



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

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British
Thoracic
Society

blf.org.uk/policy

Authors



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[JAMES MAHON](#), Associate Reviewer

[CHRIS BARTLETT](#), Consultant

[JAANA ISOJARVI](#), Information Specialist

[MARY EDWARDS](#), Research Assistant

[JULIE GLANVILLE](#), Associate Director



**British
Thoracic
Society**

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.

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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

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

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.

1 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.¹ 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.² 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.²

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.³ Lung disease accounts for 115,000 deaths per year, and the UK has the fourth highest mortality rate from lung disease in Europe.³

'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.³

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.⁴ A BTS report from 2006 using different methodology estimated the cost of lung disease to be £6.6 billion per year.⁵

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>
2. <https://www.womenshealth.gov/publications/our-publications/fact-sheet/lung-disease.html>
3. https://cdn.shopify.com/s/files/1/0221/4446/files/The_Battle_for_Breath_report_48b7e0eedc5b-43a0-a25c-2593bf9516f4.pdf?7045701451358472254
4. *Estimating the economic burden of respiratory illness in the UK* – Early report draft provided to YHEC in confidence by BLF
5. <https://www.brit-thoracic.org.uk/document-library/delivery-of-respiratory-care/burden-of-lung-disease/burden-of-lung-disease-2006>

2 Objectives

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

	Inclusion criteria	Exclusion criteria
Population	<p>Adults and/or children with lung disease/ respiratory illness including:</p> <ul style="list-style-type: none"> • Asthma; • Bronchiectasis; • COPD; • Cystic fibrosis; • Interstitial lung disease: <ul style="list-style-type: none"> • Sarcoidosis; • IPF; • Lung cancer; • Mesothelioma; • Obstructive sleep apnoea; • Pneumonia/lower respiratory tract infections; • Respiratory tuberculosis. <p>Reports of mixed populations, including other less prevalent lung diseases such as asbestos-related conditions, were also eligible.</p>	<p>Conditions that are not lung disease or respiratory illnesses.</p>

	Inclusion criteria	Exclusion criteria
Intervention	<p>For the economic burden question, the costs of policy and service interventions identified in the cost effectiveness studies were eligible.</p> <p>For the cost effectiveness of interventions question, eligible health policy and service interventions included, but were not limited to:</p> <ul style="list-style-type: none"> • Earlier diagnosis national screening programmes; • Awareness campaigns; • Drugs/accurate prescribing; • Drug adherence; • Smoking cessation; • Supported self-management; • Pulmonary rehabilitation; • Vaccination programmes; • Integrated care. <p>Eligible interventions were those implemented or modelled at an international, national, regional or system-wide level including within single-site health-related institutions, e.g. hospitals.</p>	<p>For the cost effectiveness of interventions question, studies modelling the cost effectiveness of drug treatments and other non-policy and service interventions were not eligible:</p> <ul style="list-style-type: none"> • Surgery; • Physiotherapy; • Radiotherapy.
Outcomes	<p>Eligible economic burden outcomes were:</p> <ul style="list-style-type: none"> • Direct costs: <ul style="list-style-type: none"> • Primary care costs; • Hospital costs (inpatient and outpatient): <ul style="list-style-type: none"> • Costs associated with A&E admissions; • Community care costs; • Non-hospital treatment costs. • Indirect costs: <ul style="list-style-type: none"> • Healthy years of life lost/mortality; • State benefits; • Social care costs; • Sickness absence: <ul style="list-style-type: none"> • Income loss; • Cost of productivity loss; • Costs of presenteeism; • Informal care. <p>Cost effectiveness summary outcomes (also including cost-utility analyses and cost-benefit analyses) e.g.:</p> <ul style="list-style-type: none"> • Cost per QALY; • Cost per DALY; • ICERs; • Outcomes from cost-benefit analysis studies, e.g. costs per X avoided; • Costs outcomes from cost-minimisation studies). <p>Meta-analyses of these outcomes were also eligible.</p>	<p>For the cost effectiveness of interventions question, studies not reporting outcomes in terms of cost effectiveness, cost-utility analysis, cost-benefit analysis or cost-minimisation analysis were not eligible.</p>

	Inclusion criteria	Exclusion criteria
Study types	<p>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.</p> <p>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.</p> <p>For the cost effectiveness of interventions question, review articles, SLRs, meta-analyses or HTAs were prioritised.</p> <p>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:</p> <ul style="list-style-type: none"> • Cost effectiveness analyses; • Cost-utility analyses; • Cost-benefit analyses; • Cost-minimisation analyses. 	Conference abstracts.
Limits	<p>For the economic burden question, only studies based in the UK were eligible.</p> <p>For the cost effectiveness of interventions question, reviews of studies from the following countries were eligible:</p> <ul style="list-style-type: none"> • Europe (including the UK); • North America; • Australasia. <p>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.</p>	<p>For the economic burden question any country other than the UK was excluded.</p> <p>For the cost effectiveness of interventions question, studies including countries not in Europe, North America or Australasia were not eligible unless data were stratified.</p>

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 UK⁶, 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).

6. Validated MEDLINE and Embase UK filters; https://medicinesevents.nice.org.uk/NPC/media/uploaded/EVNPC/event_237/2016_JID_-_UK_filters_handout.docx

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 (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 tumor?) 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\$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 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 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.

