National Institute for Clinical Excellence

Lung cancer

The diagnosis and treatment of lung cancer

National cost-impact report

Clinical Guideline 24
National cost-impact report to accompany 'Lung cancer: the diagnosis and treatment of lung cancer'

Issue date: February 2005

This report is an assessment of the costs of implementing the recommendations in 'Lung cancer: the diagnosis and treatment of lung cancer' and is available from the NICE website (www.nice.org.uk/CG024costtemplate).

The Institute's full guidance on lung cancer is available from the NICE website (www.nice.org.uk/CG024NICEguideline).

An abridged version of the guidance (a 'quick reference guide') is also available from the NICE website (www.nice.org.uk/CG024quickrefguide). Printed copies of the quick reference guide can be obtained from the NHS Response Line: telephone 0870 1555 455 and quote reference number N0825.

Information for the Public is available from the NICE website (www.nice.org.uk/CG024publicinfo) or from the NHS Response Line (quote reference number N0826 for a version in English and N0827 for a version in English and Welsh).

This guidance is written in the following context:

This report represents the view of the Institute, which was arrived at after careful consideration of the available data and through consulting healthcare professionals. It should be read in conjunction with the full guideline. The report and templates are implementation tools and focuses on those areas that were considered to have significant impact on resource utilisation.

It should be noted that the cost and activity assessments in the reports are estimates based on a number of assumptions. They provide an indication of the likely impact of the principal recommendations and are not absolute figures. Assumptions used in the report are based on assessment of the national average. Local practice may be different from this, and the template can be used to estimate local impact.

National Institute for Clinical Excellence

MidCity Place

71 High Holborn

London WC1V 6NA

www.nice.org.uk

Published by the National Institute for Clinical Excellence

February 2005

Contents

Executive summary

Background

This report looks at the cost impact of implementing the NICE Guideline ‘Lung cancer: the diagnosis and treatment of lung cancer’. The costing method adopted is outlined in Appendix A and uses the most accurate data available, and expert opinion.

The evaluation covers the impact in England and Wales; there are no appreciable differences in how lung cancer is diagnosed and treated in the two countries.

Method

The project followed a structured approach involving:

- background research into the Guideline content, current clinical practice, published information and data
- the development of models to identify the clinical and financial impact of the Guideline
- testing of assumptions, models and conclusions
- production of a final report encompassing research, results and conclusions
- production of a template that can be used to assess local impact.

We consider the assessment presented to be reasonable given the limited detailed data regarding diagnosis and treatment paths. It was produced in conjunction with key clinicians and reviewed by people with clinical and financial expertise.

Scope

Because of the breadth and complexity of the Guideline, the evaluation focuses on areas that are considered to require the most additional resources to implement. We identified these areas in conjunction with the Guideline Development Group and key clinicians. They are:

- providing access to positron emission tomography (PET) scanning
- performing computed tomography (CT) scans before bronchoscopy as part of diagnosis
- providing lung cancer nurse specialists
- providing continuous hyperfractionated accelerated radiotherapy (CHART) for patients undergoing radical radiotherapy
- providing adjuvant chemotherapy after surgical resection
- providing therapies for patients with advanced non-small-cell lung cancer (NSCLC).

A constraint to the evaluation was the lack of systematically collected data on current care pathways. Because of this, we used a number of assumptions in the costing model, and tested these with key clinicians.

Total cost impact

The annual revenue changes in costs arising from fully implementing the Guideline are summarised in Tables 1 and 2.

Table 1 Annual revenue changes in costs in England

Guideline recommendation	£000s	£000s
PET scanning		
additional cost of scans	7,532	
saving from reduced surgical resections	–870	
Net cost		**6,662**
CT before bronchoscopies		
additional cost of CT scans	292	
saving from reduced bronchoscopies	–1,465	
Net cost		–1,173
Increased lung cancer nurses		**2,011**
CHART		
additional cost of CHART	3,633	
saving from reduced conventional radiotherapy	–1,326	
Net cost		2,307
Adjuvant chemotherapy following surgical resection		**2,866**
Therapies for advanced cancer		
additional cost of chemotherapy	11,189	
saving from reduced radiotherapy	–614	
Net cost		**10,575**
GRAND TOTAL		**23,248**

In addition, significant capital expenditure may be needed to increase access to PET scanning facilities in England. This is predicted to be more than £62 million, and 25% of the anticipated workload of the scanners will be related to lung cancer.

Table 2 Annual revenue changes in costs in Wales

Guideline recommendation	£000s	£000s
PET scanning		
additional cost of scans	469	
saving from reduced surgical resections.	–57	
Net cost		**412**
CT before bronchoscopies		
additional cost of CT scans	18	
saving from reduced bronchoscopies	-91	
Net cost		**–73**
Increased lung cancer nurses		**114**
CHART		
additional cost of CHART	224	
saving from reduced conventional radiotherapy	–82	
Net cost		**142**
Adjuvant chemotherapy following surgical resection		**179**
Therapies for advanced cancer		
additional cost of chemotherapy	697	
saving from reduced radiotherapy	–38	
Net cost		**659**
GRAND TOTAL		**1,433**

A strategy has been set up to review the provision of PET in Wales; currently most patients travel to London for PET scans.

Implementation

To accompany this report, a template has been produced that enables organisations such as primary care trusts (PCTs) to estimate the local impact and replace variables with ones that depict the current local position. A sample calculation using this template showed that a PCT with a population of 150,000 could expect to incur additional costs of £72,000.

The costing template is designed to assist those assessing the resource impact of the guideline at a local level. NICE clinical guidelines are developmental standards within the Department of Health's document *Standards for Better Health* and therefore full implementation of the guideline may take place over a number of years. The cost-impact data presented here may help inform local action plans demonstrating how implementation of the guideline will be achieved.

1 Introduction

1.1 Context

1.1.1 Supporting implementation has been identified as a major area of work for NICE. As part of our strategy to support implementation, we are committed to providing tools and resources that enable health service managers to incorporate NICE guidelines into their planning and resource frameworks. An important part of this is providing information about the cost implications of implementing the guidelines.

1.1.2 We have carried out a project to estimate the costs of implementing the NICE Guideline 'Lung cancer: the diagnosis and treatment of lung cancer' in England and Wales. The project has two main outputs.

- this report, which gives estimates of the national costs involved
- a local cost template that local health planners can use to determine the cost of implementing the Guideline, by altering the assumptions used to reflect local circumstances. Appendix B provides more details of factors to consider when assessing local impact.

1.1.3 This report does not reproduce the Guideline on lung cancer and should be read in conjunction with it (see www.nice.org.uk/CG024).

1.1.4 The accompanying costing template is designed to assist those assessing the resource impact of the guideline at a local level. NICE clinical guidelines are developmental standards in the Department of Health's document *Standards for Better Health* and therefore full implementation of the guideline may take place over a number of years. The cost-impact data presented here may help inform local action plans demonstrating how implementation of the guideline will be achieved.

1.2 Process

1.2.1 We use a structured approach for costing guidelines (see Appendix A).

1.2.2 Little information has been systematically collected about lung cancer management, and this led to problems in building a comprehensive bottom-up model for costing.

1.2.3 To overcome this limitation, we had to make assumptions in the costing model in areas where data on diagnosis and treatment pathways were unavailable. We developed these assumptions and tested them for reasonableness with members of the Guideline Development Group (GDG) and key clinical practitioners in the NHS.

1.3 Scope of the cost-impact analysis

1.3.1 The Guideline offers best practice advice on the care of adults who are suspected of having, or are diagnosed with, lung cancer. It does not cover the diagnosis or management of people with mesothelioma, lung metastases from cancer arising from outside the lung or the prevention of lung cancer; nor does it cover children. Therefore, these issues are also outside the scope of this assessment of the implementation costs.

1.3.2 We initially considered all the recommendations in the Guideline. However, because of the breadth and complexity of the Guideline, we worked with the Guideline Development Group and other practitioners to identify the recommendations that would have the most significant impact on resources (see Figure 1). Costing work has focused on these recommendations.

