Costing report: tuberculosis: prevention, diagnosis, management and service organisation
Implementing the NICE guideline on tuberculosis (NG33)

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**This report is written in the following context**

This report represents the view of NICE, which was arrived at after careful consideration of the available data and through consulting with healthcare professionals. It should be read in conjunction with the NICE guideline. The report and template are implementation tools and focus on the recommendations that were considered to have a significant impact on national resource utilisation.

The cost and activity assessments in the report are estimates based on a number of assumptions. They provide an indication of the likely impact and are not absolute figures. Assumptions used in the report are based on assessment of the national average. Local practice may be different from this, and the template can be amended to reflect local practice.

Implementation of the guidance is the responsibility of local commissioners and/or providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity and foster good relations. Nothing in this costing tool should be interpreted in a way that would be inconsistent with compliance with those duties.

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Summary

This costing report looks at the resource impact of implementing the NICE guideline on tuberculosis in England.

The guideline is an update of NICE guideline CG117 (published 2011) and replaces it. It also incorporates recommendations from NICE guideline PH37 (published March 2012).

NHS England and Public Health England have been working to reduce the harm caused by tuberculosis (TB) to many individuals and communities. TB is a notifiable disease, meaning that clinicians have a statutory duty to notify local authorities or a local Public Health England centre of suspected cases. Agencies at all levels, including national and local government, clinical commissioning groups and the third sector are committed to working in partnership to decrease the incidence of TB, fight the spread of drug resistant forms of the disease, reduce current health inequality and, ultimately, eliminate TB as a public health problem. Providers for this guideline may include primary, secondary and specialist services which will also include services for prisons and immigration removal centres.

**Significant resource-impact recommendations**

This report focuses on the recommendations that are considered to have the greatest resource impact nationally, and therefore require the most additional resources to implement or can potentially generate the biggest savings.

**Net resource impact**

The annual change in resource use arising from implementing the recommendations considered in the costing analysis is summarised in table 1.

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1 The following impacts have been defined as significant:
- where the number of people affected by the guidance recommendations is estimated to be over 300 (equivalent to 1 patient per 170,000; in practice, smaller populations may have no patients or possibly more than 1, particularly if it is a disease that runs in families and there is a cluster in one area)
- where initial costing work indicates that the national cost is more than £1 million (equivalent to £2000 per 100,000 population).
Table 1 net resource impact of recommendations for tuberculosis for the population of England

<table>
<thead>
<tr>
<th>Recommendation summary</th>
<th>Recommendation number</th>
<th>Cost impact (£000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offer testing to diagnose latent TB in adults aged 18 to 65 who are close contacts of a person with pulmonary or laryngeal TB, assess for active TB and offer treatment for all positive results</td>
<td>1.2.1.1</td>
<td>1,808</td>
</tr>
<tr>
<td><strong>Total resource impact (£000)</strong></td>
<td></td>
<td>1,808</td>
</tr>
</tbody>
</table>

**Costs**

The guideline suggests changing the age criteria for testing for latent TB and the criteria that signify a positive test result for latent TB. The result of these changes will mean there will be more outpatient appointments, more tests performed and there will be more positive results for latent TB; there will also be more tests performed for active TB. More people will therefore receive treatment for active and latent TB and more staff may be needed to care for the increase in people being tested and treated.

The guideline suggests testing for HIV and hepatitis B and C before treating latent TB. Expert clinical opinion suggests there may be variation in current practice and costs may need to be considered at a local level.

Any resource impact associated with the service organisation recommendations (section 1.8 in the guideline, see section 3.3 of this document for further information) is likely to vary widely depending how local services are currently organised and local demographics, but could be significant in certain areas. For further details of local costs or savings that may be incurred in these areas see the full cost impact analysis to support the development of tuberculosis service delivery recommendations report.

**Benefits and savings**

Current practice for diagnosing latent TB is to use a Mantoux test in people aged 18 to 34. People with a positive test for latent TB also receive an interferon-gamma release assay test. People aged 35 to 65 receive a chest X-ray to test for active TB. The new guideline suggests offering Mantoux testing alone to diagnose latent TB in people aged 18 to 65 who are close contacts of a person with pulmonary or
laryngeal TB. The savings to the provider, because of the reduced number of interferon-gamma release assay tests and chest X-rays will be offset against the increase in costs for testing more people for latent and active TB.