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 tumor?) 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)

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 (cessation 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 metasyntes\$ 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

Database / information source	Interface / URL
MEDLINE and Medline in process	Ovid SP
Embase	Ovid SP
Cochrane Database of Systematic Reviews	Cochrane Library
Database of Abstracts of Reviews of Effects	Cochrane Library
NHS EED	Cochrane Library
Health Technology Assessment Database	Cochrane Library
NHS Evidence (this also searches NICE publications)	https://www.evidence.nhs.uk/
CEA registry	http://healtheconomics.tuftsmedicalcenter.org/cear4/SearchingtheCEARegistry/SearchtheCEARegistry.aspx
Research Papers in Economics (RePeC)	http://repec.org/
Health Services/Technology Assessment Texts (HSTAT)	https://www.ncbi.nlm.nih.gov/books/NBK16710/

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 software⁷.

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,

7. Thomson Reuters. Endnote [X8 for Windows & Mac]. [program] Philadelphia: Thomson Reuters; 2015. Available from: <http://endnote.com/>

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.

4 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

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

4.1.2 Cost effectiveness searches

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

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

4.2 Record selection

4.2.1 Economic burden searches

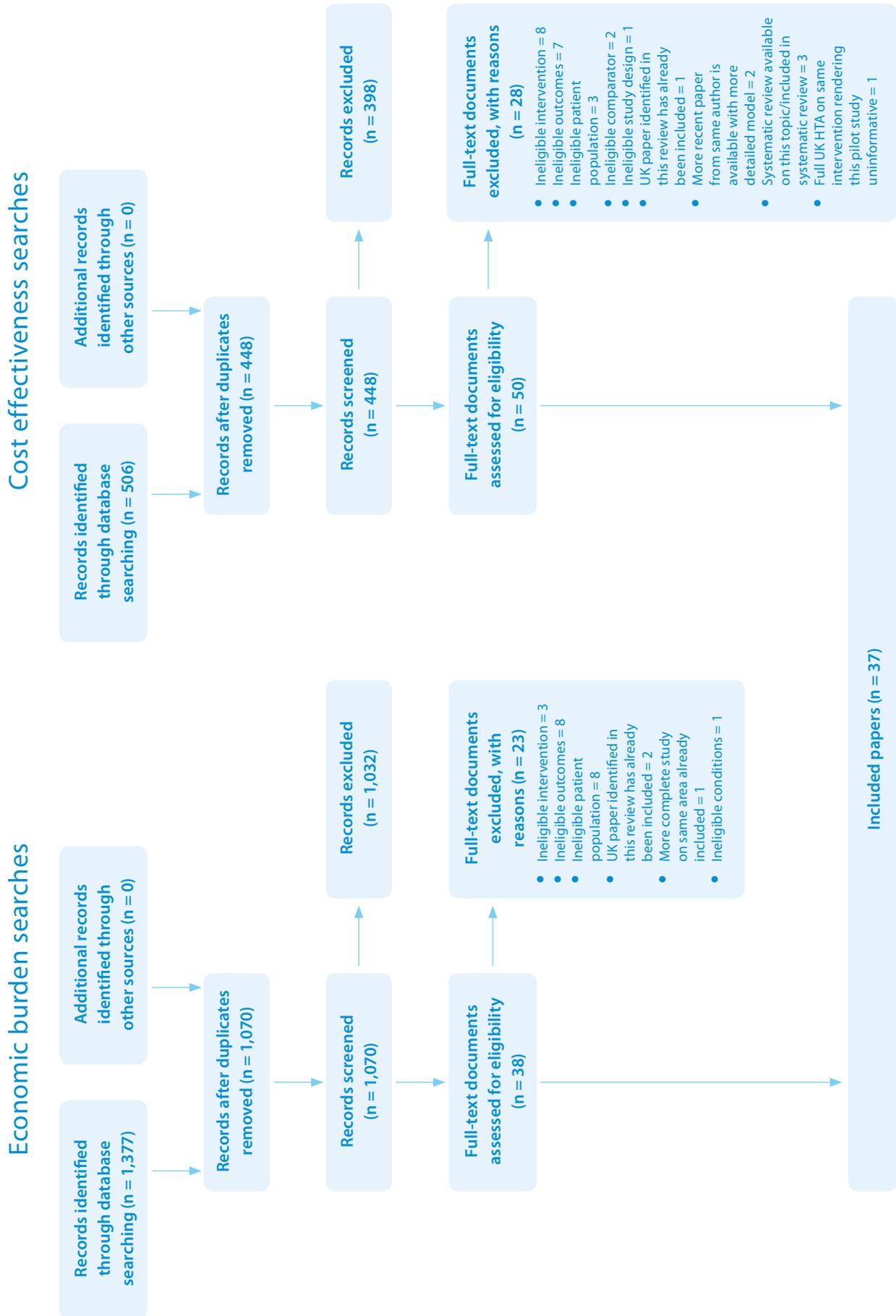
Following deduplication, 1,070 records were screened. Thirty-eight records were selected for review of full texts, with 15 documents selected for the review and 23 documents excluded from the review with reasons.

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).

Figure 4.1: Flow diagram of the record selection process



4.3 Economic burden review: results

4.3.1 Asbestos-related mesothelioma

One paper (Watterson 2006¹) 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 2009² and Gupta 2004³), two were cost of illness studies (Mukherjee 2016⁴ and Ayres 2011⁵), and one was a literature review (Bahadori 2009⁶). Total annual direct costs in the most recent UK population-wide study⁴ were £964.9m, with annual indirect costs (state benefits only) estimated to be £146.9m.