Figure 1: Recommendations that have significant impact on resources

Key areas	Recommendation number	Key priority?
Providing access to positron emission tomography (PET) scanning	1.3.1.4 to 1.3.1.10	✓
Performing CT scans before bronchoscopy as part of diagnosis	1.2.2 and 1.2.3	
Providing lung cancer nurse specialists	1.10.4	✓
Providing continuous hyperfractionated accelerated radiotherapy (CHART) for patients undergoing radical radiotherapy	1.5.4	✓
Providing adjuvant chemotherapy following surgical resection	1.7.5	
Providing therapies for patients with advanced NSCLC	Various	✓

1.3.3 Ten of the recommendations in the Guideline have been identified as key priorities for implementation, and four of these are also among the six recommendations considered to have significant resource impact.

1.3.4 We have limited the consideration of costs to direct costs to the NHS that will arise from implementation. We have not included costs to the individual, the private sector or the not-for-profit sector. Where applicable, any cost savings arising from a change in practice have been offset against the cost of implementing the change.

1.4 Epidemiology of lung cancer

1.4.1 In England and Wales, nearly 29,000 deaths were attributed to lung cancer in 2002. Lung cancer is the most common cause of cancer death for men, who account for 60% of lung cancer cases. In women, lung cancer is the second most common cause of cancer death, after breast cancer. Survival rates for lung cancer are very poor – slightly more than 20% of patients are alive 1 year after diagnosis and 5–6% are alive after 5 years. These figures are

around 5 percentage points lower than the European averages and 7–10 points lower than those of the USA.

1.4.2 Lung cancers are classified into two main categories: small-cell lung cancers (SCLC), which account for about 20% of cases, and non-small-cell lung cancers (NSCLC), which account for the other 80%. Part of the diagnostic process is to 'stage' the disease to describe its extent and spread. Treatment and prognosis depends, to a large extent, on the stage of the disease.

1.5 Models of care

1.5.1 Reliable and recent data have been collected on the incidence of lung cancer in the general population. However, there is little quantitative information on many elements of the current care pathway or on the different tests undertaken when establishing a diagnosis of lung cancer.

1.5.2 The NHS has been working to improve cancer services since the publication of the Calman–Hine report in 1995, and has been implementing service improvement via the Cancer Services Collaborative Programme since 2000. Therefore, data on care before 1995 may not accurately reflect current service provision.

1.5.3 In order to establish the model of care, we had discussions with the programme director for the LUCADA project[1], who is also national lead clinician for lung cancer in the Department of Health's cancer services collaborative programme. These discussions established a model of care for both diagnosis and treatment that was considered to be typical of existing practice in the NHS.

1.5.4 Following the discussions, we made assumptions about how this model may change with implementation of the Guideline, and the Guideline Development Group commented on the model of current

[1] Lung Cancer Dataset – a project currently at national rollout stage following pilots being evaluated. As yet, there is no validated output available that could inform this model.

and potential pathways of care. We tested the assumptions for reasonableness against other data sources where possible, and in discussion with other experts in various fields.

2 Background

2.1 General assumptions made

2.1.1 The model is based on annual incidence and population estimates (see Figure 2).

Figure 2: Annual incidence of lung cancer

	England	**Wales**
Incidence of lung cancer (per 100,000)	62	65
Population estimate (100,000s)	494	29
Total cases	**30,658**	**1908**

Based on Cancer Research UK data for 2001.

2.1.2 One of the key assumptions is that not all patients included in the incidence figures will be subject to the diagnostic process. Some cases of lung cancer are identified on the death certificate only, in patients where disease is presumably very advanced. Sometimes diagnosis is made on the basis of clinical features and investigations such as a chest X-ray alone if the patient is too frail to undergo any further tests to make a definitive diagnosis.

2.1.3 Following discussions with practitioners, we have estimated that about 85% of patients are subject to the diagnostic pathway. This is in line with the findings of the Thames Cancer Registry, which noted an average for ‘death certificate only’ registrations of 19%, with variation for different health authorities between 10% and 28%. The period covered by this sample was 1995–99 and services are expected to have improved since then.

2.1.4 One of the recommendations in the Guideline is that public awareness of the signs and symptoms of lung cancer should be increased, so that patients consult their GP earlier. Therefore, based on discussions with clinicians, we assume that the number of patients subject to diagnostic tests and treatments will increase. The model assumes the number will increase from 85% to 90%, because clinicians felt that improvement beyond this was unlikely. This is a general assumption that affects all elements of the model.

2.1.5 Assumptions made when estimating costs of specific recommendations are detailed in Section 3 of this report. Appendix C summarises the main assumptions about the current and future models of care, and the proportion of patients who will have various tests and procedures. This is not a full list of the tests and procedures that patients are subject to, but is confined to those that are likely to be most affected by the Guideline.

2.1.6 The results of calculations in this report have been rounded to whole numbers, so the totals may not equal the sum of component parts.

2.2 Basis of unit costs

2.2.1 The way the NHS is funded has recently undergone reform with the introduction of Payment by Results, based on a national tariff. The national tariff will be applied to all activity for which Healthcare Resource Groups[2] (HRGs) or other appropriate case-mix measures are available. Where a national tariff price or indicative price exists for an activity this has been used as the unit cost, this has then been inflated by the national average market forces factor.

2.2.2 Using these prices ensures that the costs in the report are the cost to the primary care trust (PCT) of purchasing predicted changes in

[2] HRGs are a means of classifying patients who are clinically similar and consume similar levels of resources for diagnosis, treatment and care.

activity at the 2005/06 tariff price, but they may not represent the actual cost to individual trusts of delivering the activity.

2.2.3 For new or developing services, where there is no national average unit cost, some trusts already undertaking this activity have been asked their current unit cost.

3 Cost of significant resource impact recommendations

3.1 PET scanning

Background

3.1.1 Positron emission tomography (PET) is a medical imaging technology that uses short-lived radionuclides attached to biological molecules to visualise abnormalities caused by disease processes such as cancer. There is a strong evidence base for its use in diagnosing lung cancer and determining the spread of disease, particularly for patients being considered for surgery or radical radiotherapy. It can also be used to assess the response to treatment in some patients. The NICE Guideline recommends that every cancer network should have a system of rapid access to PET scanning and gives details of the patients for whom a scan is recommended (recommendations 1.3.1.4 to 1.3.1.10).

3.1.2 There was consensus among all those consulted that the recommendations on PET scanning would have the largest cost impact. The impact is two-fold: firstly the cost of providing access to PET scanners, and secondly the revenue cost of undertaking an increased number of scans.

3.1.3 In the costing model, we assessed the revenue cost of undertaking scans assuming access to scanning facilities. The cost of securing

access cannot easily be determined because there are a number of routes that cancer networks can take to secure access to PET–CT scanning facilities, including capital procurement and/or collaboration with private providers of static or mobile scanning facilities.

3.1.4 The Department of Health produced a consultation document *A Framework for the Development of Positron Emission tomography (PET) Services in England* in July 2004 (www.dh.gov.uk/assetRoot/04/08/65/27/04086527.pdf). This document noted that the capital cost of installing up to 16 PET scanners and six cyclotrons (to produce radionuclides) is more than £62 million. (The scanners currently available are PET–CT scanners.) This is for all conditions where PET is known to be effective, of which lung cancer makes up 25% of the expected workload.

3.1.5 A strategy group has been set up to review the provision of PET in Wales and has submitted an outline business case. At present patients usually travel to London for PET scans. For patients who are unable to travel to London, a limited number (ten scans in 2003/04) are undertaken using a private mobile scanner in Cardiff.

3.1.6 In addition to providing access to PET scanners, there will be non-recurrent revenue start-up costs for the training of medical staff, radiographers and/or nuclear medicine technicians, radiochemists and radiopharmacy technicians.

Assumptions made

3.1.7 We estimated that 2% of the patients on the care pathway currently have PET scans; this is more than 500 scans a year.

3.1.8 Currently there are only six NHS scanners and these are all in London and the south-east of England. To comply with the Guideline we anticipate that the number of patients being scanned

will rise to 30% of those following the diagnosis pathway. This estimate is based on expert opinion and has been validated through studies of numbers of patients considered suitable for radical treatment.

3.1.9 At present, some patients are only discovered to have metastases at operation, making surgery futile. PET scanning would identify metastases in most of these patients, and avoid the need for surgery. The cost of surgery avoided has been offset against the additional cost of PET scanning.

