce escape of infectious droplet nuclei into public areas during opening and closing of the isolation room door. The use of ultraviolet germicidal irradiation may be considered for both duct and upper-room disinfection.

Aerosol-generating procedures (e.g. nebulised therapy, physiotherapy, sputum induction and bronchoscopy) require appropriate enclosing devices, or to be conducted in specially adapted respiratory isolation rooms with sufficient local exhaust and air changes per hour to ensure removal of virtually all airborne particles between each patient use (see Appendix 5).

Exposure of healthcare workers to infection risk should be minimised; appropriate systems of nursing (eg named-nurse system, primary nursing) can significantly reduce the number of nurses and other healthcare workers involved in the direct care of individual patients. While the patient is infectious, visitors should be restricted to those who have already been in close contact with the patient prior to diagnosis, and kept to a minimum. The physician in charge should make an individual assessment for risks to immunocompromised visitors.

Discontinuation of respiratory isolation for immunocompromised patients is dependent on:

- a minimum of three consecutive negative sputum smears over a 14 day period,
- significant clinical improvement (including complete resolution of cough) following at least 14 days' treatment, and
- compliance with, and tolerance to, the drug regimen.

Early planning for discharge is critical, with tolerance of treatment, likelihood of good treatment compliance, and drug resistant infection influencing the timing and practical arrangements.

## **20.4 Drug resistant tuberculosis**

HIV infection is a risk factor for multi-drug resistant tuberculosis (MDRTB). **Directly observed therapy is recommended**, and lifetime follow-up should include at least annual radiography. Follow-up arrangements must include advice from an experienced chest physician or other designated specialist. Further guidance is given in Section 9.

## **E. OTHER ASPECTS**

### **21 Education & training**

There have been significant worldwide changes in the incidence, presentation and management of tuberculosis over the past few years. There is a professional obligation on medical and nursing staff, particularly those directly involved with cases or contacts, to remain aware of recent advances e.g. through Continuing Professional Development initiatives. There is also a need to reinforce the increasing importance of mycobacterial infection to medical and nursing staff in all disciplines at undergraduate and postgraduate levels.

### **22 Audit**

Local procedures for information flow (e.g. notification), contact tracing and management for sporadic cases and for outbreaks are amenable to simple audit, and should be the subject of regular review by clinicians, laboratory staff, public health physicians and contact tracers. Formal audit of treatment outcomes has been shown to be important and of benefit in other European countries. Local comparisons with national data will be facilitated by the establishment of the detailed national dataset within the proposed enhanced surveillance scheme.

### **23 Research**

Epidemiological research will be considerably enhanced by improved national surveillance. Drug resistance, molecular epidemiology and methods of delivering treatment to poor compliers are examples of important aspects which merit further research.

### **24 Resources**

The resources required to provide an adequate service will vary with the size of the population covered and with the local incidence of tuberculosis, but each Health Board should ensure that sufficient resources are allocated to the control and surveillance of tuberculosis within its area. In addition to the requirements for Public Health Medicine input (CPHM(CD&EH) and support staff), tuberculosis Control Nurses or other contact tracers should be employed in adequate numbers to ensure complete and efficient follow-up of contacts within the health board area; clinicians with appropriate experience and expertise in management of tuberculosis should be identifiable as such for patients within each health board area; specialist facilities should be identified for treatment of immunocompromised patients and MDRTB; training needs should be evaluated and met; and targeted case-finding or health promotion initiatives (e.g. for specific ethnic groups, homeless persons) should be deployed where appropriate. Co-ordination of procedures and protocols at health board and at national level will help ensure efficient use of resources and maximise health gain.

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**G. APPENDICES**

## APPENDIX 1: Scottish Mycobacteria Reference Laboratory specimen form

### SCOTTISH MYCOBACTERIA REFERENCE LABORATORY

Dr B Watt  
Bacteriology Laboratory  
City Hospital  
Greenbank Drive  
Edinburgh EH10 5SB

Telephone Numbers:-  
Dr B Watt 0131-536-6357  
Office 0131-536-6449  
Laboratory 0131-536-6723  
Fax 0131-536-6152

### Mycobacteria Typing and Drug Register

For SMRL Office Use Only

Lab No	Date	Received	Glycerol	Pyruvate	TBR No
--------	------	----------	----------	----------	--------

Patient's Surname ..... Forename ..... Sex M/F

Home Address ..... Date of Birth ...../...../.....

..... Postcode ..... Occupation .....

Country of Origin ..... Date of entry into the UK ...../...../.....

Race or Ethnic Group ..... Hospital or Clinic No. ....

Laboratory Sending Culture .....

Date of specimen or received date ...../...../..... Culture Reference No .....

Year originally notified as Tuberculosis ..... AFB Microscopy POS/NEG

Site of Lesion from which Culture Derived :

Sputum ..... Pus (site) ..... Lymph node (site) .....

Abdominal ..... Bone ..... Broncho Alveolar .....

Cutaneous ..... CSF ..... Gastric Asp/Wash .....

Genito-urinary ..... Joint ..... Pericardium .....