The treatment options for latent and active TB have changed since the previous guideline. The same treatment options are now used for people who are known to have HIV and the use of pyridoxine has also been introduced. Assuming people are following the previous guideline and calculating an average cost for treatment and staff costs may result in some average cost savings. Any savings as a result of this will be offset against the increased cost of treating more people.

**Local costing template**

The costing template produced to support this guideline enables organisations in England, Wales and Northern Ireland to estimate the impact locally and replace variables with ones that depict the current local position.
1 Introduction

1.1 Supporting implementation

1.1.1 The NICE clinical guideline on tuberculosis is supported by:

- a national costing report; this document
- a local costing template; a spreadsheet that can be used to estimate the local cost of implementation.

1.2 What is the aim of this report?

1.2.1 It aims to help organisations plan for the financial implications of implementing NICE guidance.

1.2.2 It does not reproduce the NICE guideline on tuberculosis and should be read in conjunction with it.

1.2.3 The costing template that accompanies this report is designed to help those assessing the local resource impact in England, Wales or Northern Ireland.

1.3 Epidemiology of tuberculosis

1.3.1 England has one of the highest TB rates in Western Europe. According to Public Health England, TB incidence has remained relatively steady since 2005. In 2013 there were approximately 7,300 new cases of TB recorded in England.

1.3.2 TB cases tend to cluster in urban areas where populations of at risk groups are high. These include areas with many people born in countries with a high incidence of TB; a high level of homelessness, poor housing or poverty; and high rates of problem drug use.

1.4 Current service provision

1.4.1 When a person presents with a suspected case of active pulmonary TB, an X-ray is taken. If the X-ray is suggestive of TB, sputum samples are
also taken. Treatment for active pulmonary TB is with a combination of antibiotics.

1.4.2 When a person presents with suspected active TB outside the lungs, a variety of radiological and laboratory tests are done. Treatment is with the same combination of antibiotics as for pulmonary TB.

1.4.3 Mantoux tests and/or interferon-gamma testing are used to diagnose latent TB. These are performed as part of contact-tracing initiatives after the diagnosis of active TB. Various regimens of antibiotics are prescribed to treat latent TB.

2 Costing methodology

2.1 Process

2.1.1 We use a structured approach for costing clinical guidelines (see appendix A). We have to make assumptions in the costing model. These are tested for reasonableness with members of the committee and key clinical practitioners in the NHS.

2.1.2 The guideline offers best practice advice on tuberculosis.

2.2 General assumptions made

2.2.1 According to Public Health England’s Tuberculosis in the UK, in 2013 there were approximately 7,300 notified cases of TB in England, approximately 53% (3,900) of which were pulmonary or laryngeal TB.

2.2.2 Expert clinical opinion is that there will be around 4 contacts for every person diagnosed with pulmonary or laryngeal TB. This totals approximately 15,500 contacts across the whole of England.

2.2.3 It has been assumed in the costing template that all testing for latent and active TB will take place in secondary care settings. It is also assumed an outpatient appointment tariff will be paid which will include the cost of testing.
3 Significant resource-impact recommendations

3.1 Recommendation 1.2.1.1: diagnosing latent TB

Offer Mantoux\(^2\) testing to diagnose latent TB in adults aged 18 to 65 who are close contacts of a person with pulmonary or laryngeal TB.

- If the Mantoux test is inconclusive, refer the person to a TB specialist.
- If the Mantoux test is positive (an induration of 5 mm or larger, regardless of BCG history), assess for active TB.
- If the Mantoux test is positive but a diagnosis of active TB is excluded, consider an interferon gamma release assay if more evidence of infection is needed to decide on treatment. This could be, for example, if the person needs enhanced case management or if there could be adverse events from treatment.
- If the Mantoux is positive, and if an IGRA was done and that is also positive, offer them treatment for latent TB infection.

Background

3.1.1 TB is a curable disease caused by a bacterium called *Mycobacterium tuberculosis*. It is spread through inhalation of droplets containing the bacterium that are coughed out by someone with infectious TB. Once inhaled the bacteria reach the lung and grow slowly over several weeks. In over 80% of people the infection clears but, in a small number of people, a defensive barrier is built round the infection and the TB bacteria lies dormant. This is called latent TB. Some people with latent TB will develop active TB.