3.1.10 Predicting the future surgical resection rate is complex. We anticipate that PET scanning will reduce the rate of futile surgery by identifying patients with occult advanced disease before they have surgery. However, this is likely to be offset by a general improvement in diagnostic and staging procedures, together with improved multidisciplinary team working, which could increase the number of patients considered for surgery. The current resection rate is estimated to be 9%, and – through discussion with practitioners – we have estimated that this will fall to 8%.

3.1.11 There is no average reference cost for PET scans, so we contacted a number of trusts that currently undertake PET scanning to establish their costs. The average cost at 2004/05 prices is £971 per scan (range £875–1050).

3.1.12 Most radical surgical procedures (that is, lobectomy of lung, total pneumonectomy or excision of a segment of lung) fall within the HRG D02:complex thoracic procedures. The national tariff price including average market forces factor for this HRG is £6301.

Cost summary

3.1.13 The net cost of introducing PET scanning is summarised in Figure 3.

Figure 3: Net cost of PET scanning

		Current		Proposed		Change	
	Unit cost £	**Activity**	**Cost £000s**	**Activity**	**Cost £000s**	**Activity**	**Cost £000s**
ENGLAND							
PET scans	971	521	506	8,278	8,038	7,757	7,531
Surgical resections	6,301	2,345	14,776	2,207	13,906	-138	-870
Net cost			**15,282**		**21,944**		**6,662**
WALES							
PET scans	971	32	31	515	500	483	469
Surgical resections	6,301	146	920	137	863	–9	–57
Net cost			**951**		**1363**		**412**

Other considerations

3.1.14 PET scanning could reduce the number of patients undergoing futile radical radiotherapy. PET scanning is also useful in assessing response to treatment.

3.1.15 The current estimated lung resection rate of 9% is considerably lower than in other comparable countries (for example, two studies in Holland and the USA had rates of 24% and 25% respectively[3]). Even within the NHS, rates of between 7% and 20% have been reported. This model assumes a modest reduction; however, over time, if patients present at an earlier stage because of improved awareness of symptoms or faster diagnosis, more may be

[3] As reported in *The critical under provision of thoracic surgery in the UK - report of a joint working group of The British Thoracic Society and The Society of Cardiothoracic Surgeons of Great Britain and Ireland* (www.brit-thoracic.org.uk/docs/thoracic_surgery.doc).

candidates for resection, bringing rates closer to those in the rest of Europe.

3.1.16 Should this happen, the additional cost of surgery may be offset by lower costs of treatment for advanced disease and improvement in the survival rates.

3.1.17 The Guideline recommends that each cancer network should have access to a PET scanner. The DH plan recommends 22 scanners, which is less than one per network (there are 34 networks) and less than recommended in a report from an Intercollegiate Standing Committee on Nuclear Medicine. As PET scanning becomes indicated in more disease types the number of scanners required may prove to be higher.

3.2 Undertaking CT before bronchoscopy

Background

3.2.1 The NICE Guideline recommends that patients should be offered a contrast-enhanced chest CT scan to further the diagnosis and stage the disease (recommendations 1.2.2 and 1.2.3). The CT scan should be performed before an intended fibreoptic bronchoscopy.

3.2.2 A CT scan provides useful information that can be used for decisions on further investigations. There is good research evidence that this avoids some invasive investigations by identifying patients for whom bronchoscopy would not provide much benefit, and improves the accuracy of invasive investigations, avoiding the need for further bronchoscopies if the first is inconclusive.

3.2.3 In discussion with practitioners in the NHS, we found that CT scans are not always performed before bronchoscopy because of limited access to CT scanners. Bronchoscopy is usually easier to arrange, so may be performed first in some units.

Assumptions made

3.2.4 The model of current and potential practice is based on discussions with practitioners, and reflects 'typical' practice rather than centres of best practice. The model assumes that 70% of patients currently undergo a CT scan (either before or after bronchoscopy), and if scanning is undertaken first in future then this could increase to 85%.

3.2.5 The percentage and number of bronchoscopies are estimated relative to the number of patients and the estimates incorporate an element for repeat procedures. We have assumed 80% of patients currently undergo the procedure and that this is likely to reduce to 65%.

3.2.6 The cost per bronchoscopy is £503, based on the tariff price for HRG D07: fibreoptic bronchoscopy. The cost per CT is £56, based on the indicative tariff.

Cost summary

3.2.7 The predicted reduction in the costs of bronchoscopies more than covers the cost of additional CT scans, so a net saving is forecast (Figure 4).

Figure 4: Net cost of undertaking CT before bronchoscopy

		Current		Proposed		Change	
	Unit cost £	**Activity**	**Cost £000s**	**Activity**	**Cost £000s**	**Activity**	**Cost £000s**
ENGLAND							
CT scans	56	18,241	1,021	23,453	1,313	5,212	292
Bronchoscopies	503	20,847	10,486	17,934	9,021	-2,913	-1,465
Net cost			**11,507**		**10,334**		**-1,173**
WALES							
CT scans	56	1135	64	1459	82	324	18
Bronchoscopies	503	1297	652	1116	561	–181	–91
Net cost			**716**		**643**		**–73**

Other considerations

3.2.8 Most patients will need at least one test to establish a tissue diagnosis. If they do not have a bronchoscopy, procedures such as CT-guided lung biopsy will be used. However, in one unit that introduced a policy of CT scanning before any biopsy procedures, the proportion of patients requiring two or more biopsy-type diagnostic tests fell from 43% to 25%.

3.2.9 Some clinicians consider that to guarantee timely access to CT scans there needs to be an increase in the number of scanners, which may involve access to capital funds. However, some units have already redesigned their services in order to book slots and undertake CT scans before bronchoscopies are done.

3.2.10 Department of Health initiatives are underway to improve capacity for diagnostic tests by incorporating diagnostics in treatment centres.

3.2.11 For these reasons, we have considered only the revenue cost of tests and procedures in this report (unlike PET scanning where we have noted the capital cost because there is a clear need for equipment).

3.2.12 The net saving from reducing the requirement for bronchoscopies by changing the order of tests could possibly be reinvested in increasing CT scanning capacity; however, this decision will depend on other local factors and will be complex to implement. There are also issues regarding how easy it is make savings when some of the costs saved are fixed costs such as provision of equipment and facilities.

3.3 The role of lung cancer nurses

Background

3.3.1 One of the key priorities for implementation in the Guideline relates to cancer units having one or more trained lung cancer nurse specialists (recommendation 1.10.4). There was a consensus among people consulted that the number of lung cancer nurses would need to increase to allow them to undertake the full role envisaged, including prediagnosis counselling, continuing support and facilitating communication.

3.3.2 Very little data exists on the current number of nurse specialists dealing with lung cancer. This is complicated further because most nurse specialists' caseloads include mesothelioma patients.

3.3.3 Ten trusts were contacted to estimate the present level of provision. These included hospitals in the tertiary and secondary sectors, across a geographical spread. It was found that the caseload per whole time equivalent (WTE) varied between 110 and 450, with the mean being 177. The main method by which variations in caseload is managed is by limiting input into each case.

3.3.4 The trust that had the lowest caseload per WTE appeared to comply with the Guideline because the nurse specialists saw all patients before diagnosis and maintained close contact with patients in whom lung cancer was diagnosed. This included methodical follow-up of all suspect chest X-rays. The trust that had the highest caseload per WTE focused on confirmed patients receiving active treatment only and did not follow patients along the full pathway of care.

Assumptions made

3.3.5 The NICE Guideline does not include any guidance on service configuration or caseload for nurses. For this cost-impact

assessment, we used the British Thoracic Society recommendation that the caseload of 1.0 WTE lung cancer nurse should be 150. This includes cases of mesothelioma, so we have assumed that the number of cases of lung cancer dealt with by 1.0 WTE nurse is 138, based on the ratio of incidence of primary lung cancer to mesothelioma.

3.3.6 Calculations based on this assumption indicate that there is an underprovision of specialist nurses (Figure 5).

3.3.7 It has been assumed that under Agenda for Change lung cancer specialist nurses will fall within Band 7. Therefore the average cost per nurse is £37,936 including employer oncosts.

