Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

October 2017
Authors

York Health Economics Consortium is a health economics consulting company owned by the University of York. It provides a range of services, including economic modelling, literature searching, systematic reviews, network meta-analyses, patient-reported outcomes, service review and applied research and training to the NHS and the pharmaceutical and health care industries. YHEC also carries out work for a range of clients outside the health sector, including Local Authorities and the voluntary sector. Current clients include: NHS England, the National Institute for Health and Care Excellence (NICE), a range of local NHS trusts and several large multi-national pharmaceutical, device and nutrition companies.

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The British Thoracic Society (BTS) exists to improve standards of care for people with respiratory disease, and to support and develop those who provide that care for them.

Our vision is one of better lung health for all. Our mission is three-fold:
- To champion excellence in the diagnosis, treatment and care of people with lung disease and those delivering it;
- To influence NHS policy and services to help reduce the health and economic burden of lung disease;
- To work with, and support, individuals and organisations across the NHS and beyond who share our vision.

The BTS is a multi-disciplinary professional society with over 3,400 members, as of mid-2017. These include doctors, nurses, respiratory physiotherapists, scientists and other professionals with a respiratory interest. All join because they share the Society’s vision. Many also want to make a difference, and around 13% of the UK membership is involved with the Society’s activities across the UK at any given time.

The Society values and actively seeks out the opportunity to work collaboratively with others to further its aims, and seeks to maintain a global outlook.

The BTS is a registered charity and a Company Limited by Guarantee.

brit-thoracic.org.uk

This phase of the British Lung Foundation Health Economics programme is supported by a charitable donation from Pfizer Limited; the company had no influence over the content.

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Foreword

Over 12 million people in the UK have been diagnosed with a lung condition, and lung disease is the nation’s third biggest killer.

The good news is that we have a committed workforce, world-leading research and clinical guidelines, some highly cost effective treatments and strong examples of integrated care. But the historic lack of a national plan with sufficient investment has held uniform progress back – contributing to a situation where some key patient outcomes have not improved over the last ten years.

Lung disease is a major burden on the UK economy. Research published by the British Lung Foundation earlier this year showed that respiratory illness costs us £11 billion each year, of which almost £10 billion falls directly on the NHS.

This new report brings together the best evidence and data available on the costs of lung disease to the UK and, crucially, the cost effectiveness of different interventions. We hope it will be of use to anyone working in and around respiratory policy and practice.

We are a long way from understanding the true impact of lung disease. In many areas, we were surprised at the lack of economic evidence available. The research team could find very little robust, up-to-date data on the costs of lung cancer, despite the disease being responsible for more deaths each year than any other form of cancer. And evidence on indirect costs, such as social care, was limited across virtually all conditions.

Some of the report’s findings, though, will not be unexpected. For example, it reinforces that smoking cessation is one of the most effective and cost effective ways to prevent and treat chronic obstructive pulmonary disease (COPD). This is already well known. Yet six in ten local authority areas in England have cut funding to stop smoking support services.

If the NHS and partners, across the board, appropriately invested in the highly effective treatments outlined in this report, there would be huge health and economic benefits for the NHS and society.

We need to make this case for change more strongly to improve patient outcomes. That’s why we are working alongside other patient and professional groups to establish the nation’s first ever Taskforce for Lung Health. We will spend the next year building on this preliminary report, gathering new evidence and consulting widely, culminating in the delivery of a five year strategy for lung disease to help improve lung health across every part of the nation.

We will use this report to help inform this work, ensuring that everything we ask for delivers real benefits for patients and is cost effective and sustainable for the NHS. Finally, we hope to work with others to fill in the gaps in the evidence base and increase all our understanding of the most effective ways to prevent, diagnose and treat lung disease.

Dr Penny Woods, Chief Executive of the British Lung Foundation, and Dr Lisa Davies, Chair of the British Thoracic Society’s Board of Trustees
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# Abbreviations

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<th>Description</th>
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<tr>
<td>AUSS</td>
<td>Australian (dollars)</td>
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<tr>
<td>BCG</td>
<td>Bacillus Calmette-Guérin vaccine</td>
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<td>BLF</td>
<td>British Lung Foundation</td>
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<td>BTS</td>
<td>British Thoracic Society</td>
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<td>CANS</td>
<td>Canadian (dollars)</td>
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<tr>
<td>CBA</td>
<td>Cost-benefit analysis</td>
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<tr>
<td>CDSR</td>
<td>Cochrane Database of Systematic Reviews</td>
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<td>CEA</td>
<td>Cost effectiveness analysis</td>
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<td>CF</td>
<td>Cystic fibrosis</td>
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<tr>
<td>CMA</td>
<td>Cost-minimisation analysis</td>
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<tr>
<td>COPD</td>
<td>Chronic Obstructive Pulmonary Disease</td>
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<tr>
<td>CRD</td>
<td>Centre for Reviews and Dissemination</td>
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<tr>
<td>CT</td>
<td>Computed tomography</td>
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<tr>
<td>CUA</td>
<td>Cost-utility analysis</td>
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<td>DALY</td>
<td>Disability-Adjusted Life Year</td>
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<tr>
<td>DARE</td>
<td>Database of Abstracts of Reviews of Effects</td>
</tr>
<tr>
<td>HSTAT</td>
<td>Health Services/Technology Assessment Texts</td>
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<td>HTA</td>
<td>Health Technology Assessment</td>
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<tr>
<td>ICER</td>
<td>Incremental Cost effectiveness Ratio</td>
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<td>IGRA</td>
<td>Interferon-Gamma Release Assays</td>
</tr>
<tr>
<td>IPF</td>
<td>Idiopathic Pulmonary Fibrosis</td>
</tr>
<tr>
<td>LYG</td>
<td>Life year gained</td>
</tr>
<tr>
<td>NHS</td>
<td>National Health Service</td>
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<td>NICE</td>
<td>National Institute for Health and Care Excellence</td>
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<td>NOK</td>
<td>Norwegian Krone</td>
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<tr>
<td>NR</td>
<td>Not reported</td>
</tr>
<tr>
<td>NRT</td>
<td>Nicotine replacement therapy</td>
</tr>
<tr>
<td>PCV13</td>
<td>Pneumococcal conjugate vaccine</td>
</tr>
<tr>
<td>PICOS</td>
<td>Population, intervention, comparators, outcomes, study design</td>
</tr>
<tr>
<td>PPSV23</td>
<td>23-valent polysaccharide vaccine</td>
</tr>
<tr>
<td>QALY</td>
<td>Quality-Adjusted Life Year</td>
</tr>
<tr>
<td>QFT-IT</td>
<td>QuantiFERON Gold in Tube</td>
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<tr>
<td>SLR</td>
<td>Systematic Literature Review</td>
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<tr>
<td>TB</td>
<td>Tuberculosis</td>
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<tr>
<td>TST</td>
<td>Tuberculin skin test</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>USA</td>
<td>United States of America</td>
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<td>YHEC</td>
<td>York Health Economics Consortium</td>
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Executive summary

This report describes the conduct and results of a literature review of the available evidence on the economic costs of lung disease and the cost effectiveness of policy and service interventions. This review was conducted by York Health Economics Consortium on behalf of the British Lung Foundation (BLF) and the British Thoracic Society (BTS).

Methods

Extensive literature searches were undertaken in May 2017 to identify published evidence for the current economic burden (both direct and indirect costs) of lung disease as well as information on the cost effectiveness of policy and service interventions used to treat lung disease worldwide, expressed in cost effectiveness analyses (CEA), cost-minimisation analyses (CMA), cost-benefit analyses (CBA) and cost-utility analyses (CUA).

Burden of illness studies were limited to those published from 2000 to 2017 and the reviews of cost effectiveness of policy and service interventions were limited to those published from 2007 to 2017. Primary studies for the cost effectiveness questions were limited to those published in the last five years.

Results

The searches identified 1,377 records for the economic burden question and 506 records for the cost effectiveness question. Thirty-eight documents were eligible for the review following detailed assessment.

Economic burden results are summarised as follows:

- Direct hospital costs for asbestos-related mesothelioma in Scotland: £0.9m (2000);
- Asthma total annual direct costs (2012) for UK were £964.9m, with annual indirect costs (state benefits only) estimated to be £146.9m;
- COPD direct costs for England were £1.50bn (2011) and £159m for the same year in Scotland;
- Cystic fibrosis annual ‘per patient’ cost of €21,316 (2012) for direct costs and €21,716 for indirect costs;
- Lung cancer costs identified were considered outdated.
The cost effectiveness of policy and service interventions are summarised as follows:

- A meta-analysis found all education and environmental interventions in asthma assessed in the analysis to be cost saving;
- A systematic review found self-management methods in asthma to be cost saving or to have favourable cost effectiveness ratios;
- For COPD self-management, smoking cessation advice or campaigns, a pharmacy-led adherence improvement programme and telehealth were found to be highly cost effective and often less costly and more effective, except for nurse-led self-management, which was found in three out of four studies to be dominated by usual care;
- A lung cancer public awareness campaign (‘Be Clear on Cancer’; a marketing campaign delivered across England by Public Health England) had an ICER between £13,500 and £18,000 per QALY gained;
- The evidence on the cost effectiveness of screening for lung cancer was highly variable with ICERs ranging from $1,500 to $250,000 per QALY gained;
- Vaccinations for pneumonia in older adults had reported ICERs in three studies in the range that would be considered cost effective in the UK;
- A community pharmacist screening programme in Australia for sleep apnoea was found to be a dominant strategy, costing less and generating more QALYs than no screening;
- Several non-UK studies reported screening for tuberculosis to be highly cost effective or even a dominant strategy, but the one UK study suggested that screening people in close contact to TB patients resulted in an ICER no lower than £37,000 per QALY gained, suggesting that screening of such people would not be cost effective in the UK.

Discussion

For economic burden there is recent and robust available evidence on the direct costs of asthma, COPD and cystic fibrosis (albeit per patient rather than at a population level) in the UK. The direct cost estimates of COPD do not include community care costs such as community nursing, which are likely to be significant for this patient group. There is some recent evidence, but with a poor level of detail, on the direct cost of pertussis per patient. Outside of these conditions, the evidence on direct costs is outdated (such as the costs for lung cancer) or non-existent.
Recent and robust evidence on indirect costs for all conditions, except for asthma and cystic fibrosis, is lacking, with evidence on the indirect costs of asthma being limited to state benefit payments associated with the condition. The indirect costs associated with informal care for cystic fibrosis were the largest single cost item and several of the lung conditions (such as COPD) may require similar levels of informal care. As such the lack of evidence on indirect costs for lung disease is problematic in understanding the true economic burden of the conditions.

A substantial evidence base exists on non-pharmaceutical policy-related interventions for lung disease including several large and well-conducted systematic reviews and meta-analyses. This evidence suggests that certain interventions, notably self-management in asthma, smoking cessation in COPD, awareness campaigns for lung cancer, and vaccination for pneumonia are all likely to be cost effective and, in several cases, are dominant strategies.

For other interventions, such as screening for TB, the economic evidence is equivocal with further research probably required to establish cost effectiveness.

There are several interventions that the available evidence suggests are unlikely to be cost effective. These interventions included annual or one-off screening for people at high risk of lung cancer where the ICERs per QALY gained were generally well above the levels that would ordinarily be considered cost effective in the UK. Nurse-led self-management for COPD was found to be the least cost effective of all interventions with three of the four identified studies on the intervention finding it generated worse patient outcomes at a higher cost than usual care.
Introduction

This report describes the conduct and results of a literature review of the available evidence on the economic costs of lung disease and the cost effectiveness of policy and service interventions. This review was conducted by York Health Economics Consortium on behalf of the British Lung Foundation (BLF) and the British Thoracic Society (BTS).

1.1 Background

Lung disease, or respiratory disease, encompasses a number of lung conditions including asthma, bronchiectasis, chronic obstructive pulmonary disease (COPD), cystic fibrosis, idiopathic pulmonary fibrosis (IPF), lung cancer, mesothelioma, obstructive sleep apnoea, pneumonia/lower respiratory tract infections, respiratory tuberculosis and sarcoidosis. Signs and symptoms vary by specific lung condition, but generally can involve breathing difficulties, shortness of breath, decreased ability to exercise, persistent coughing and pain or discomfort when breathing. Some lung diseases can lead to respiratory failure and death. Causes of lung disease are known to include smoking, radon, infection, asbestos and air pollution, but not all causes are known.

The BLF reported in 2016 in ‘The Battle for Breath’ that 12 million people have been diagnosed with a lung disease in the UK and there are 700,000 hospital admissions each year in the UK related to lung disease. Lung disease accounts for 115,000 deaths per year, and the UK has the fourth highest mortality rate from lung disease in Europe.

‘The Battle for Breath’ describes how people living in the most deprived areas of the UK are more than twice as likely as people living elsewhere to develop lung cancer and COPD and states that some lung diseases are much more common than previously thought. The report suggests that IPF is twice as common as stated in guidance produced by the National Institute for Health and Care Excellence (NICE) and bronchiectasis is four times more common than NHS figures suggest.

Lung disease places a significant burden on the NHS and wider government spending. BLF research estimates that lung disease costs society £11 billion per year. A BTS report from 2006 using different methodology estimated the cost of lung disease to be £6.6 billion per year.

The BLF and BTS wish to build a comprehensive outline of the economic burden of lung disease to the UK. This review was designed to identify
published evidence for the current economic burden (both direct and indirect costs) of lung disease as well as information on the cost effectiveness of policy and service interventions used to treat lung disease worldwide, expressed in cost effectiveness analyses (CEA), cost-minimisation analyses (CMA), cost-benefit analyses (CBA) and cost-utility analyses (CUA).

It is anticipated that this review will inform the development of proposals by BLF, BTS and the respiratory community to appropriate bodies to improve respiratory policy, services and care to deliver improved respiratory outcomes. The BLF and BTS have commissioned this review to inform the shape and scope of a new project, including the range of disease areas and interventions to be covered, aiming to ‘fill in the gaps’ and give strong recommendations as to the interventions which are the most cost effective. The BLF and BTS also anticipate that this review will help the respiratory community to assess, going forward, whether current UK national resources dedicated to the prevention, diagnosis, and management of lung disease seem proportionate to its economic burden.

1. A full listing of conditions can be found at: https://www.blf.org.uk/support-for-you
4. Estimating the economic burden of respiratory illness in the UK – Early report draft provided to YHEC in confidence by BLF
The objective of this review was to broaden and enhance the understanding of the BLF and BTS in terms of the available evidence on the direct and indirect economic costs of lung disease and the cost effectiveness of different policy and service interventions to treat lung disease.
3 Methods

3.1 Eligibility Criteria

Eligible studies for this review were those meeting the criteria described in Table 3.1. Full details of the eligibility criteria are in Appendix B.

Table 3.1: Eligibility criteria

<table>
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<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
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<tbody>
<tr>
<td><strong>Population</strong></td>
<td>Conditions that are not lung disease or respiratory illnesses.</td>
</tr>
<tr>
<td>Adults and/or children with lung disease/respiratory illness including:</td>
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<tr>
<td>• Asthma;</td>
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<tr>
<td>• Bronchiectasis;</td>
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<td>• COPD;</td>
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<td>• Cystic fibrosis;</td>
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<td>• Interstitial lung disease:</td>
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<td>• Sarcoidosis;</td>
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<td>• IPF;</td>
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<td>• Lung cancer;</td>
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<td>• Mesothelioma;</td>
<td></td>
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<td>• Obstructive sleep apnoea;</td>
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<td>• Pneumonia/lower respiratory tract infections;</td>
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<td>• Respiratory tuberculosis.</td>
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<tr>
<td>Reports of mixed populations, including other less prevalent lung diseases such as asbestos-related conditions, were also eligible.</td>
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<tr>
<td>Inclusion criteria</td>
<td>Exclusion criteria</td>
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<td>-----------------------------------------------------------------------------------</td>
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<tr>
<td><strong>Intervention</strong></td>
<td></td>
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<tr>
<td>For the economic burden question, the costs of policy and service interventions</td>
<td>For the cost effectiveness of interventions question, studies modelling the cost</td>
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<td>identified in the cost effectiveness studies were eligible.</td>
<td>effectiveness of drug treatments and other non-policy and service interventions</td>
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<td></td>
<td>were not eligible:</td>
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<td></td>
<td>• Surgery;</td>
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<td></td>
<td>• Physiotherapy;</td>
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<td></td>
<td>• Radiotherapy.</td>
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<tr>
<td>For the cost effectiveness of interventions question, eligible health policy and</td>
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<td>service interventions included, but were not limited to:</td>
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<tr>
<td>• Earlier diagnosis national screening programmes;</td>
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<td>• Awareness campaigns;</td>
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<td>• Drugs/accurate prescribing;</td>
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<td>• Drug adherence;</td>
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<td>• Smoking cessation;</td>
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<td>• Supported self-management;</td>
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<td>• Pulmonary rehabilitation;</td>
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<td>• Vaccination programmes;</td>
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<td>• Integrated care.</td>
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<tr>
<td>Eligible interventions were those implemented or modelled at an international,</td>
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<td>national, regional or system-wide level including within single-site health-related</td>
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<td>institutions, e.g. hospitals.</td>
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<td><strong>Outcomes</strong></td>
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<tr>
<td>Eligible economic burden outcomes were:</td>
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<tr>
<td>• Direct costs:</td>
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<td>• Primary care costs;</td>
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<td>• Hospital costs (inpatient and outpatient):</td>
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<td>• Costs associated with A&amp;E admissions;</td>
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<td>• Community care costs;</td>
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<td>• Non-hospital treatment costs.</td>
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<tr>
<td>• Indirect costs:</td>
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<tr>
<td>• Healthy years of life lost/mortality;</td>
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<td>• State benefits;</td>
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<td>• Social care costs;</td>
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<td>• Sickness absence:</td>
<td></td>
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<td>• Income loss;</td>
<td></td>
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<td>• Cost of productivity loss;</td>
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<td>• Costs of presenteeism;</td>
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<tr>
<td>• Informal care.</td>
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<tr>
<td>Cost effectiveness summary outcomes (also including cost-utility analyses and</td>
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<tr>
<td>cost-benefit analyses) e.g.:</td>
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<tr>
<td>• Cost per QALY;</td>
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<td>• Cost per DALY;</td>
<td></td>
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<tr>
<td>• ICERs;</td>
<td></td>
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<tr>
<td>• Outcomes from cost-benefit analysis studies, e.g. costs per X avoided;</td>
<td></td>
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<tr>
<td>• Costs outcomes from cost-minimisation studies).</td>
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<tr>
<td>Meta-analyses of these outcomes were also eligible.</td>
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</tbody>
</table>
**Literature review:** the economic costs of lung disease and the cost effectiveness of policy and service interventions

<table>
<thead>
<tr>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
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</thead>
<tbody>
<tr>
<td><strong>Study types</strong></td>
<td>Conference abstracts.</td>
</tr>
<tr>
<td>To produce this review within the available resource, we used a staged approach to retrieve study designs where we expected to get the most synthesised data.</td>
<td></td>
</tr>
<tr>
<td>For the economic burden question cost of illness and burden of illness studies were eligible, along with reviews and health technology assessments reporting estimates of the burden of disease.</td>
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<tr>
<td>For the cost effectiveness of interventions question, review articles, SLRs, meta-analyses or HTAs were prioritised.</td>
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</tr>
<tr>
<td>If these study types were not identified, we planned to expand the scope of eligible study designs to the following types of primary studies published in the last five years:</td>
<td></td>
</tr>
<tr>
<td>• Cost effectiveness analyses;</td>
<td></td>
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<tr>
<td>• Cost-utility analyses;</td>
<td></td>
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<tr>
<td>• Cost-benefit analyses;</td>
<td></td>
</tr>
<tr>
<td>• Cost-minimisation analyses.</td>
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<tr>
<td><strong>Limits</strong></td>
<td>For the economic burden question any country other than the UK was excluded.</td>
</tr>
<tr>
<td>For the economic burden question, only studies based in the UK were eligible.</td>
<td>For the cost effectiveness of interventions question, studies including countries not in Europe, North America or Australasia were not eligible unless data were stratified.</td>
</tr>
<tr>
<td>For the cost effectiveness of interventions question, reviews of studies from the following countries were eligible:</td>
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<tr>
<td>• Europe (including the UK);</td>
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<tr>
<td>• North America;</td>
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<tr>
<td>• Australasia.</td>
<td></td>
</tr>
<tr>
<td>Studies including multiple countries were only eligible if all the countries were within these continents or if data for any eligible countries were reported separately.</td>
<td></td>
</tr>
</tbody>
</table>

COPD = Chronic Obstructive Pulmonary Disease, DALY = Disability-Adjusted Life Year, HTA = Health Technology Assessment, ICER = Incremental Cost effectiveness Ratio, IPF = Idiopathic Pulmonary Fibrosis, QALY = Quality-Adjusted Life Year, SLR = Systematic Literature Review
3.2 Limits

The searches for burden of illness studies were limited to evidence published from 2000 to 2017 and the searches for reviews of cost effectiveness of policy and service interventions were limited to reviews published from 2007 to 2017, so the evidence is as current as possible.

Primary studies for the cost effectiveness questions were limited to those published in the last five years.

3.3 Identifying relevant trials

We designed search strategies to capture published and unpublished studies relevant to the review’s objectives and informed by the eligibility criteria described in section 3.1 and Appendix B.