3.1.2 Because of evidence of the benefits, harms and costs of treating latent TB, the upper age limit for offering testing has been increased from 35 to 65 years.

3.1.3 The presence of active TB must be excluded before starting treatment for latent TB.

\(^2\) At the time of publication (January 2016) the BNF states: ‘The Mantoux test is recommended for tuberculin skin testing, but no licensed preparation is currently available. Guidance for healthcare professionals is available at www.dh.gov.uk/immunisation.’
3.1.4 Taking medication in the wrong dose or combination, irregularly or for too short a time can lead to drug resistance. Drug-resistant strains of TB are much harder to treat and significantly increase a person’s risk of long-term complications or death. There is a need to ensure that people with TB are identified and their disease is managed in a timely and effective manner.

**Assumptions made**

3.1.5 To diagnose latent TB currently, contacts of a person with TB who are aged 18 to 34 receive a Mantoux test; those with a positive test result also receive an interferon-gamma release assay test. All contacts aged 35 to 65 receive a chest X-ray to test for active TB.

3.1.6 The new guideline suggests using a Mantoux test alone for all contacts aged 18 to 65. Based on national population figures it is assumed 64% (approximately 9,900) of all contacts tested will be aged 18 to 65.

3.1.7 Under current practice, an induration of 6 mm or larger on a Mantoux test is considered a positive test result. Expert clinical opinion suggests that approximately 27% of those tested have an induration of 6 mm or larger on a Mantoux test. However, 59% of those people are discounted because of previous BCG vaccinations and therefore receive no further treatment. The remaining people are considered to have a positive test result for latent TB and currently receive treatment.

3.1.8 The new guideline suggests that when testing for latent TB previous BCG vaccinations should be disregarded and that a reduced induration of 5 mm or larger should be considered as a positive test result. Expert clinical opinion suggests this will increase the number of positive test results by 2%, resulting in 29% of people tested having a positive result. Everybody who has a positive test result for latent TB will also be assessed for active TB.

3.1.9 According to the World Health Organization’s [Guidelines on the management of latent tuberculosis infection](https://www.who.int/tb/publications/WHO_TB_Guidelines_ML_2016.pdf), 10% of people with latent TB will develop active TB in their lifetime, with the majority developing it within the first 5 years. Therefore we have assumed that in the first year of being
diagnosed with latent TB, 2% of people will test positive for active TB. The remaining 98% of people will receive treatment for latent TB.

3.1.10 According to Thorax’s [Impact of TB on the survival of people living with HIV infection in England, Wales and Northern Ireland](#) 4% of people diagnosed with TB have HIV. We have therefore assumed that 4% of people will have HIV and will receive appropriate medication for TB and HIV.

Cost summary

3.1.11 The net cost of diagnosing latent TB is summarised in table 2.

Table 2 net cost of diagnosing latent TB for the population of England

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>Proposed</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of people</td>
<td>Cost (£000)</td>
<td>Number of people</td>
</tr>
<tr>
<td>Outpatient</td>
<td>9,900</td>
<td>1,632</td>
<td>9,900</td>
</tr>
<tr>
<td>appointments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment for</td>
<td>400</td>
<td>315</td>
<td>2,800</td>
</tr>
<tr>
<td>latent TB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment for</td>
<td>8</td>
<td>9</td>
<td>57</td>
</tr>
<tr>
<td>active TB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>1,956</td>
<td>3,764</td>
<td></td>
</tr>
</tbody>
</table>

3.1.12 There may also be an increase in the number of people being referred to TB specialists as a result of the increase in people being tested for latent TB.

Other considerations

3.1.13 The costing template assumes latent TB testing takes place in secondary care settings. However, they may take place in primary care or non-primary care settings and costs should be assessed locally.

3.1.14 The number of people with active TB in the costing template only relates to the number of people that have been diagnosed though contact tracing.
3.1.15 Active case-finding has the potential to improve early diagnosis and prevent further transmission. Over time it will reduce the number of cases of active TB and future contact tracing. Commissioning pathways to investigate social contacts are not clearly established (Collaborative tuberculosis strategy for England Public Health England).