Cost summary

Figure 5: Cost of increased lung cancer nurses

		Current		Proposed		Change	
	Unit cost £	**WTE**	**Cost £000s**	**WTE**	**Cost £000s**	**WTE**	**Cost £000s**
ENGLAND							
Lung cancer nurses	37,936	147	5,577	200	7,587	53	2,011
WALES							
Lung cancer nurses	37,936	9	341	12	455	3	114

Other considerations

3.3.8 The cost in Figure 5 does not reflect the non-recurrent cost of recruiting and training nurses. It is also possible that the increased role for lung cancer nurses, including more active follow-up, will relieve the workload of medical staff.

3.3.9 Using the local cost template is likely to indicate that at least one part-time nurse is required. The potential to recruit to a part-time specialist post may be limited and will need to be assessed locally. Another factor to consider is the location of lung cancer nurses for

patients who receive care at their local hospital and are referred to tertiary centres for specialist treatment.

3.3.10 There is also overlap between lung cancer nurses and other specialist nurses in areas such as oncology and palliative care. The number of nurses required will depend on other support staff.

3.4 Increased use of CHART

Background

3.4.1 The use of continuous hyperfractionated accelerated radiotherapy (CHART) for patients with stage I or II NSCLC who are medically inoperable is one of the key priorities for implementation identified by the Guideline Development Group (recommendation 1.5.4).

3.4.2 CHART involves treatment being given three times a day for 12 days. Conventional radical radiotherapy is typically given over 4 to 6 weeks with no weekend treatments.

Assumptions made

3.4.3 It is estimated that the proportion of patients on the diagnostic and treatment pathway having radical radiotherapy is currently 3.0%, of which only a very small proportion (0.1% of lung cancer patients) receive CHART. The model assumes that a small proportion of non-CHART regimens will continue to be provided (0.5%) with the remainder (2.5%) converting to CHART.

3.4.4 The indicative tariff for radiotherapy gives a cost of £2145 for the conventional radiotherapy regimen involving complex teletherapy with imaging and multiple planning. The cost for CHART is £4271 for the treatment plus a cost of £100 per night for patient accommodation for 12 nights.

Cost summary

3.4.5 Calculations based on the assumptions above show a net increase in cost (Figure 6).

Figure 6: Increased cost for CHART

		Current		Proposed		Change	
	Unit cost £	**Activity**	**Cost £000s**	**Activity**	**Cost £000s**	**Activity**	**Cost £000s**
ENGLAND							
Conventional RT	2,145	756	1,622	138	296	-618	-1,326
CHART	5,471	26	142	690	3,775	664	3,633
Net cost			**1,764**		**4,071**		**2,307**
WALES							
Conventional RT	2,145	47	101	9	19	–38	–82
CHART	5,471	2	11	43	235	41	224
Net cost			**112**		**254**		**142**

Other considerations

3.4.6 There are additional costs involved in providing treatments in the evening and at weekends, because patients need to stay near the centre, and staff need to work out of hours. For this reason, CHART appears to be more costly than conventional radical radiotherapy and has not been adopted at many centres. However, analysis of health economic research shows it to be economically effective because CHART reduces mortality compared with conventional treatment.

3.4.7 It is also possible that the difference in overall costs of treatment between CHART and conventional radiotherapy is smaller than has been assumed. One clinical trial estimated that the difference is reduced when the cost of patients' journeys to hospital for radiotherapy over a long period is offset against the accommodation costs for a patient undergoing CHART.

3.4.8 The low number of patients having the treatment and the requirement for evening and weekend working make it unlikely that CHART will be viable at all 50 radiotherapy centres in England. One provider was found to deliver CHART in an inpatient setting, and charges £16,000 per patient. A second provider takes a different approach and accommodates the patients in a lodge at a cost of £100 per inpatient day, increasing the cost of delivering the radiotherapy by £1200.

3.4.9 CHART may also be offered to patients with stage IIIA/IIIB disease and some other forms of cancer. This would increase the numbers being offered CHART to around 10% and might make it more attractive for a centre to provide CHART.

3.5 Adjuvant chemotherapy after surgical resection

Background

3.5.1 The NICE Guideline recommends that adjuvant chemotherapy is offered to NSCLC patients who have had a complete resection (recommendation 1.7.5). Adjuvant chemotherapy is given after surgery with curative intent and has been shown to improve survival rates.

3.5.2 Although this is not one of the key priorities for implementation identified by the Guideline Development Group, initial consultation highlighted that additional resources may be needed to implement this change in practice.

Assumptions made

3.5.3 We assumed that the total number of suitable patients (those who have had complete resections and are fit and willing to have adjuvant chemotherapy) is small, at around 5%. On the basis of discussions with practitioners, we estimate that about 1% of

patients with lung cancer are currently receiving adjuvant chemotherapy.

3.5.4 The weighted average cost of the various types of chemotherapy that are used for lung cancer is £2561 per regimen[4], and it is assumed that the cost of adjuvant chemotherapy will be similar.

Cost summary

3.5.5 Calculations using the assumptions above show a net increase in cost (Figure 7).

Figure 7: Cost of undertaking adjuvant chemotherapy after resection

		Current		Proposed		Change	
	Unit cost £	**Activity**	**Cost £000s**	**Activity**	**Cost £000s**	**Activity**	**Cost £000s**
ENGLAND Adjuvant chemotherapy	2,561	261	668	1,380	3,534	1,119	2,866
WALES Adjuvant chemotherapy	2,561	16	41	86	220	70	179

[4] Cost of chemotherapy based on differential cost between 'best supportive care' and chemotherapy regimes considered as part of clinical trials. This includes costs of inpatient and outpatient care in addition to drug costs. Reference cost data for chemotherapy is not considered suitable because of wide variation in costs and inconsistent activity measurement.

3.6 Therapies for advanced NSCLC

Background

3.6.1 The Guideline makes a number of recommendations on therapies for advanced NSCLC. Initial discussions did not highlight much change; however, subsequent research has shown that – although the cost changes may not be as great – a substantial number of patients may be affected, so the cost impact could be significant.

3.6.2 Stage III or IV NSCLC is generally not considered to be curable, and overall 5-year survival rates are less than 1%. The Guideline Development Group considered that the care for patients with advanced lung cancer should be an active process, including treatments such as chemotherapy and radiotherapy to improve symptoms, quality of life and medium-term survival.

Assumptions made

3.6.3 Estimates of the number of patients affected by the recommendations on advanced NSCLC vary. The chemotherapy expert on the Guideline Development Group considers that the number of treatments is likely to rise by 20–50%. However, the Royal College of Physicians estimates that more than 16,000 patients (49%) are eligible for chemotherapy each year. For the model in this project, we assumed that the proportion of patients receiving chemotherapy will double from 15% to 30%.

3.6.4 The Guideline recommends considering single-agent docetaxel for second-line chemotherapy, and this is likely to increase the number of patients offered second-line chemotherapy.

3.6.5 The current cost of chemotherapy in the model is £2561[4]. The cost of radiotherapy is based on the indicative tariff plus average market forces factor for simple teletherapy and is £802.

3.6.6 Practitioners consider that increasing the provision of chemotherapy will lead to a small reduction in the need for radiotherapy. They estimated that 40% of patients receive radiotherapy now, and that this will fall to 35% after the Guideline is implemented.

Cost summary

3.6.7 Calculations using the assumptions above lead to the costs shown in Figure 8.

Figure 8: Cost of palliative therapies for advanced NSCLC

		Current		Proposed		Change	
	Unit cost £	**Activity**	**Cost £000s**	**Activity**	**Cost £000s**	**Activity**	**Cost £000s**
ENGLAND							
Palliative chemotherapy	2,561	3,909	10,011	8,278	21,200	4,369	11,189
Palliative radiotherapy	802	10,424	8,360	9,657	7,745	-766	-614
Net cost			**18,371**		**28,945**		**10,575**
WALES							
Palliative chemotherapy	2,561	243	622	515	1319	272	697
Palliative radiotherapy	802	649	520	601	482	–48	–38
Net cost			**1142**		**1801**		**659**

4 Sensitivity analysis

4.1 Methodology

4.1.1 There are a number of assumptions in the model for which no empirical evidence exists. Because of the limited data, the model developed is mainly based on discussions of typical values with NHS practitioners and therefore subject to a degree of uncertainty.