3.3.1 Economic burden question

The MEDLINE (OvidSP interface) strategy to identify studies reporting the economic burden of lung diseases in the United Kingdom is shown in Figure 3.1. The strategy employs a multi-stranded approach and comprises two parts. The first part comprises four concepts:

- Lung diseases (search lines 1–27);
- Search terms to capture economic burden (search lines 28–39);
- Search terms to capture systematic reviews (search lines 41–43);
- A search filter for UK studies (NICE geographical filter for UK, search lines 57–64).

The second part identifies studies of the economic burden without a study type limit (search lines 47–50). The two parts of the strategy are combined in search line 53.

Animal studies are removed from MEDLINE using a standard algorithm (search line 54).

Publication types that are unlikely to yield relevant study reports (news, comments, editorials, letters, case reports) and records with the phrase ‘case report’ in the title field are excluded from the strategy (search line 55). Conference abstracts were excluded where possible.

The search is limited to records published since 2000 (search line 69).

Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

Figure 3.1: Search strategy to identify studies of the economic burden of lung disease in Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>

1. exp Asthma/ (117684)
2. (asthma or asthmatic).ti,ab,kf. (139109)
3. exp Bronchiectasis/ (8468)
4. bronchiectasis.ti,ab,kf. (8653)
5. ((persistent or abnormal) adj3 (bronchï$ adj3 dilatat$)).ti,ab,kf. (9)
6. Pulmonary Disease, Chronic Obstructive/ (30746)
7. COPD.ti,ab,kf. (36313)
8. (chronic obstructive adj3 (lung or pulmonary)).ti,ab,kf. (42114)
9. Cystic Fibrosis/ (32040)
10. Cystic fibrosis.ti,ab,kf. (39340)
11. Lung Diseases, Interstitial/ (7623)
12. interstitial lung disease$.ti,ab,kf. (7805)
13. Idiopathic Pulmonary Fibrosis/ (2252)
14. (idiopathic adj3 pulmonary fibrosis).ti,ab,kf. (6044)
15. Sarcoidosis, Pulmonary/ (3036)
16. (sarcoidosis adj3 (lung$1 or pulmonary)).ti,ab,kf. (3341)
17. exp Lung Neoplasms/ (205589)
18. ((cancer or neoplasm$ or tumo?r$) adj3 (lung$1 or pulmonary)).ti,ab,kf. (157304)
19. exp Mesothelioma/ (12989)
20. mesothelioma.ti,ab,kf. (13673)
21. Sleep Apnea, Obstructive/ (15516)
22. obstructive sleep apn?ea.ti,ab,kf. (21774)
23. exp Pneumonia/ (84210)
24. pneumonia.ti,ab,kf. (101167)
25. (lower respiratory tract adj3 infection$).ti,ab,kf. (5974)
26. Tuberculosis, Pulmonary/ (72080)
27. (tuberculosis adj3 (lung or respiratory or pulmonary)).ti,ab,kf. (49188)
28. or/1-27 (753219)
29. “cost of illness”/ (22559)
30. (costing adj3 (illness$ or disease$ or sickness$)).ti,ab,kf. (42)
31. (burden adj3 (illness$ or disease$ or sickness$)).ti,ab,kf. (23859)
32. (burden adj3 (family or human$)).ti,ab,kf. (2531)
33. (economic or human$ adj3 consequence$)).ti,ab,kf. (5370)
34. exp health care costs/ (56457)
35. (cost or costs).ti,ab,kf. (434700)
36. (resource$1 adj4 use$1).ti,ab,kf. (24163)
37. (resource$1 adj4 usage).ti,ab,kf. (512)
38. (resource$1 adj4 utili$).ti,ab,kf. (12538)
39. (visit or visits or hospitalization$1 or hospitalisation$1 or admission$1 or admitted or emergency room or rescue).ti,ab,kf. (580101)
40. or/29-39 (1044410)
41. 28 and 40 (61582)
42. (systematic adj3 review).ti,kf. (73664)
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

43. (meta-analy$ or metaanaly$ or meta-synthes$ or metasynthes$ or meta-regressi$ or metaregressi$).ti.kf. (73060)
44. systematic overview.ti.kf. (229)
45. or/42-44 (123173)
46. 41 and 45 (803)
47. (costing adj3 (illness$ or disease$ or sickness$)).ti. (6)
48. (burden adj3 (illness$ or disease$ or sickness$)).ti. (3264)
49. (economic adj3 consequence$1).ti. (539)
50. costs.ti. (28765)
51. or/47-50 (32517)
52. 28 and 51 (1449)
53. 46 or 52 (2232)
54. exp Animals/ not Humans/ (4398892)
55. (news or comment or letter or editorial or case reports).pt. or case report.ti. (3478950)
56. 53 not (54 or 55) (2143)
57. exp Great Britain/ (344024)
58. (national health service* or nhs*).ti,ab.in. (141443)
59. (english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english)).ti,ab. (88733)
60. (gb or “g.b.” or britain* or (british* not “british columbia”) or uk or “u.k.” or united kingdom* or (england* not “new england”) or northern ireland* or northern irish* or scotland* or scottish* or ((wales or “south wales”) not “new south wales”) or welsh*).ti,ab,jw,in. (1751209)
61. (bath or “bath’s” or ((birmingham not alabama*) or (“birmingham’s” not alabama*) or bradford or “bradford’s” or brighton or “brighton’s” or bristol or “bristol’s” or carlisle* or “carlisle’s” or (cambridge not (massachusetts* or boston* or harvard*)) or (“cambridge’s” not (massachusetts* or boston* or harvard*)) or (canterbury not new zealand*) or (“canterbury’s” not new zealand*) or chelmsford or “chelmsford’s” or chester or “chester’s” or chichester or “chichester’s” or coventry or “coventry’s” or derby or “derby’s” or durham not (carolina* or nc)) or (“durham’s” not (carolina* or nc)) or euy or “ely’s” or exeter or “exeter’s” or gloucester or “gloucester’s” or hereford or “hereford’s” or hull or “hull’s” or lancaster or “lancaster’s” or leeds* or leicester or “leicester’s” or (lincoln not nebraska*) or (“lincoln’s” not nebraska*) or (liverpool not (new south wales* or nsw) or (“liverpool’s” not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or (“london’s” not (ontario* or ont or toronto*)) or manchester or “manchester’s” or (newcastle not (new south wales* or nsw)) or (“newcastle’s” not (new south wales* or nsw)) or (norwich or “norwich’s” or nottingham or “nottingham’s” or oxford or “oxford’s” or peterborough or “peterborough’s” or plymouth or “plymouth’s” or portsmouth or “portsmouth’s” or preston or “preston’s” or ripon or “ripon’s” or salford or “salford’s” or salisbury or “salisbury’s” or sheffield or “sheffield’s” or southampton or “southampton’s” or st albans or stoke or “stoke’s” or “stoke’s” or sunderland or “sunderland’s” or truro or “truro’s” or wakefield or “wakefield’s” or wells or westminster or “westminster’s” or winchester or “winchester’s” or wolverhampton or “wolverhampton’s” or (worcester not (massachusetts* or boston* or harvard*)) or (“worcester’s” not (massachusetts* or boston* or harvard*)) or (york not (“new york**” or ny or ontario* or ont or toronto*)) or (“york’s” not (“new york**” or ny or ontario* or ont or toronto*)))))).ti,ab.in. (1128712)
62. (bangor or “bangor’s” or cardiff or “cardiff’s” or newport or “newport’s” or st asaph or “st asaph’s” or st davids or swansea or “swansea’s”).ti,ab.in. (42981)
63. (aberdeen or “aberdeen’s” or dundee or “dundee’s” or edinburgh or “edinburgh’s” or glasgow or “glasgow’s” or inverness or (perth not australia*) or (“perth’s” not australia*) or stirling or “stirling’s”).ti,ab,in. (164445)
64. (armagh or “armagh’s” or belfast or “belfast’s” or lisburn or “lisburn’s” or londonderry or “londonderry’s” or derry or “derry’s” or newry or “newry’s”).ti,ab,in. (20339)
65. or/57-64 (2261918)
66. (exp africa/ or exp americas/ or exp antarctic regions/ or exp arctic regions/ or exp asia/ or exp australia/ or exp oceania/) not (exp great britain/ or europe/) (2523275)
67. 65 not 66 (2144476)
68. 56 and 67 (355)
69. limit 68 to yr=”2000-current” (342)
70. remove duplicates from 69 (324)

Key to Ovid symbols and commands

$ Unlimited right-hand truncation symbol
$N Limited right-hand truncation - restricts the number of characters following the word to N
ti,ab,kf. Searches are restricted to the Title, Abstract, Keyword Heading Word fields
adjN Retrieves records that contain terms (in any order) within a specified number (N) of words of each other
/ Searches are restricted to the Subject Heading field
exp The subject heading is exploded
pt. Search is restricted to the publication type field
or/1-27 Combines sets 1 to 27 using OR

3.3.2 Cost effectiveness of interventions question

The MEDLINE (OvidSP interface) strategy to identify reviews of the cost effectiveness of health policy and service interventions in lung diseases is shown in Figure 3.2.

The strategy comprises the following concepts:

- Lung diseases (search lines 1–27);
- A search filter for economic evaluations (CRD NHS EED filter, search lines 29–45);
- Health policy and service interventions (search lines 47–68);
- Search terms to capture systematic reviews (search lines 71–73).

Animal studies are removed using a standard algorithm in MEDLINE (search line 76). Publication types that are unlikely to yield relevant study reports (news, comments, editorials, letters, case reports) and records with the phrase ‘case report’ in the title field are excluded (search line 77). Conference abstracts were excluded where possible. The search is limited to records published since 2007.
**Literature review:** the economic costs of lung disease and the cost effectiveness of policy and service interventions

**Figure 3.2:** Search strategy to identify systematic reviews of the cost effectiveness of policy and service interventions in Ovid MEDLINE(R)

Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>

1. exp Asthma/ (117684)
2. (asthma or asthmatic).ti,ab,kf. (139109)
3. exp Bronchiectasis/ (8468)
4. bronchiectasis.ti,ab,kf. (8653)
5. ((persistent or abnormal) adj3 (bronchi$ adj3 dilatat$)).ti,ab,kf. (9)
6. Pulmonary Disease, Chronic Obstructive/ (30746)
7. COPD.ti,ab,kf. (36313)
8. (chronic obstructive adj3 (lung or pulmonary)).ti,ab,kf. (42114)
9. Cystic Fibrosis/ (32040)
10. cystic fibrosis.ti,ab,kf. (39340)
11. Lung Diseases, Interstitial/ (7623)
12. interstitial lung disease$.$ti,ab,kf. (7805)
13. Idiopathic Pulmonary Fibrosis/ (2252)
14. ((idiopathic adj3 pulmonary fibrosis).ti,ab,kf. (6044)
15. Sarcoidosis, Pulmonary/ (3036)
16. (sarcoidosis adj3 (lung$1 or pulmonary)).ti,ab,kf. (3341)
17. exp Lung Neoplasms/ (205589)
18. ((cancer or neoplasm$ or tumo?r$) adj3 (lung$1 or pulmonary)).ti,ab,kf. (157304)
19. exp Mesothelioma/ (12989)
20. mesothelioma.ti,ab,kf. (13673)
21. Sleep Apnea, Obstructive/ (15516)
22. obstructive sleep apn?ea.ti,ab,kf. (21774)
23. exp Pneumonia/ (84210)
24. pneumonia.ti,ab,kf. (101167)
25. (lower respiratory tract adj3 infection$).ti,ab,kf. (5974)
26. Tuberculosis, Pulmonary/ (72080)
27. (tuberculosis adj3 (lung or respiratory or pulmonary)).ti,ab,kf. (49188)
28. or/1-27 (753219)
29. Economics/ (27100)
30. exp “Costs and cost analysis”/ (211049)
31. Economics, dental/ (1898)
32. exp “Economics, hospital”/ (22491)
33. Economics, medical/ (9061)
34. Economics, nursing/ (3986)
35. Economics, pharmaceutical/ (2763)
36. (economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (627254)
37. (expenditure$ not energy).ti,ab. (24276)
38. value for money.ti,ab. (1351)
39. budget$.ti,ab. (24520)
40. or/29-39 (768477)
41. ((energy or oxygen) adj cost).ti,ab. (3582)
42. (metabolic adj cost).ti,ab. (1157)
43. (energy or oxygen) adj expenditure).ti,ab. (21575)
44. or/41-43 (25417)
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

45. 40 not 44 (762660)
46. 28 and 45 (21977)
47. Mass screening/ (93348)
48. (early or earlier) adj3 (diagnos$ or detecti$ or screeni$).ti,ab,kf. (161927)
49. Health Promotion/ (64935)
50. Health Education/ (58207)
51. Patient Education as Topic/ (80051)
52. ( awareness adj3 campaign$).ti,ab,kf. (1956)
53. (health adj3 (promoti$ or educati$)).ti,ab,kf. (81970)
54. (patient adj3 educati$).ti,ab,kf. (20645)
55. Drug Prescriptions/ and Physician’s Practice Patterns/ (3729)
56. (accurate$ or correct$) adj3 (prescribi$ or prescripti$).ti,ab,kf. (552)
57. Patient Compliance/ (53949)
58. Medication Adherence/ (13128)
59. (medication$ or patient$) adj3 (adhere$ or complian$).ti,ab,kf. (37495)
60. Smoking Cessation/ (24933)
61. (smoking adj3 (cession or quit$ or stop$)).ti,ab,kf. (28407)
62. Self Care/ (29908)
63. (support$ adj3 (self-manag$ or self-care)).ti,ab,kf. (2358)
64. pulmonary rehabilitat$.ti,ab,kf. (2799)
65. exp Immunization Programs/ (11457)
66. (vaccine$ or vaccinat$) adj3 (program$ or campaign$).ti,ab,kf. (11214)
67. Delivery of Health Care, Integrated/ (10488)
68. (integrat$ or coordinat$ or co-ordinat$ or comprehensive or seamless or transmural or new model$) adj3 care).ti,ab,kf. (27619)
69. or/47-68 (674487)
70. 46 and 69 (3653)
71. (systematic adj3 review).ti,kf. (73664)
72. (meta-analy$ or metaanaly$ or meta-synthes$ or metasynthes$ or meta-regressi$ or metaregressi$).ti,kf. (73060)
73. systematic overview$.ti,kf. (236)
74. or/71-73 (123178)
75. 70 and 74 (63)
76. exp Animals/ not Humans/ (4398892)
77. (news or comment or letter or editorial or case reports).pt. or case report.ti. (3478950)
78. 75 not (76 or 77) (63)
79. limit 78 to yr=“2007-current” (56)
80. remove duplicates from 79 (53)

Key to Ovid symbols and commands

$ Unlimited right-hand truncation symbol
$N Limited right-hand truncation - restricts the number of characters following the word to N
 ti,ab,kf. Searches are restricted to the Title, Abstract, Keyword Heading Word fields
adjN Retrieves records that contain terms (in any order) within a specified number (N) of words of each other
/ Searches are restricted to the Subject Heading field
exp The subject heading is exploded
pt. Search is restricted to the publication type field
or/1-27 Combines sets 1 to 27 using OR
3.4 Resources searched

We undertook searches of the resources listed in Table 3.2.

Table 3.2: Databases and information sources searched

<table>
<thead>
<tr>
<th>Database / information source</th>
<th>Interface / URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE and Medline in process</td>
<td>Ovid SP</td>
</tr>
<tr>
<td>Embase</td>
<td>Ovid SP</td>
</tr>
<tr>
<td>Cochrane Database of Systematic Reviews</td>
<td>Cochrane Library</td>
</tr>
<tr>
<td>Database of Abstracts of Reviews of Effects</td>
<td>Cochrane Library</td>
</tr>
<tr>
<td>NHS EED</td>
<td>Cochrane Library</td>
</tr>
<tr>
<td>Health Technology Assessment Database</td>
<td>Cochrane Library</td>
</tr>
<tr>
<td>NHS Evidence (this also searches NICE publications)</td>
<td><a href="https://www.evidence.nhs.uk/">https://www.evidence.nhs.uk/</a></td>
</tr>
<tr>
<td>Research Papers in Economics (RePeC)</td>
<td><a href="http://repec.org/">http://repec.org/</a></td>
</tr>
<tr>
<td>Health Services/Technology Assessment Texts (HSTAT)</td>
<td><a href="https://www.ncbi.nlm.nih.gov/books/NBK16710/">https://www.ncbi.nlm.nih.gov/books/NBK16710/</a></td>
</tr>
</tbody>
</table>

3.4.1 Running the search strategies and downloading results

We adapted the MEDLINE search strategy to perform efficiently in the other databases and information resources listed in Table 3.2. All search strategies are presented in full in Appendix A. Results were deduplicated using EndNote bibliographic software.

3.5 Study selection

The search results were rapidly assessed for relevance to the eligibility criteria described in Section 3.1. First, we removed obviously irrelevant records, such as animal studies, commentaries and news items,

and records on issues unrelated to the topic of interest. Then, one reviewer screened the records using information in the title and abstracts to decide whether the records met the eligibility criteria.

Potentially relevant full papers were obtained and assessed in detail for relevance to the eligibility criteria, and the final selection of studies was made. Being a pragmatic review, this review was based on single researcher record selection throughout.

The eligibility criteria were assessed in the following order so that the first ‘no’ response has been used as the primary reason for exclusion of the study, and the remaining criteria did not need to be assessed:

- Study design;
- Intervention;
- Population;
- Outcomes.

### 3.6 Data extraction

Data from each of the eligible studies were extracted by one reviewer into an Excel template. The following data were extracted:

- Bibliographic details of the review or study;
- Review or study type (e.g. systematic literature review, cost of illness study);
- Population;
- **Economic burden outcomes:**
  - Country of study;
  - Population of interest of the study (in case of population subsets);
  - Date of study;
  - Currency;
  - Cost year;
  - Direct costs summary;
  - Indirect costs summary.
- **Economic evidence about the policy and service interventions:**
  - High level analysis description (e.g. meta-analysis, cost-effectiveness, cost-utility, cost-benefit, cost-minimisation);
  - Country/countries of study;
  - Population of interest of the study;
  - Date of study;
  - Brief summary of policy intervention;
  - Brief summary of comparator (if any);
  - Outcomes summary.
  - Any synthesis outcomes reported in a meta-analysis were briefly summarised.

A quality assessment of identified studies, using a published checklist of indicators that would analyse the quality of a study, would normally be part of a systematic review. As this was a pragmatic review, no formal quality assessment of identified studies was undertaken.
Results

4.1 Results of the searches

The searches were undertaken on 12 and 15 May 2017 and retrieved 1,377 records for the economic burden question (Table 4.1) and 506 records for the cost effectiveness of interventions question (Table 4.2).

4.1.1 Economic burden searches

Table 4.1: Economic burden question: Number of records retrieved by the searches

<table>
<thead>
<tr>
<th>Database / information source</th>
<th>Number of records retrieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE and Medline in process</td>
<td>324</td>
</tr>
<tr>
<td>Embase</td>
<td>538</td>
</tr>
<tr>
<td>Cochrane Database of Systematic Reviews</td>
<td>22</td>
</tr>
<tr>
<td>Database of Abstracts of Reviews of Effects</td>
<td>217</td>
</tr>
<tr>
<td>NHS EED</td>
<td>206</td>
</tr>
<tr>
<td>Health Technology Assessment Database</td>
<td>66</td>
</tr>
<tr>
<td>NHS Evidence</td>
<td>1</td>
</tr>
<tr>
<td>CEA registry</td>
<td>0</td>
</tr>
<tr>
<td>Research Papers in Economics (RePeC)</td>
<td>3</td>
</tr>
<tr>
<td>Health Services/Technology Assessment Texts (HSTAT)</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL NUMBER OF RECORDS RETRIEVED</strong></td>
<td><strong>1,377</strong></td>
</tr>
</tbody>
</table>
4.1.2 Cost effectiveness searches

Table 4.2: Cost effectiveness of interventions question: Number of records retrieved by the searches

<table>
<thead>
<tr>
<th>Database / information source</th>
<th>Number of records retrieved</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE and Medline in process</td>
<td>53</td>
</tr>
<tr>
<td>EMBASE</td>
<td>126</td>
</tr>
<tr>
<td>Cochrane Database of Systematic Reviews</td>
<td>32</td>
</tr>
<tr>
<td>Database of Abstracts of Reviews of Effects</td>
<td>105</td>
</tr>
<tr>
<td>NHS EED</td>
<td>153</td>
</tr>
<tr>
<td>Health Technology Assessment Database</td>
<td>14</td>
</tr>
<tr>
<td>NHS Evidence</td>
<td>1</td>
</tr>
<tr>
<td>CEA registry</td>
<td>18</td>
</tr>
<tr>
<td>Research Papers in Economics (RePeC)</td>
<td>1</td>
</tr>
<tr>
<td>Health Services/Technology Assessment Texts (HSTAT)</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL NUMBER OF RECORDS RETRIEVED</strong></td>
<td><strong>506</strong></td>
</tr>
</tbody>
</table>

4.2 Record selection

4.2.1 Economic burden searches
Following deduplication, 1,070 records were screened. Thirty-eight records were selected for review of full texts, with 15 documents selected for the review and 23 documents excluded from the review with reasons.