### 3.2 Other considerations

#### Service organisation

3.2.1 The guideline incorporates and adapts NICE’s guideline on tuberculosis: identification and management in under-served groups. That guideline is incorporated into recommendations in section 1.8 of the new guideline.

3.2.2 Any resource impact associated with these recommendations is likely to vary widely depending on current local service organisation arrangements and local demographics, but it could be significant in certain areas.

3.2.3 As part of developing the new guideline, we carried out a cost impact analysis. The aim of this was to estimate the cost impact of key service delivery and organisational factors arising during the update of CG117. The cost impact analysis was undertaken in line with the NICE methodology for developing costing tools and the NICE interim methods for developing service delivery guidance.

3.2.4 The analysis looked at TB support workers, rapid radiology referral, direct A&E department referral, and TB coordinators. These areas are covered by the following sections in the new guideline: 1.8.2, 1.8.8 and 1.8.9.

3.2.5 For further details of local costs or savings that may be incurred in these areas please refer to the full cost impact analysis to support the development of tuberculosis service delivery recommendations report.

#### HIV, hepatitis B and C testing

3.2.6 Recommendations 1.2.5.2 and 1.2.5.3 state offering HIV and hepatitis B and C testing before starting treatment for latent TB.
3.2.7 An HIV or hepatitis B and C test costs approximately £10 each (PH33 and PH43) and a pre or post-test discussion costs approximately £50 (Unit costs of Health and Social Care Department of Health and Department for Education 2014). Expert clinical opinion suggests there is variation in current practice and therefore any potential costs need to be considered at a local level.

Multidisciplinary TB teams

3.2.8 To provide care for the increased numbers of people with active and latent TB, there may be a need for additional staff in some areas. This should be evaluated locally, but where possible current resources should be used.

3.3 Benefits and savings

The new recommendations on diagnosing latent TB may result in savings to the provider because of the reduced number of interferon-gamma release assay tests and chest X-rays. Treatment options for both active and latent TB have changed since the previous guideline and are now more cost efficient.

The new recommendations may also reduce the risk of an outbreak situation and reduce the number of cases that develop into active TB. Implementing the guideline may therefore reduce the annual treatment costs of active TB and the costs associated with an outbreak, and prevent human suffering.

Infection control protocols enable services to be more responsive to current events and make it easier to share best practice and continued learning.

4 Sensitivity analysis

4.1 Methodology

4.1.1 There are a number of assumptions in the model for which no empirical evidence exists; these are therefore subject to a degree of uncertainty.

4.1.2 We used appropriate minimum and maximum values of variables in the sensitivity analysis to assess which variables have the biggest impact on
the net cost or saving. This enables users to identify the significant cost drivers.

4.1.3 It is not possible to arrive at an overall range for total cost because the minimum or maximum of individual lines are unlikely to occur simultaneously. We undertook 1-way sensitivity analysis, altering each variable independently to identify those that have greatest impact on the calculated total cost.

4.1.4 Appendix B contains a table detailing all variables modified, and the key conclusions drawn are discussed below.

4.2 Impact of sensitivity analysis on costs

Variation in the number of people receiving testing for latent TB

4.2.1 The baseline percentage of contacts aged 18 to 65 who will receive a Mantoux test is 64%. This leads to a cost impact of £1.8 million in England. Varying the percentage from 54 to 74% leads to a cost impact between £1.2 million and £2.4 million.

Variation in the number of contacts testing positive for latent TB

4.2.2 The baseline percentage of contacts who test positive for latent TB, with an induration of 5mm or larger, is 29%. This leads to a cost impact of £1.8 million in England. Varying the percentage from 25 to 34% leads to a cost impact between £1.5 million and £2.2 million.

Variation in the number of contacts per each case of active TB

4.2.3 The baseline number of contacts for each case of active TB is 4. This leads to a cost impact of £1.8 million in England. Varying the number of contacts from 2 to 6 leads to a cost impact between £1 million and £2.7 million.