4.1.2 As part of discussions with practitioners, we discussed possible minimum and maximum values of variables, and calculated their impact on costs across this range.

4.1.3 We used the national tariff plus market forces factor where possible to determine cost. This is based on reference costs, and we used the variation of costs for the 25th and 75th percentile compared with the reference cost national average as a guide to inform the maximum and minimum range of costs.

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

4.1.5 A table detailing all variables modified is attached as Appendix D and the key conclusions drawn are discussed below.

4.2 Impact of sensitivity analysis on costs

Proportion of patients subject to care pathway

4.2.1 We found the proportion of patients following a specialist care pathway in the future had significant impact on variation in total cost. The value assumed is 90%, with variation modelled from 85% to 95%. This results in total cost ranging from £20.2 million to

£29.2 million. The impact is great because this value affects all other calculations.

4.2.2 However, there is a similar range of values for the proportion of patients on the current care pathway. In practice, it is the differential between current and future numbers that is important. It is unlikely that the number of cases in the future will be lower than it is now, and if the current number is understated, then the number is less likely to increase significantly in the future. Therefore, any risk resulting from material difference in baseline estimates is likely to be minimal because changes in estimates of current and future proportions are likely to increase or decrease in tandem.

Assumed number of surgical cases

4.2.3 The model assumes a small decrease in predicted percentage requiring lung resection following the introduction of PET. This is a short-term prediction and in the longer term it is likely that, if patients present at an earlier stage because of improved awareness, more may be candidates for resection and this would increase the rate.

4.2.4 An increase of 1% in the resection rate will result in 294 additional procedures at a cost of £1.9 million.

Cost of CHART

4.2.5 We based the cost of CHART on the indicative tariff price combined with an estimate of £100 per day for patient accommodation costs, a cost of £5,471. However, one consultee noted that his hospital charges £16,000 to provide a course of CHART. This large variation in the cost of CHART results in a significant cost variation of between £1.2 million and £9.9 million.

Increase in chemotherapy for advanced cancer

4.2.6 The cost estimate for chemotherapy varies significantly because of uncertainty about the prediction of future rates, which results in a larger range of minimum and maximum values. The model assumes 30% will receive chemotherapy, with variation of +/- 10%. This results in cost variation from £3.7 million to £18.8 million.

4.2.7 The cost of chemotherapy is also subject to uncertainty and has a large range for minimum and maximum costs. Although data is collected as part of reference costs, the DH found significant variation in the costs submitted by individual trusts and further study revealed inconsistencies in activity measures used.

4.2.8 The model assumes a cost of £2561, with a range of £808 to £4969. Different regimens and the method of delivery in an inpatient or outpatient setting all contribute to varying costs. This results in the cost for advanced therapies varying from £3.1 million to £22.4 million.

5 Conclusion

5.1 Identification of key cost areas

5.1.1 In discussions with the members of the Guideline Development Group and other clinical practitioners in the NHS, we identified and quantified the recommendations that will have the most significant impact on resources arising from implementing this Guideline. These recommendations are noted in Figure 1.

5.1.2 The assumptions used to calculate costs are based on expert opinion. We applied reality tests against existing data wherever possible, but this was limited by availability of detailed data.

5.1.3 The accompanying template allows you to update assumptions to reflect local practice and costs (www.nice.org.uk/CG024).

5.2 Total cost

5.2.1 Figure 9 summarises the revenue costs of implementing the recommendations in the Guideline that we considered to have the most significant impact on resources. These are annual values but, because of the poor prognosis for most lung cancer patients, there is unlikely to be a cumulative effect resulting from extended life.

Figure 9: Total cost of recommendations with significant resource impact

ENGLAND	£000s	£000s
PET scanning		
additional cost of scans	7,532	
saving from reduced surgical resections.	-870	
Net cost		**6,662**
CT before bronchoscopies		
additional cost of CT scans	292	
saving from reduced bronchoscopies	-1,465	
Net cost		**-1,173**
Increased lung cancer nurses		**2,011**
CHART		
additional cost of CHART	3,633	
saving from reduced conventional radiotherapy	-1,326	
Net cost		**2,307**
Adjuvant chemotherapy following surgical resection		**2,866**
Therapies for advanced cancer		
additional cost of chemotherapy	11,189	
saving from reduced radiotherapy	-614	
Net cost		**10,575**
GRAND TOTAL		**23,248**

Figure 9 (continued)

WALES	£000s	£000s
PET scanning		
additional cost of scans	469	
saving from reduced surgical resections.	–57	
Net cost		**412**
CT before bronchoscopies		
additional cost of CT scans	18	
saving from reduced bronchoscopies	–91	
Net cost		**–73**
Increased lung cancer nurses		**114**
CHART		
additional cost of CHART	224	
saving from reduced conventional radiotherapy	–82	
Net cost		**142**
Adjuvant chemotherapy following surgical resection		**179**
Therapies for advanced cancer		
additional cost of chemotherapy	697	
saving from reduced radiotherapy	–38	
Net cost		**659**
GRAND TOTAL		**1,433**

5.2.2 In addition to the revenue costs of diagnosis and treatment, significant capital expenditure is needed to increase access to PET scanning. This is thought to be more than £62 million, with 25% of the anticipated workload being related to lung cancer.

5.2.3 We also identified other non-recurrent costs to train additional staff for PET scanning and additional lung cancer nurses. There is some debate about the cost of increasing access to CT scanning. However, other initiatives such as the New Opportunities Fund and the introduction of diagnostic centres will also improve access in this area.

5.2.4 Wherever possible, we used the national tariff price or reference cost as the basis for unit costs. These are derived on a full cost absorption basis and will include capital charges and other

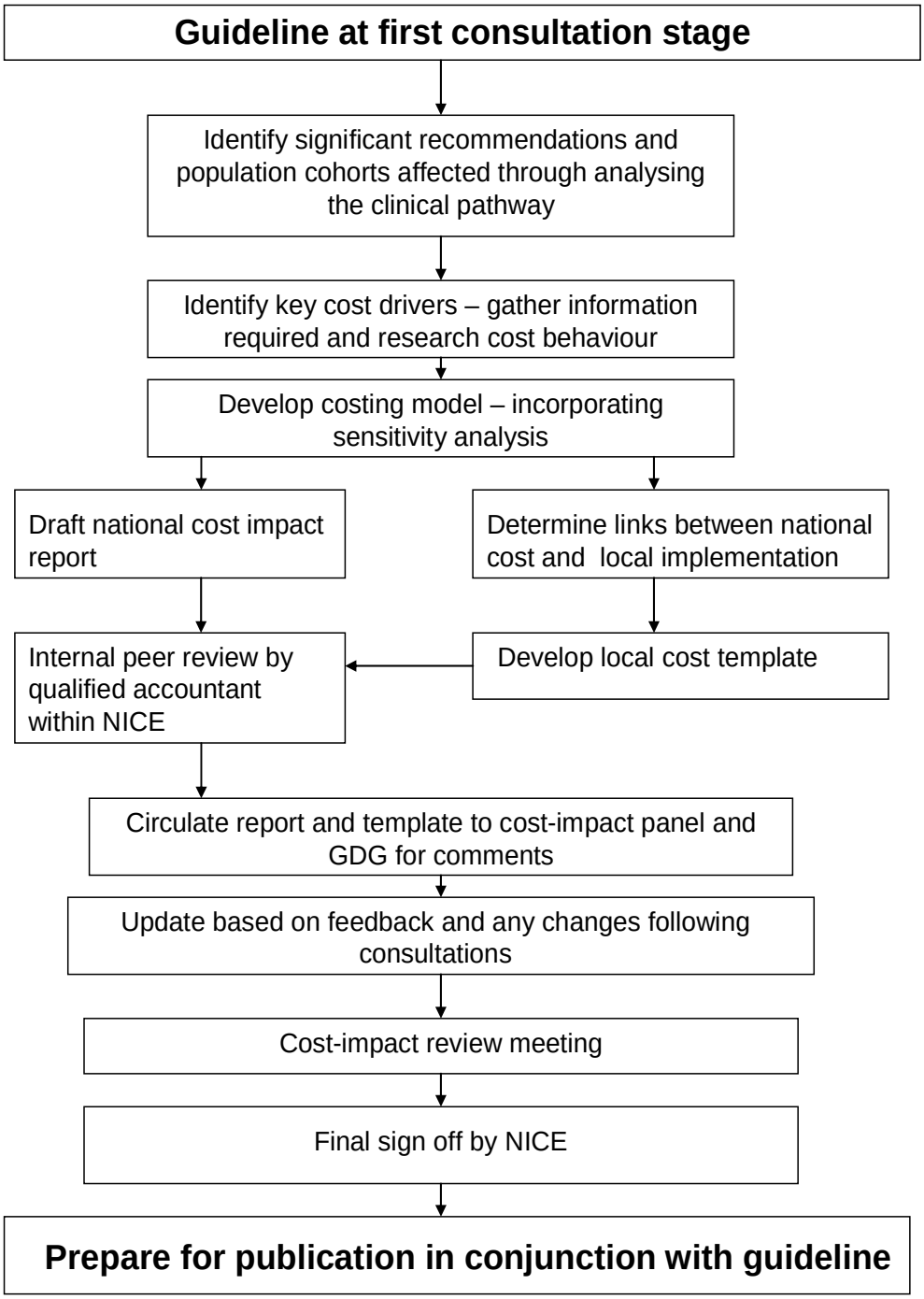
overheads, so should enable additional capital investment over the life of a piece of equipment.