Table 4.3: Asbestos-related mesothelioma: study details

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

NR = not reported

Table 4.4: Asbestos-related mesothelioma: direct costs

Study	Population costs or average patient costs	Primary care consultations	Community prescriptions	Hospital costs	Community care costs	Non-hospital treatment costs	Total direct costs
Watterson	Total population	NR	NR	£0.9m	NR	NR	£0.9m

NR = not reported

Table 4.5: Asthma: study summaries

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

NR = not reported

Table 4.6: Asthma: direct costs

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

NR = not reported

Table 4.7: Asthma: indirect costs

Study	Population costs or average patient costs	State benefits	Social care costs	Income loss	Productivity loss	Presenteeism	Informal care	Total indirect costs
Anandan	Total population	NR	NR	NR	NR	NR	NR	NR
Bahadori	Average patient	NR	NR	NR	NR	NR	NR	NR
Gupta	Total population	NR	NR	NR	NR	NR	NR	NR
Mukherjee	Total population	£146.932m	NR	NR	NR	NR	NR	£146.9m
Ayres	Total population	NR	NR	NR	NR	NR	NR	NR

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 2006⁷, McLean 2016⁸ and Punekar 2015⁹). 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 2015¹⁰, 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

Study	Study type	Population	Whole population or Sample (n)	Country	Year of study	Cost year	Timeframe	Direct costs	Indirect costs	Healthy life lost
Murtagh	Cost of illness	COPD	Sample (49)	Northern Ireland	2000	NR	Annual	£172 per patient	NR	NR
McLean	Cost of illness	COPD	Whole population	England and Scotland	2016	NR	Annual	England: 2011 £1.50bn. 2030 £2.32bn. Scotland: 2011 £159m. 2030 £207m	NR	NR
Punekar	Cost of illness	COPD (newly diagnosed)	Sample (7,881)	UK	2008–2009	2011	Two years from diagnosis	£2,047 per patient	NR	NR

NR = not reported

Table 4.9: COPD: direct costs

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

NR = not reported

Table 4.10: Cystic fibrosis: study summary

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

NR = not reported

Table 4.11: Cystic fibrosis: direct costs

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

NR = not reported

Table 4.12: Cystic fibrosis: indirect costs

Study	Population costs or average patient costs	State benefits	Social care costs	Income loss	Productivity loss	Presenteeism	Informal care	Total indirect costs
Angelis	Average patient	NR	€47	NR	€6,222	NR	€21,447	€27,716 per patient

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 2008¹¹ and Oliver 2001¹²). 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 2014¹³, 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

Study	Study type	Population	Whole population or Sample (n)	Country	Year of study	Cost year	Timeframe	Direct costs	Indirect costs	Healthy life lost
Fleming	Cost of illness	Lung cancer	Whole population (724)	Northern Ireland	2001	2004	Annual (from presentation)	Total hospital costs in 12 months from presentation: £4.0m	NR	NR
Oliver	Cost of illness	Lung cancer	Sample (109)	England	1994–97	1999	From diagnosis to death	£11,556 per patient	NR	NR

NR = not reported

Table 4.14: Lung cancer: direct costs

Study	Population costs or average patient costs	Primary care consultations	Community prescriptions	Hospital costs	Community care costs	Non-hospital treatment costs	Total direct costs
Fleming	Average patient	NR	NR	£4.0m	NR	NR	£4.0m
Oliver	Total population	NR	NR	NR	NR	NR	£11,556 per patient

NR = not reported

Table 4.15: Pertussis: study summary

Study	Study type	Population	Whole population or Sample (n)	Country	Year of study	Cost year	Timeframe	Direct costs	Indirect costs	Healthy life lost
Van Hoek	Cost of illness	Pertussis	Sample (639)	UK	2012	2012	Course of infection	£56 per patient	NR	Loss of 0.097 QALYs infection period

NR = not reported

Table 4.16: Pertussis: direct costs

Study	Population costs or average patient costs	Primary care consultations	Community prescriptions	Hospital costs	Community care costs	Non-hospital treatment costs	Total direct costs
Van Hoek	Average patient	NR	NR	NR	NR	NR	£56 per patient

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 2013¹⁴) was a meta-analysis; the second (Van Eeden 2016¹⁵) 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

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

Italics = data were sourced from a systematic review

Table 4.18: Asthma: cost effectiveness study results

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
Jassal	Environmental education and/or environmental changes	Cost consequence	Societal	Annual savings	NR	NR	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.
<i>Gallefos</i>	Self-management	Cost consequence	Societal	NR	NR	NR	Cost saving of between 3,400 NOK and 4,500 NOK per patient with improved health outcomes
<i>Kauppinen</i>	Self-management	Cost consequence	NR	5 years	NR	NR	No significant difference in clinical and health related outcomes at 5 years but fewer sickness days with self-management
<i>McLean</i>	Self-management	Cost consequence	NR	NR	NR	NR	Cost savings of \$201 per patient with improved health outcomes and reduced days off work with self-management
<i>Van de Meer</i>	Self-management	Cost utility	Societal	NR	\$26,700 per QALY gained with intervention	NR	NR

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
<i>Schermer</i>	Self-management	Cost utility	Societal	NR	Intervention is less costly (-€13) and generates more QALYs (+0.024) compared to usual care and so dominates	NR	NR

Italics = data were sourced from a systematic review; NOK = Norwegian Kroner; NR = not reported

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 2015¹⁶, Baker 2017¹⁷ and Kirsch 2015¹⁸), two were meta-analyses (Boland 2013¹⁹ and Hoogendoorn 2010²⁰) and one was an economic model based upon a meta-analysis (Jordan 2015²¹). The remaining six papers were primary studies (Boland 2015²², Boven 2014²³, Christenhusz 2012²⁴, de San Miguel 2013²⁵, Paré 2013²⁶ and Mullen 2015²⁷). 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

