Title:

Improving Outcomes: A Strategy for Cancer

Lead department or agency:

Department of Health

Other departments or agencies:

Impact Assessment (IA)

IA No: 5054

Date: 07/01/2011

Stage: Final

Source of intervention: Domestic

Type of measure: Other

Summary: Intervention and Options

What is the problem under consideration? Why is government intervention necessary?

Over 250,000 people are diagnosed with cancer every year and around 130,000 die from the disease. Currently about 1.8 million people are living with and beyond a cancer diagnosis.

Although improvements have been made in the quality of cancer services in England in recent decades, a significant gap remains in both survival and mortality rates compared to the European average. The gaps appear to be due to later diagnosis and specific capacity limitations. The NHS has not been able to achieve expected survival rates. A Strategy is a necessary but not sufficient condition for the NHS to be able to achieve expected survival rates.

What are the policy objectives and the intended effects?

While recognising that there have been improvements in cancer services and outcomes over the last decade, the Coalition Government now wants to deliver improved outcomes, by tackling preventable incidence, by earlier diagnosis and by improving the quality and efficiency of cancer services.

The strategy sets out how this can be done, linked to the new Outcomes Frameworks, and it is aimed to increase the numner of people surviving at least 5 years beyond diagnosis by 5,000 every year by 2014/15. The benefits in this IA are estimated in terms of monetised Quality Adjusted Life Years (QALYs).

What policy options have been considered, including any alternatives to regulation? Please justify preferred option (further details in Evidence Base)

Option 1: Do nothing – CRS 2007 measures implemented would continue to be delivered. Centrally organised service development and implementation of any further measures or at other locations would stop. Note that implementation for screening has changed since 2007.

Option 2: Improve outcomes for patients by continuing with the implementation of CRS measures in the roll out phase along with a few additional measures, i.e. public awareness, screening and treatment measures already announced.

Option 3: As option 2 plus measures to improve cancer survival rates by providing further increased radiotherapy capacity, earlier diagnosis of cancer and information to provide an indication of improved outcomes, particularly from improved access to cancer diagnostics.

The preferred option is Option 3 as it provides a substantial higher net benefit than Option 2..

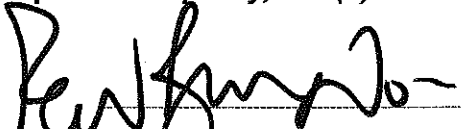
Will the policy be reviewed? It will be reviewed. **If applicable, set review date:** in approximately 3-4 years

What is the basis for this review? Not applicable. **If applicable, set sunset clause date:** Month/Year

Are there arrangements in place that will allow a systematic collection of monitoring information for future policy review? Yes

SELECT SIGNATORY Sign-off For final proposal stage Impact Assessments:

I have read the Impact Assessment and I am satisfied that (a) it represents a fair and reasonable view of the expected costs, benefits and impact of the policy, and (b) the benefits justify the costs.

Signed by the responsible Minister:  Date: 10 Jan 2011

Summary: Analysis and Evidence

Policy Option 1

Description:

IA OPTION 3: Extending cancer screening, significant improvement in radiotherapy capacity, greater public awareness of cancer and improved access to diagnostics.

Price Base Year	PV Base Year **2010**	Time Period Years **10**	Net Benefit (Present Value (PV)) (£m)		
			Low: **Optional**	High: **Optional**	Best Estimate: 26,683

COSTS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Cost** (Present Value)
Low	Optional	1-4	Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	76		860	**7,182**

Description and scale of key monetised costs by 'main affected groups'

Increased radiotherapy capacity via a small increase in machines, access to specialized treatment overseas & improved utilization of existing machines. Improvements to the current screening programmes and the induction of flexible sigmodoscopy. Improved primary care access to key diagnostics and a publicity campaign to improve public awareness of symptoms. Data collection changes to provide an early indication of improved outcomes. Costs are based on opportunity costs rather than case costs

Other key non-monetised costs by 'main affected groups'

The cost of treating cancer is likely to increase in coming years because of an ageing population, rising incidence, alonside the potential for new treatments and improved diagnostic capability. This challenge is common to all options within this IA.

BENEFITS (£m)	**Total Transition** (Constant Price)	Years	**Average Annual** (excl. Transition) (Constant Price)	**Total Benefit** (Present Value)
Low	Optional		Optional	**Optional**
High	Optional		Optional	**Optional**
Best Estimate	0		3,693	**33,866**

Description and scale of key monetised benefits by 'main affected groups'

The pathway improvement in the cervical screening programme will provide cash releasing savings.