5.3 Summary

5.3.1 This report gives a national picture of current practice and the potential changes arising from implementation of the NICE Guideline on lung cancer. We produced it by developing a model based on expert opinion and on the detailed data that is available and has been validated by other experts on lung cancer.

5.3.2 We consider this assessment to be reasonable, given the limited detailed data regarding diagnosis and treatment paths and the time available. However, the costs presented are estimates and should not be taken as the full cost of implementing the Guideline.

Appendix A: Approach to costing guidelines



Appendix B: Accompanying Local Cost Template

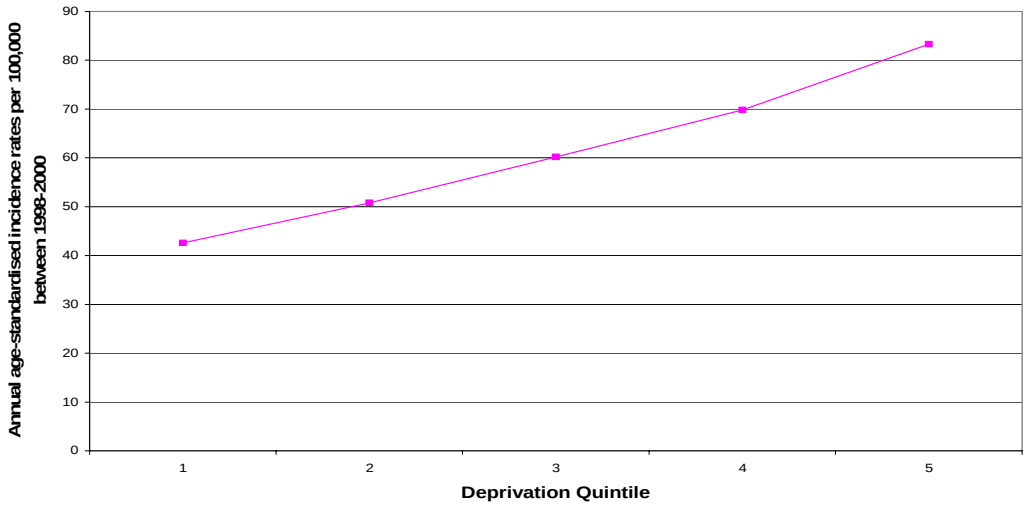
To accompany this report, we developed a Microsoft Excel template that allows local costs to be calculated using data on individual PCT populations and local incidence data. The local impact is calculated using the same methodology as in the national cost impact assessment. The model has been designed to allow multiple PCTs to be combined to reflect local joint commissioning where applicable.

Different networks or cancer treatment centres may be at different stages of development, and we designed the template to assess local impact to enable variables reflecting local practice to be entered and used in the calculations.

Weighting for deprivation

There is a clear positive association between deprivation and lung cancer incidence as demonstrated below. This does not affect the calculations of the national cost of implementing the Guideline, but the costing template for local use includes deprivation weighting.

Effect of deprivation on lung cancer incidence



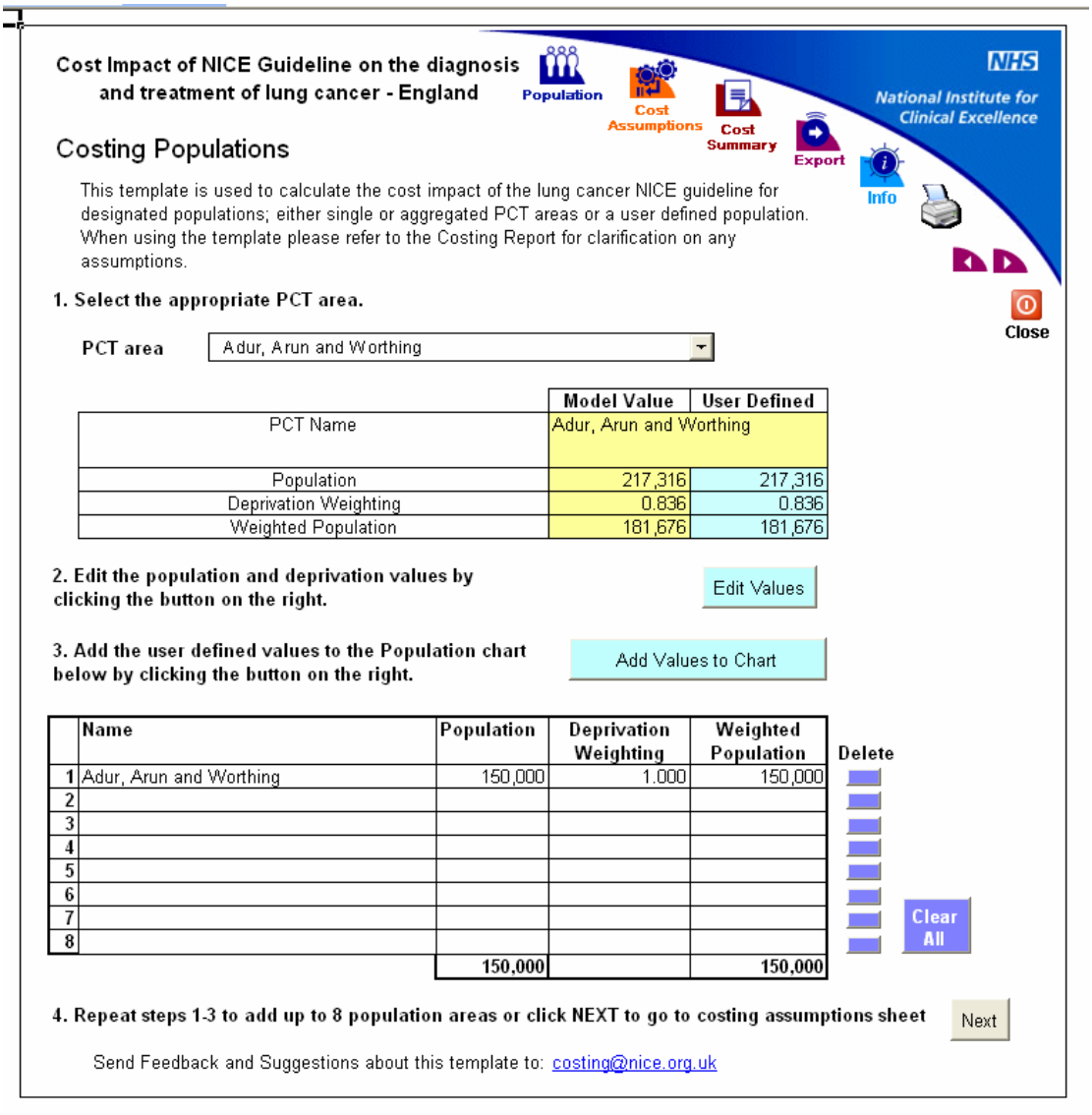
Unit costs used

Where a national tariff price or indicative price exists for an activity then this has been used as the unit cost. The tariff has been increased by the national average market forces factor. The template provides the option to update unit