4.2.2 Cost effectiveness searches
Following deduplication, 448 records were screened. These included systematic reviews and meta-analyses, and primary studies. Fifty records were selected for review of full texts, with 22 documents selected for the review and 28 documents excluded from the review with reasons.

On close assessment eligible documents from both searches could inform either question. Thirty-seven documents were eligible and 51 documents were excluded with reasons (see Figure 4.1).
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

Figure 4.1: Flow diagram of the record selection process

**Economic burden searches**
- Records identified through database searching (n = 1,377)
- Additional records identified through other sources (n = 0)
- Records after duplicates removed (n = 1,070)
- Records screened (n = 1,070)
- Full-text documents assessed for eligibility (n = 38)
  - Full-text documents excluded, with reasons (n = 23)
    - Ineligible intervention = 3
    - Ineligible outcomes = 8
    - Ineligible patient population = 8
    - UK paper identified in this review has already been included = 2
    - More complete study on same area already included = 1
    - Ineligible conditions = 1
- Included papers (n = 37)

**Cost effectiveness searches**
- Records identified through database searching (n = 506)
- Additional records identified through other sources (n = 0)
- Records after duplicates removed (n = 448)
- Records screened (n = 448)
- Full-text documents assessed for eligibility (n = 50)
  - Full-text documents excluded, with reasons (n = 28)
    - Ineligible intervention = 8
    - Ineligible outcomes = 7
    - Ineligible patient population = 3
    - Ineligible comparator = 2
    - Ineligible study design = 1
    - UK paper identified in this review has already been included = 1
    - More recent paper from same author is available with more detailed model = 2
    - Systematic review available on this topic included in systematic review = 3
    - Full UK HTA on same intervention rendering this pilot study uninformative = 1
- Included papers (n = 37)
4.3 Economic burden review: results

4.3.1 Asbestos-related mesothelioma

One paper (Watterson 2006) reported on the economic burden of asbestos-related mesothelioma (see Tables 4.3 and 4.4). The study was for Scotland only and estimated direct healthcare costs (hospital costs only) of the condition for the patient population in Scotland in 2000 to be £0.9m.

4.3.2 Asthma

Five papers reported on the economic burden of asthma, including one study on occupational asthma (see Tables 4.5, 4.6 and 4.7). Two studies were database analyses (Anandan 2009 and Gupta 2004), two were cost of illness studies (Mukherjee 2016 and Ayres 2011), and one was a literature review (Bahadori 2009). Total annual direct costs in the most recent UK population-wide study were £964.9m, with annual indirect costs (state benefits only) estimated to be £146.9m.

Table 4.3: Asbestos-related mesothelioma: study details

<table>
<thead>
<tr>
<th>Study</th>
<th>Study type</th>
<th>Population</th>
<th>Whole population or Sample (n)</th>
<th>Country</th>
<th>Year of study</th>
<th>Cost year</th>
<th>Timeframe</th>
<th>Direct costs</th>
<th>Indirect costs</th>
<th>Healthy life lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watterson</td>
<td>Cost of illness</td>
<td>Asbestos-related mesothelioma</td>
<td>Whole population (100)</td>
<td>Scotland</td>
<td>2000</td>
<td>2000</td>
<td>Diagnosis until death</td>
<td>£0.9m</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

NR = not reported

Table 4.4: Asbestos-related mesothelioma: direct costs

<table>
<thead>
<tr>
<th>Study</th>
<th>Population costs or average patient costs</th>
<th>Primary care consultations</th>
<th>Community prescriptions</th>
<th>Hospital costs</th>
<th>Community care costs</th>
<th>Non-hospital treatment costs</th>
<th>Total direct costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watterson</td>
<td>Total population</td>
<td>NR</td>
<td>NR</td>
<td>£0.9m</td>
<td>NR</td>
<td>NR</td>
<td>£0.9m</td>
</tr>
</tbody>
</table>

NR = not reported
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

Table 4.5: Asthma: study summaries

<table>
<thead>
<tr>
<th>Study</th>
<th>Study type</th>
<th>Population</th>
<th>Whole population or Sample (n)</th>
<th>Country</th>
<th>Year of study</th>
<th>Cost year</th>
<th>Timeframe</th>
<th>Direct costs</th>
<th>Indirect costs</th>
<th>Healthy life lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anandan</td>
<td>Database analysis</td>
<td>Asthma</td>
<td>Whole population</td>
<td>Scotland</td>
<td>2003–2005</td>
<td>2005</td>
<td>Annual</td>
<td>£98.2m</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Bahadori</td>
<td>Literature review (1 UK study identified)</td>
<td>Asthma</td>
<td>Sample (29)</td>
<td>UK</td>
<td>2009 (review)</td>
<td>NR</td>
<td>Annual</td>
<td>£816 per patient</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Gupta</td>
<td>Database analysis</td>
<td>Asthma</td>
<td>Whole population</td>
<td>UK</td>
<td>2004</td>
<td>2000</td>
<td>Annual</td>
<td>£658.0m</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Mukherjee</td>
<td>Cost of illness</td>
<td>Asthma</td>
<td>Whole population</td>
<td>UK</td>
<td>2011–2012</td>
<td>2012</td>
<td>Annual</td>
<td>£964.9m</td>
<td>£146.9m</td>
<td>NR</td>
</tr>
<tr>
<td>Ayres</td>
<td>Cost of illness (occupational)</td>
<td>Asthma</td>
<td>Whole population</td>
<td>UK</td>
<td>2003</td>
<td>2004</td>
<td>Lifetime</td>
<td>£3.4m–£4.8m (direct + indirect costs)</td>
<td>NR</td>
<td></td>
</tr>
</tbody>
</table>

NR = not reported

Table 4.6: Asthma: direct costs

<table>
<thead>
<tr>
<th>Study</th>
<th>Population costs or average patient costs</th>
<th>Primary care consultations</th>
<th>Community prescriptions</th>
<th>Hospital costs</th>
<th>Community care costs</th>
<th>Non-hospital treatment costs</th>
<th>Total direct costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anandan</td>
<td>Total population</td>
<td>£0.8m</td>
<td>£94.9m</td>
<td>£2.5m</td>
<td>NR</td>
<td>NR</td>
<td>£98.2m</td>
</tr>
<tr>
<td>Bahadori</td>
<td>Average patient</td>
<td>NR</td>
<td>NR</td>
<td>£816</td>
<td>NR</td>
<td>NR</td>
<td>£816 per patient</td>
</tr>
<tr>
<td>Gupta</td>
<td>Total population</td>
<td>£98.4m</td>
<td>£594.9m</td>
<td>£63.1m</td>
<td>NR</td>
<td>NR</td>
<td>£658.0m</td>
</tr>
<tr>
<td>Mukherjee</td>
<td>Total population</td>
<td>£161.230m</td>
<td>£666.445m</td>
<td>£137.229m</td>
<td>NR</td>
<td>NR</td>
<td>£964.9m</td>
</tr>
<tr>
<td>Ayres</td>
<td>Total population</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>£3.4m–£4.8m (Total direct and indirect)</td>
<td></td>
</tr>
</tbody>
</table>

NR = not reported
Table 4.7: Asthma: indirect costs

<table>
<thead>
<tr>
<th>Study</th>
<th>Population costs or average patient costs</th>
<th>State benefits</th>
<th>Social care costs</th>
<th>Income loss</th>
<th>Productivity loss</th>
<th>Presenteeism</th>
<th>Informal care</th>
<th>Total indirect costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anandan</td>
<td>Total population</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Bahadori</td>
<td>Average patient</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Gupta</td>
<td>Total population</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Mukherjee</td>
<td>Total population</td>
<td>£146.932m</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>£146.9m</td>
</tr>
<tr>
<td>Ayres</td>
<td>Total population</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

NR = not reported

4.3.3 COPD

Three papers reported on the economic burden of COPD (Tables 4.8 and 4.9). All three were cost of illness studies (Murtagh 2006, McLean 2016 and Punekar 2015). McLean provided the most recent population estimate for direct costs of COPD as £1.50bn in 2011 in England and £159m for the same year in Scotland. No studies provided an estimate of the indirect costs of COPD in the UK.

4.3.4 Cystic fibrosis

One paper (a cost of illness study) reported on the economic burden of cystic fibrosis (Angelis 2015, see Tables 4.10, 4.11 and 4.12). This paper provided an annual ‘per patient’ cost of €21,316 for direct costs and €21,716 for indirect costs. The largest single cost was for informal care (€21,447 per patient). In addition to the cost, an annual QALY loss of 0.29 per patient was estimated for people with cystic fibrosis.
### Table 4.8: COPD: study summaries

<table>
<thead>
<tr>
<th>Study</th>
<th>Study type</th>
<th>Population</th>
<th>Whole population or Sample (n)</th>
<th>Country</th>
<th>Year of study</th>
<th>Cost year</th>
<th>Timeframe</th>
<th>Direct costs</th>
<th>Indirect costs</th>
<th>Healthy life lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murtagh</td>
<td>Cost of illness</td>
<td>COPD</td>
<td>Sample (49)</td>
<td>Northern Ireland</td>
<td>2000</td>
<td>NR</td>
<td>Annual</td>
<td>£172 per patient</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Punekar</td>
<td>Cost of illness</td>
<td>COPD (newly diagnosed)</td>
<td>Sample (7,881)</td>
<td>UK</td>
<td>2008–2009</td>
<td>2011</td>
<td>Two years from diagnosis</td>
<td>£2,047 per patient</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

NR = not reported

### Table 4.9: COPD: direct costs

<table>
<thead>
<tr>
<th>Study</th>
<th>Population costs or average patient costs</th>
<th>Primary care consultations</th>
<th>Community prescriptions</th>
<th>Hospital costs</th>
<th>Community care costs</th>
<th>Non-hospital treatment costs</th>
<th>Total direct costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murtagh</td>
<td>Average patient</td>
<td>£20</td>
<td>£97</td>
<td>£55</td>
<td>NR</td>
<td>NR</td>
<td>£172 per patient</td>
</tr>
<tr>
<td>McLean</td>
<td>Total population</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>England: 2011 £1.50bn. 2030 £2.32bn. Scotland: 2011 £159m. 2030 £207m</td>
</tr>
<tr>
<td>Punekar</td>
<td>Average patient</td>
<td>£1,197</td>
<td>NR</td>
<td>£850</td>
<td>NR</td>
<td>NR</td>
<td>£2,047 per patient</td>
</tr>
</tbody>
</table>

NR = not reported
### Table 4.10: Cystic fibrosis: study summary

<table>
<thead>
<tr>
<th>Study</th>
<th>Study type</th>
<th>Population</th>
<th>Whole population or Sample (n)</th>
<th>Country</th>
<th>Year of study</th>
<th>Cost year</th>
<th>Timeframe</th>
<th>Direct costs</th>
<th>Indirect costs</th>
<th>Healthy life lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angelis</td>
<td>Cost of illness</td>
<td>Cystic fibrosis</td>
<td>Sample (73)</td>
<td>UK</td>
<td>2012</td>
<td>2012</td>
<td>Annual</td>
<td>€21,316 per patient</td>
<td>€21,716 per patient</td>
<td>0.29 QALY loss per patient year</td>
</tr>
</tbody>
</table>

NR = not reported

### Table 4.11: Cystic fibrosis: direct costs

<table>
<thead>
<tr>
<th>Study</th>
<th>Population costs or average patient costs</th>
<th>Primary care consultations</th>
<th>Community prescriptions</th>
<th>Hospital costs</th>
<th>Community care costs</th>
<th>Non-hospital treatment costs</th>
<th>Total direct costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angelis</td>
<td>Average patient</td>
<td>€3,823 (includes outpatient appointments)</td>
<td>€7,053</td>
<td>€6,759</td>
<td>€463</td>
<td>€3,218</td>
<td>€21,316 per patient</td>
</tr>
</tbody>
</table>

NR = not reported

### Table 4.12: Cystic fibrosis: indirect costs

<table>
<thead>
<tr>
<th>Study</th>
<th>Population costs or average patient costs</th>
<th>State benefits</th>
<th>Social care costs</th>
<th>Income loss</th>
<th>Productivity loss</th>
<th>Presenteeism</th>
<th>Informal care</th>
<th>Total indirect costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angelis</td>
<td>Average patient</td>
<td>NR</td>
<td>€47</td>
<td>NR</td>
<td>€6,222</td>
<td>NR</td>
<td>€21,447</td>
<td>€27,716 per patient</td>
</tr>
</tbody>
</table>

NR = not reported
4.3.5 Lung cancer

Two papers reported on the economic burden of lung cancer (see Tables 4.13 and 4.14). Both were cost of illness studies (Fleming 2008 and Oliver 2001). Neither study provided an up-to-date or UK-wide estimate of the cost of lung cancer. Given the development of novel (but costly) treatments for lung cancer, the costs in these studies should be seen as conservative estimates of the costs of lung cancer in 2017.

4.3.6 Pertussis

One included paper (a cost of illness study) reported on the economic burden of pertussis (Van Hoek 2014, see Tables 4.15 and 4.16). The study was of a sample of people who developed the infection and estimated a direct cost per patient of £56 over the course of infection with a loss of 0.097 QALYs owing to infection.

Table 4.13: Lung cancer: study summaries

<table>
<thead>
<tr>
<th>Study</th>
<th>Study type</th>
<th>Population</th>
<th>Whole population or Sample (n)</th>
<th>Year of study</th>
<th>Cost year</th>
<th>Timeframe</th>
<th>Direct costs</th>
<th>Indirect costs</th>
<th>Healthy life lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleming</td>
<td>Cost of illness</td>
<td>Lung cancer</td>
<td>Whole population (724)</td>
<td>2001</td>
<td>Annual (from presentation)</td>
<td>Total hospital costs in 12 months from presentation: £4.0m</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Oliver</td>
<td>Cost of illness</td>
<td>Lung cancer</td>
<td>Sample (109)</td>
<td>1994–97</td>
<td>From diagnosis to death</td>
<td>£11,556 per patient</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
</tbody>
</table>

NR = not reported

Table 4.14: Lung cancer: direct costs

<table>
<thead>
<tr>
<th>Study</th>
<th>Population costs or average patient costs</th>
<th>Primary care consultations</th>
<th>Community prescriptions</th>
<th>Hospital costs</th>
<th>Community care costs</th>
<th>Non-hospital treatment costs</th>
<th>Total direct costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleming</td>
<td>Average patient</td>
<td>NR</td>
<td>NR</td>
<td>£4.0m</td>
<td>NR</td>
<td>NR</td>
<td>£4.0m</td>
</tr>
<tr>
<td>Oliver</td>
<td>Total population</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>£11,556 per patient</td>
</tr>
</tbody>
</table>

NR = not reported
4.4 Results of cost effectiveness studies

The cost effectiveness review included systematic reviews and meta-analyses, and primary studies.

Where included systematic reviews have used data from primary studies, we have referenced the systematic review rather than the individual primary studies. Author names in italics indicate that the data were sourced from a systematic review rather than directly from the primary study. Full details of these primary studies can be found by consulting the relevant referenced systematic review.

Where data were sourced from a primary study, we have referenced these studies directly.

4.4.1 Asthma

Two papers reported on the cost effectiveness of asthma interventions (Table 4.17 and Table 4.18). One (Jassal 2013\(^{14}\)) was a meta-analysis; the second (Van Eeden 2016\(^{15}\)) was a systematic review including data from five studies. The meta-analysis assessed the effect of environmental education and/or environmental changes on healthcare expenditure and found all education and environmental interventions to be cost saving. The systematic review assessed various methods of self-management. All produced cost savings and improved outcomes or favourable cost effectiveness ratios.
Table 4.17: Asthma: cost effectiveness study details

<table>
<thead>
<tr>
<th>Study</th>
<th>From literature review</th>
<th>Country</th>
<th>Study year</th>
<th>Sample size</th>
<th>Intervention</th>
<th>Intervention detail</th>
<th>Comparator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jassal</td>
<td>Meta-analysis (9 studies)</td>
<td>USA</td>
<td>2009</td>
<td>c.650 across studies</td>
<td>Environmental education/ environmental changes</td>
<td>Three interventions. Environmental education by non-medical or medical providers, environmental education by non-medical providers with allergen covers and pest management</td>
<td>Usual care</td>
</tr>
<tr>
<td>Gallefos</td>
<td>Yes (van Eeden)</td>
<td>Norway</td>
<td>2001</td>
<td>78</td>
<td>Self-management</td>
<td>Group/individual sessions with physiotherapist and self-management plan</td>
<td>Educational plan</td>
</tr>
<tr>
<td>Kauppinen</td>
<td>Yes (van Eeden)</td>
<td>NR</td>
<td>1998</td>
<td>162</td>
<td>Self-management</td>
<td>Self-management plan</td>
<td>Usual care</td>
</tr>
<tr>
<td>McLean</td>
<td>Yes (van Eeden)</td>
<td>USA</td>
<td>2003</td>
<td>242</td>
<td>Self-management</td>
<td>Self-management according to HOP Asthma Care Module</td>
<td>Usual care</td>
</tr>
<tr>
<td>Van de Meer</td>
<td>Yes (van Eeden)</td>
<td>USA</td>
<td>2010</td>
<td>200</td>
<td>Self-management</td>
<td>Internet based self-management</td>
<td>Usual care</td>
</tr>
<tr>
<td>Schermer</td>
<td>Yes (van Eeden)</td>
<td>NR</td>
<td>2002</td>
<td>192</td>
<td>Self-management</td>
<td>Guided self-management with a family physician</td>
<td>Usual care</td>
</tr>
</tbody>
</table>

Italics = data were sourced from a systematic review
Table 4.18: Asthma: cost effectiveness study results

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Type of analysis</th>
<th>Perspective</th>
<th>Time horizon</th>
<th>ICER</th>
<th>Cost effectiveness outcomes</th>
<th>Cost outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jassal</td>
<td>Environmental education and/or environmental changes</td>
<td>Cost consequence</td>
<td>Societal</td>
<td>Annual savings</td>
<td>NR</td>
<td>NR</td>
<td>Cost savings over no intervention: Environmental education by medical providers $13.2m. Environmental education by non-medical providers $14.1m. Environmental education by non-medical providers, allergen impermeable covers, pest management $8.1m.</td>
</tr>
<tr>
<td>Gallefos</td>
<td>Self-management</td>
<td>Cost consequence</td>
<td>Societal</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Cost saving of between 3,400 NOK and 4,500 NOK per patient with improved health outcomes</td>
</tr>
<tr>
<td>Kauppinen</td>
<td>Self-management</td>
<td>Cost consequence</td>
<td>NR</td>
<td>5 years</td>
<td>NR</td>
<td>NR</td>
<td>No significant difference in clinical and health related outcomes at 5 years but fewer sickness days with self-management</td>
</tr>
<tr>
<td>McLean</td>
<td>Self-management</td>
<td>Cost consequence</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>Cost savings of $201 per patient with improved health outcomes and reduced days off work with self-management</td>
</tr>
<tr>
<td>Van de Meer</td>
<td>Self-management</td>
<td>Cost utility</td>
<td>Societal</td>
<td>$26,700 per QALY gained with intervention</td>
<td>NR</td>
<td>NR</td>
<td></td>
</tr>
</tbody>
</table>
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

4.4.2 COPD

Twelve included papers reported on the cost effectiveness of COPD interventions (see Tables 4.19 and 4.20). Three papers were systematic reviews (Bermingham 2015\textsuperscript{16}, Baker 2017\textsuperscript{17} and Kirsch 2015\textsuperscript{18}), two were meta-analyses (Boland 2013\textsuperscript{19} and Hoogendoorn 2010\textsuperscript{20}) and one was an economic model based upon a meta-analysis (Jordan 2015\textsuperscript{21}). The remaining six papers were primary studies (Boland 2015\textsuperscript{22}, Boven 2014\textsuperscript{23}, Christenhusz 2012\textsuperscript{24}, de San Miguel 2013\textsuperscript{25}, Paré 2013\textsuperscript{26} and Mullen 2015\textsuperscript{27}). Interventions considered in the studies were self-management, nurse-led self-management, smoking cessation advice or campaigns, a pharmacy-led adherence improvement programme, and telehealth. All interventions were found to be highly cost effective and often dominant strategies, except for nurse-led self-management, which was found in three out of four studies to be dominated by usual care.