The improvements in radiotherapy capacity, screening programmes and earlier diagnosis will provide QALY benefits and will be demonstrated by improved survival rates.

Other key non-monetised benefits by 'main affected groups'

Improved information will allow both commissioner and providers to benchmark their performance particularly in relation to improved access to diagnostics and this will provide an early indication of their delivery of improved outcomes for patients. Better information for patients will provide opportunities for being better informed and be more in control of their treatment which in turn should drive up quality.

Key assumptions/sensitivities/risks **Discount rate (%)** 1.5

An increase in radiotherapy capacity from the existing set of equipment can be delivered over a relatively short time and the new equipment will deliver the target capacity.
The research findings regarding flexible sigmoidoscopy are validated in the pilots and the National Screening Committee recommend the programme proceeds to full roll out
The planned growth in diagnostic demand can be met from capacity that already exists or can be delivered.
The results of the pilot campaigns deliver sufficient benefit to gain ERG approval to a wider roll out
The campaigns and the improved access to diagnostics provides an increase in the number of cancers detected at an earlier stage and this results in the desired improvement in survival rates

Direct impact on business (Equivalent Annual) £m):			**In scope of OIOO?**	**Measure qualifies as**
Costs: 0	**Benefits:** 0	**Net:** 0	No	NA

Enforcement, Implementation and Wider Impacts

What is the geographic coverage of the policy/option?			England		
From what date will the policy be implemented?			01/04/2011		
Which organisation(s) will enforce the policy?			n/a		
What is the annual change in enforcement cost (£m)?			n/a		
Does enforcement comply with Hampton principles?			Yes		
Does implementation go beyond minimum EU requirements?			N/A		
What is the CO_2 equivalent change in greenhouse gas emissions? (Million tonnes CO_2 equivalent)			**Traded:** 0	**Non-traded:** 0	
Does the proposal have an impact on competition?			No		
What proportion (%) of Total PV costs/benefits is directly attributable to primary legislation, if applicable?			**Costs:** NA	**Benefits:** NA	
Distribution of annual cost (%) by organisation size (excl. Transition) (Constant Price)	**Micro** 0	**< 20** 0	**Small** 0	**Medium** 0	**Large** 0
Are any of these organisations exempt?	Yes/No	Yes/No	Yes/No	Yes/No	Yes/No

Specific Impact Tests: Checklist

Set out in the table below where information on any SITs undertaken as part of the analysis of the policy options can be found in the evidence base. For guidance on how to complete each test, double-click on the link for the guidance provided by the relevant department.

Please note this checklist is not intended to list each and every statutory consideration that departments should take into account when deciding which policy option to follow. It is the responsibility of departments to make sure that their duties are complied with.

Does your policy option/proposal have an impact on…?	**Impact**	**Page ref within IA**
Statutory equality duties[1] Statutory Equality Duties Impact Test guidance	Yes	23
Economic impacts		
Competition Competition Assessment Impact Test guidance	No	23
Small firms Small Firms Impact Test guidance	No	23
Environmental impacts		
Greenhouse gas assessment Greenhouse Gas Assessment Impact Test guidance	No	24
Wider environmental issues Wider Environmental Issues Impact Test guidance	No	24
Social impacts		
Health and well-being Health and Well-being Impact Test guidance	Yes	24
Human rights Human Rights Impact Test guidance	No	24
Justice system Justice Impact Test guidance	No	24
Rural proofing Rural Proofing Impact Test guidance	No	24
Sustainable development Sustainable Development Impact Test guidance	No	24

[1] Public bodies including Whitehall departments are required to consider the impact of their policies and measures on race, disability and gender. It is intended to extend this consideration requirement under the Equality Act 2010 to cover age, sexual orientation, religion or belief and gender reassignment from April 2011 (to Great Britain only). The Toolkit provides advice on statutory equality duties for public authorities with a remit in Northern Ireland.

Evidence Base (for summary sheets) – Notes

Use this space to set out the relevant references, evidence, analysis and detailed narrative from which you have generated your policy options or proposal. Please fill in **References** section.

References

Include the links to relevant legislation and publications, such as public impact assessments of earlier stages (e.g. Consultation, Final, Enactment) and those of the matching IN or OUTs measures.