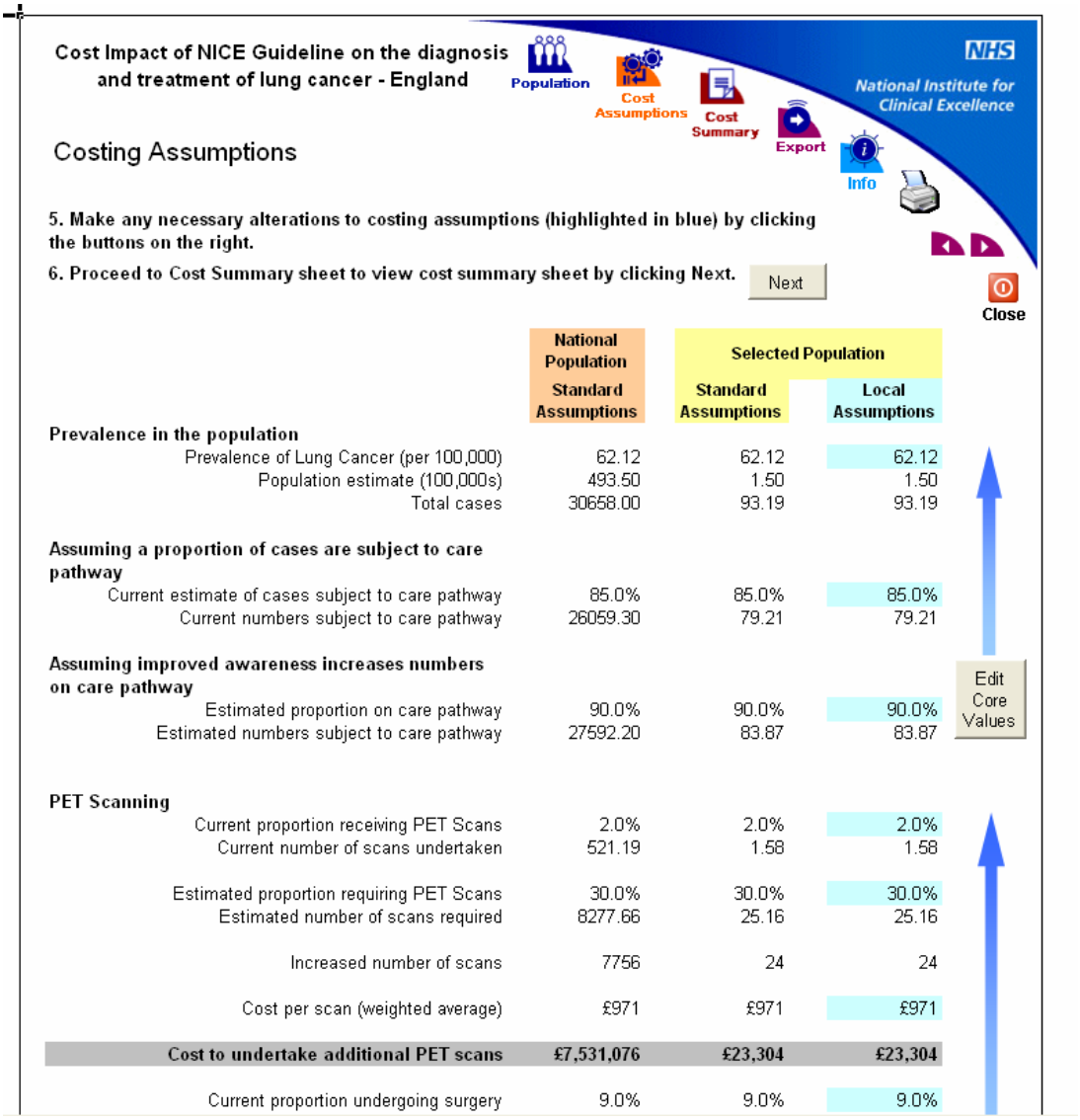
costs to reflect local cost and it is suggested that the local tariff including local market forces factor is used.

Format of template

The template has three main sheets. The screen shot below shows the first sheet, which allows users to select their PCT(s). On the basis of the population, deprivation weighting and prevalence, the template will estimate the number of cases expected in the area.



Sheet two (shown below) allows users to alter the variables used in the national model to reflect local circumstances.



Cost Impact of NICE Guideline on the diagnosis and treatment of lung cancer - England

Population | Cost Assumptions | Cost Summary | Export | Info

NHS National Institute for Clinical Excellence

Costing Assumptions

5. Make any necessary alterations to costing assumptions (highlighted in blue) by clicking the buttons on the right.

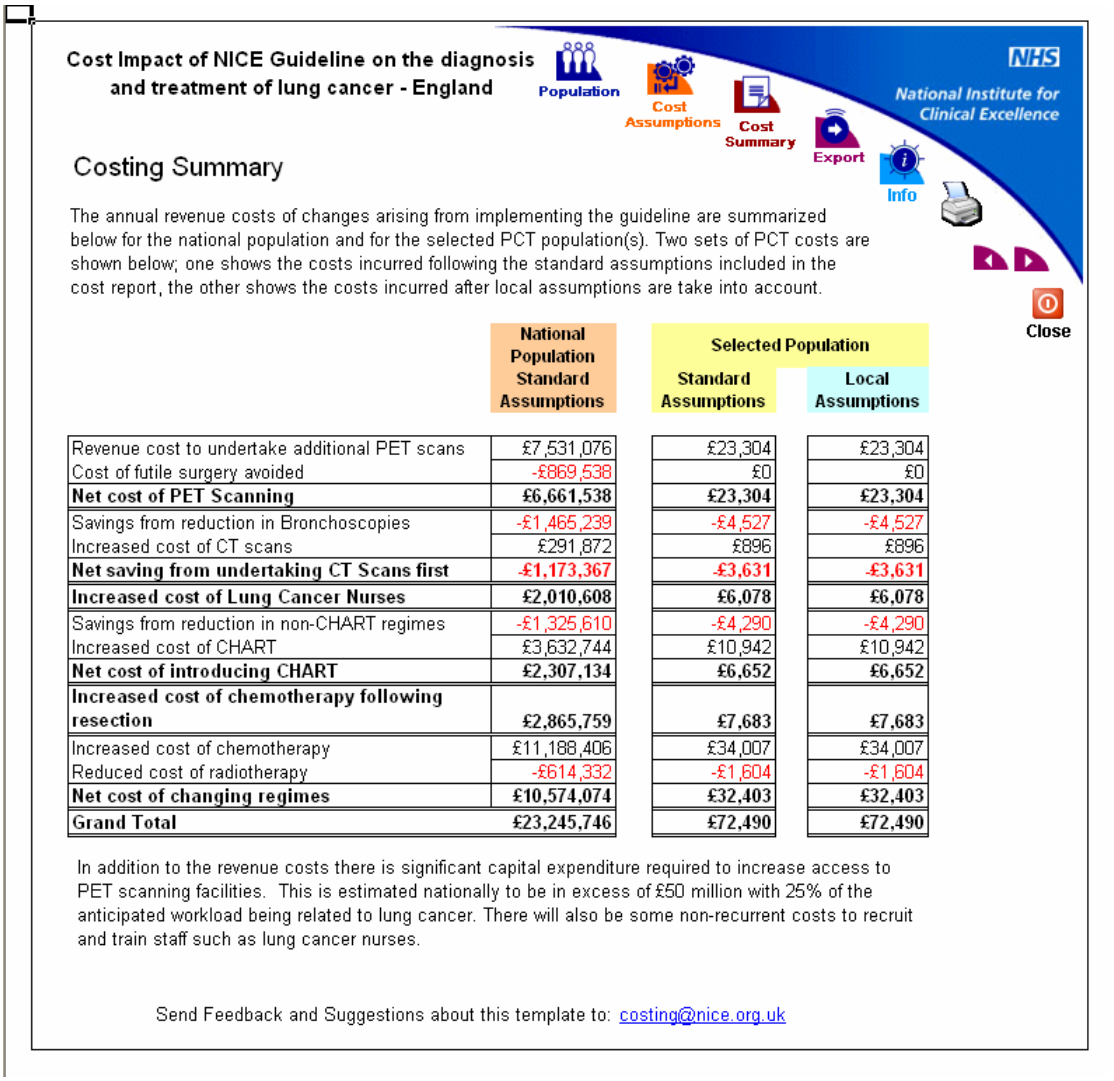
6. Proceed to Cost Summary sheet to view cost summary sheet by clicking Next. Next