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

Study	From literature review	Country	Study year	Sample size	Intervention	Intervention detail	Comparator
<i>Sridhar</i>	Yes (Baker)	UK	2006	122	Nurse-led self-management	NR	Usual care
Boland	Meta-analysis	Netherlands (perspective)	2013	c.1,600 across trials	Disease management	Integrated, bespoke approaches	Usual care
Boven	No	Belgium	2013	Hypothetical model	Improving medication adherence	Optimisation of medication through community pharmacists assessing adherence and inhaler technique	Usual care
Christenhusz	No	Netherlands	2002	225	Smoking cessation programme	Intensive smoking cessation support including individual counselling, group sessions and medications	Minimal intervention (not described)
Hoogendoorn	Meta-analysis (9 studies including Christenhusz)	Netherlands	2009	c.7,000 across studies	Smoking cessation programme	Minimal counselling, intensive counselling, counselling + pharmacotherapy	Usual care
Jordan	Economic model based upon meta-analysis	UK	2015	Hypothetical model	Self-management	Intensive self-management following exacerbation	Usual care
<i>Menn</i>	Yes (Kirsch)	NR	2012	NR	Smoking cessation programme	Nicotine gum plus group therapy	Advice to stop smoking

Study	From literature review	Country	Study year	Sample size	Intervention	Intervention detail	Comparator
<i>Chandra</i>	Yes (Kirsch)	NR	2012	NR	Smoking cessation programme	Intensive counselling, NRT, Intensive counselling + NRT	Usual care and placebo
<i>Atsou</i>	Yes (Kirsch)	NR	2011	NR	Smoking cessation programme	Smoking cessation programme	Usual care
<i>Hurley</i>	Yes (Kirsch)	NR	2008	NR	Smoking cessation programme	Australian National Tobacco Campaign	None
de San Miguel	No	Australia	2013	80	Telehealth remote monitoring	Telehealth equipment installed in patients' homes that measured and automatically sent key vital signs	Information only
Paré	No	Canada	2013	60	Telehealth remote monitoring	Telemonitoring equipment with patient having to send data over the internet	Usual care
Mullen	No	Canada	2014	956	Smoking cessation programme	Smoking cessation delivered in hospital including patient advice, pharmacotherapy and educational guidance	Usual care

Italics = data were sourced from a systematic review;
 NR = not reported; NRT = Nicotine replacement therapy

Table 4.20: COPD: cost effectiveness study results

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
Boland	Multidisciplinary care	Cost utility	Societal	2 years	Dominated by usual care (intervention was more costly with fewer QALYs)	NR	NR
Waterhouse	Pulmonary rehabilitation in hospital	Cost utility	NHS	18 months	£28,250 per QALY gained	NR	NR
Bourbeau	Nurse-led self-management	Cost consequence	Third party payer	NR	NR	NR	Additional costs of intervention exceeded savings by €440 per patient
Gallefoss	Nurse-led self-management	Cost effectiveness	Societal	NR	NR	NR	Self-management saved 9,300 NOK per person
Monnikhof	Nurse-led self-management	Cost utility	Societal	NR	Dominated by usual care (self-management was more costly and no more effective)	NR	NR
Sridhar	Nurse-led self-management	Cost consequence	NHS	NR	NR	NR	Usual care costs (including unscheduled healthcare) were £10.70 lower per patient than nurse-led self-management

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
Boland	Disease management	Cost consequence (meta-analysis of 7 trials)	Health care provider	Annual savings	NR	NR	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
Boven	Improving medication adherence	Cost utility	Health care provider	1 year	Dominant. Saved money and generated QALYs (<0.001 QALY gain)	NR	Cost saving (including exacerbation, medication and pharmacy costs) of €227 per patient with intervention
Hoogendoorn	Smoking cessation programme	Cost utility	Health care provider	25 years	Compared to usual care: Intensive counselling €8,200 per QALY gained; Minimal counselling €16,900 per QALY gained; Intensive counselling + pharmacotherapy €2,400 per QALY gained	NR	NR

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
Christenhusz	Smoking cessation programme	Cost consequence	Health care provider	1 year	NR	NR	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
Jordan	Self-management	Cost utility	NHS	30 years	£8,218 per QALY gained with intensive self-management compared to usual care	NR	NR
Menn	Smoking cessation programme	Cost utility	Societal	60 years	Intervention is less costly (-€1,185) and generates more QALYs (+0.54) compared to advice alone	NR	NR

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
<i>Chandra</i>	Smoking cessation programme	Cost utility	Third party payer	NR	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	NR	NR
<i>Atsou</i>	Smoking cessation programme	Cost utility	Societal	Lifetime	Intervention is less costly (-€2,127) and generates more QALYs (+0.679) compared to usual care. However, costs of intervention were not included	NR	NR
<i>Hurley</i>	Smoking cessation programme	Cost consequence	Third party payer	Lifetime	NR	NR	Campaign avoided 32,668 cases of COPD and saved €257m
de San Miguel	Telehealth remote monitoring	Cost consequence	Third party payer	6 months	NR	NR	Cost savings of AUS\$2,931 per patient after cost of intervention

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
Paré	Telehealth remote monitoring	Cost consequence	Third party payer	6 months	NR	NR	Telehealth generated a saving of CAN\$1,613 per patient or a return on investment of 14%
Mullen	Smoking cessation programme	Cost utility	Third party payer	Lifetime	Cessation programme is dominant (costs less and generates more QALYs than usual care)	NR	NR

Italics = data were sourced from a systematic review; COPD = Chronic Obstructive Pulmonary Disease;

NOK = Norwegian Krone; NR = not reported; QALY= Quality-Adjusted Life Year

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 2014²⁸, Hinde 2015²⁹ and Villanti 2013³⁰) and one paper was a systematic review (Raymakers 2016³¹). One study²⁹ 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.