No.	Legislation or publication
1	Equity and excellence: Liberating the NHS
2	Healthy Lives, Healthy People: Our strategy for public health in England
3	Within the Evidence Summary, footnotes have been used to identify other relevant references
4	

+ Add another row

Evidence Base

Ensure that the information in this section provides clear evidence of the information provided in the summary pages of this form (recommended maximum of 30 pages). Complete the **Annual profile of monetised costs and benefits** (transition and recurring) below over the life of the preferred policy (use the spreadsheet attached if the period is longer than 10 years).

The spreadsheet also contains an emission changes table that you will need to fill in if your measure has an impact on greenhouse gas emissions.

Annual profile of monetised costs and benefits* - (£m) constant prices

	Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	Y_9
Transition costs	6.2	6.2	25.9	37.4	0	0	0	0	0	0
Annual recurring cost	151	455	542	713	969	1007	1183	1165	1209	1207
Total annual costs	157	461	568	750	969	1007	1183	1165	1209	1207
Transition benefits										
Annual recurring benefits	83	1270	1998	3075	4457	4633	5280	5263	5435	5437
Total annual benefits										

* For non-monetised benefits please see summary pages and main evidence base section

Microsoft Office
Excel Worksheet

Evidence Base

Problem under consideration

1. Over 250,000 people are diagnosed with cancer every year. More than one in three of us will develop cancer in our lifetime and one in four of us will die of cancer. At any one time, over 1.8 million people are living with and beyond a cancer diagnosis.

2. Despite improvements in survival, mortality and quality of cancer services, cancer outcomes in England have historically been poor when compared with the rest of Europe. It is generally accepted that the reason that survival in England is still well below the EU average for most cancers is due to cancers being diagnosed when they are more advanced (ie diagnosed at a later stage), compared to comparable EU countries. (Source: Eurocare 4 and Prof Michel Coleman).

3. The main gap on a national basis is present in 1-year survival (suggesting late stage diagnosis). The gap remains in 5-year survival, although the gap for 5-year survival for those that survive 1st year is generally smaller. To put this in context, if England were to achieve post-diagnosis survival rates at the European average, then each year an additional 5,000 people would survive for at 5 years after diagnosis. This will require an increase in the proportion of patients who are diagnosed at an early stage of the cancer and should reduce the proportion of patients first diagnosed via an emergency route.

4. There are still wide variations across the country both in outcomes measures (1 and 5 year survival) as well as certain proxy measures, suggesting that a strategy is needed to provide a clear and up-to-date guide to those measures that are the most important to achieve the desired improvements in outcomes .

5. Post-diagnosis survival can be recorded readily, but is an imperfect measure of success. Improvements in post-diagnosis survival do not necessarily mean that people are living longer: if diagnosis is made earlier, some of the improvement will be only apparent (caused by survival being measured from an earlier starting point). Separating this effect – which also affects international comparisons - from genuine improvement in life expectancy is challenging.

6. Survival and mortality rates are not the only challenges. Many patients are living with and beyond cancer for longer periods of time, and so must have their needs met, to allow them to live as healthy a life as possible, for as long as possible. There are also variations in patients' experience of care, so we need to ensure services are designed to meet the needs and wishes of all patients.

7. As well as having a devastating human impact, cancer also has a significant financial impact on the NHS and the wider economy. It is estimated that in 2008/09, NHS expenditure on cancer services was over £5.1 billion (and the NAO have estimated that expenditure is actually around £6.3 billion). The total cost of cancer to society as a whole has been estimated at £18.3 billion for the same year. These costs are set to rise still further as incidence increases, people live for longer with cancer and new treatments become available.

8. Cancer incidence is continuing to increase by about 4 percent per annum. This is due to a combination of population aging, and increases in the age-standardised rates of cancer registrations (see http://www.statistics.gov.uk/pdfdir/can1010.pdf). This growth will put continuing pressure on cancer services capacity, and on reducing the gap with comparable country outcomes.

Rationale for intervention and policy objective

9. While recognising that there have been improvements in cancer services and outcomes in recent decades, we now want to take further steps: to tackle preventable incidence and to improve the quality and efficiency of cancer services.

10. In cancer care, we are failing to achieve the Coalition Government's aim to deliver health outcomes that are among the best in the world. Outcomes for patients in England continue to lag behind those in those in countries of comparable wealth.