Pleural effusion ..... Urine ..... Other (specify) .....

Comments from Local Laboratory .....

#### Categories

#### Delete as necessary

A. Previous history of Tuberculosis

YES	NO
-----	----

B. Treatment Failure

YES	NO
-----	----

C. Relapse Case

YES	NO
-----	----

D. Other Factors

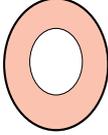
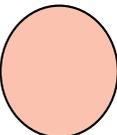
H/A	NO
-----	----

## **APPENDIX 2: Enhanced Surveillance of Mycobacteria in Scotland (ESMI) data collection forms**

Contents under development: to be supplied

## APPENDIX 3: Self reporting card

Tick which picture is most like your reaction after seven days.  
THEN post immediately to the address overleaf  
If in doubt, telephone the number overleaf

Name: Address:	A  Nothing to see	B  1-6 small raised red dots
C  A raised red ring with normal skin in the middle	D  A raised red circle	E  A raised red circle with blisters or ulcers

*Adapted from Selby CD, Allen MB & Leitch AG<sup>11</sup>.*

## APPENDIX 4: High risk countries

*This section is reproduced from the UK Interdepartmental Working Group guidelines<sup>3</sup>.*

### **Countries considered high prevalence for tuberculosis for the purposes of screening new immigrants, refugees and asylum seekers for tuberculosis and for selective neonatal BCG immunisation policies**

This list has been prepared from data supplied by WHO, using a cut off incidence rate of 40/100,000 population as a starting point. To take account of variations in reporting, data for the last few years have been considered and geographical areas or continents rather than individual countries. The incidence of 40/100,000 is an arbitrary level, based on the recommendations of the British Thoracic Society Joint Tuberculosis Committee. A few isolated countries with rates of 40/100,000 or above (eg Portugal) are excluded in the interests of developing cohesive policy.

#### **1. SOUTH EAST ASIA**

(Afghanistan, Bangladesh, Bhutan, Korea, India, Indonesia, Maldives, Mongolia, Myanmar, Nepal, Sri Lanka, Thailand)

Reported incidence rates in 1991 varied from 35.4/100,000 for Sri Lanka (the only country with a rate below 40) to 180.3 for India with an overall rate for the region of 165.3. It is recommended that **all** countries are considered 'high prevalence'.

#### **2. MIDDLE EAST**

Djibouti and the Yemen have reported high rates in recent years and should be considered high prevalence. The remaining countries are not considered high risk areas.

#### **3. AFRICA including North Africa**

(Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Djibouti, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Kenya, Lesotho, Liberia, Madagascar, Mali, Malawi, Mauritania, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Reunion, Rwanda, Saint Helena, Sao Tome & Principe, Senegal, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zaire, Zambia, Zimbabwe)

In 1991 the overall incidence rate for the region was 78.3/100,000. Rates over 100/100,000 were reported from Angola, Botswana, Ethiopia, Guinea-Bissau, Lesotho, Malawi, Mauritania, Mozambique, Namibia, South Africa, Uganda, Zambia and Zimbabwe.

**All** countries should be considered 'high prevalence'.

#### **4. SOUTH AND CENTRAL AMERICA**

Belize, Bolivia, Brazil, Chile, Dominican Republic, Ecuador, El Salvador, French Guiana, Haiti, Honduras, Nicaragua, Panama, Paraguay and Peru, have all reported rates greater than 40/100,000 in recent years. All remaining countries are not considered high risk.

#### **5. EUROPE**

Eastern European countries (other than the Czech and Slovak Republics), countries of the former Soviet Union and Turkey report increasing tuberculosis rates and should be considered for screening.

This list has been prepared using data up to 1994. It may be subject to revision in the light of new information from the World Health Organization.

## **APPENDIX 5: HIV and multi-drug resistant tuberculosis**

Insert UK Interdepartmental Working Group Guidelines on this topic

## **APPENDIX 6: Letter to contacts**

Specimen form letter for contacts of a case of tuberculosis

**ANYWHERE HEALTH BOARD**

Department of Public Health Medicine  
123 Blank Road  
Anytown  
AN1 2BC

Dear .....,

**Contact with tuberculosis**

I am writing to inform you that you have been in contact with someone suffering from tuberculosis (TB). The risk of catching this infection is very small indeed, and you do not need any special tests.

To be safe, I enclose a “TB Contact Card”. If you need to see your own doctor (GP) in the next year, please show him or her this card. If you develop any new or unusual chest problems, you should see your doctor within a few days.

Thank you for your cooperation

Yours sincerely

Dr A N Other  
Consultant in Public Health Medicine

## **APPENDIX 7: Contact card**

### **ANYWHERE HEALTH BOARD**

#### **Tuberculosis Contact Card**

NAME .....

ADDRESS .....

Date of issue .....

You have recently been in contact with someone who had tuberculosis (TB). It is rare to catch TB without very close contact. However, to be safe, please show this card to your General Practitioner if you need to see him or her in the next year. This is most important if you have any chest symptoms.

If you wish to know more, please phone  
Dr A N Other  
Consultant in Public Health Medicine  
tel 01234 567 8910