Table 4.19: COPD: cost effectiveness study details

<table>
<thead>
<tr>
<th>Study</th>
<th>From literature review</th>
<th>Country</th>
<th>Study year</th>
<th>Sample size</th>
<th>Intervention</th>
<th>Intervention detail</th>
<th>Comparator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boland</td>
<td>No</td>
<td>Netherlands</td>
<td>2011</td>
<td>1,086</td>
<td>Multidisciplinary care</td>
<td>Integrated, bespoke approaches</td>
<td>Usual care</td>
</tr>
<tr>
<td>Waterhouse</td>
<td>Yes (Bermingham)</td>
<td>UK</td>
<td>2010</td>
<td>240</td>
<td>Pulmonary rehabilitation in hospital</td>
<td>NR</td>
<td>Pulmonary rehabilitation in community</td>
</tr>
<tr>
<td>Bourbeau</td>
<td>Yes (Baker)</td>
<td>Canada</td>
<td>2006</td>
<td>191</td>
<td>Nurse-led self-management</td>
<td>NR</td>
<td>Usual care</td>
</tr>
<tr>
<td>Gallefoss</td>
<td>Yes (Baker)</td>
<td>Norway</td>
<td>2004</td>
<td>62</td>
<td>Nurse-led self-management</td>
<td>NR</td>
<td>Usual care</td>
</tr>
<tr>
<td>Monninkhof</td>
<td>Yes (Baker)</td>
<td>Netherlands</td>
<td>2004</td>
<td>248</td>
<td>Nurse-led self-management</td>
<td>NR</td>
<td>Usual care</td>
</tr>
</tbody>
</table>

Italics = data were sourced from a systematic review; NOK = Norwegian Kroner; NR = not reported
<table>
<thead>
<tr>
<th>Study</th>
<th>From literature review</th>
<th>Country</th>
<th>Study year</th>
<th>Sample size</th>
<th>Intervention</th>
<th>Intervention detail</th>
<th>Comparator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sridhar</td>
<td>Yes (Baker)</td>
<td>UK</td>
<td>2006</td>
<td>122</td>
<td>Nurse-led self-management</td>
<td>NR</td>
<td>Usual care</td>
</tr>
<tr>
<td>Boland</td>
<td>Meta-analysis</td>
<td>Netherlands (perspective)</td>
<td>2013</td>
<td>c.1,600 across trials</td>
<td>Disease management</td>
<td>Integrated, bespoke approaches</td>
<td>Usual care</td>
</tr>
<tr>
<td>Boven</td>
<td>No</td>
<td>Belgium</td>
<td>2013</td>
<td></td>
<td>Hypothetical model</td>
<td>Improving medication adherence</td>
<td>Usual care</td>
</tr>
<tr>
<td>Christenhusz</td>
<td>No</td>
<td>Netherlands</td>
<td>2002</td>
<td>225</td>
<td>Smoking cessation programme</td>
<td>Intensive smoking cessation support including individual counselling, group sessions and medications</td>
<td>Minimal intervention (not described)</td>
</tr>
<tr>
<td>Hoogendoorn</td>
<td>Meta-analysis (9 studies including Christenhusz)</td>
<td>Netherlands</td>
<td>2009</td>
<td>c.7,000 across studies</td>
<td>Smoking cessation programme</td>
<td>Minimal counselling, intensive counselling, counselling + pharmacotherapy</td>
<td>Usual care</td>
</tr>
<tr>
<td>Jordan</td>
<td>Economic model based upon meta-analysis</td>
<td>UK</td>
<td>2015</td>
<td></td>
<td>Hypothetical model</td>
<td>Self-management following exacerbation</td>
<td>Usual care</td>
</tr>
<tr>
<td>Menn</td>
<td>Yes (Kirsch)</td>
<td>NR</td>
<td>2012</td>
<td>NR</td>
<td>Smoking cessation programme</td>
<td>Nicotine gum plus group therapy</td>
<td>Advice to stop smoking</td>
</tr>
<tr>
<td>Study</td>
<td>From literature review</td>
<td>Country</td>
<td>Study year</td>
<td>Sample size</td>
<td>Intervention</td>
<td>Intervention detail</td>
<td>Comparator</td>
</tr>
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</tr>
<tr>
<td>Chandra</td>
<td>Yes (Kirsch)</td>
<td>NR</td>
<td>2012</td>
<td>NR</td>
<td>Smoking cessation programme</td>
<td>Intensive counselling, NRT, Intensive counselling + NRT</td>
<td>Usual care and placebo</td>
</tr>
<tr>
<td>Atsou</td>
<td>Yes (Kirsch)</td>
<td>NR</td>
<td>2011</td>
<td>NR</td>
<td>Smoking cessation programme</td>
<td>Smoking cessation programme</td>
<td>Usual care</td>
</tr>
<tr>
<td>Hurley</td>
<td>Yes (Kirsch)</td>
<td>NR</td>
<td>2008</td>
<td>NR</td>
<td>Smoking cessation programme</td>
<td>Australian National Tobacco Campaign</td>
<td>None</td>
</tr>
<tr>
<td>de San Miguel</td>
<td>No</td>
<td>Australia</td>
<td>2013</td>
<td>80</td>
<td>Telehealth remote monitoring</td>
<td>Telehealth equipment installed in patients’ homes that measured and automatically sent key vital signs</td>
<td>Information only</td>
</tr>
<tr>
<td>Paré</td>
<td>No</td>
<td>Canada</td>
<td>2013</td>
<td>60</td>
<td>Telehealth remote monitoring</td>
<td>Telemonitoring equipment with patient having to send data over the internet</td>
<td>Usual care</td>
</tr>
<tr>
<td>Mullen</td>
<td>No</td>
<td>Canada</td>
<td>2014</td>
<td>956</td>
<td>Smoking cessation programme</td>
<td>Smoking cessation delivered in hospital including patient advice, pharmacotherapy and educational guidance</td>
<td>Usual care</td>
</tr>
</tbody>
</table>

Italics = data were sourced from a systematic review;  
NR = not reported; NRT = Nicotine replacement therapy
Table 4.20: COPD: cost effectiveness study results

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Type of analysis</th>
<th>Perspective</th>
<th>Time horizon</th>
<th>ICER</th>
<th>Cost effectiveness outcomes</th>
<th>Cost outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boland</td>
<td>Multidisciplinary care</td>
<td>Cost utility</td>
<td>Societal</td>
<td>2 years</td>
<td>Dominated by usual care (intervention was more costly with fewer QALYs)</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Waterhouse</td>
<td>Pulmonary rehabilitation in hospital</td>
<td>Cost utility</td>
<td>NHS</td>
<td>18 months</td>
<td>£28,250 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Bourbeau</td>
<td>Nurse-led self-management</td>
<td>Cost consequence</td>
<td>Third party payer</td>
<td>NR</td>
<td>NR</td>
<td>Additional costs of intervention exceeded savings by €440 per patient</td>
<td></td>
</tr>
<tr>
<td>Gallefoss</td>
<td>Nurse-led self-management</td>
<td>Cost effectiveness</td>
<td>Societal</td>
<td>NR</td>
<td>NR</td>
<td>Self-management saved 9,300 NOK per person</td>
<td></td>
</tr>
<tr>
<td>Monninkhof</td>
<td>Nurse-led self-management</td>
<td>Cost utility</td>
<td>Societal</td>
<td>NR</td>
<td>Dominated by usual care (self-management was more costly and no more effective)</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Sridhar</td>
<td>Nurse-led self-management</td>
<td>Cost consequence</td>
<td>NHS</td>
<td>NR</td>
<td>NR</td>
<td>Usual care costs (including unscheduled healthcare) were £10.70 lower per patient than nurse-led self-management</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Intervention</td>
<td>Type of analysis</td>
<td>Perspective</td>
<td>Time horizon</td>
<td>ICER</td>
<td>Cost effectiveness outcomes</td>
<td>Cost outcomes</td>
</tr>
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<tr>
<td>Boland</td>
<td>Disease management</td>
<td>Cost consequence (meta-analysis of 7 trials)</td>
<td>Health care provider</td>
<td>Annual savings</td>
<td>NR</td>
<td>NR</td>
<td>Meta-analysis showed average savings of £898 per patient per year. This excluded intervention costs of disease management. Whilst six of the seven trials showed a saving when disease management costs were included, no studies carried out statistical significance tests on these savings</td>
</tr>
<tr>
<td>Boven</td>
<td>Improving medication adherence</td>
<td>Cost utility</td>
<td>Health care provider</td>
<td>1 year</td>
<td>Dominant. Saved money and generated QALYs (&lt;0.001 QALY gain)</td>
<td>NR</td>
<td>Cost saving (including exacerbation, medication and pharmacy costs) of €227 per patient with intervention</td>
</tr>
<tr>
<td>Hoogendoorn</td>
<td>Smoking cessation programme</td>
<td>Cost utility</td>
<td>Health care provider</td>
<td>25 years</td>
<td>Compared to usual care: Intensive counselling €8,200 per QALY gained; Minimal counselling €16,900 per QALY gained; Intensive counselling + pharmaco-therapy €2,400 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Study</td>
<td>Intervention</td>
<td>Type of analysis</td>
<td>Perspective</td>
<td>Time horizon</td>
<td>ICER</td>
<td>Cost effectiveness outcomes</td>
<td>Cost outcomes</td>
</tr>
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</tr>
<tr>
<td>Christenhusz</td>
<td>Smoking cessation programme</td>
<td>Cost consequence</td>
<td>Health care provider</td>
<td>1 year</td>
<td>NR</td>
<td>NR</td>
<td>The intensive intervention saved €14 in healthcare costs (including the cost of the intervention) with fewer exacerbations and hospital days and a higher number of quitters than minimal intervention. Intensive intervention was therefore a dominant strategy</td>
</tr>
<tr>
<td>Jordan</td>
<td>Self-management</td>
<td>Cost utility</td>
<td>NHS</td>
<td>30 years</td>
<td>£8,218 per QALY gained with intensive self-management compared to usual care</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Menn</td>
<td>Smoking cessation programme</td>
<td>Cost utility</td>
<td>Societal</td>
<td>60 years</td>
<td>Intervention is less costly (-€1,185) and generates more QALYs (+0.54) compared to advice alone</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Intervention</td>
<td>Type of analysis</td>
<td>Perspective</td>
<td>Time horizon</td>
<td>ICER</td>
<td>Cost effectiveness outcomes</td>
<td>Cost outcomes</td>
</tr>
<tr>
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<td>---------------------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Chandra</td>
<td>Smoking cessation programme</td>
<td>Cost utility</td>
<td>Third party payer</td>
<td>NR</td>
<td>All four strategies dominate usual care (less costly and more QALYs). Intensive counselling dominates all other strategies with highest QALY gain (0.58) and largest cost saving (€1,476) compared to usual care</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Atsou</td>
<td>Smoking cessation programme</td>
<td>Cost utility</td>
<td>Societal</td>
<td>Lifetime</td>
<td>Intervention is less costly (-€2,127) and generates more QALYs (+0.679) compared to usual care. However, costs of intervention were not included</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Hurley</td>
<td>Smoking cessation programme</td>
<td>Cost consequence</td>
<td>Third party payer</td>
<td>Lifetime</td>
<td></td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>de San Miguel</td>
<td>Telehealth remote monitoring</td>
<td>Cost consequence</td>
<td>Third party payer</td>
<td>6 months</td>
<td></td>
<td>Cost savings of AUS$2,931 per patient after cost of intervention</td>
<td>NR</td>
</tr>
</tbody>
</table>
4.4.3 Lung cancer

Four papers reported on the cost effectiveness of lung cancer interventions (see Table 4.21 and Table 4.22). Three papers were primary studies (Black 2014, Hinde 2015 and Villanti 2013) and one paper was a systematic review (Raymakers 2016). One study assessed a public awareness campaign found to have an ICER between £13,500 and £18,000 per QALY gained, which would ordinarily be considered cost effective by NICE or Public Health England. The remaining three studies all explored screening, either annual or one-off. The evidence on the cost effectiveness of screening was highly variable with ICERs ranging from $1,500 to $250,000 per QALY gained.
### Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

Table 4.21: Lung cancer: cost effectiveness study details

<table>
<thead>
<tr>
<th>Study</th>
<th>From literature review</th>
<th>Country</th>
<th>Study year</th>
<th>Sample size</th>
<th>Intervention</th>
<th>Intervention detail</th>
<th>Comparator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>No</td>
<td>USA</td>
<td>2002–2009</td>
<td>53,302</td>
<td>Screening</td>
<td>Computed tomography screening for high risk patients</td>
<td>No screening</td>
</tr>
<tr>
<td>Hinde</td>
<td>No</td>
<td>UK</td>
<td>2015</td>
<td></td>
<td>Hypothetical model</td>
<td>Public awareness campaigns</td>
<td>No campaign</td>
</tr>
<tr>
<td>Villanti</td>
<td>No</td>
<td>USA</td>
<td>2013</td>
<td>NR</td>
<td>Screening with and without smoking cessation</td>
<td>Annual screening for high risk smokers and ex-smokers, 50–65-year-olds, with and without a smoking cessation programme</td>
<td>No screening</td>
</tr>
<tr>
<td>Beinfeld</td>
<td>Yes (Raymakers 2016)</td>
<td>US</td>
<td>2002</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>One-time screening to 50-year-old males</td>
<td>No screening</td>
</tr>
<tr>
<td>Black</td>
<td>Yes (Raymakers 2016)</td>
<td>US</td>
<td>2014</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>Annual screening of 55–74-year-olds with 30+ pack years</td>
<td>No screening</td>
</tr>
<tr>
<td>Chirikos</td>
<td>Yes (Raymakers 2016)</td>
<td>US</td>
<td>2002</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>Annual screening of 60 years+ with 10+ pack years</td>
<td>No screening</td>
</tr>
<tr>
<td>Mahadevia</td>
<td>Yes (Raymakers 2016)</td>
<td>US</td>
<td>2003</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>Annual screening of current or former smokers aged 60 years</td>
<td>No screening</td>
</tr>
<tr>
<td>Manser</td>
<td>Yes (Raymakers 2016)</td>
<td>Australia</td>
<td>2005</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>Annual screening of males aged 60–64 years and with history of 40-a-day for 40 years</td>
<td>No screening</td>
</tr>
<tr>
<td>Marshall</td>
<td>Yes (Raymakers 2016)</td>
<td>US</td>
<td>2001</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>Annual screening of 60–74-year-olds</td>
<td>No screening</td>
</tr>
<tr>
<td>Study</td>
<td>From literature review</td>
<td>Country</td>
<td>Study year</td>
<td>Sample size</td>
<td>Intervention</td>
<td>Intervention detail</td>
<td>Comparator</td>
</tr>
<tr>
<td>---------------</td>
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<td>------------------</td>
</tr>
<tr>
<td>Marshall</td>
<td>Yes (Raymakers 2016)</td>
<td>US</td>
<td>2001</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>One-time screening of 60–74-year-olds (low and high risk)</td>
<td>No screening</td>
</tr>
<tr>
<td>McMahon</td>
<td>Yes (Raymakers 2016)</td>
<td>US</td>
<td>2011</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>Annual screening of 50–74-year-olds</td>
<td>No screening</td>
</tr>
<tr>
<td>Pyenson</td>
<td>Yes (Raymakers 2016)</td>
<td>US</td>
<td>2012</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>NR</td>
<td>No screening</td>
</tr>
<tr>
<td>Pyenson (2)</td>
<td>Yes (Raymakers 2016)</td>
<td>US</td>
<td>2014</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>NR</td>
<td>No screening</td>
</tr>
<tr>
<td>Shemueli</td>
<td>Yes (Raymakers 2016)</td>
<td>Israel</td>
<td>2013</td>
<td>NR</td>
<td>Screening (Low dose computed tomography)</td>
<td>NR</td>
<td>No screening</td>
</tr>
</tbody>
</table>

Italicics = data were sourced from a systematic review;
NR = not reported
### Table 4.22: Lung cancer: cost effectiveness study results

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Type of analysis</th>
<th>Perspective</th>
<th>Time horizon</th>
<th>ICER</th>
<th>Cost effectiveness outcomes</th>
<th>Cost outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>Screening</td>
<td>Cost utility</td>
<td>Societal</td>
<td>Lifetime</td>
<td>$81,000 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Hinde</td>
<td>Public awareness campaigns</td>
<td>Cost utility</td>
<td>NHS</td>
<td>Lifetime</td>
<td>£13,660 per QALY gained for regional campaign. £18,173 per QALY gained for national campaign</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Villanti</td>
<td>Screening with and without smoking cessation</td>
<td>Cost utility</td>
<td>Third party payer</td>
<td>15 years</td>
<td>$28,240–$47,115 for screening alone. $23,185–$35,545 for screening with smoking cessation</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Beinfeld</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost utility</td>
<td>Societal</td>
<td>Lifetime</td>
<td>NR</td>
<td>$161,000 per LYG</td>
<td>NR</td>
</tr>
<tr>
<td>Black</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost utility</td>
<td>Societal</td>
<td>Lifetime</td>
<td>$89,381 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Chirikos</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost utility</td>
<td>Third party payer</td>
<td>15 years</td>
<td>NR</td>
<td>$66,479 per LYG</td>
<td>NR</td>
</tr>
<tr>
<td>Mahadevia</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost utility</td>
<td>Societal</td>
<td>20 years</td>
<td>$116,300 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Study</td>
<td>Intervention</td>
<td>Type of analysis</td>
<td>Perspective</td>
<td>Time horizon</td>
<td>ICER</td>
<td>Cost effectiveness outcomes</td>
<td>Cost outcomes</td>
</tr>
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</tr>
<tr>
<td>Manser</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost utility</td>
<td>Third party payer</td>
<td>15 years</td>
<td>$105,090 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Marshall</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost utility</td>
<td>NR</td>
<td>5 years</td>
<td>$27,756 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Marshall</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost effectiveness</td>
<td>NR</td>
<td>5 years</td>
<td>NR</td>
<td>$8,460 per LYG</td>
<td>NR</td>
</tr>
<tr>
<td>McMahon</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost utility</td>
<td>Societal</td>
<td>Lifetime</td>
<td>$169,097–$243,077 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Pyenson</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost utility</td>
<td>Third party payer</td>
<td>15 years</td>
<td>NR</td>
<td>$19,448 per LYG</td>
<td>NR</td>
</tr>
<tr>
<td>Pyenson (2)</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost utility</td>
<td>Third party payer</td>
<td>Lifetime</td>
<td>NR</td>
<td>$18,452 per LYG</td>
<td>NR</td>
</tr>
<tr>
<td>Shemueli</td>
<td>Screening (Low dose computed tomography)</td>
<td>Cost effectiveness</td>
<td>Health care provider</td>
<td>Lifetime</td>
<td>$1,540 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

*Italics = data were sourced from a systematic review;*  
*LYG = Life year gained; NR = not reported; QALY= Quality-Adjusted Life Year*
4.4.4 Pertussis

One paper (a systematic review) reported on the cost effectiveness of pertussis interventions (Rodriguez-Cobo 2008\textsuperscript{32}, see Tables 4.23 and 4.24). The intervention assessed in the study was a vaccination booster given to children or adolescents. The evidence from published studies on the cost effectiveness of a booster vaccination suggests that the ICER for the UK of a booster could be as low as £14,500 per QALY gained or as high as £55,900 per LYG (as the QALY gain would be lower than the LYG the ICER would be somewhat higher than £55,900 per QALY gained).

Table 4.23: Pertussis: cost effectiveness study details

<table>
<thead>
<tr>
<th>Study</th>
<th>From literature review</th>
<th>Country</th>
<th>Study year</th>
<th>Sample size</th>
<th>Intervention</th>
<th>Intervention detail</th>
<th>Comparator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iskedijan (1)</td>
<td>Yes (Rodriguez)</td>
<td>Canada</td>
<td>2003</td>
<td>NR</td>
<td>Vaccination booster</td>
<td>Given at age 14</td>
<td>No booster</td>
</tr>
<tr>
<td>Iskedijan (2)</td>
<td>Yes (Rodriguez)</td>
<td>Canada</td>
<td>2003</td>
<td>NR</td>
<td>Vaccination booster</td>
<td>Given at age 12</td>
<td>No booster</td>
</tr>
<tr>
<td>Stevenson</td>
<td>Yes (Rodriguez)</td>
<td>England and Wales</td>
<td>2000</td>
<td>NR</td>
<td>Vaccination booster</td>
<td>Given at age 4–5</td>
<td>No booster</td>
</tr>
<tr>
<td>Edmunds</td>
<td>Yes (Rodriguez)</td>
<td>England and Wales</td>
<td>2001</td>
<td>NR</td>
<td>Vaccination booster</td>
<td>Given to preschool children or to adolescents</td>
<td>Given to adolescents</td>
</tr>
<tr>
<td>Caro</td>
<td>Yes (Rodriguez)</td>
<td>USA</td>
<td>2002</td>
<td>NR</td>
<td>Vaccination booster</td>
<td>Given at age 11–18</td>
<td>No booster</td>
</tr>
<tr>
<td>Lee (1)</td>
<td>Yes (Rodriguez)</td>
<td>USA</td>
<td>2004</td>
<td>NR</td>
<td>Vaccination booster</td>
<td>Given every 10 years from age 11</td>
<td>No booster</td>
</tr>
<tr>
<td>Purdy</td>
<td>Yes (Rodriguez)</td>
<td>USA</td>
<td>2002</td>
<td>NR</td>
<td>Vaccination booster</td>
<td>Given every 10 years from age 10</td>
<td>No booster</td>
</tr>
<tr>
<td>Lee (2)</td>
<td>Yes (Rodriguez)</td>
<td>USA</td>
<td>1995–96</td>
<td>NR</td>
<td>Vaccination booster</td>
<td>Given to adolescents</td>
<td>No booster</td>
</tr>
</tbody>
</table>

\textit{Italics = data were sourced from a systematic review;}
\textit{NR = not reported}
Table 4.24: Pertussis: cost effectiveness study results

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Type of analysis</th>
<th>Perspective</th>
<th>Time horizon</th>
<th>ICER</th>
<th>Cost effectiveness outcomes</th>
<th>Cost outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iskedijan (1)</td>
<td>Vaccination booster</td>
<td>Cost effectiveness</td>
<td>Societal</td>
<td>10 years</td>
<td>NR</td>
<td>$CAN 527/case avoided</td>
<td>NR</td>
</tr>
<tr>
<td>Iskedijan (2)</td>
<td>Vaccination booster</td>
<td>Cost effectiveness</td>
<td>Societal</td>
<td>10 years</td>
<td>NR</td>
<td>$CAN 188/ case avoided</td>
<td>NR</td>
</tr>
<tr>
<td>Stevenson</td>
<td>Vaccination booster</td>
<td>Cost utility</td>
<td>Health care provider</td>
<td>5 years</td>
<td>£14,500 to £35,000 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Edmunds</td>
<td>Vaccination booster</td>
<td>Cost effectiveness</td>
<td>Societal</td>
<td>Lifetime</td>
<td>NR</td>
<td>£25,800–£55,900/ LYG</td>
<td>NR</td>
</tr>
<tr>
<td>Caro</td>
<td>Vaccination booster</td>
<td>Cost effectiveness</td>
<td>Societal</td>
<td>10 years</td>
<td>NR</td>
<td>£22,000 per LYG</td>
<td>NR</td>
</tr>
<tr>
<td>Lee (1)</td>
<td>Vaccination booster</td>
<td>Cost utility</td>
<td>Societal</td>
<td>Lifetime</td>
<td>$1.5 million/QALY compared to adolescent booster alone. $23,000/QALY compared to no booster</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Purdy</td>
<td>Vaccination booster</td>
<td>Cost benefit</td>
<td>Societal</td>
<td>10 years</td>
<td>NR</td>
<td>NR</td>
<td>$32 break even cost</td>
</tr>
<tr>
<td>Lee (2)</td>
<td>Vaccination booster</td>
<td>Cost benefit</td>
<td>Societal</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>$100,000 saved</td>
</tr>
</tbody>
</table>

Italics = data were sourced from a systematic review;
LYG = Life year gained; NR = not reported; QALY = Quality-Adjusted Life Year
4.4.5 Pneumonia

Three papers, all primary studies, reported on the cost effectiveness of pneumonia interventions (Boccalini 2013, Chen 2014 and Evers 2007, see Tables 4.25 and 4.26). All interventions considered were vaccinations to older adults. The reported ICERs in all three studies are in the range that would be considered cost effective in the UK.