11. The Strategy has noted "the evidence and analyses that have become available in recent months. These include:

    - a new international benchmarking project – findings from which suggest that English survival rates continue to lag behind the best performing countries in the partnership and that, with the

exception of breast cancer, we are not narrowing the "survival gap" to move closer to the best performing countries;

- an analysis of variations in drug usage across a number of different countries – which shows that the UK has a low rank for the most recently licensed cancer drugs;
- research into the way in which patients are first diagnosed with cancer – which shows that about a quarter of cancer patients are diagnosed via emergency routes and that the survival rates for those diagnosed via emergency routes is considerably lower than other cancer patients;
- a review of the quality of cancer registration – which demonstrates that deficiencies could not be significant enough to account for the differences in survival rates that have been observed;
- clinical trials of screening – new research shows that a one-off procedure using flexible-sigmoidoscopy could save 3,000 lives per year;
- measurement of service quality through peer review – which shows that performance is improving overall but is unacceptable in a small number of multidisciplinary teams; and
- a new cancer patient experience survey – which demonstrates which areas require more attention to improve patient experience.

12. Achieving improvements in outcomes will be the focus of the performance management of cancer services in future. *Cancer – Improving Outcomes Strategy* sets out how the reforms described in *Equity and excellence: Liberating the NHS*, *Healthy Lives, Healthy People: Our strategy for public health in England* and associated documents will be used to deliver this.

13. Through the approaches in the strategy, it is aimed to increase the number of 5-year survivors by 5,000 every year by 2014/15.

Description of options considered (including do nothing)

14. There are a number of areas in which cancer services can potentially be improved in order to deliver improved outcomes and efficiency: data collection, radiotherapy, inpatient management, screening and early diagnosis. The choice is deciding which and how much of these areas to improve with finite resources to provide the best outcome for patients.

15. There is a range of action planned to respond to the challenges identified but, in particular, we need to:

    - reduce the incidence of cancers which are preventable, by lifestyle changes
    - improve uptake of screening and introduce new screening programmes where there is evidence to justify them
    - achieve earlier diagnosis of cancer, to increase the scope for successful treatment
    - make sure that all patients have access to the best possible treatment.

Option 1: Do nothing

16. The Cancer Reform Strategy (2007) set out a series of measures to address the challenge of cancer mainly over the five years 2008-2012. The impact assessment outlined the growth in a wide range of expenditure lines, which largely reached a steady level of expenditure by 2010/11.

17. This option would be to continue to deliver those measures that had already been implemented (or partly implemented) but further centrally organised service development and implementation would stop. Note that implementation has varied since CRS2007, especially for screening. For example, the randomisation of rollout for the breast cancer screening programme is being carried out over two 3-year screening programmes, rather than one.

Option 2: Service development (Roll-out of existing programmes)

18. This option aims to provide some improved outcomes for patients by continuing with the implementation of measures currently in the roll out phase, along with limited additional developments, i.e. campaigns to raise public awareness, screening and treatment measures already announced by the Coalition Government.

19. Option 2 is not included in the summary sheets above, as this is a Final IA. However, discussion of Option 2 is included in the Evidence Base, as it helps explain the logic behind Option 3, which builds on Option 2.

Option 3: Improving Outcomes

20. This option would include measures in option 2, but aims to improve cancer survival rates in line with the strategy's objective by providing significantly improved primary care access to key cancer diagnostics. It would also provide relevant performance information, to monitor both use of the improved access as well as progress towards improved survival rates (using proxy indicators). It takes account of the progress achieved to date, latest implementation plans and emerging research, as well as other evidence regarding existing and potential new services. The intention would be to provide a stronger focus on outcomes, while taking into account the current economic situation.