Close

	National Population	Selected Population	
	Standard Assumptions	Standard Assumptions	Local Assumptions
Prevalence in the population			
Prevalence of Lung Cancer (per 100,000)	62.12	62.12	62.12
Population estimate (100,000s)	493.50	1.50	1.50
Total cases	30658.00	93.19	93.19
Assuming a proportion of cases are subject to care pathway			
Current estimate of cases subject to care pathway	85.0%	85.0%	85.0%
Current numbers subject to care pathway	26059.30	79.21	79.21
Assuming improved awareness increases numbers on care pathway			
Estimated proportion on care pathway	90.0%	90.0%	90.0%
Estimated numbers subject to care pathway	27592.20	83.87	83.87
PET Scanning			
Current proportion receiving PET Scans	2.0%	2.0%	2.0%
Current number of scans undertaken	521.19	1.58	1.58
Estimated proportion requiring PET Scans	30.0%	30.0%	30.0%
Estimated number of scans required	8277.66	25.16	25.16
Increased number of scans	7756	24	24
Cost per scan (weighted average)	£971	£971	£971
Cost to undertake additional PET scans	**£7,531,076**	**£23,304**	**£23,304**
Current proportion undergoing surgery	9.0%	9.0%	9.0%

Edit Core Values

Finally, a third sheet summarises the results for users, as shown below:



Cost Impact of NICE Guideline on the diagnosis and treatment of lung cancer - England

Population | Cost Assumptions | Cost Summary | Export | Info | Close

NHS National Institute for Clinical Excellence

Costing Summary

The annual revenue costs of changes arising from implementing the guideline are summarized below for the national population and for the selected PCT population(s). Two sets of PCT costs are shown below; one shows the costs incurred following the standard assumptions included in the cost report, the other shows the costs incurred after local assumptions are take into account.

	National Population Standard Assumptions	Selected Population Standard Assumptions	Selected Population Local Assumptions
Revenue cost to undertake additional PET scans	£7,531,076	£23,304	£23,304
Cost of futile surgery avoided	-£869,538	£0	£0
Net cost of PET Scanning	**£6,661,538**	**£23,304**	**£23,304**
Savings from reduction in Bronchoscopies	-£1,465,239	-£4,527	-£4,527
Increased cost of CT scans	£291,872	£896	£896
Net saving from undertaking CT Scans first	**-£1,173,367**	**-£3,631**	**-£3,631**
Increased cost of Lung Cancer Nurses	**£2,010,608**	**£6,078**	**£6,078**
Savings from reduction in non-CHART regimes	-£1,325,610	-£4,290	-£4,290
Increased cost of CHART	£3,632,744	£10,942	£10,942
Net cost of introducing CHART	**£2,307,134**	**£6,652**	**£6,652**
Increased cost of chemotherapy following resection	**£2,865,759**	**£7,683**	**£7,683**
Increased cost of chemotherapy	£11,188,406	£34,007	£34,007
Reduced cost of radiotherapy	-£614,332	-£1,604	-£1,604
Net cost of changing regimes	**£10,574,074**	**£32,403**	**£32,403**
Grand Total	**£23,245,746**	**£72,490**	**£72,490**

In addition to the revenue costs there is significant capital expenditure required to increase access to PET scanning facilities. This is estimated nationally to be in excess of £50 million with 25% of the anticipated workload being related to lung cancer. There will also be some non-recurrent costs to recruit and train staff such as lung cancer nurses.

Send Feedback and Suggestions about this template to: costing@nice.org.uk

Appendix C: Model of care assumptions

Proportion of patients that are subject to different diagnostic tests and treatments (Based on expert opinion)

	Current practice	following NICE guidance	change in practice
PET scanning	2%	30%	28%
Surgical resection	9%	8%	-1%
Bronchoscopies	80%	65%	-15%
CT Scans	70%	85%	15%
Radical radiotherapy for stages i / ii	2.9%	0.5%	-2.4%
CHART	0.1%	2.5%	2.4%
Adjuvant chemotherapy after surgical resection	1%	5%	4%
Palliative chemotherapy for stages iii/iv	15%	30%	15%
Palliative radiotherapy for stages iii/iv	40%	35%	-5%

This is only those tests that are considered to have significant resource impact as a result of implemention

Assesment of sensitivity of costs to range of variables

Parameter Varied	Baseline value	Range	Baseline cost £000s	Cost for minimum value £000s	Cost for maximum value £000s	Variation in cost across range £000s
Numbers subject to care pathway						
Proportion of cases subject to current care pathway. Impact on total cost.	85%	80% to 90%	24,708	28,034	21,378	6,656
Proportion of cases subject to care pathway in future. Impact on total cost.	90%	85% to 90%	24,708	20,187	29,228	9,041
PET Scanning						
Projected % requiring PET scans. Impact on net cost of PET scanning.	30.00%	25% to 35%	7,084	5,659	8,508	2,849
Cost of PET scans. Impact on net cost of PET scanning.	£971	£845 to £1050	7,084	6,044	7,735	1,691
Predicted % requiring lung resection. Impact on net cost of PET Scanning.	8%	7% to 15%	7,084	5,237	20,026	14,789
Cost of major lung procedure (D02). Impact on net cost of PET scanning.	£6,301	£2296 to £6931	7,084	7,672	6,991	681
CT prior to bronchoscopy						
Predicted % requiring bronchoscopy. Impact on net cost of CT prior to bronchoscopy.	65%	55% to 75%	-1,248	-2,725	229	2,954
Cost of bronchoscopy. Impact on net cost of CT prior to bronchoscopy.	£503	£338 to £721	-1,248	-736	-1,923	1,187
Predicted % requiring CT scans. Impact on net cost of CT prior to bronchoscopy.	85%	70% to 95%	-1,248	-1,495	-1,084	411
Cost of CT scan. Impact on net cost of CT prior to bronchoscopy.	£56	£50 to £103	-1,248	-1,282	-988	294
Lung Cancer nurses						
Predicted number of lung cancer nurses. Impact on cost of additional nurses	200 wte	184 wte to 230 wte	2,127	1,481	3,337	1,856
Cost per WTE. Impact on cost of additional nurses.	£37,936	£32,771 to £43,515	2,127	1,837	2,440	603
CHART for radical radiotherapy						
The switch of radical RT from traditional to CHART has been assessed assuming that the overall proportion remains at 3%, but that the transfer from one regime to another varies from 0.5% CHART to 2.9% CHART, with the remainder on traditional RT.	2.5% CHART and 0.5% traditional	0.5% to2.9% being CHART	2,453	501	2,843	2,342
Cost of traditional radical RT. Impact on net cost of CHART.	£2,145	£1587 to £2324	2,453	2,820	2,336	484
Cost of CHART. Impact on net cost of CHART.	£5,471	£3711 to £16000	2,453	1,211	9,887	8,676
Adjuvant chemotherapy following resection						
Predicted % requiring adjuvant chemotherapy following resection. Impact on cost of adjuvant chemotherapy.	5.00%	1% to 10%	3,048	41	6,807	6,766
Cost of chemotherapy. Impact on cost of adjuvant chemotherapy.	£2,561	£808 to £4969	3,048	962	5,913	4,951
Therapies for advanced cancer						
Predicted % requiring chemotherapy for advanced cancer. Impact on cost of therapies for advanced cases.	30.00%	20% to 40%	11,245	3,730	18,760	15,030
Cost of chemotherapy. Impact on cost of therapies for advanced cases.	£2,561	£808 to £4969	11,245	3,100	22,433	19,333
Predicted % requring radiotherapy for advanced cancer. Impact on cost of therapies for advanced cases.	35.00%	30% to 45%	11,245	10,068	13,600	3,532
Cost of radiotherapy. Impact on cost of therapies for advanced cases.	£802	£607 to £1068	11,245	11,404	11,028	376