Table 4.25: Pneumonia: cost effectiveness study details

<table>
<thead>
<tr>
<th>Study</th>
<th>From literature review</th>
<th>Country</th>
<th>Study year</th>
<th>Sample size</th>
<th>Intervention</th>
<th>Intervention detail</th>
<th>Comparator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boccalini</td>
<td>No</td>
<td>Italy</td>
<td>2012</td>
<td>Hypothetical model</td>
<td>Vaccination PCV13 or PCV13+PPV23 to those aged 65 (1 cohort), 65 and 70 (2 cohorts) or 65, 70 and 75 (3 cohorts) over a five year period</td>
<td>No vaccination</td>
<td></td>
</tr>
<tr>
<td>Chen</td>
<td>No</td>
<td>USA</td>
<td>2012</td>
<td>Hypothetical model</td>
<td>Vaccination Main strategy: PCV13 for adults over 50. Extended strategy: PCV13 for adults over 50 with PCV13+PPSV23 for people who are immunocompromised from age 65</td>
<td>No vaccination</td>
<td></td>
</tr>
<tr>
<td>Evers</td>
<td>No</td>
<td>England and Wales, Scotland, 8 other Western European countries</td>
<td>2007</td>
<td>Hypothetical model</td>
<td>Vaccination in people over 65</td>
<td>No vaccination</td>
<td></td>
</tr>
</tbody>
</table>

Italicics = data were sourced from a systematic review; 
NR = not reported; PCV = Pneumococcal conjugate vaccine; PPSV23 = 23-valent polysaccharide vaccine
Table 4.26: Pneumonia: cost effectiveness study results

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Type of analysis</th>
<th>Perspective</th>
<th>Time horizon</th>
<th>ICER</th>
<th>Cost effectiveness outcomes</th>
<th>Cost outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boccalini</td>
<td>Vaccination</td>
<td>Cost utility</td>
<td>Health care provider</td>
<td>5 years</td>
<td>PCV13: 1 Cohort €6,987. 2 cohorts €19,289. 3 cohorts €22,109. PCV13+PPV23: 1 Cohort €21,493. 2 cohorts €24,443. 3 cohorts €27,866</td>
<td>Cost per life year gained. PCV13: 1 Cohort €12,783. 2 cohorts €14,363. 3 cohorts €16,214. PCV13+PPV23: 1 Cohort €16,172. 2 cohorts €18,198. 3 cohorts €20,428</td>
<td>NR</td>
</tr>
<tr>
<td>Chen</td>
<td>Vaccination</td>
<td>Cost utility</td>
<td>Third party payer</td>
<td>Lifetime</td>
<td>For the main strategy, $25,841 per QALY gained compared to no vaccination. For the extended strategy, $23,416 per QALY gained compared to no vaccination</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Evers</td>
<td>Vaccination</td>
<td>Cost utility</td>
<td>Health care provider</td>
<td>Lifetime</td>
<td>England and Wales €17,228 per QALY gained. Scotland €13,920 per QALY gained</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

Italics = data were sourced from a systematic review;  
NR = not reported; QALY= Quality-Adjusted Life Year
4.4.6 Sleep apnoea

One primary study reported on the cost effectiveness of a sleep apnoea intervention (Perraudin 201336, see Tables 4.27 and 4.28). This study investigated a community pharmacist screening programme in Australia. Screening was found to be a dominant strategy, costing less and generating more QALYs than no screening.

Table 4.27: Sleep apnoea: cost effectiveness study details

<table>
<thead>
<tr>
<th>Study</th>
<th>From literature review</th>
<th>Country</th>
<th>Study year</th>
<th>Sample size</th>
<th>Intervention</th>
<th>Intervention detail</th>
<th>Comparator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perraudin</td>
<td>No</td>
<td>Australia</td>
<td>2013</td>
<td>Hypothetical model</td>
<td>Screening</td>
<td>Community pharmacist screening programme</td>
<td>No screening</td>
</tr>
</tbody>
</table>

Table 4.28: Sleep apnoea: cost effectiveness study results

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Type of analysis</th>
<th>Perspective</th>
<th>Time horizon</th>
<th>ICER</th>
<th>Cost effectiveness outcomes</th>
<th>Cost outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perraudin</td>
<td>Screening</td>
<td>Cost utility</td>
<td>Societal</td>
<td>5 years</td>
<td>Screening with community pharmacist is dominant to no screening (costing less and generating more QALYs)</td>
<td>NR</td>
<td>NR</td>
</tr>
</tbody>
</table>

NR = not reported; QALY = Quality-Adjusted Life Year
4.4.7 Tuberculosis

One systematic review reported on the cost effectiveness of a tuberculosis (TB) intervention (Nienhaus 201137), specifically screening of people at risk compared to no screening (see Tables 4.29 and 4.30). Although several non-UK studies reported screening of one form or another to be highly cost effective or even a dominant strategy, the one UK study suggested that screening people in close contact to TB patients resulted in an ICER no lower than £37,000 per QALY gained, suggesting that screening of such people would not be cost effective in the UK.

Table 4.29: Tuberculosis: cost effectiveness study details

<table>
<thead>
<tr>
<th>Study</th>
<th>From literature review</th>
<th>Country</th>
<th>Study year</th>
<th>Sample size</th>
<th>Intervention</th>
<th>Intervention detail</th>
<th>Comparator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pooran</td>
<td>Yes (Nienhaus)</td>
<td>UK</td>
<td>2010</td>
<td>NR</td>
<td>Screening</td>
<td>For people in close contact to TB patients: Tuberculin skin test (TST), Quantiferon Gold in Tube (QFT-IT), TSPOT-TB</td>
<td>No screening</td>
</tr>
<tr>
<td>Marra</td>
<td>Yes (Nienhaus)</td>
<td>Canada</td>
<td>2008</td>
<td>NR</td>
<td>Screening</td>
<td>For people in close contact to TB patients: Tuberculin skin test (TST), Quantiferon (QFT)</td>
<td>No screening</td>
</tr>
<tr>
<td>Oxlade</td>
<td>Yes (Nienhaus)</td>
<td>Canada</td>
<td>2007</td>
<td>NR</td>
<td>Screening</td>
<td>For people in close contact to TB patients: Tuberculin skin test (TST), Quantiferon (QFT)</td>
<td>No screening</td>
</tr>
<tr>
<td>Kowada</td>
<td>Yes (Nienhaus)</td>
<td>Japan</td>
<td>2008</td>
<td>NR</td>
<td>Screening</td>
<td>Close contacts IGRA only, TST only or TST+IGRA</td>
<td>No screening</td>
</tr>
<tr>
<td>de Perlo</td>
<td>Yes (Nienhaus)</td>
<td>USA</td>
<td>2009</td>
<td>NR</td>
<td>Screening</td>
<td>HCWs with and without BCG vaccination. QFT-G and TST</td>
<td>No screening</td>
</tr>
<tr>
<td>Deuffe-Burban</td>
<td>Yes (Nienhaus)</td>
<td>France</td>
<td>2010</td>
<td>NR</td>
<td>Screening</td>
<td>Close contacts. TST&gt;10mm + QFT, QFT</td>
<td>No screening</td>
</tr>
<tr>
<td>Diel et al.</td>
<td>Yes (Nienhaus)</td>
<td>Germany</td>
<td>2007</td>
<td>NR</td>
<td>Screening</td>
<td>Close contacts. TST&gt;5, TST&gt;10, QFT</td>
<td>No screening</td>
</tr>
</tbody>
</table>

Italics = data were sourced from a systematic review; NR = not reported; QFT = quantiferon; TB = tuberculosis; TST = tuberculin skin test
Table 4.30: Tuberculosis: cost effectiveness study results

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Type of analysis</th>
<th>Perspective</th>
<th>Time horizon</th>
<th>ICER</th>
<th>Cost effectiveness outcomes</th>
<th>Cost outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pooran</td>
<td>Screening</td>
<td>Cost effectiveness</td>
<td>NR</td>
<td>2 years</td>
<td>NR</td>
<td>ICERs vary from £37,206 per case averted for TST+T-SPOT to £47,940 per case averted for TST</td>
<td>NR</td>
</tr>
<tr>
<td>Marra</td>
<td>Screening</td>
<td>Cost utility</td>
<td>NR</td>
<td>20 years</td>
<td>QFT (BCG+) + TST (BCG-) was the dominant strategy</td>
<td>NR</td>
<td></td>
</tr>
<tr>
<td>Oxlade</td>
<td>Screening</td>
<td>Cost effectiveness</td>
<td>NR</td>
<td>20 years</td>
<td>NR</td>
<td>TST cost saving compared to other screening and no screening in close contacts</td>
<td>NR</td>
</tr>
<tr>
<td>Kowada</td>
<td>Screening</td>
<td>Cost utility</td>
<td>NR</td>
<td>Lifetime</td>
<td>NR</td>
<td>IGRA only is the most cost effective strategy with an ICER of $471.54 per QALY gained compared to no screening</td>
<td>NR</td>
</tr>
<tr>
<td>de Perlo</td>
<td>Screening</td>
<td>Cost utility</td>
<td>NR</td>
<td>Lifetime</td>
<td>NR</td>
<td>HCWs with no BCG vaccination: QFT-G $14,092 QALY gained. HCWs with BCG vaccination: QFT-G $103,047 per QALY gained</td>
<td>NR</td>
</tr>
<tr>
<td>Deuffe-Burban</td>
<td>Screening</td>
<td>Cost effectiveness</td>
<td>NR</td>
<td>Lifetime</td>
<td>NR</td>
<td>TST&gt;10mm+QFT €780 per LYG. QFT dominated. No screening €560 per LYG</td>
<td>NR</td>
</tr>
<tr>
<td>Diel et al.</td>
<td>Screening</td>
<td>Cost effectiveness</td>
<td>NR</td>
<td>20 years</td>
<td>NR</td>
<td>All screening dominates no screening</td>
<td>NR</td>
</tr>
</tbody>
</table>

Italics = data were sourced from a systematic review; NR = not reported; QALY = Quality-Adjusted Life Year; QFT = quantiferon; TB = tuberculosis; TST = tuberculin skin test

4.5 Other papers
The British Lung Foundation report on the burden of respiratory illness was identified in the literature search\(^38\). The report was not included in this review as it was not specifically about any of the respiratory conditions considered in this research and also because it formed part of the background for the research presented here.
Discussion

5.1 Economic burden

There is recent and robust available evidence on the direct costs of asthma, COPD and cystic fibrosis (albeit per patient rather than at a population level) in the UK. The direct costs estimates of COPD do not include community care costs, such as community nursing, which are likely to be significant for this patient group. There is some recent evidence, but with a poor level of detail, on the direct cost of pertussis per patient. Outside of these conditions, the evidence on direct costs is outdated (such as the evidence on costs for lung cancer) or non-existent.

Recent and robust evidence on indirect costs for all conditions, except for asthma and cystic fibrosis, is lacking, with evidence on the indirect costs of asthma being limited to state benefit payments associated with the condition. The indirect costs associated with informal care for cystic fibrosis were the largest single cost item and several of the lung conditions (such as COPD) may require similar levels of informal care. As such the lack of evidence on indirect costs for lung disease is problematic in understanding the true economic burden of the conditions.

5.2 Cost effectiveness of policy interventions

A substantial evidence base exists on non-pharmaceutical policy-related interventions for lung disease including several large and well-conducted systematic reviews and meta-analyses. This evidence suggests that certain interventions, notably self-management in asthma, smoking cessation in COPD, awareness campaigns for lung cancer, and vaccination for pneumonia are all likely to be cost effective and, in several cases, are dominant strategies.

For other interventions, such as screening for TB, the economic evidence is equivocal with further research probably required to establish cost effectiveness.

There are several interventions that available evidence suggests are unlikely to be cost effective. These interventions included annual or one-off screening for people at high risk of lung cancer, where the ICERs per QALY gained were generally well above the levels that would ordinarily be considered cost effective in the UK. Nurse-led self-management for COPD was found to be the least cost effective of all interventions with three of the four identified studies on the intervention finding it generated worse patient outcomes at a higher cost than usual care.
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

References


Appendix A: Search Strategies

**Economic burden question**

A1. Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>

URL/Interface: OvidSP

Search date: 12 May 2017

Records retrieved: 324

<table>
<thead>
<tr>
<th>Economic burden question</th>
<th>Number of records</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. exp Asthma/</td>
<td>117684</td>
</tr>
<tr>
<td>2. (asthma or asthmatic).ti,ab,kf.</td>
<td>139109</td>
</tr>
<tr>
<td>3. exp Bronchiectasis/</td>
<td>8468</td>
</tr>
<tr>
<td>4. bronchiectasis.ti,ab,kf.</td>
<td>8653</td>
</tr>
<tr>
<td>5. ((persistent or abnormal) adj3 (bronchi$ adj3 dilatat$)).ti,ab,kf.</td>
<td>9</td>
</tr>
<tr>
<td>6. Pulmonary Disease, Chronic Obstructive/</td>
<td>30746</td>
</tr>
<tr>
<td>7. COPD.ti,ab,kf.</td>
<td>36313</td>
</tr>
<tr>
<td>8. (chronic obstructive adj3 (lung or pulmonary)).ti,ab,kf.</td>
<td>42114</td>
</tr>
<tr>
<td>9. Cystic Fibrosis/</td>
<td>32040</td>
</tr>
<tr>
<td>10. cystic fibrosis.ti,ab,kf.</td>
<td>39340</td>
</tr>
<tr>
<td>11. Lung Diseases, Interstitial/</td>
<td>7623</td>
</tr>
<tr>
<td>12. interstitial lung disease$.ti,ab,kf.</td>
<td>7805</td>
</tr>
<tr>
<td>13. Idiopathic Pulmonary Fibrosis/</td>
<td>2252</td>
</tr>
<tr>
<td>14. (idiopathic adj3 pulmonary fibrosis).ti,ab,kf.</td>
<td>6044</td>
</tr>
<tr>
<td>15. Sarcoidosis, Pulmonary/</td>
<td>3036</td>
</tr>
<tr>
<td>16. (sarcoidosis adj3 (lung$1 or pulmonary)).ti,ab,kf.</td>
<td>3341</td>
</tr>
<tr>
<td>17. exp Lung Neoplasms/</td>
<td>205589</td>
</tr>
<tr>
<td>18. ((cancer or neoplasm$ or tumo?r$) adj3 (lung$1 or pulmonary)).ti,ab,kf.</td>
<td>157304</td>
</tr>
<tr>
<td>19. exp Mesothelioma/</td>
<td>12989</td>
</tr>
<tr>
<td>20. mesothelioma.ti,ab,kf.</td>
<td>13673</td>
</tr>
<tr>
<td>21. Sleep Apnea, Obstructive/</td>
<td>15516</td>
</tr>
<tr>
<td>22. obstructive sleep apn?ea.ti,ab,kf.</td>
<td>21774</td>
</tr>
<tr>
<td>23. exp Pneumonia/</td>
<td>84210</td>
</tr>
<tr>
<td>24. pneumonia.ti,ab,kf.</td>
<td>101167</td>
</tr>
<tr>
<td>25. (lower respiratory tract adj3 infection$).ti,ab,kf.</td>
<td>5974</td>
</tr>
<tr>
<td>26. Tuberculosis, Pulmonary/</td>
<td>72080</td>
</tr>
<tr>
<td>27. (tuberculosis adj3 (lung or respiratory or pulmonary)).ti,ab,kf.</td>
<td>49188</td>
</tr>
<tr>
<td>28. or/1-27 (753219)</td>
<td></td>
</tr>
<tr>
<td>29. “cost of illness”/</td>
<td>22559</td>
</tr>
<tr>
<td>30. (costing adj3 (illness$ or disease$ or sickness$)).ti,ab,kf.</td>
<td>42</td>
</tr>
<tr>
<td>31. (burden adj3 (illness$ or disease$ or sickness$)).ti,ab,kf.</td>
<td>23859</td>
</tr>
<tr>
<td>32. (burden adj3 (family or human$)).ti,ab,kf.</td>
<td>2531</td>
</tr>
</tbody>
</table>
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

33. (economic or human$) adj3 consequence$1).ti,ab,kf. (5370)
34. exp health care costs/ (56457)
35. (cost or costs).ti,ab,kf. (434700)
36. (resource$1 adj4 use$1).ti,ab,kf. (24163)
37. (resource$1 adj4 usage).ti,ab,kf. (512)
38. (resource$1 adj4 utili$).ti,ab,kf. (12538)
39. (visit or visits or hospitalization$1 or hospitalisation$1 or admission$1 or admitted or emergency room or rescue).ti,ab,kf. (580101)
40. or/29-39 (1044410)
41. 28 and 40 (61582)
42. (systematic adj3 review).ti,kf. (73664)
43. (meta-analy$ or metaanaly$ or meta-synthes$ or metasynthes$ or meta-regressi$ or metaregressi$).ti,kf. (73060)
44. systematic overview.ti,kf. (229)
45. or/42-44 (123173)
46. 41 and 45 (803)
47. (costing adj3 (illness$ or disease$ or sickness$)).ti. (6)
48. (burden adj3 (illness$ or disease$ or sickness$)).ti. (3264)
49. (economic adj3 consequence$1).ti. (539)
50. costs.ti. (28765)
51. or/47-50 (32517)
52. 28 and 51 (1449)
53. 46 or 52 (2232)
54. exp Animals/ not Humans/ (4398892)
55. (news or comment or letter or editorial or case reports).pt. or case report.ti. (3478950)
56. 53 not (54 or 55) (2143)
57. exp Great Britain/ (344024)
58. (national health service* or nhs*).ti,ab,in. (141443)
59. (english not (published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english).ti,ab. (88733)
60. (gb or “g.b.” or britain* or (british* not “british columbia”) or uk or “u.k.” or united kingdom* or (england* not “new england”) or northern ireland* or northern irish* or scotland* or scottish* or ((wales or “south wales”) not “new south wales”) or welsh*).ti,ab,jw,in. (1751209)
61. (bath or “bath’s” or ((birmingham not alabama*) or (“birmingham’s” not alabama*) or bradford or “bradford’s” or brighton or “brighton’s” or bristol or “bristol’s” or carlisle* or “carlisle’s” or (cambridge not (massachusetts* or boston* or harvard*)) or (“cambridge’s” not (massachusetts* or boston* or harvard*)) or (canterbury not nealand*) or (“canterbury’s” not nealand*) or chelmsford or “chelmsford’s” or chester or “chester’s” or chichester or “chichester’s” or coventry or “coventry’s” or derby or “derby’s” or (durham not (carolina* or nc)) or (“durham’s” not (carolina* or nc)) or eley or “eley’s” or exeter or “exeter’s” or gloucester or “gloucester’s” or hereford or “hereford’s” or hull or “hull’s” or lancaster or “lancaster’s” or leeds* or leicester or “leicester’s” or (lincoln not nebraska*) or (“lincoln’s” not nebraska*) or (liverpool not (new south wales* or nsw)) or (“liverpool’s” not (new south wales* or nsw)) or ((london not (ontario* or ont or toronto*)) or (“london’s” not (ontario* or ont or toronto*)) or manchester or “manchester’s” or (newcastle not (new south wales* or nsw)) or (“newcastle’s” not (new south wales* or nsw)) or norwich or “norwich’s” or nottingham or “nottingham’s” or oxford or “oxford’s” or peterborough or “peterborough’s” or plymouth or “plymouth’s”
or portsmouth or "portsmouth's" or preston or "preston's" or ripon or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or sunderland or "sunderland's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or (worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*))) or (york not ("new york"* or ny or ontario* or ont or toronto*)) or ("york's" not ("new york"* or ny or ontario* or ont or toronto*)) or (bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or st asaph or "st asaph's" or st davids or swansea or "swansea's"),ti,ab,in. (1128712)
62. (aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's"),ti,ab,in. (164445)
63. (armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's"),ti,ab,in. (20339)
64. or/57-64 (2261918)
65. (exp africa/ or exp americas/ or exp antarctic regions/ or exp arctic regions/ or exp asia/ or exp australia/ or exp oceania/) not (exp great britain/ or europe/) (2523275)
66. 65 not 66 (2144476)
67. 56 and 67 (355)
68. limit 68 to yr="2000-current" (342)
69. remove duplicates from 69 (324)