Table 4.21: Lung cancer: cost effectiveness study details

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

Study	From literature review	Country	Study year	Sample size	Intervention	Intervention detail	Comparator
<i>Marshall</i>	Yes (Raymakers 2016)	US	2001	NR	Screening (Low dose computed tomography)	One-time screening of 60–74-year-olds (low and high risk)	No screening
<i>McMahon</i>	Yes (Raymakers 2016)	US	2011	NR	Screening (Low dose computed tomography)	Annual screening of 50–74-year-olds	No screening
<i>Pyenson</i>	Yes (Raymakers 2016)	US	2012	NR	Screening (Low dose computed tomography)	NR	No screening
<i>Pyenson (2)</i>	Yes (Raymakers 2016)	US	2014	NR	Screening (Low dose computed tomography)	NR	No screening
<i>Shemueli</i>	Yes (Raymakers 2016)	Israel	2013	NR	Screening (Low dose computed tomography)	NR	No screening

Italics = data were sourced from a systematic review;

NR = not reported

Table 4.22: Lung cancer: cost effectiveness study results

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
Black	Screening	Cost utility	Societal	Lifetime	\$81,000 per QALY gained	NR	NR
Hinde	Public awareness campaigns	Cost utility	NHS	Lifetime	£13,660 per QALY gained for regional campaign. £18,173 per QALY gained for national campaign	NR	NR
Villanti	Screening with and without smoking cessation	Cost utility	Third party payer	15 years	\$28,240–\$47,115 for screening alone. \$23,185–\$35,545 for screening with smoking cessation	NR	NR
<i>Beinfeld</i>	Screening (Low dose computed tomography)	Cost effectiveness	Societal	Lifetime	NR	\$161,000 per LYG	NR
<i>Black</i>	Screening (Low dose computed tomography)	Cost utility	Societal	Lifetime	\$89,381 per QALY gained	NR	NR
<i>Chirikos</i>	Screening (Low dose computed tomography)	Cost utility	Third party payer	15 years	NR	\$66,479 per LYG	NR
<i>Mahadevia</i>	Screening (Low dose computed tomography)	Cost utility	Societal	20 years	\$116,300 per QALY gained	NR	NR

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
<i>Manser</i>	Screening (Low dose computed tomography)	Cost utility	Third party payer	15 years	\$105,090 per QALY gained	NR	NR
<i>Marshall</i>	Screening (Low dose computed tomography)	Cost utility	NR	5 years	\$27,756 per QALY gained	NR	NR
<i>Marshall</i>	Screening (Low dose computed tomography)	Cost effectiveness	NR	5 years	NR	\$8,460 per LYG	NR
<i>McMahon</i>	Screening (Low dose computed tomography)	Cost utility	Societal	Lifetime	\$169,097–\$243,077 per QALY gained	NR	NR
<i>Pyenson</i>	Screening (Low dose computed tomography)	Cost utility	Third party payer	15 years	NR	\$19,448 per LYG	NR
<i>Pyenson (2)</i>	Screening (Low dose computed tomography)	Cost utility	Third party payer	Lifetime	NR	\$18,452 per LYG	NR
<i>Shemueli</i>	Screening (Low dose computed tomography)	Cost effectiveness	Health care provider	Lifetime	\$1,540 per QALY gained	NR	NR

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 2008³², 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

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

Italics = data were sourced from a systematic review;

NR = not reported

Table 4.24: Pertussis: cost effectiveness study results

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

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 2013³³, Chen 2014³⁴ and Evers 2007³⁵, 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

Study	From literature review	Country	Study year	Sample size	Intervention	Intervention detail	Comparator
Boccalini	No	Italy	2012	Hypothetical model	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	No vaccination
Chen	No	USA	2012	Hypothetical model	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	No vaccination
Evers	No	England and Wales, Scotland, 8 other Western European countries	2007	Hypothetical model	Vaccination	Vaccination in people over 65	No vaccination

Italics = 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

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
Boccalini	Vaccination	Cost utility	Health care provider	5 years	PCV13: 1 Cohort €16,987. 2 cohorts €19,289. 3 cohorts €22,109. PCV13+PPV23: 1 Cohort €21,493. 2 cohorts €24,443. 3 cohorts €27,866	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	NR
Chen	Vaccination	Cost utility	Third party payer	Lifetime	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	NR	NR
Evers	Vaccination	Cost utility	Health care provider	Lifetime	England and Wales €17,228 per QALY gained. Scotland €13,920 per QALY gained	NR	NR

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

Study	From literature review	Country	Study year	Sample size	Intervention	Intervention detail	Comparator
Perraudin	No	Australia	2013	Hypothetical model	Screening	Community pharmacist screening programme	No screening

Table 4.28: Sleep apnoea: cost effectiveness study results

Study	Intervention	Type of analysis	Perspective	Time horizon	ICER	Cost effectiveness outcomes	Cost outcomes
Perraudin	Screening	Cost utility	Societal	5 years	Screening with community pharmacist is dominant to no screening (costing less and generating more QALYs)	NR	NR

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

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

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

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

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 search³⁸. 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.

5 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.