5 Impact of guidance for commissioners

5.1.1 TB services will need to work with commissioners to identify and plan for any increase in activity which may occur after publication of the guidance.
5.1.2 Public Health England and NHS England are committed to working in partnership with the NHS, clinical commissioning groups and local authorities to tackle TB. Their focus is to build on the assets already in the NHS and the public health system, to support and strengthen local services in tackling TB.

5.1.3 NHS England have identified £10 million in 2015-16 for the development of latent TB testing and treatment services. This is planned to be distributed to lead CCGs on the basis of a locally developed TB strategy (Collaborative tuberculosis strategy for England Public Health England).

6 Conclusion

6.1 Total national cost for England

6.1.1 Using the recommendations with a significant resource impact shown in table 1 and assumptions specified in section 3 we have estimated the annual cost of implementing these recommendations in England to be £1.8 million. Table 3 shows the cost breakdown of the recommendation with the most significant resource impact.

Table 3 net resource impact of recommendations for tuberculosis for the population of England

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Recommendation number</th>
<th>Cost impact (£000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offer testing to diagnose latent TB, in adults aged 18 to 65 who are close contacts of a person with pulmonary or laryngeal TB, assess for active TB and offer treatment for all positive results</td>
<td>1.2.1.1</td>
<td>1,808</td>
</tr>
<tr>
<td>Total resource impact (£000)</td>
<td></td>
<td>1,808</td>
</tr>
</tbody>
</table>

6.1.2 The costs presented are estimates and should not be taken as the full cost of implementing the guideline.

6.2 Next steps

6.2.1 The local costing template produced to support this guideline enables organisations such as primary care trusts or health boards in Wales and...
Northern Ireland to estimate the impact locally and replace variables with ones that depict the current local position. A sample calculation using this template showed that the population of England could expect to incur additional costs of £1.8 million. Use this template to calculate the cost of implementing this guidance in your area.
Appendix A Approach to costing guidelines

Guideline at first consultation stage

- Analyse the clinical pathway to identify significant recommendations and population cohorts affected
- Identify key cost drivers – gather information needed and research cost behaviour
- Develop costing model – incorporating sensitivity analysis

Draft national cost-impact report

Determine links between national cost and local implementation

Internal peer review by qualified accountant within NICE

Develop local costing template

Circulate report and template to cost-impact panel and GDG for comments

Update based on feedback and any changes following consultations

Cost-impact review meeting

Final sign-off by NICE

Prepare for publication in conjunction with guideline
## Appendix B Results of sensitivity analysis

<table>
<thead>
<tr>
<th>Individual variable sensitivity</th>
<th>Baseline value</th>
<th>Minimum value</th>
<th>Maximum value</th>
<th>Recurrent costs (Baseline costs (£000s)</th>
<th>Minimum costs (£000s)</th>
<th>Maximum costs (£000s)</th>
<th>Change (£000s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence of tuberculosis (TB)</td>
<td>0.010%</td>
<td>0.001%</td>
<td>0.100%</td>
<td>1,808</td>
<td>134</td>
<td>13,359</td>
<td>13,225</td>
</tr>
<tr>
<td>Proportion of pulmonary or laryngeal TB</td>
<td>53%</td>
<td>43%</td>
<td>63%</td>
<td>1,808</td>
<td>1,467</td>
<td>2,149</td>
<td>682</td>
</tr>
<tr>
<td>Number of contacts per case of active TB</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>1,808</td>
<td>904</td>
<td>2,712</td>
<td>1,808</td>
</tr>
<tr>
<td>Contacts aged 18 to 65 who receive a Mantoux test to screen for latent TB at an outpatient appointment</td>
<td>64%</td>
<td>54%</td>
<td>74%</td>
<td>1,808</td>
<td>1,220</td>
<td>2,396</td>
<td>1,176</td>
</tr>
<tr>
<td>Contacts who test positive for latent TB with an induration of 5 mm or larger</td>
<td>29%</td>
<td>25%</td>
<td>34%</td>
<td>1,808</td>
<td>1,514</td>
<td>2,176</td>
<td>662</td>
</tr>
<tr>
<td>People who test negative for active TB and receive treatment for latent TB</td>
<td>98%</td>
<td>90%</td>
<td>100%</td>
<td>1,808</td>
<td>1,844</td>
<td>1,799</td>
<td>-45</td>
</tr>
</tbody>
</table>