A2. Embase <1974 to 2017 May 11>
URL/Interface: OvidSP
Search date: 12 May 2017
Records retrieved: 538
18. ((cancer or neoplasm$ or tumo?r$) adj3 (lung$1 or pulmonary$)).ti,ab,kw. (210708)
19. mesothelioma/ (12659)
20. mesothelioma.ti,ab,kw. (18054)
21. sleep disordered breathing/ (28591)
22. obstructive sleep apn?ea.ti,ab,kw. (34079)
23. exp pneumonia/ (244097)
24. pneumonia.ti,ab,kw. (136601)
25. exp lower respiratory tract infection/ (192206)
26. (lower respiratory tract adj3 infection$).ti,ab,kw. (8137)
27. lung tuberculosis/ (59898)
28. (tuberculosis adj3 (lung or respiratory or pulmonary$)).ti,ab,kw. (36978)
29. or/1-28 (1 188220)
30. “cost of illness”/ (16590)
31. (costing adj3 (illness$ or disease$ or sickness$)).ti,ab,kw. (64)
32. (burden adj3 (illness$ or disease$ or sickness$)).ti,ab,kw. (33649)
33. (burden adj3 (family or human$)).ti,ab,kw. (3417)
34. ((economic or human$) adj3 consequence$1)).ti,ab,kw. (6583)
35. exp health care cost/ (246495)
36. (cost or costs).ti,ab,kw. (553766)
37. (resource$1 adj4 use$1).ti,ab,kw. (31688)
38. (resource$1 adj4 usage).ti,ab,kw. (717)
39. (resource$1 adj4 utili$).ti,ab,kw. (19710)
40. (visit or visits or hospitalization$1 or hospitalisation$1 or admission$1 or admitted or emergency room or rescue).ti,ab,kw. (864385)
41. or/30-40 (1537898)
42. 29 and 41 (125786)
43. (systematic adj3 review).ti,kw. (85482)
44. (meta-analy$ or metaanaly$ or meta-synthes$ or metasynthes$ or meta-regressi$ or metaregressi$).ti,kw. (91017)
45. systematic overview.ti,kw. (258)
46. or/43-45 (147316)
47. 42 and 46 (1365)
48. (costing adj3 (illness$ or disease$ or sickness$)).ti. (8)
49. (burden adj3 (illness$ or disease$ or sickness$)).ti. (4461)
50. (economic adj3 consequence$1).ti. (666)
51. costs.ti. (35444)
52. or/48-51 (40496)
53. 29 and 52 (2477)
54. 47 or 53 (3813)
55. (animal/ or animal experiment/ or animal model/ or animal tissue/ or nonhuman/) not exp human/ (5589291)
56. (conference abstract or conference paper or conference proceeding or conference review or letter or editorial).pt. or case report.ti. (4989013)
57. 54 not (55 or 56) (2782)
58. United Kingdom/ (380484)
59. (national health service* or nhs*).ti,ab,in,ad. (250432)
60. (english not (published or publication* or translat* or written or language* or speak* or literature or citation*) adj5 english)).ti,ab. (31510)
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

61. (gb or “g.b.” or britain* or (british* not “british columbia”) or uk or “u.k.” or united kingdom* or (england* not “new england”) or northern ireland* or northern irish* or scotland* or scottish* or ((wales or “south wales”) not “new south wales”) or welsh*).ti,ab,jw,in,ad. (2714005)

62. (bath or “bath’s” or ((birmingham not alabama*) or (“birmingham’s” not alabama*)) or bradford or “bradford’s” or brighton or “brighton’s” or bristol or “bristol’s” or carlisle* or “carlisle’s” or (cambridge not (massachusetts* or boston* or harvard*)) or (“cambridge’s” not (massachusetts* or boston* or harvard*)) or (cambury not (canbury not nebraska*) or (“cambury’s” not nebraska*) or (liverpool not (new south wales* or nsw)) or (“liverpool’s” not (new south wales* or nsw)) or (“london not (ontario* or ont or toronto*)” or (“london’s” not (ontario* or ont or toronto*)) or manchester or “manchester’s” or (newcastle not (new south wales* or nsw)) or (“newcastle’s” not (new south wales* or nsw))) or norwich or “norwich’s” or nottingham or “nottingham’s” or oxford* or “oxford’s” or peterborough or “peterborough’s” or plymouth or “plymouth’s” or portsmouth or “portsmouth’s” or preston or “preston’s” or ripon or “ripon’s” or salford or “salford’s” or salisbury or “salisbury’s” or sheffield or “sheffield’s” or southampton or “southampton’s” or st albans or stoke or “stoke’s” or sunderland or “sunderland’s” or truro or “truro’s” or wakefield or “wakefield’s” or wells or westminster or “westminster’s” or winchester or “winchester’s” or wolverhampton or “wolverhampton’s” or (worcester not (massachusetts* or boston* or harvard*)) or (“worcester’s” not (massachusetts* or boston* or harvard*)) or (york not (“new york*” or ny or ontario* or ont or toronto*)) or (“york’s” not (“new york*” or ny or ontario* or ont or toronto*)) or (“york’s” not (“new york*” or ny or ontario* or ont or toronto*))).ti,ab,in,ad. (2014683)

63. (bangor or “bangor’s” or cardiff or “cardiff’s” or newport or “newport’s” or st asaph or “st asaph’s” or st davids or swansea or “swansea’s”).ti,ab,in,ad. (81090)

64. (aberdeen or “aberdeen’s” or dundee or “dundee’s” or edinburgh or “edinburgh’s” or glasgow or “glasgow’s” or inverness or (perth not australia*) or (“perth’s” not australia*) or stirling or “stirling’s”).ti,ab,in,ad. (279520)

65. (armagh or “armagh’s” or belfast or “belfast’s” or lisburn or “lisburn’s” or londonderry or “londonderry’s” or derry or “derry’s” or newry or “newry’s”).ti,ab,in,ad. (36407)

66. or/58-65 (3310258)

67. (exp “arctic and antarctic”/ or exp oceanic regions/ or exp western hemisphere/ or exp india/ or exp asia/* or exp “australia and new zealand/*) not (united kingdom*/ or europe/)).ti,ab,in,ad. (2627645)

68. 66 not 67 (3144991)

69. 57 and 68 (578)

70. limit 69 to yr=“2000-current” (554)

71. remove duplicates from 70 (538)
#1. [mh Asthma] (10008)
#2. (asthma or asthmatic) (28508)
#3. [mh Bronchiectasis] (194)
#4. bronchiectasis (820)
#5. ((persistent or abnormal) near/3 (bronch* near/3 dilatat*)) (2)
#6. [mh "Pulmonary Disease, Chronic Obstructive"] (3068)
#7. COPD (10580)
#8. (chronic obstructive near/3 (lung or pulmonary)) (9458)
#9. mh "Cystic Fibrosis"] (1210)
#10. "cystic fibrosis" (4492)
#11. [mh "Lung Diseases, Interstitial"] (103)
#12. interstitial next lung next disease* (549)
#13. [mh "Idiopathic Pulmonary Fibrosis"] (72)
#14. (idiopathic near/3 pulmonary fibrosis) (471)
#15. [mh "Sarcoidosis, Pulmonary"] (65)
#16. (sarcoidosis near/3 (lung* or pulmonary)) (201)
#17. [mh "Lung Neoplasms"] (5801)
#18. ((cancer or neoplasm* or tumo?r*) near/3 (lung* or pulmonary)) (12946)
#19. [mh Mesothelioma] (113)
#20. mesothelioma (389)
#21. [mh "Sleep Apnea, Obstructive"] (1115)
#22. obstructive next sleep next apn*ea (3080)
#23. [mh Pneumonia] (2911)
#24. pneumonia (10978)
#25. ("lower respiratory tract" near/3 infection*) (1179)
#26. [mh "Tuberculosis, Pulmonary"] (942)
#27. (tuberculosis near/3 (lung or respiratory or pulmonary)) (2504)
#28. [or #1-#27] (73887)
#29. [mh "Cost of Illness"] (1321)
#30. (costing near/3 (illness* or disease* or sickness*)) (6)
#31. (burden near/3 (illness* or disease* or sickness*)) (1995)
#32. (burden near/3 (family or human*)) (325)
#33. (economic or human*) near/3 consequence*) (487)
#34. [mh "Health care Costs"] (7377)
#35. (cost or costs) (69472)
#36. (resource? near/4 use*) (3997)
#37. (resource? near/4 usage*) (21)
#38. (resource? near/4 utili*) (747)
#39. (visit or visits or hospitalization* or hospitalization* or admission* or admitted or "emergency room" or rescue) (83157)
#40. [or #29-#39] (137386)
#41. #28 and #40 (138888)
#42. (costing near/3 (illness* or disease* or sickness*)):ti (0)
#43. (burden near/3 (illness* or disease* or sickness*)):ti (119)
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

#44. (economic near/3 consequence*):ti (68)
#45. costs.ti (1)
#46. (or #42-#45) (188)
#47. #28 and #46 (22)
#48. #41 or #47 (13888)
#49. [mh “Great Britain”] (6624)
#50. (national next health next service* or nhs*) (29316)
#51. (english not (published or publication* or translat* or written or language* or speak* or literature or citation*) near/5 english)) (47424)
#52. (gb or “g.b.” or britain* or (british* not “british columbia”) or uk or “u.k.” or united next kingdom* or (england* not “new england”) or northern next ireland* or northern next irish* or scotland* or scottish* or (wales or “south wales”) not “new south wales”) or welsh*) (166994)
#53. (bath or “bath’s” or ((birmingham not alabama*) or (“birmingham’s” not alabama*)) or bradford or “bradford’s” or brighton or “brighton’s” or bristol or “bristol’s” or carlisle* or “carlisle’s” or (cambridge not (massachusetts* or boston* or harvard*)) or (“cambridge’s” not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or (“canterbury’s” not zealand*) or chelmsford or “chelmsford’s” or chester or “chester’s” or chichester or “chichester’s” or coventry or “coventry’s” or derby or “derby’s” or (durham not (carolina* or nc)) or (“durham’s” not (carolina* or nc)) or ely or “ely’s” or exeter or “exeter’s” or gloucester or “gloucester’s” or hereford or “hereford’s” or hull or “hull’s” or lancaster or “lancaster’s” or leeds* or leicester or “leicester’s” or (lincoln not nebraska*) or (“lincoln’s” not nebraska*) or (liverpool not (new south wales* or nsw)) or (“liverpool’s” not (new south wales* or nsw)) or “london’s” not (ontario* or ont or toronto*)) or (“london’s” not (ontario* or ont or toronto*)) or manchester or “manchester’s” or (newcastle not (new south wales* or nsw)) or (“newcastle’s” not (new south wales* or nsw)) or norwich or “norwich’s” or nottingham or “nottingham’s” or oxford or “oxford’s” or peterborough or “peterborough’s” or plymouth or “plymouth’s” or portmouth or “portsmouth’s” or preston or “preston’s” or ripon or “ripon’s” or salford or “salford’s” or salisbury or “salisbury’s” or sheffield or “sheffield’s” or southampton or “southampton’s” or st albans or stoke or “stoke’s” or st pierre or “st pierre’s” or st saviour or “st saviour’s” or truro or “truro’s” or wakefield or “wakefield’s” or wells or westminster or “westminster’s” or winchester or “winchester’s” or wolverhampton or “wolverhampton’s” or worcester or (“worcester’s” not (massachusetts* or boston* or harvard*)) or (“worcester’s” not (massachusetts* or boston* or harvard*)) or (london not (“new york*” or ny or ontario* or ont or toronto*)) or (“london’s” not (“new york*” or ny or ontario* or ont or toronto*)) or (“london’s” not (“new york*” or ny or ontario* or ont or toronto*)) or (“london’s” not (“new york*” or ny or ontario* or ont or toronto*)) or (“london’s” not (“new york*” or ny or ontario* or ont or toronto*))) (96548)
#54. (bangor or “bangor’s” or cardiff or “cardiff’s” or newport or “newport’s” or “st asaph” or “st asaph’s” or st davids or swansea or “swansea’s”) (1986)
#55. (aberdeen or “aberdeen’s” or dundee or “dundee’s” or edinburgh or “edinburgh’s” or glasgow or “glasgow’s” or inverness or (perth not australia*) or (“perth’s” not australia*) or stirling or “stirling’s”) (13611)
#56. (armagh or “armagh’s” or belfast or “belfast’s” or lisburn or “lisburn’s” or londonderry or “londonderry’s” or derry or “derry’s” or newry or “newry’s”) (1395)
#57. [or #51-#56] (231989)
#58. ([mh africa] or [mh Americas] or [mh “antarctic regions”) or (mh “arctic regions”) or [mh asia] or [mh Australia] or [mh oceania]) not (mh “great Britain”) or [mh ^Europe]) (48795)
#59. #57 not #58 (225984)
#60. #48 and #59 Publication Year from 2000 to 2017, in Other Reviews (217)
A4. Health Technology Assessment Database (HTA), Issue 4 of 4, October 2016
URL/Interface: Cochrane Library, Wiley
Search date: 12 May 2017
Records retrieved: 66

#1. [mh Asthma] (10008)
#2. (asthma or asthmatic) (28508)
#3. [mh Bronchiectasis] (194)
#4. bronchiectasis (820)
#5. ((persistent or abnormal) near/3 (bronchi* near/3 dilat*)) (2)
#6. [mh ^"Pulmonary Disease, Chronic Obstructive"] (3068)
#7. COPD (10580)
#8. (chronic obstructive near/3 (lung or pulmonary)) (9458)
#9. [mh ^"Cystic Fibrosis"] (1210)
#10. "cystic fibrosis" (4492)
#11. [mh ^"Lung Diseases, Interstitial"] (103)
#12. interstitial next lung next disease* (549)
#13. [mh ^"Idiopathic Pulmonary Fibrosis"] (72)
#14. (idiopathic near/3 pulmonary fibrosis) (471)
#15. [mh ^"Sarcoidosis, Pulmonary"] (65)
#16. (sarcoidosis near/3 (lung* or pulmonary)) (201)
#17. [mh "Lung Neoplasms"] (5801)
#18. (cancer or neoplasm* or tumo?r*) near/3 (lung* or pulmonary)) (12946)
#19. [mh Mesothelioma] (113)
#20. mesothelioma (389)
#21. [mh ^"Sleep Apnea, Obstructive"] (1115)
#22. obstructive next sleep next apn*ea (3080)
#23. [mh Pneumonia] (2911)
#24. pneumonia (10978)
#25. ("lower respiratory tract" near/3 infection*) (1179)
#26. [mh ^"Tuberculosis, Pulmonary"] (942)
#27. (tuberculosis near/3 (lung or respiratory or pulmonary)) (2504)
#28. (or #1-#27) (73887)
#29. [mh ^"Cost of Illness"] (1321)
#30. (costing near/3 (illness* or disease* or sickness*)) (6)
#31. (burden near/3 (illness* or disease* or sickness*)) (1995)
#32. (burden near/3 (family or human*)) (325)
#33. ((economic or human*) near/3 consequence*) (487)
#34. [mh ^"Health care Costs"] (7377)
#35. (cost or costs) (69472)
#36. (resource? near/4 use*) (3997)
#37. (resource? near/4 usage*) (21)
#38. (resource? near/4 utili*) (747)
#39. (visit or visits or hospitalization* or hospitalization* or admission* or admitted or "emergency room" or rescue) (83157)
#40. (or #29-#39) (137386)
#41. #28 and #40 (138888)
#42. (costing near/3 (illness* or disease* or sickness*)):ti (0)
#43. (burden near/3 (illness* or disease* or sickness*)):ti (119)
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions blf.org.uk/policy

#44. (economic near/3 consequence*):ti (68)
#45. costs.ti (1)
#46. (or #42-#45) (188)
#47. #28 and #46 (22)
#48. #41 or #47 (13888)
#49. [mh "Great Britain"] (6624)
#50. (national next health next service* or nhs* (29316)
#51. (english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) near/5 english)) (7424)
#52. (gb or "g.b." or britain* or (british* not "british columbia") or uk or "u.k." or united next kingdom* or (england* not "new england") or northern next ireland* or northern next irish* or scotland* or scottish* or (wales or "south wales") not "new south wales") or welsh*) (166994)
#53. (bath or "bath's" or ((birmingham not alabama*) or ("birmingham's" not alabama*) or bradford or "bradford's" or brighton or "brighton's" or bristol or "bristol's" or carlisle* or "carlisle's" or (cambridge not (massachusetts* or boston* or harvard*)) or ("cambridge's" not (massachusetts* or boston* or harvard*)) or (canterbury not zealand*) or ("canterbury's" not zealand*) or chelmsford or "chelmsford's" or chester or "chester's" or chichester or "chichester's" or coventry or "coventry's" or derby or "derby's" or (durham not (carolina* or nc)) or ("durham's" not (carolina* or nc)) or ely or "ely's" or exeter or "exeter's" or gloucester or "gloucester's" or hereford or "hereford's" or hull or "hull's" or lancaster or "lancaster's" or leeds* or leicester or "leicester's" or lincoln not nebraska*) or ("lincoln's" not nebraska*) or (liverpool not (new south wales* or nsw)) or ("liverpool's" not (new south wales* or nsw)) or (london not (ontario* or ont or toronto*))) or ("london's" not (ontario* or ont or toronto*)) or manchester or "manchester's" or (newcastle not (new south wales* or nsw)) or (newcastle's not (new south wales* or nsw)) or norwich or "norwich's" or nottingham or "nottingham's" or oxford or "oxford's" or peterborough or "peterborough's" or plymouth or "plymouth's" or portsmouth or "portsmouth's" or preston or "preston's" or ripon* or "ripon's" or salford or "salford's" or salisbury or "salisbury's" or sheffield or "sheffield's" or southampton or "southampton's" or st albans or stoke or "stoke's" or stourbridge or "stourbridge's" or truro or "truro's" or wakefield or "wakefield's" or wells or westminster or "westminster's" or winchester or "winchester's" or wolverhampton or "wolverhampton's" or worcester not (massachusetts* or boston* or harvard*)) or ("worcester's" not (massachusetts* or boston* or harvard*)) or (york not ("new york"* or ny or ontario* or ont or toronto*)) or ("york's" not ("new york"* or ny or ontario* or ont or toronto*)) or ("york's" not ("new york"* or ny or ontario* or ont or toronto*))) (96548)
#54. (bangor or "bangor's" or cardiff or "cardiff's" or newport or "newport's" or "st asaph" or "st asaph's" or st davids or swansea or "swansea's") (186)
#55. (aberdeen or "aberdeen's" or dundee or "dundee's" or edinburgh or "edinburgh's" or glasgow or "glasgow's" or inverness or (perth not australia*) or ("perth's" not australia*) or stirling or "stirling's") (13611)
#56. (armagh or "armagh's" or belfast or "belfast's" or lisburn or "lisburn's" or londonderry or "londonderry's" or derry or "derry's" or newry or "newry's") (1395)
#57. (or #51-#56) (231989)
#58. ([mh africa] or [mh americas] or (mh "antarctic regions") or [mh "arctic regions"] or [mh asia] or [mh australia] or [mh oceania]) not ([mh "great Britain"] or [mh ^Europe]) (48795)
#59. #57 not #58 (225984)
#60. #48 and #59 Publication Year from 2000 to 2017, in Technology Assessments (66)
A5. NHS Economic Evaluation Database (NHS EED), Issue 2 of 4, April 2015
URL/Interface: Cochrane Library, Wiley
Search date: 12 May 2017
Records retrieved: 206