6

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7 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

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 tumor?) 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\$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 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 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)

A2. Embase <1974 to 2017 May 11>

URL/Interface: OvidSP

Search date: 12 May 2017

Records retrieved: 538

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. "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 metasyntes\$ 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)

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 (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 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,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 africa/ or exp asia/ or exp "australia and new zealand"/) not (united kingdom/ or europe/) (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)

A3. Database of Abstracts of Reviews of Effect (DARE), Issue 2 of 4, April 2015**URL/Interface: Cochrane Library, Wiley****Search date: 12 May 2017****Records retrieved: 217**

- #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 ^"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 (13888)
- #42. (costing near/3 (illness* or disease* or sickness*)):ti (0)
- #43. (burden near/3 (illness* or disease* or sickness*)):ti (119)

- #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 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*)))))) (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 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 tumor*) 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 (13888)
- #42. (costing near/3 (illness* or disease* or sickness*)):ti (0)
- #43. (burden near/3 (illness* or disease* or sickness*)):ti (119)

- #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 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*)))))) (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 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 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 tumor*) 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 (13888)
- #42. (costing near/3 (illness* or disease* or sickness*)):ti (0)
- #43. (burden near/3 (illness* or disease* or sickness*)):ti (119)

- #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 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*)))))) (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 Economic Evaluations (206)

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 dilat*)):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 tumor*) 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)

- #44. (economic near/3 consequence*):ti (68)
- #45. costs.ti (1)
- #46. {or #42-#45} (188)
- #47. #28 and #46 (17)
- #48. #41 or #47 (10340)
- #49. [mh "Great Britain"] (6624)
- #50. (national next health next service* or nhs*):ti,ab,kw (2328)
- #51. (english not ((published or publication* or translat* or written or language* or speak* or literature or citation*) near/5 english)):ti,ab,kw (3251)
- #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*):ti,ab,kw (24885)
- #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 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,kw (12104)
- #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"):ti,ab,kw (248)
- #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"):ti,ab,kw (3493)
- #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"):ti,ab,kw (147)
- #57. {or #51-#56} (38046)
- #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 (37370)
- #60. #48 and #59 Publication Year from 2000 to 2017, in Cochrane Reviews (Reviews and Protocols) (22)

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/>**Searching the CEA Registry/Search the CEA Registry.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

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 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.

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 dilat\$)).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 tumor\$) 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 apnea.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)
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 (cessation 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)

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 dilat\$)).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 pharmacoeconomics/ (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,kf. (35390)
67. or/45-66 (846311)
68. 44 and 67 (8602)
69. (systematic adj3 review).ti,kw. (85482)
70. (meta-analy\$ or metaanaly\$ or meta-synthes\$ or metasyntes\$ 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)

A13. Database of Abstracts of Reviews of Effect (DARE), Issue 2 of 4, April 2015**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)

- #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. ((integrat* 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 Other Reviews (105)

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. ((integrat* 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)

- #44. [mh ^"Self Care"] (3749)
- #45. (support* near/3 (self-manag* or self-care)) (706)
- #46. pulmonary next rehabilitat* (1194)
- #47. [mh "Immunization Programs"] (462)
- #48. ((vaccine* or vaccinat* or immuni?at*) near/3 (program* or campaign*)) (1395)
- #49. [mh ^"Delivery of Health Care, Integrated"] (352)
- #50. (((integrat* or co-ordinate* or coordinate* or transmural* or comprehensive or seamless or new next model*) near/3 care) (2322)
- #51. {or #29-#50} (68556)
- #52. #28 and #51 Publication Year from 2007 to 2017, in Economic Evaluations (153)

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)

- #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)

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>**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

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.

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.

9 Appendix C: Excluded Studies

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

Record	Exclusion reason
Angelis A, Tordrup D, Kanavos P. Socio-economic burden of rare diseases: A systematic review of cost of illness evidence. <i>Health Policy</i> . 2015;119(7):964-79.	Ineligible outcomes
Chaker L, Falla A, van der Lee SJ, Muka T, Imo D, Jaspers L, et al. The global impact of non-communicable diseases on macro-economic productivity: a systematic review. <i>Eur J Epidemiol</i> . 2015;30(5):357-95.	Ineligible outcomes
Chapmann KR, Mannino DM, Soriano JB, Vermeire PA, Buist AS, Thun MJ, et al. Epidemiology and costs of chronic obstructive pulmonary disease. <i>Eur Respir J</i> . 2006;27(1):188-207.	Ineligible outcomes
Chevreur K, Michel M, Brigham KB, Lopez-Bastida J, Linertova R, Oliva-Moreno J, et al. Social/economic costs and health-related quality of life in patients with cystic fibrosis in Europe. <i>Eur J Health Econ</i> . 2016;17(Suppl 1):7-18.	Ineligible intervention
Chung F, Barnes N, Allen M, Angus R, Corris P, Knox A, et al. Assessing the burden of respiratory disease in the UK. <i>Respir Med</i> . 2002;96(12):963-75.	Ineligible outcomes
Dasgupta R, Guest JF. Factors affecting UK primary-care costs of managing patients with asthma over 5 years. <i>Pharmacoeconomics</i> . 2003;21(5):357-69.	Ineligible patient population
Guest JF, Ruiz FJ, Greener MJ, Trotman IF. Palliative care treatment patterns and associated costs of healthcare resource use for specific advanced cancer patients in the UK. <i>Eur J Cancer Care</i> . 2006;15(1):65-73.	More complete study on same area already included
Izquierdo-Alonso JL, de Miguel-Diez J. Economic impact of pulmonary drugs on direct costs of stable chronic obstructive pulmonary disease. <i>COPD</i> . 2004;1(2):215-23.	Ineligible patient population
Kennedy MPT, Hall PS, Callister MEJ. Secondary-care costs associated with lung cancer diagnosed at emergency hospitalisation in the United Kingdom. <i>Thorax</i> . 2017;January 30:e-pub.	Ineligible patient population
Linneberg A, Dam Petersen K, Hahn-Pedersen J, Hammerby E, Serup-Hansen N, Boxall N. Burden of allergic respiratory disease: a systematic review. <i>Clin Mol All</i> . 2016;14:12.	Ineligible patient population
London SJ, Romieu I. Health costs due to outdoor air pollution by traffic. <i>Lancet</i> . 2000;356(9232):782-83.	Ineligible patient population