Risks and assumptions

21. Increased expenditure, over and above Option 1, is required to deliver the programmes in Options 2 and 3. It is assumed that this expenditure will be funded as part of the spending review. In turn, this funding may depend on savings elsewhere in the NHS, so there is a funding risk.
22. The evidence for the expected outcomes resulting from the programmes in these options is based on availability. Inevitably, RCT-type evidence is not generally available, and consequently the evidence varies in its robustness and applicability. There is therefore considerable uncertainty around the estimates for benefits in the options, and in general in the relationship between programmes (eg screening, earlier diagnosis) and outcomes. This applies particularly to earlier diagnosis.
23. Some of the increased services require an increase in workforce, particularly earlier diagnosis, and radiotherapy. It is estimated that the increases required are manageable, and will in practice be a mixture of new staff and staff retrained from other surplus areas. There is a small relative risk that sufficient staff will not be available to meet the increase in services in Options 2 or 3.
24. The aim of the policy is to increase both life expectancy and 1 and 5 year survival. This will require a shift in the proportion of patients first diagnosed with a late stage to an early stage cancer. Given that 95% of cancer patients are currently diagnosed following presentation with symptoms, this shift will require changes in behaviour of both patients and the medical profession. There is a risk that without coordinated changes in behaviour significantly fewer benefits may result from earlier diagnosis.
25. As noted in Paragraph 5, it is recognised that measuring post-diagnosis survival will exaggerate the benefits of earlier diagnosis, because survival is being measured from an earlier starting point. (This is known as "lead time bias".) It is therefore possible that there could be significant improvements in 1 and 5-year survival rates without any corresponding benefit to patients, in terms of improved life-span. This risk cannot be discounted completely: however preliminary calculations suggest that the package of measures proposed here would remain cost-effective even after correcting for lead time bias.
26. The following assumptions have been used for internal consistency and consistency with the IA Technical Guidance:
    - value of a QALY at £60,000
    - discount rate for benefits at 1.5%
    - discount rate for costs at 3.5%.
27. Each of the options uses a number of key assumptions which could be expressed as risks, and these are set out in the earlier summary pages. Underpinning this strategy is an assumption that the funding identified will be available, cancer remains one of those policies which Ministers classify as a priority for funding, and the amounts remain affordable. For convenience, the key assumptions related to the recommended option are repeated below:

- An increase in radiotherapy capacity from the existing set of equipment can be delivered over the relatively short time planned and the new equipment will deliver the target capacity.
- The research findings regarding flexible sigmoidoscopy are validated in the pilots and the National Screening Committee recommend the programme proceeds to full roll out
- The planned growth in diagnostic demand can be met from equipment and work force capacity that already exists or growth in these resources can be delivered.
- The results of the pilot public awareness campaigns deliver sufficient benefit to gain ERG approval to a wider roll out
- The public awareness campaigns and the improved access to diagnostics provide an increase in the number of cancers detected at an earlier stage and this results in the desired improvement in survival rates.
- Improvements achieved in 1-year and 5-year post-diagnosis survival rates are assumed to reflect substantial improvements in real survival, rather than primarily being caused by lead time bias. This assumption is reflected in all calculations of benefits, though some sensitivity analysis is also provided.

28. While the NHS investment figures within this impact assessment represent our central estimates of NHS spend, we will be holding the service to account for the outcomes delivered as a result, rather than for the spend itself.

Costs (cash basis) and benefits of each option

29. Costs in this IA have not been costed at Opportunity Cost, ie they have not been multiplied by 2.4. Therefore, benefit to cost ratios need to be considered in this light. In other words, we are looking for benefit to cost ratios of at least 2.4 to justify expenditure.

30. Option 2 is estimated to have the following summary costs and benefits, in relation to Option 1:

	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	
COSTS*	0	1	2	3	4	5	6	7	8	9	Total
	£m	£m	£m	£m	£m	£m	£m	£m	£m	£m	£m
Radiotherapy	15.0	30.5	46.6	50.6	49.9	49.1	48.3	47.6	46.8	46.0	430.4
Screening	10.5	21.0	43.8	53.5	85.0	85.0	85.0	85.0	85.0	85.0	638.8
Awareness & early diagnosis	10.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	190.0
Sub-Total	35.5	71.5	110.4	124.1	154.9	154.1	153.3	152.6	151.8	151.0	1259.2
BENEFITS											
Radiotherapy	59.6	129.7	176.4	223.1	215.1	207.0	198.8	190.5	182.1	173.8	1,756.0
Earlier diagnosis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Screening	0.0	0.0	540.1	1,097.6	1,883.9	1,944.9	1,996.1	2,040.5	2,069.9	2,081.1	13,654.1
Total Benefits	**59.6**	**129.7**	**716.5**	**1,320.6**	**2,099.0**	**2,151.9**	**2,194.8**	**2,230.9**	**2,252.1**	**2,254.9**	**15,410.2**

*Not on opportunity cost basis

31. Option 3 is estimated to have the following summary costs and benefits, in relation to Option 1:

	2011/12	***2012/13***	***2013/14***	***2014/15***	***2015/16***	***2016/17***	***2017/18***	***2018/19***	***2019/20***	***2020/21***	
COSTS[1]	***0***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***Total***
	£m	£m	£m	£m	£m	£m	£m	£m	£m	£m	£m
Radiotherapy	17.0	35.5	56.6	66.6	65.9	66.2	64.4	63.6	62.8	62.0	560.4
Screening & Prevention	12.8	24.8	42.5	52.2	84.3	84.3	84.3	84.3	84.3	84.3	638.1
Awareness & early diagnosis	33.0	136.0	146.7	198.3	273.7	289.1	364.4	357.8	376.6	376.6	2,552.2
Sub-Total	62.8	196.3	245.8	317.1	423.9	439.6	513.1	505.7	523.7	522.9	3750.9
Efficiency Savings											
Screening (HPV Triage)	0.0	-6.7	-20.2	-20.2	-20.2	-20.2	-20.2	-20.2	-20.2	-20.2	-168.0
Revenue Costs less savings	**62.8**	**189.6**	**225.6**	**296.9**	**403.7**	**419.4**	**492.9**	**485.5**	**503.5**	**502.7**	**3582.9**