#1. [mh Asthma] (10008)
#2. (asthma or asthmatic) (28508)
#3. [mh Bronchiectasis] (194)
#4. bronchiectasis (820)
#5. (persistent or abnormal) near/3 (bronchi* near/3 dilat*) (2)
#6. [mh ^"Pulmonary Disease, Chronic Obstructive"] (3068)
#7. COPD (10580)
#8. (chronic obstructive near/3 (lung or pulmonary)) (9458)
#9. [mh ^"Cystic Fibrosis"] (1210)
#10. “cystic fibrosis” (4492)
#11. [mh ^"Lung Diseases, Interstitial")] (103)
#12. interstitial next lung next disease* (549)
#13. [mh ^"Idiopathic Pulmonary Fibrosis"] (72)
#14. (idiopathic near/3 pulmonary fibrosis) (471)
#15. [mh ^"Sarcoidosis, Pulmonary"] (65)
#16. (sarcoidosis near/3 (lung* or pulmonary)) (201)
#17. [mh “Lung Neoplasms”] (5801)
#18. ((cancer or neoplasm* or tumo?r*) near/3 (lung* or pulmonary)) (12946)
#19. [mh Mesothelioma] (113)
#20. mesothelioma (389)
#21. [mh ^"Sleep Apnea, Obstructive"] (1115)
#22. obstructive next sleep next apn*ea (3080)
#23. [mh Pneumonia] (2911)
#24. pneumonia
#25. (“lower respiratory tract” near/3 infection*) (1179)
#26. [mh ^"Tuberculosis, Pulmonary"] (942)
#27. (tuberculosis near/3 (lung or respiratory or pulmonary)) (2504)
#28. (or #1-#27) (73887)
#29. [mh ^"Cost of Illness"] (1321)
#30. (costing near/3 (illness* or disease* or sickness*)) (6)
#31. (burden near/3 (illness* or disease* or sickness*)) (1995)
#32. (burden near/3 (family or human*)) (325)
#33. (economic or human*) near/3 consequence*) (487)
#34. [mh ^"Health care Costs"] (7377)
#35. (cost or costs) (69472)
#36. (resource? near/4 use*) (3997)
#37. (resource? near/4 usage*) (21)
#38. (resource? near/4 utili*) (747)
#39. (visit or visits or hospitalization* or hospitalization* or admission* or admitted or “emergency room” or rescue) (83157)
#40. (or #29-#39) (137386)
#41. #28 and #40 (138888)
#42. (costing near/3 (illness* or disease* or sickness*)):ti (0)
#43. (burden near/3 (illness* or disease* or sickness*)):ti (119)
A6. Cochrane Database of Systematic Reviews (CDSR), Issue 5 of 12, May 2017
URL/Interface: Cochrane Library, Wiley
Search date: 12 May 2017
Records retrieved: 22

#1. [mh Asthma] (10008)
#2. (asthma or asthmatic):ti,ab,kw (26041)
#3. [mh Bronchiectasis] (194)
#4. bronchiectasis:ti,ab,kw (660)
#5. ((persistent or abnormal) near/3 (bronchi* near/3 dilatat*)):ti,ab,kw (1)
#6. [mh ^"Pulmonary Disease, Chronic Obstructive"] (3068)
#7. COPD:ti,ab,kw (9952)
#8. (chronic obstructive near/3 (lung or pulmonary)):ti,ab,kw (8703)
#9. [mh ^"Cystic Fibrosis"] (1210)
#10. "cystic fibrosis":ti,ab,kw (3983)
#11. [mh ^"Lung Diseases, Interstitial"] (103)
#12. interstitial next lung next disease*:ti,ab,kw (516)
#13. [mh ^"Idiopathic Pulmonary Fibrosis"] (72)
#14. (idiopathic near/3 pulmonary fibrosis):ti,ab,kw (447)
#15. [mh ^"Sarcoidosis, Pulmonary"] (65)
#16. (sarcoidosis near/3 (lung* or pulmonary)):ti,ab,kw (170)
#17. [mh "Lung Neoplasms"] (5801)
#18. ((cancer or neoplasm* or tumo?r*) near/3 (lung* or pulmonary)):ti,ab,kw (12258)
#19. [mh Mesothelioma] (113)
#20. mesothelioma:ti,ab,kw (370)
#21. [mh ^"Sleep Apnea, Obstructive"] (1115)
#22. obstructive next sleep next apn*ea:ti,ab,kw (2976)
#23. [mh Pneumonia] (2911)
#24. pneumonia:ti,ab,kw (9584)
#25. ("lower respiratory tract" near/3 infection*):ti,ab,kw (973)
#26. [mh ^"Tuberculosis, Pulmonary"] (942)
#27. (tuberculosis near/3 (lung or respiratory or pulmonary)):ti,ab,kw (1977)
#28. (or #1-#27) (69254)
#29. [mh ^"Cost of Illness"] (1321)
#30. (costing near/3 (illness* or disease* or sickness*)):ti,ab,kw (2)
#31. (burden near/3 (illness* or disease* or sickness*)):ti,ab,kw (1266)
#32. (burden near/3 (family or human*)):ti,ab,kw (217)
#33. ((economic or human*) near/3 consequence*):ti,ab,kw (295)
#34. [mh "Health care Costs"] (7377)
#35. (cost or costs):ti,ab,kw (54412)
#36. (resource? near/4 use*):ti,ab,kw (1046)
#37. (resource? near/4 usage*):ti,ab,kw (15)
#38. (resource? near/4 utili*):ti,ab,kw (363)
#39. (visit or visits or hospitalization* or hospitalization* or admission* or admitted or "emergency room" or rescue):ti,ab,kw (973074)
#40. (or #29-#39) (120517)
#41. #28 and #40 (10340)
#42. (costing near/3 (illness* or disease* or sickness*)):ti (0)
#43. (burden near/3 (illness* or disease* or sickness*)):ti (119)
A7. NHS Evidence
URL/Interface: https://www.evidence.nhs.uk/
Search date: 11 May 2017
Records retrieved: 1

• (“lung diseases” OR “lung disease”) AND (“economic burden” OR “humanistic burden” OR resource)
• (asthma or bronchiectasis or copd or “chronic obstructive pulmonary disease” or “cystic fibrosis” or “interstitial lung disease”) AND (“economic burden” OR “humanistic burden” OR resource)
• (“pulmonary sarcoidosis” or “lung cancer” or “lung neoplasms” or mesothelioma or “obstructive sleep apnea”) AND (“economic burden” OR “humanistic burden” OR resource)
• (pneumonia or “lower respiratory tract infections” or “pulmonary tuberculosis”) AND (“economic burden” OR “humanistic burden” OR resource)

Records were screened for relevant studies by an information specialist.

A8. CEA Registry
URL/Interface: http://healtheconomics.tuftsmedicalcenter.org/cear4/
SearchingtheCEARegistry/SearchtheCEARegistry.aspx
Search date: 12 May 2017
Records retrieved: No records

Basic search was used. Boolean operators or date limits are not supported. Terms were searched separately and the results were screened for relevant studies by an information specialist.

• lung diseases
• asthma
• bronchiectasis
• copd
• chronic obstructive pulmonary disease
• cystic fibrosis
• interstitial lung disease
• pulmonary sarcoidosis
• lung cancer
• lung neoplasms
• mesothelioma
• obstructive sleep apnea
• pneumonia
• lower respiratory tract infections
• pulmonary tuberculosis
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

A9. Research Papers in Economics (RePeC)
URL/Interface: http://econpapers.repec.org/
Search date: 12 May 2017
Records retrieved: 3

- ("lung disease" or "lung diseases" or asthma or bronchiectasis or copd or "chronic obstructive pulmonary disease" or "cystic fibrosis" or "interstitial lung disease" or "pulmonary sarcoidosis" or "lung cancer" or "lung neoplasms" or mesothelioma or "obstructive sleep apnea" or pneumonia or "lower respiratory tract infections" or "pulmonary tuberculosis") and ("economic burden" or "humanistic burden" or "resource use") and ("systematic review" or "meta-analysis" or metaregression or "meta-regression" or "systematic overview")

Title, abstract and keyword search option was used. The interface does not appear to support date limits. Results were ordered by date and screened for relevant studies by an information specialist.

A10. Health Services/Technology Assessment Texts (HSTAT)
URL/Interface: https://www.ncbi.nlm.nih.gov/books/NBK16710/
Search date: 11 May 2017
Records retrieved: No records

- (lung diseases or asthma or bronchiectasis or copd or chronic obstructive pulmonary disease or cystic fibrosis or interstitial lung disease or pulmonary sarcoidosis or lung cancer or lung neoplasms or mesothelioma or obstructive sleep apnea or pneumonia or lower respiratory tract infections or pulmonary tuberculosis) and (burden or cost or costing or resource use or economic) AND hstatcollect(filter) Limits: Publication year between 2000 and 2017

Records were screened for relevant studies by an information specialist.
Cost effectiveness question

A11. Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>
URL/Interface: OvidSP
Search date: 12 May 2017
Records retrieved: 53

1. exp Asthma/ (117684)
2. (asthma or asthmatic).ti,ab,kf. (139109)
3. exp Bronchiectasis/ (8468)
4. bronchiectasis.ti,ab,kf. (8653)
5. ((persistent or abnormal) adj3 (bronchi$. adj3 dilatat$)).ti,ab,kf. (9)
6. Pulmonary Disease, Chronic Obstructive/ (30746)
7. COPD.ti,ab,kf. (36313)
8. (chronic obstructive adj3 (lung or pulmonary)).ti,ab,kf. (42114)
9. Cystic Fibrosis/ (32040)
10. cystic fibrosis.ti,ab,kf. (39340)
11. Lung Diseases, Interstitial/ (7623)
12. interstitial lung disease$.ti,ab,kf. (7805)
13. Idiopathic Pulmonary Fibrosis/ (2252)
14. (idiopathic adj3 pulmonary fibrosis).ti,ab,kf. (6044)
15. Sarcoïdosis, Pulmonary/ (3036)
16. (sarcoïdosis adj3 (lung$1 or pulmonary)).ti,ab,kf. (3341)
17. exp Lung Neoplasms/ (205589)
18. (cancer or neoplasm$ or tumo$r$) adj3 (lung$1 or pulmonary)).ti,ab,kf. (157304)
19. exp Mesothelioma/ (12989)
20. mesothelioma.ti,ab,kf. (13673)
21. Sleep Apnea, Obstructive/ (15516)
22. obstructive sleep apn$ea.ti,ab,kf. (21774)
23. exp Pneumonia/ (84210)
24. pneumonia.ti,ab,kf. (101167)
25. (lower respiratory tract adj3 infection$).ti,ab,kf. (5974)
26. Tuberculosis, Pulmonary/ (72080)
27. (tuberculosis adj3 (lung or respiratory or pulmonary)).ti,ab,kf. (49188)
28. or/1-27 (753219)
29. Economics/ (27100)
30. exp “Costs and cost analysis”/ (211049)
31. Economics, dental/ (1898)
32. exp “Economics, hospital”/ (22491)
33. Economics, medical/ (9061)
34. Economics, nursing/ (3986)
35. Economics, pharmaceutical/ (2763)
36. (economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (627254)
37. (expenditure$ not energy).ti,ab. (24276)
38. value for money.ti,ab. (1351)
39. budget$.ti,ab. (24520)
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

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<th>Literature review</th>
<th>40. or/29-39 (768477)</th>
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<td>41. (energy or oxygen) adj cost).ti,ab. (3582)</td>
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<td>42. (metabolic adj cost).ti,ab. (1157)</td>
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<td>43. (energy or oxygen) adj expenditure).ti,ab. (21575)</td>
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<td>45. 40 not 44 (762660)</td>
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<td>46. 28 and 45 (21977)</td>
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<td>47. Mass screening/ (93348)</td>
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<td>48. ((early or earlier) adj3 (diagnos$ or detecti$ or screeni$)).ti,ab,kf. (161927)</td>
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<td>50. Health Education/(58207)</td>
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<td>51. Patient Education as Topic/ (80051)</td>
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<td>52. (awareness adj3 campaign$).ti,ab,kf. (1956)</td>
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<td>53. (health adj3 (promoti$ or educa$)).ti,ab,kf. (81970)</td>
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<td>54. (patient adj3 educati$).ti,ab,kf. (20645)</td>
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<td>55. Drug Prescriptions/ and Physician’s Practice Patterns/ (3729)</td>
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<td>56. ((accurate$ or correct$) adj3 (prescribi$ or prescripti$)).ti,ab,kf. (552)</td>
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<td>57. Patient Compliance/ (53949)</td>
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<td>58. Medication Adherence/ (13128)</td>
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<td>59. ((medication$ or patient$) adj3 (adhere$ or complian$)).ti,ab,kf. (37495)</td>
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<td>60. Smoking Cessation/ (24933)</td>
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<td>62. Self Care/ (29908)</td>
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<td>63. (support$ adj3 (self-manag$ or self-care$)).ti,ab,kf. (2358)</td>
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<td>64. pulmonary rehabilitat$.ti,ab,kf. (2799)</td>
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<td>65. exp Immunization Programs/ (11457)</td>
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<td>66. ((vaccine$ or vaccinat$) adj3 (program$ or campaign$)).ti,ab,kf. (11214)</td>
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<td>67. Delivery of Health Care, Integrated/ (10488)</td>
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<td>68. ((integrat$ or coordinat$ or co-ordinat$ or comprehensive or seamless or transmural or new model$) adj3 care).ti,ab,kf. (27619)</td>
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<td>69. or/47-68 (674487)</td>
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<td>70. 46 and 69 (3653)</td>
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<td>71. (systematic adj3 review).ti,kf. (73664)</td>
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<td>72. (meta-analy$ or metaanaly$ or meta-synthes$ or metasynthes$ or meta-regressi$ or metaregressi$).ti,kf. (73060)</td>
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<td>73. systematic overview$.ti,kf. (236)</td>
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<td>79. limit 78 to yr=&quot;2007-current&quot; (56)</td>
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A12. Embase <1974 to 2017 May 11>
URL/Interface: OvidSP
Search date: 12 May 2017
Records retrieved: 126

1. exp asthma/ (225909)
2. (asthma or asthmatic).ti,ab,kw. (193365)
3. exp bronchiectasis/ (16783)
4. bronchiectasis.ti,ab,kw. (11663)
5. (persistent or abnormal) adj3 (bronchi$ adj3 dilatat$).ti,ab,kw. (22)
6. chronic obstructive lung disease/ (98421)
7. COPD.ti,ab,kw. (65259)
8. (chronic obstructive adj3 (lung or pulmonary)).ti,ab,kw. (58987)
9. cystic fibrosis/ (59809)
10. cystic fibrosis.ti,ab,kw. (54466)
11. interstitial lung disease/ (15049)
12. interstitial lung disease$.ti,ab,kw. (13395)
13. fibrosing alveolitis/ (16674)
14. (idiopathic adj3 pulmonary fibrosis).ti,ab,kw. (9938)
15. lung sarcoidosis/ (4029)
16. (sarcoidosis adj3 (lung$1 or pulmonary)).ti,ab,kw. (4377)
17. exp lung tumor/ (280983)
18. ((cancer or neoplasm$ or tumor$) adj3 (lung$1 or pulmonary)).ti,ab,kw. (210708)
19. mesothelioma/ (12659)
20. mesothelioma.ti,ab,kw. (18054)
21. sleep disordered breathing/ (28591)
22. obstructive sleep apn?ea.ti,ab,kw. (34079)
23. exp pneumonia/ (244097)
24. pneumonia.ti,ab,kw. (136601)
25. exp lower respiratory tract infection/ (192206)
26. (lower respiratory tract adj3 infection$).ti,ab,kw. (8137)
27. lung tuberculosis/ (59898)
28. (tuberculosis adj3 (lung or respiratory or pulmonary)).ti,ab,kw. (36978)
29. or/1-28 (1188220)
30. health economics/ (34776)
31. exp economic evaluation/ (256369)
32. exp health-care-cost/ (246495)
33. exp pharmacoconomics/ (184320)
34. (economic$ or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic$).ti,ab. (780632)
35. (expenditure$ not energy).ti,ab. (31054)
36. value for money.ti,ab. (1863)
37. budget$.ti,ab. (30340)
38. or/30-37 (1111623)
39. ((energy or oxygen) adj cost).ti,ab. (3641)
40. (metabolic adj cost).ti,ab. (1170)
41. ((energy or oxygen) adj expenditure).ti,ab. (25747)
42. or/39-41 (29621)
43. 38 not 42 (1105618)
44. 29 and 43 (51677)
45. mass screening/ (52093)
46. (early or earlier) adj3 (diagnos$ or detecti$ or screeni$).ti,ab,kw. (220984)
47. health promotion/ (82061)
48. health education/ (87758)
49. patient education/ (98513)
50. (awareness adj3 campaign$).ti,ab,kw. (2776)
51. (health adj3 (promoti$ or educati$)).ti,ab,kw. (90603)
52. (patient adj3 educati$).ti,ab,kw. (30046)
53. prescriptions/ and clinical practice/ (7904)
54. (accurate$ or correct$) adj3 (prescribi$ or prescripti$).ti,ab,kw. (897)
55. patient compliance/ (114721)
56. medication compliance/ (17114)
57. (medication$ or patient$) adj3 (adhere$ or complian$).ti,ab,kw. (59273)
58. smoking cessation/ (47634)
59. (smoking adj3 (cessation or quit$ or stop$)).ti,ab,kw. (34982)
60. self care/ (42543)
61. (support$ adj3 (self-manag$ or self-care)).ti,ab,kw. (2782)
62. pulmonary rehabilitation/ (4545)
63. pulmonary rehabilitat$.ti,ab,kw. (4914)
64. (vaccine$ or vaccinat$ or immuni?at$) adj3 (program$ or campaign$).ti,ab,kw. (19053)
65. integrated health care system/ (8899)
66. (integrat$ or coordinat$ or co-ordinat$ or comprehensive or seamless or transmural or new model$) adj3 care).ti,ab,kw. (35390)
67. or/45-66 (846311)
68. 44 and 67 (8602)
69. (systematic adj3 review).ti,kw. (85482)
70. (meta-analy$ or metaanal$ or meta-synthes$ or metasynthes$ or meta-regressi$ or metaregressi$).ti,kw. (91017)
71. systematic overview$.ti,kw. (266)
72. or/69-71 (147322)
73. 68 and 72 (170)
74. (animal/ or animal experiment/ or animal model/ or animal tissue/ or nonhuman/) not exp human/ (5589291)
75. (conference abstract or conference paper or conference proceeding or conference review or letter or editorial).pt. or case report.ti. (4989013)
76. 73 not (74 or 75) (148)
77. limit 76 to yr="2007-current" (129)
78. remove duplicates from 77 (126)
URL/Interface: Cochrane Library, Wiley
Search date: 12 May 2017
Records retrieved: 105

#1. [mh Asthma] (10008)
#2. (asthma or asthmatic) (28508)
#3. [mh Bronchiectasis] (194)
#4. bronchiectasis (820)
#5. (persistent or abnormal) near/3 (bronchi* near/3 dilatat*) (2)
#6. [mh "Pulmonary Disease, Chronic Obstructive"] (3068)
#7. COPD (10580)
#8. (chronic obstructive near/3 (lung or pulmonary)) (9458)
#9. [mh "Cystic Fibrosis"] (1210)
#10. "cystic fibrosis" (4492)
#11. [mh "Lung Diseases, Interstitial"] (103)
#12. interstitial next lung next disease* (549)
#13. [mh "Idiopathic Pulmonary Fibrosis"] (72)
#14. (idiopathic near/3 pulmonary fibrosis) (471)
#15. [mh "Sarcoidosis, Pulmonary"] (65)
#16. (sarcoidosis near/3 (lung* or pulmonary)) (201)
#17. [mh "Lung Neoplasms"] (5801)
#18. (cancer or neoplasm* or tumo?r*) near/3 (lung* or pulmonary)) (12946)
#19. [mh Mesothelioma] (113)
#20. mesothelioma (389)
#21. [mh "Sleep Apnea, Obstructive"] (1115)
#22. obstructive next sleep next apn*ea (3080)
#23. [mh Pneumonia] (2911)
#24. pneumonia (10978)
#25. ("lower respiratory tract" near/3 infection*) (1179)
#26. [mh "Tuberculosis, Pulmonary"] (942)
#27. (tuberculosis near/3 (lung or respiratory or pulmonary)) (2504)
#28. (or #1-#27) (73887)
#29. [mh ^Economics] (63)
#30. [mh "costs and cost analysis"] (25269)
#31. [mh ^Economics, Dental"] (4)
#32. [mh "Economics, Hospital"] (1778)
#33. [mh ^Economics, Medical"] (41)
#34. [mh ^Economics, Nursing"] (19)
#35. [mh ^Economics, Pharmaceutical"] (244)
#36. (economic* or cost or costs or costly or costing or price or
prices or pricing or pharmacoeconomic*) (80765)
#37. (expenditure* not energy) (1925)
#38. "value for money" (394)
#39. budget* (1218)
#40. (or #29-#39) (81306)
#41. (energy or oxygen) near cost) (531)
#42. (metabolic near cost) (144)
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