Lopez AD, Shibuya K, Rao C, Mathers CD, Hansell AL, Held LS, et al. Chronic obstructive pulmonary disease: Current burden and future projections. <i>Eur Respir J</i> . 2006;27(2):397-412.	UK paper identified in this review has already been included
Marti J, Hall P, Hamilton P, Lamb S, McCabe C, Lall R, et al. One-year resource utilisation, costs and quality of life in patients with acute respiratory distress syndrome (ARDS): Secondary analysis of a randomised controlled trial. <i>J Intensive Care</i> . 2016;4 (1)(56)	Ineligible intervention
McIntosh ED, Conway P, Willingham J, Lloyd A. The cost-burden of paediatric pneumococcal disease in the UK and the potential cost effectiveness of prevention using 7-valent pneumococcal conjugate vaccine. <i>Vaccine</i> . 2003;21(19-20):2564-72.	Ineligible patient population
Melegaro A, Edmunds WJ, Pebody R, Miller E, George R. The current burden of pneumococcal disease in England and Wales. <i>J Infect</i> . 2006;52(1):37-48.	Ineligible outcomes
Muka T, Imo D, Jaspers L, Colpani V, Chaker L, van der Lee SJ, et al. The global impact of non-communicable diseases on healthcare spending and national income: a systematic review. <i>Eur J Epidemiol</i> . 2015;30(4):251-77.	Ineligible intervention
Neville RG, Hoskins G, Smith B, McCowan C. The economic and human costs of asthma in Scotland. <i>Prim Care Respir J</i> . 2003;12(4):115-18.	Ineligible outcomes
Nkonki L, Tugendhaft A, Hofman K. A systematic review of economic evaluations of CHW interventions aimed at improving child health outcomes. <i>Hum Resour Health</i> . 2017;15(1):19.	Ineligible patient population
Oppong R, Coast J, Hood K, Nuttall J, Smith RD, Butler CC, et al. Resource use and costs of treating acute cough/lower respiratory tract infections in 13 European countries: results and challenges. <i>Eur J Health Econ</i> . 2011;12(4):319-29.	UK paper identified in this review has already been included
Srivastava K, Thakur D, Sharma S, Puneekar YS. Systematic review of humanistic and economic burden of symptomatic chronic obstructive pulmonary disease. <i>Pharmacoeconomics</i> . 2015;33(5):467-88.	Ineligible outcomes
Trueman D, Woodcock F, Hancock E. Estimating the economic burden of respiratory illness in the UK. London: British Lung Foundation (BLF); 01 March 2017. Available from: https://cdn.shopify.com/s/files/1/0221/4446/files/PC-1601_-_Economic_burden_report_FINAL_8cdaba2a-589a-4a49-bd14-f45d66167795.pdf?1309501094450848169 .	Ineligible conditions
Valtorta NK, Hanratty B. Socioeconomic variation in the financial consequences of ill health for older people with chronic diseases: A systematic review. <i>Maturitas</i> . 2013;74(4):313-33.	Ineligible patient population
Vervloet D, Williams AE, Lloyd A, Clark TJH. Costs of managing asthma as defined by a derived Asthma Control Test™ score in seven European countries. <i>Eur Respir Rev</i> . 2006;15(98):17-23.	Ineligible outcomes

Table C.2: Cost effectiveness question: excluded studies (28)

Record	Exclusion reason
Cronin J, Murphy A, Savage E. Can chronic disease be managed through integrated care cost effectively? Evidence from a systematic review. <i>Ir J Med Sci.</i> 2017;05:05.	UK paper identified in this review has already been included
Abdel-Aleem H, El-Gibaly Omaima MH, FE-S EL-GA, Al-Attar Ghada ST. Mobile clinics for women's and children's health. <i>Cochrane Database Syst Rev.</i> 2016(8):Art. No.: CD009677.	Ineligible outcomes
Boswell KA, Cook CL, Burch SP, Eaddy MT, Ron Cantrell C. Associating medication adherence with improved outcomes: A systematic literature review. <i>Am J Pharm Benefits.</i> 2012;4(4):e97-e108.	Ineligible outcomes
Campo MT, Fouad H, Solis-Bravo MM, Sanchez-Uriz MA, Mahillo-Fernandez I, Esteban J. Cost effectiveness of different screening strategies (single or dual) for the diagnosis of tuberculosis infection in healthcare workers. <i>Infect Control Hosp Epidemiol.</i> 2012;33(12):1226-34.	Systematic review available on this topic
Canadian Agency for Drugs and Technologies in Health (CADTH). Continuous positive airway pressure compared with oral devices or lifestyle changes for the treatment of obstructive sleep apnea: a review of the clinical and cost effectiveness. <i>HTA Database.</i> 2014; (4): 1-18. Available from: http://onlinelibrary.wiley.com/o/cochrane/clhta/articles/HTA-32016000158/frame.html	Ineligible intervention
Centre for Policy on Ageing. Pulmonary rehabilitation for patients with chronic obstructive pulmonary disease. London: Centre for Policy on Ageing; 01 May 2014. Available from: http://www.cpa.org.uk/information/reviews/CPA-Rapid-Review-Pulmonary-Rehabilitation-for-patients-with-Chronic-Obstructive-Pumonary-Disease.pdf .	Ineligible outcomes
Cox NS, Alison JA, Rasekaba T, Holland AE. Telehealth in cystic fibrosis: a systematic review. <i>J Telemed Telecare.</i> 2012;18(2):72-78.	Ineligible outcomes
de Bruin SR, Heijink R, Lemmens LC, Struijs JN, Baan CA. Impact of disease management programs on healthcare expenditures for patients with diabetes, depression, heart failure or chronic obstructive pulmonary disease: a systematic review of the literature. <i>Health Policy.</i> 2011;101(2):105-21.	More recent review available that covers same studies
Dretzke J, Blissett D, Dave C, Mukherjee R, Price M, Bayliss S, et al. The cost effectiveness of domiciliary non-invasive ventilation in patients with end-stage chronic obstructive pulmonary disease: A systematic review and economic evaluation. <i>Health Technol Assess.</i> 2015;19(81):1-246.	Ineligible intervention
Ganguli A, Clewell J, Shillington AC. The impact of patient support programs on adherence, clinical, humanistic, and economic patient outcomes: A targeted systematic review. <i>Patient Prefer Adherence.</i> 2016;10:711-25.	Ineligible outcomes
Goffin JR, Flanagan WM, Miller AB, Fitzgerald NR, Memon S, Wolfson MC, et al. Cost effectiveness of Lung Cancer Screening in Canada. <i>JAMA oncology.</i> 2015;1(6):807-13.	Systematic review available on this topic