Capital Costs											
Radiotherapy	2.6	2.6	10.8	15.6	0.0	0.0	0.0	0.0	0.0	0.0	
Capital Costs	**2.6**	**2.6**	**10.8**	**15.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**31.6**
NET Cost, incl Capital	65.4	192.2	236.4	312.5	403.7	419.4	492.9	485.5	503.5	502.7	**3614.49**

Benefits	*2011/12* *0*	*2012/13* *1*	*2013/14* *2*	*2014/15* *3*	*2015/16* *4*	*2016/17* *5*	*2017/18* *6*	*2018/19* *7*	*2019/20* *8*	*2020/21* *9*	*Total*
Radiotherapy	83.4	180.5	282.4	388.8	380.8	372.7	364.5	356.2	347.8	339.5	3,096.6
Earlier diagnosis (Life-years at £60,000 *0.5)		1,089.7	1,175.5	1,588.9	2,192.3	2,315.7	2,919.0	2,866.2	3,016.8	3,016.8	20,180.9
Screening (see separate sheet)	0.0	0.0	540.1	1,097.6	1,883.9	1,944.9	1,996.1	2,040.5	2,069.9	2,081.1	13,654.1
TOTAL BENEFITS	**83.4**	**1,270.3**	**1,998.0**	**3,075.3**	**4,457.0**	**4,633.3**	**5,279.6**	**5,262.8**	**5,434.6**	**5,437.4**	**36,931.6**

Notes: 1 Not on opportunity cost basis

2 QALYs not available for earlier diagnosis. Life-years converted to QALYs, assuming that 1 life-year is approximately 0.5 QALYs. This approach is likely to underestimate QALYs as it only takes account of mortality gains, and ignores gains in quality of life.

Summary of Costs and Benefits for All Options

SUMMARY OF COSTS* AND BENEFITS

	2011/12 *0*	*2012/13* *1*	*2013/14* *2*	*2014/15* *3*	*2015/16* *4*	*2016/17* *5*	*2017/18* *6*	*2018/19* *7*	*2019/20* *8*	*2020/21* *9*	***Total yrs1-10***
	£m	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**
Option 1											
Net costs	0	0	0	0	0	0	0	0	0	0	**0**
Benefits	0	0	0	0	0	0	0	0	0	0	**0**
Option 2											
Net costs	36	72	110	124	155	154	153	153	152	151	**1,259**
Benefits	60	130	717	1,321	2,099	2,152	2,195	2,231	2,252	2,255	**15,410**
Option 3											
Net costs	65	192	236	313	404	419	493	486	504	503	**3,614**
Benefits	83	1,270	1,998	3,075	4,457	4,633	5,280	5,263	5,435	5,437	**36,932**

* Not on opportunity cost basis

Summary of Costs and Benefits for All Options, presented on an opportunity cost basis.

32. For the NHS and other public organisations providing health care, the opportunity cost of re-allocating money to meet the cancer strategy will lead to an additional social cost. NICE assesses the cost of a QALY to the NHS at £25,000 each. Hence, the opportunity cost of around £25,000 of DH funding is one QALY. However, it is estimated that the general public value one QALY at £60,000, and therefore the opportunity cost of public funding in terms of QALYs should be monetised at £60,000 for each QALY to obtain its "true" value. In practice, this means that benefits need to be around 2.4 greater than costs in order to achieve an improvement in the cost-effectiveness of the overall DH budget. Generally, in this IA, we have presented costs at estimated cost rather than opportunity cost, and looked for the above benefit/cost ratio. However, this table takes the alternative approach and presents the costs on an opportunity cost basis.

33.