#43. (energy or oxygen) near expenditure (2912)
#44. (or #41-#43) (3417)
#45. #40 not #44 (80442)
#46. #28 and #45 (7092)
#47. [mh "Mass screening"] (4763)
#48. (early or earlier) near/3 (diagnos* or detecti* or screeni*) (6177)
#49. [mh "Health Promotion"] (5074)
#50. [mh "Health Education"] (3527)
#51. [mh "Patient Education as Topic"] (8030)
#52. (awareness near/3 campaign*) (106)
#53. (health near/3 (promot* or educati*)) (18891)
#54. (patient near/3 educati*) (12636)
#55. [mh "Drug Prescriptions"] and [mh "Physician's Practice Patterns"] (147)
#56. (accurate* or correct*) near/3 (prescribi* or prescripti*) (49)
#57. [mh "Patient Compliance"] (9088)
#58. [mh "Medication Adherence"] (1672)
#59. (medication* or patient*) near/3 (adhere* or complian*) (22515)
#60. [mh "Smoking Cessation"] (3810)
#61. (smoking near/3 (cessation or quit* or stop*)) (7673)
#62. [mh "Self Care"] (3749)
#63. (support* near/3 (self-manag* or self-care)) (706)
#64. pulmonary next rehabilitat* (1194)
#65. [mh "Immunization Programs"] (462)
#66. ((vaccine* or vaccinat* or immuni?at*) near/3 (program* or campaign*)) (1395)
#67. [mh "Delivery of Health Care, Integrated"] (352)
#68. ((integrai* or co-ordina* or coordinate* or transmural* or comprehensive or seamless or new next model*) near/3 care) (2322)
#69. (or #47-#68) (68521)
#70. #46 and #69 Publication Year from 2007 to 2017, in Other Reviews (105)
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

A14. Health Technology Assessment Database (HTA), Issue 4 of 4, October 2016
URL/Interface: Cochrane Library, Wiley
Search date: 12 May 2017
Records retrieved: 14

#1. [mh Asthma] (10008)
#2. (asthma or asthmatic) (28508)
#3. [mh Bronchiectasis] (194)
#4. bronchiectasis (820)
#5. (persistent or abnormal) near/3 (bronchi* near/3 dilatat*) (2)
#6. [mh "Pulmonary Disease, Chronic Obstructive"] (3068)
#7. COPD (10580)
#8. (chronic obstructive near/3 (lung or pulmonary)) (9458)
#9. [mh "Cystic Fibrosis"] (1210)
#10. "cystic fibrosis" (4492)
#11. [mh "Lung Diseases, Interstitial"] (103)
#12. interstitial next lung next disease* (549)
#13. [mh " idiopathic Pulmonary Fibrosis"] (72)
#14. (idiopathic near/3 pulmonary fibrosis) (471)
#15. [mh "Sarcoidosis, Pulmonary"] (65)
#16. (sarcoidosis near/3 (lung* or pulmonary)) (201)
#17. [mh "Lung Neoplasms"] (5801)
#18. (cancer or neoplasm* or tumo?r*) near/3 (lung* or pulmonary)) (12946)
#19. [mh Mesothelioma] (113)
#20. mesothelioma (389)
#21. [mh "Sleep Apnea, Obstructive"] (1115)
#22. obstructive next sleep next apn*ea (3080)
#23. [mh Pneumonia] (2911)
#24. pneumonia (10978)
#25. ("lower respiratory tract" near/3 infection*) (1179)
#26. [mh "Tuberculosis, Pulmonary"] (942)
#27. (tuberculosis near/3 (lung or respiratory or pulmonary)) (2504)
#28. (or #1-#27) (73887)
#29. [mh ^Economics] (63)
#30. [mh "costs and cost analysis"] (25269)
#31. [mh ^Economics, Dental"] (4)
#32. [mh "Economics, Hospital"] (1778)
#33. [mh ^Economics, Medical"] (41)
#34. [mh ^Economics, Nursing"] (19)
#35. [mh ^Economics, Pharmaceutical"] (244)
#36. (economic* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic*) (80765)
#37. (expenditure* not energy) (1925)
#38. "value for money" (394)
#39. budget* (1218)
#40. (or #29-#39) (81306)
#41. (energy or oxygen) near cost) (531)
#42. (metabolic near cost) (144)
#43. (energy or oxygen) near expenditure) (2912)
#44. (or #41-#43) (3417)
#45. #40 not #44 (80442)
#46. #28 and #45 (7092)
#47. [mh ^"Mass screening"] (4763)
#48. (early or earlier) near/3 (diagnos* or detecti* or screeni*) (6177)
#49. [mh ^"Health Promotion"] (5074)
#50. [mh ^"Health Education"] (3527)
#51. [mh "Patient Education as Topic"] (8030)
#52. (awareness near/3 campaign*) (106)
#53. (health near/3 (promot* or educati*)) (18891)
#54. (patient near/3 educati*) (12636)
#55. [mh ^"Drug Prescriptions"] and [mh ^"Physician’s Practice Patterns"] (147)
#56. (accurate* or correct*) near/3 (prescribi* or prescripti*) (49)
#57. [mh ^"Patient Compliance"] (9088)
#58. [mh ^"Medication Adherence"] (1672)
#59. (medication* or patient*) near/3 (adhere* or complian*) (22515)
#60. [mh ^"Smoking Cessation"] (3810)
#61. (smoking near/3 (cessation or quit* or stop*)) (7673)
#62. [mh ^"Self Care"] (3749)
#63. (support* near/3 (self-manag* or self-care)) (706)
#64. pulmonary next rehabilitat* (1194)
#65. [mh "Immunization Programs"] (462)
#66. ((vaccine* or vaccinat* or immuni?at*) near/3 (program* or campaign*)) (1395)
#67. [mh ^"Delivery of Health Care, Integrated"] (352)
#68. ((integrtat* or co-ordinate* or coordinate* or transmural* or comprehensive
or seamless or new next model*) near/3 care) (2322)
#69. (or #47-#68) (68521)
#70. #46 and #69 Publication Year from 2007 to 2017, in Technology Assessments (14)
A15. NHS Economic Evaluation Database (NHS EED), Issue 2 of 4, April 2015
URL/Interface: Cochrane Library, Wiley
Search date: 12 May 2017
Records retrieved: 153

#1. [mh Asthma] (10008)
#2. (asthma or asthmatic) (28508)
#3. [mh Bronchiectasis] (194)
#4. bronchiectasis (820)
#5. ((persistent or abnormal) near/3 (bronchi* near/3 dilatat*)) (2)
#6. [mh "Pulmonary Disease, Chronic Obstructive"] (3068)
#7. COPD (10580)
#8. (chronic obstructive near/3 (lung or pulmonary)) (9458)
#9. [mh "Cystic Fibrosis"] (1210)
#10. "cystic fibrosis" (4492)
#11. [mh "Lung Diseases, Interstitial"] (103)
#12. interstitial next lung next disease* (549)
#13. [mh "Idiopathic Pulmonary Fibrosis"] (72)
#14. (idiopathic near/3 pulmonary fibrosis) (471)
#15. [mh "Sarcoidosis, Pulmonary"] (65)
#16. (sarcoidosis near/3 (lung* or pulmonary)) (201)
#17. [mh "Lung Neoplasms"] (5801)
#18. ((cancer or neoplasm* or tumo?r*) near/3 (lung* or pulmonary)) (12946)
#19. [mh Mesothelioma] (113)
#20. mesothelioma (389)
#21. [mh "Sleep Apnea, Obstructive"] (1115)
#22. obstructive next sleep next apn*ea (3080)
#23. [mh Pneumonia] (2911)
#24. pneumonia (10978)
#25. ("lower respiratory tract" near/3 infection*) (1179)
#26. [mh "Tuberculosis, Pulmonary"] (942)
#27. (tuberculosis near/3 (lung or respiratory or pulmonary)) (2504)
#28. (or #1-#27) (73887)
#29. [mh "Mass screening"] (4763)
#30. (early or earlier) near/3 (diagnos* or detecti* or screeni*) (6177)
#31. [mh "Health Promotion"] (5074)
#32. [mh "Health Education"] (3527)
#33. [mh "Patient Education as Topic"] (8030)
#34. (awareness near/3 campaign*) (106)
#35. (health near/3 (promot* or educati*)) (18891)
#36. (patient near/3 educati*) (12636)
#37. [mh "Drug Prescriptions"] and [mh "Physician's Practice Patterns"] (147)
#38. (accurate* or correct*) near/3 (prescribi* or prescripti*) (49)
#39. [mh "Patient Compliance"] (9088)
#40. [mh "Medication Adherence"] (1672)
#41. ((medication* or patient*) near/3 (adhere* or complian*)) (22515)
#42. [mh "Smoking Cessation"] (3810)
#43. (smoking near/3 (cessation or quit* or stop*)) (7673)
### Literature Review

- **the economic costs of lung disease and the cost effectiveness of policy and service interventions**

#### A16. Cochrane Database of Systematic Reviews (CDSR), Issue 5 of 12, May 2017

**URL/Interface:** Cochrane Library, Wiley

**Search date:** 12 May 2017

**Records retrieved:** 32

#### 1. [mh Asthma] (10008)
#### 2. (asthma or asthmatic):ti,ab,kw (26041)
#### 3. [mh Bronchiectasis] (194)
#### 4. bronchiectasis:ti,ab,kw (660)
#### 5. ((persistent or abnormal) near/3 (bronchi* near/3 dilatat*)):ti,ab,kw (1)
#### 6. [mh "Pulmonary Disease, Chronic Obstructive"] (3068)
#### 7. COPD:ti,ab,kw (9952)
#### 8. (chronic obstructive near/3 (lung or pulmonary)):ti,ab,kw (8703)
#### 9. [mh "Cystic Fibrosis"] (1210)
#### 10. "cystic fibrosis":ti,ab,kw (3983)
#### 11. [mh "Lung Diseases, Interstitial"] (103)
#### 12. interstitial next lung next disease*:ti,ab,kw (516)
#### 13. [mh "Idiopathic Pulmonary Fibrosis"] (72)
#### 14. (idiopathic near/3 pulmonary fibrosis):ti,ab,kw (447)
#### 15. [mh "Sarcoidosis, Pulmonary"] (65)
#### 16. (sarcoidosis near/3 (lung* or pulmonary)):ti,ab,kw (170)
#### 17. [mh "Lung Neoplasms"] (5801)
#### 18. ((cancer or neoplasm* or tumo?r*) near/3 (lung* or pulmonary)):ti,ab,kw (12258)
#### 19. [mh Mesothelioma] (113)
#### 20. mesothelioma:ti,ab,kw (370)
#### 21. [mh "Sleep Apnea, Obstructive"] (1115)
#### 22. obstructive next sleep next apn*ea:ti,ab,kw (2976)
#### 23. [mh Pneumonia] (2911)
#### 24. pneumonia:ti,ab,kw (9584)
#### 25. ("lower respiratory tract* near/3 infection"):ti,ab,kw (973)
#### 26. [mh "Tuberculosis, Pulmonary"] (942)
#### 27. (tuberculosis near/3 (lung or respiratory or pulmonary)):ti,ab,kw (1977)
#### 28. (or #1-#27) (69254)
#### 29. [mh ^Economics] (63)
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

#30. [mh "costs and cost analysis"] (25269)
#31. [mh ^"Economics, Dental"] (4)
#32. [mh ^"Economics, Hospital"] (1778)
#33. [mh ^"Economics, Medical"] (41)
#34. [mh ^"Economics, Nursing"] (19)
#35. [mh ^"Economics, Pharmaceutical"] (244)
#36. (economic* or cost or costs or costly or costing or price or prices or pricing or pharmacoeconomic*):ti,ab (54433)
#37. (expenditure* not energy):ti,ab (1017)
#38. "value for money":ti,ab (141)
#39. budget*:ti,ab (576)
#40. (or #29-#39) (59798)
#41. (energy or oxygen) near cost):ti,ab (380)
#42. (metabolic near cost):ti,ab (103)
#43. (energy or oxygen) near expenditure):ti,ab (2439)
#44. (or #41-#43) (2802)
#45. #40 not #44 (59283)
#46. #28 and #45 (3701)
#47. [mh ^"Mass screening"] (4763)
#48. ((early or earlier) near/3 (diagnos* or detecti* or screeni*)):ti,ab,kw (5205)
#49. [mh ^"Health Promotion"] (5074)
#50. [mh ^"Health Education"] (3527)
#51. [mh ^"Patient Education as Topic"] (8030)
#52. (awareness near/3 campaign*):ti,ab,kw (62)
#53. (health near/3 (promot* or educati*)):ti,ab,kw (15588)
#54. (patient near/3 educati*):ti,ab,kw (11396)
#55. [mh ^"Drug Prescriptions"] and [mh ^"Physician's Practice Patterns"] (147)
#56. ((accurate* or correct*) near/3 (prescribi* or prescripti*)):ti,ab,kw (36)
#57. [mh ^"Patient Compliance"] (9088)
#58. [mh ^"Medication Adherence"] (1672)
#59. ((medication* or patient*) near/3 (adhere* or complian*)):ti,ab,kw (21173)
#60. [mh ^"Smoking Cessation"] (3810)
#61. (smoking near/3 (cessation or quit* or stop*)):ti,ab,kw (7192)
#62. [mh ^"Self Care"] (3749)
#63. (support* near/3 (self-manag* or self-care)):ti,ab,kw (623)
#64. pulmonary next rehabilitat*:ti,ab,kw (1057)
#65. [mh "Immunization Programs"] (462)
#66. ((vaccine* or vaccinat* or immuni?at*) near/3 (program* or campaign*)):ti,ab,kw (1042)
#67. [mh ^"Delivery of Health Care, Integrated"] (352)
#68. ((integrat* or co-ordinate* or coordinate* or transmural* or comprehensive or seamless or new next model*): near/3 care):ti,ab,kw (1790)
#69. (or #47-#68) (62717)
#70. #46 and #69 (709)
#71. #46 and #69 Publication Year from 2007 to 2017, in Cochrane reviews (reviews and protocols) (32)
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

A17. NHS Evidence
URL/Interface: https://www.evidence.nhs.uk/
Search date: 15 May 2017
Records retrieved: 1

- (“lung diseases” OR “lung disease”) AND (cost* OR economic)
- (asthma or bronchiectasis or copd or “chronic obstructive pulmonary disease” or “cystic fibrosis” or “interstitial lung disease”) AND (cost* OR economic)
- (“pulmonary sarcoidosis” or “lung cancer” or “lung neoplasms” or mesothelioma or “obstructive sleep apnea”) AND (cost* OR economic)
- (pneumonia or “lower respiratory tract infections” or “pulmonary tuberculosis”) AND (cost* OR economic)

Records were screened for relevant studies by an information specialist.

A18. CEA Registry
URL/Interface: http://healtheconomics.tuftsmedicalcenter.org/cear4/
SearchingtheCEARegistry/SearchtheCEARegistry.aspx
Search date: 12 May 2017
Records retrieved: 18

Basic search was used. Boolean operators or date limits are not supported. Terms were searched separately and the results were screened for relevant studies by an information specialist.

- lung diseases
- asthma
- bronchiectasis
- copd
- chronic obstructive pulmonary disease
- cystic fibrosis
- interstitial lung disease
- pulmonary sarcoidosis
- lung cancer
- lung neoplasms
- mesothelioma
- obstructive sleep apnea
- pneumonia
- lower respiratory tract infections
- pulmonary tuberculosis
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

A19. Research Papers in Economics (RePeC)
URL/Interface: http://econpapers.repec.org/
Search date: 12 May 2017
Records retrieved: 1

- (“lung disease” or “lung diseases” or asthma or bronchiectasis or copd or “chronic obstructive pulmonary disease” or “cystic fibrosis” or “interstitial lung disease” or “pulmonary sarcoidosis” or “lung cancer” or “lung neoplasms” or mesothelioma or “obstructive sleep apnea” or pneumonia or “lower respiratory tract infections” or “pulmonary tuberculosis”) and (“screening programme” or “screening program” or “early diagnosis” or “earlier diagnosis” or “awareness campaign” or “awareness campaigns” or “health education” or “patient education” or “health promotion” or “accurate prescribing” or “medication adherence” or “drug adherence” or “smoking cessation” or “supported self-care” or “supported self-management” or “pulmonary rehabilitation” or “vaccination programs” or “vaccination programmes” or “integrated care” or “co-ordinated care” or “coordinated care” or “transmural care” or “comprehensive care”) and (“systematic review” or “meta-analysis” or “metaanalysis” or metaregression or “meta-regression” or “systematic overview”)

Title, abstract and keyword search option was used. The interface does not appear to support date limits. Results were ordered by date and screened for relevant studies by an information specialist.

A20. Health Services/Technology Assessment Texts (HSTAT)
URL/Interface: https://www.ncbi.nlm.nih.gov/books/NBK16710/
Search date: 11 May 2017
Records retrieved: 3

- lung diseases or asthma or bronchiectasis or copd or chronic obstructive pulmonary disease or cystic fibrosis or interstitial lung disease or pulmonary sarcoidosis or lung cancer or lung neoplasms or mesothelioma or obstructive sleep apnea or pneumonia or lower respiratory tract infections or pulmonary tuberculosis and (burden or cost or costing or resource use or economic) AND hstatcollect(filter) Limits: Publication year between 2007 and 2017

Records were screened for relevant studies by an information specialist.
Appendix B: Eligibility Criteria

Eligible studies for this review were those meeting the following criteria.

Population

The population of interest was adults and/or children with lung disease/respiratory illness including:

- Asthma;
- Bronchiectasis;
- COPD;
- Cystic fibrosis;
- Interstitial lung disease:
  - IPF;
  - Sarcoidosis;
- Lung cancer;
- Mesothelioma;
- Obstructive sleep apnoea;
- Pneumonia/lower respiratory tract infections;
- Respiratory tuberculosis.

Reports of mixed populations, including other less prevalent lung diseases such as asbestos-related conditions, were also eligible.

Geographic focus

Economic burden question

Studies assessing cost of illness for the UK were required.

Cost effectiveness of interventions question

Reviews of studies from the following countries were eligible:

- UK;
- France;
- Germany;
- Italy;
- Spain;
- Austria;
- North America;
- Australasia;
- Sweden;
- Norway;
- Finland;
- Denmark;
- Iceland.
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

Studies including multiple countries were only eligible if all of the countries were within these continents or if data for any eligible countries were reported separately.

Interventions

Economic burden question
The costs of policy and service interventions identified in the cost effectiveness studies were eligible for this question.

Cost effectiveness of interventions question
Eligible health policy and service interventions included, but were not limited to:

- Earlier diagnosis national screening programmes;
- Awareness campaigns;
- Drugs/accurate prescribing;
- Drug adherence;
- Smoking cessation;
- Supported self-management;
- Pulmonary rehabilitation;
- Vaccination programmes;
- Integrated care.

Eligible interventions were those that have been implemented or modelled at an international, national, regional or system-wide level, including within single-site health-related institutions, e.g. hospitals.

Studies modelling the cost effectiveness of drug treatments and other non-policy and service interventions were not eligible:

- Surgery, including transplantation;
- Physiotherapy;
- Radiotherapy.

Outcomes

Economic burden question
Eligible economic burden outcomes of interest were:

- Direct costs:
  - Primary care costs;
  - Hospital costs (inpatient and outpatient):
    - Costs associated with A&E admissions;
  - Community care costs;
  - Non-hospital treatment costs.
- Indirect costs:
  - Healthy years of life lost/mortality;
  - State benefits;
• Social care costs;
• Sickness absence:
  • Income loss;
  • Cost of productivity loss;
• Costs of presenteeism;
• Informal care.

Cost effectiveness of interventions question
Eligible cost effectiveness summary outcomes of interest were:

• Cost per quality-adjusted life years (QALYs);
• Cost per disability-adjusted life years (DALYs);
• Incremental cost effectiveness ratios (ICERs);
• Outcomes from cost-benefit analysis studies;
• Costs outcomes from cost-minimisation studies.

Meta-analyses of these outcomes were also eligible.

Study design

To produce this review within the available resource, we used a staged approach to retrieve study designs where we expected to get the most synthesised data.

Economic burden question

Cost of illness and burden of illness studies were eligible, along with reviews and health technology assessments (HTAs) reporting estimates of the burden of disease.

Studies reported as conference abstracts were not eligible for this review as they rarely provide adequate detail.

Cost effectiveness of interventions question

Reviews, systematic literature reviews (SLRs), meta-analyses or HTAs were prioritised. When these study types did not yield sufficient data to answer the questions, we expanded the scope of eligible study designs to the following types of primary studies published in the last five years:

• Cost effectiveness analyses;
• Cost-utility analyses;
• Cost-benefit analyses;
• Cost-minimisation analyses.

Studies reported as conference abstracts were not eligible for this review as they rarely provide adequate detail.
## Appendix C: Excluded Studies

### Table C.1: Economic burden question: excluded studies (23)

<table>
<thead>
<tr>
<th>Record</th>
<th>Exclusion reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citation</td>
<td>Ineligible reason</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
### Table C.2: Cost effectiveness question: excluded studies (28)

<table>
<thead>
<tr>
<th>Record</th>
<th>Exclusion reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cronin J, Murphy A, Savage E. Can chronic disease be managed through integrated care cost effectively? Evidence from a systematic review. Ir J Med Sci. 2017;05:05.</td>
<td>UK paper identified in this review has already been included</td>
</tr>
<tr>
<td>Reference</td>
<td>Comment</td>
</tr>
<tr>
<td>-----------</td>
<td>---------</td>
</tr>
</tbody>
</table>
Literature review: the economic costs of lung disease and the cost effectiveness of policy and service interventions

<table>
<thead>
<tr>
<th>Reference</th>
<th>Ineligible intervention</th>
</tr>
</thead>
</table>
We’re the only charity in the UK looking after the nation’s lungs. We offer hope, help and a voice.

Our research finds new treatments and cures.

Our support gives people who struggle to breathe the skills, knowledge and confidence to take control of their lives.

And our work means that one day everyone will breathe clean air with healthy lungs.