Hatz MHM, Schremser K, Rogowski WH. Is individualized medicine more cost effective? A systematic review. <i>Pharmacoeconomics</i> . 2014;32(5):443-55.	Ineligible patient population
Hoogendoorn M, Rutten-van MMP, Hoogenveen RT, Al MJ, Feenstra TL. Developing and applying a stochastic dynamic population model for chronic obstructive pulmonary disease. <i>Value Health</i> . 2011;14(8):1039-47.	More recent paper from same author is available with more detailed model
Klok RM, Lindkvist RM, Ekelund M, Farkouh RA, Strutton DR. Cost effectiveness of a 10- versus 13-valent pneumococcal conjugate vaccine in Denmark and Sweden. <i>Clin Ther</i> . 2013;35(2):119-34.	Ineligible comparator
Loveman E, Copley VR, Colquitt JL, Scott DA, Clegg AJ, Jones J, et al. The effectiveness and cost effectiveness of treatments for idiopathic pulmonary fibrosis: systematic review, network meta-analysis and health economic evaluation. <i>BMC Pharmacol Toxicol</i> . 2014;15:63.	Ineligible outcomes
McQuaid EL, Garro A, Seifer R, Hammond SK, Borrelli B. Integrating asthma education and smoking cessation for parents: financial return on investment. <i>Pediatr Pulmonol</i> . 2012;47(10):950-55.	Ineligible outcomes
Najafzadeh M, Marra CA, Lynd LD, Sadatsafavi M, FitzGerald JM, McManus B, et al. Future impact of various interventions on the burden of COPD in Canada: a dynamic population model. <i>PLOS ONE</i> . 2012;7(10):e46746.	Ineligible study design
Nohlert, Helgason, Asgeir R, Tillgren, Tegelberg, Johansson. A comparison of the cost effectiveness of a high- and a low-intensity smoking cessation intervention in Sweden: a randomized trial. <i>Nicotine Tob Res</i> 2013;15(9):1519-27.	Ineligible comparator
Oberje EJM, De Kinderen RJA, Evers SMAA, Van Woerkum CMJ, De Bruin M. Cost effectiveness of medication adherence-enhancing interventions: A systematic review of trial-based economic evaluations. <i>Pharmacoeconomics</i> . 2013;31(12):1155-68.	Ineligible patient population
Pietsch JB, Garner A, Cipriano LE, Linehan JH. An integrated health-economic analysis of diagnostic and therapeutic strategies in the treatment of moderate-to-severe obstructive sleep apnea. <i>Sleep</i> . 2011;34(6):695-709.	Ineligible intervention
Pyenson BS, Sander MS, Jiang Y, Kahn H, Mulshine JL. An actuarial analysis shows that offering lung cancer screening as an insurance benefit would save lives at relatively low cost. <i>Health Aff</i> . 2012;31(4):770-79.	Included in systematic review
Rozenbaum MH, Hoek AJ, Fleming D, Trotter CL, Miller E, Edmunds WJ. Vaccination of risk groups in England using the 13 valent pneumococcal conjugate vaccine: economic analysis. <i>BMJ</i> . 2012;345(2):e6879.	Ineligible intervention
Ruger JP, Lazar CM. Economic evaluation of pharmaco- and behavioral therapies for smoking cessation: A critical and systematic review of empirical research. <i>Annu Rev Public Health</i> . 2012;33:279-305.	Ineligible patient population

Ryan D, Price D, Musgrave SD, Malhotra S, Lee AJ, Ayansina D, et al. Clinical and cost effectiveness of mobile phone supported self monitoring of asthma: multicentre randomised controlled trial. <i>BMJ</i> . 2012;344(2):e1756.	Ineligible intervention
Taylor SJ, Sohanpal R, Bremner SA, Devine A, McDaid D, Fernandez JL, et al. Self-management support for moderate-to-severe chronic obstructive pulmonary disease: a pilot randomised controlled trial. <i>Br J Gen Pract</i> . 2012;62(603):e687-95.	Full UK HTA on same intervention rendering this pilot study uninformative
Winn AN, Ekwueme DU, Guy GP, Neumann PJ. Cost-Utility Analysis of Cancer Prevention, Treatment, and Control: A Systematic Review. <i>Am J Prev Med</i> . 2016;50(2):241-48.	Ineligible intervention
Woods ER, Bhaumik U, Sommer SJ, Ziniel SI, Kessler AJ, Chan E, et al. Community Asthma Initiative: evaluation of a quality improvement program for comprehensive asthma care. <i>Pediatrics</i> . 2012;129(3):465-72.	Ineligible intervention
Zafari Z, Lynd LD, FitzGerald JM, Sadatsafavi M. Economic and health effect of full adherence to controller therapy in adults with uncontrolled asthma: a simulation study. <i>J Allergy Clin Immunol</i> . 2014;134(4):908-15 e3.	Ineligible intervention



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