SUMMARY OF COSTS AND BENEFITS - COSTS ON OPPORTUNITY COST BASIS

	2011/12	*2012/13*	*2013/14*	*2014/15*	*2015/16*	*2016/17*	*2017/18*	*2018/19*	*2019/20*	*2020/21*	
	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	***Total yrs1-10***
	£m	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**	**£m**
Option 1											
Net costs	0	0	0	0	0	0	0	0	0	0	**0**
Benefits	0	0	0	0	0	0	0	0	0	0	**0**
Net benefit	0	0	0	0	0	0	0	0	0	0	**0**
Discounted Net Benefit	0	0	0	0	0	0	0	0	0	0	**0**
Option 2											
Net costs	85	172	265	298	372	370	368	366	364	362	3,022
Benefits	60	130	717	1,321	2,099	2,152	2,195	2,231	2,252	2,255	**15,410**
Net benefit	-26	-42	452	1,023	1,727	1,782	1,827	1,865	1,888	1,893	12,388
Discounted Net Benefit	-26	-38	448	994	1,654	1,686	1,708	1,722	1,723	1,706	**11,578**
Option 3											
Net costs	157	461	567	750	969	1,007	1,183	1,165	1,208	1,207	8,675
Benefits	83	1,270	1,998	3,075	4,457	4,633	5,280	5,263	5,435	5,437	**36,932**
Net benefit	-74	809	1,431	2,325	3,488	3,627	4,097	4,097	4,226	4,231	28,257
Discounted Net Benefit	-74	806	1,410	2,264	3,355	3,453	3,866	3,826	3,907	3,870	**26,683**

The Benefits of Option 3

34. This section summarises the benefits of Option 3.

Radiotherapy

35. The benefits of radiotherapy have been estimated as follows:

Year	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*	*18/19*	*19/20*	*20/21*
Additional 10-year survivors	**278**	**602**	**941**	**1,296**	**1,269**	**1,242**	**1,215**	**1,187**	**1,159**	**1,132**
QALYs	**1,390**	**3,009**	**4,707**	**6,480**	**6,346**	**6,211**	**6,074**	**5,936**	**5,797**	**5,658**
Monetised QALYs (£m)	**83**	**181**	**282**	**389**	**381**	**373**	**364**	**356**	**348**	**340**

Screening

36. The benefits of screening diagnosis have been estimated as follows:

Year	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*	*18/19*	*19/20*	*20/21*
Additional 5-year survivors*	**0**	**0**	**450**	**915**	**1,570**	**1,621**	**1,663**	**1,700**	**1,725**	**1,734**
QALYs	**0**	**0**	**9,002**	**18,293**	**31,399**	**32,415**	**33,268**	**34,008**	**34,499**	**34,686**
Monetised QALYs (£m)	**0**	**0**	**540**	**1,098**	**1,884**	**1,945**	**1,996**	**2,040**	**2,070**	**2,081**

* Based on QALYs and assuming 20 QALYs per survivor.

Earlier Diagnosis

37. The benefits of earlier diagnosis have been estimated as follows:

Year	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*	*18/19*	*19/20*	*20/21*
Additional 5-year survivors		**1,930**	**2,082**	**2,814**	**3,882**	**4,101**	**5,169**	**4,921**	**5,254**	**5,342**
QALYs*	**0**	**18,162**	**19,591**	**26,482**	**36,538**	**38,595**	**48,651**	**47,769**	**50,280**	**50,280**
Monetised QALYs (£m)		**£1,090**	**£1,175**	**£1,589**	**£2,192**	**£2,316**	**£2,919**	**£2,866**	**£3,017**	**£3,017**

* Based on life-years, and assuming 1 life-year is approximately 0.5 QALYs.

Cancer Strategy Overall

38. The benefits of radiotherapy, screening and earlier diagnosis combined have been estimated approximately as follows:

Year	*11/12*	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*	*18/19*	*19/20*	*20/21*
Additional survivors	**278**	**2,531**	**3,473**	**5,024**	**6,721**	**6,964**	**8,047**	**7,808**	**8,139**	**8,208**
QALYs	**1,390**	**21,171**	**33,300**	**51,254**	**74,284**	**77,221**	**87,993**	**87,713**	**90,576**	**90,624**
Monetised QALYs (£m)	**83**	**1,270**	**1,998**	**3,075**	**4,457**	**4,633**	**5,280**	**5,263**	**5,435**	**5,437**

RADIOTHERAPY

39. Radiotherapy involves a high radiation dose to a tumour, and (together with surgery and chemotherapy) is one of the three principle ways of treating cancer. A course of radiotherapy may use many small treatments ('fractions') delivered each day to reach a dose that can cure a tumour, but not damage surrounding normal tissues. Linear accelerators (linacs) are currently the radiotherapy treatment systems of choice.

40. Depending on tumour, type and stage, cancer patients are treated using a combination of surgery, radiotherapy and chemotherapy. Modelling of international best practice of cancer treatment suggests that up to 52% of cancer patients should be offered radiotherapy as part of their treatment. The Cancer Reform Strategy (2007) suggested that less than 40% of patients in England had been receiving radiotherapy as part of their main treatment. The strategy outlined an ambitious plan to expand radiotherapy capacity by a further 40% to enable England to reach access rates comparable with the best in the world.

41. The NAO report *Delivering the Cancer Reform Strategy(2010)* reported that there is a wide variation in throughput per radiotherapy machine in England. If an average throughput of 8,700 factions per machine per year could be achieved across all centers, up to 20% more patients could be treated without the need for significant extra capital investment in radiotherapy capacity.

42. The NAO reported that the average capacity of a RT machine is currently 7000 fractions per year, and has changed little since the 2007 CRS. This in part is due to trusts not willing to pay for out-of-hours servicing and upgrades. Part of the expenditure (£5m per year) recognises that any future RT contracts between commissioners and providers will need to reflect this. However the overall effect, in line with QIPP, is to reduce the average cost per fraction for machines that do deliver 8,700 fractions per year.

43. Options 2 and 3 are predicated on clinical practice referring an increasing percentage of patients, and RT capacity growing in tandem to absorb this extra demand, without compromising waiting times. In addition to releasing the extra radiotherapy capacity outlined in option 2, option 3 also estimates the costs and benefits of opening additional satellite radiotherapy centers.

44. Clinical evidence suggests that some patients, who could benefit from radiotherapy, are currently being deterred from taking the treament because of long travel times in rural areas. This is a particular barrier when the patient has already undergone a surgical or chemotherapy treament, and may have to travel long distances over a number of weeks. The advances in communication techology now mean that smaller radiotherapy centers are now feasible, serviced by a clinical and planning hub many miles away, which would not have been possible a decade ago. Manchester has already opened one such satellite site in Oldham and is currently planning a second.

45. The Cancer Reform Strategy (2007) outlined an ambitious plan to expand radiotherapy capacity by a further 40% to enable England to reach access rates comparable with the best in the world.

Option 1

46. The 'do nothing' option assumes that 246 linear accelerators (linacs) are fully functional over the period 2011/12 to 2020/21 and that machines are replaced when they become 10 years old.

47. This option incurs no increase in costs over existing expenditure and delivers no QALY benefits.

Option 2: Increasing efficiency of linacs but not total number

48. Option 2 involves increasing overall average capacity to 8,700 fractions per year in 246 linear accelerators. A linear accelerator should have a maximum capacity of around 11,000 fractions per year. To account for scheduled and un-scheduled loss of capacity plus the average spare capacity needed to enable timely access of new patients, an average throughput of 8,700 patients per year is acceptable. In 2010, the national average was 7,036 fractions per machine, again with wide regional variation. So additional fractions are achieved in Option 2 by increasing the efficiency of the utilisation of the existing linacs. Key to releasing this extra capacity is ensuring maintenance and upgrades are carried out out-of-hours to minimise lost time during the normal working schedule.

		2011/12	2012/13	2013/14	2014/15
Option 2	**Cost (£millions)**	**£11**	**£17**	**£22**	**£26**
	Additional fractions	93,899	204,347	277,857	351,370
	Fractions per million	35.1	37.2	38.5	39.8
	Treatments	6,624	14,415	19,600	24,786

49. The additional lives saved and the QALYs gained have been modelled as follows:

		2011/12	2012/13	2013/14	2014/15
Option 2	Additional patients living 10 years	199	432	588	744
	Total QALY gain	994	2162	2940	3718
	Monetised QALYs (£m)	60	130	176	223
	Estimated access ratio	37%	39%	40%	42%

Option 3: Increasing efficiency of linacs, and increasing number of linacs by 12

50. Option 3 expands capacity and envisages that clinical practice changes go further to move more services to satellite sites. This would help to improve the geographical spread of services, and would improve patient choice. Option 3 is effectively option 2 plus an increase of 12 in the number of linear accelerators over the SR period, in areas which currently have long travel distances to the nearest radiotherapy centre.

		2011/12	2012/13	2013/14	2014/15
Option 3	**Cost (£millions)**	**£13**	**£22**	**£32**	**£42**
	Additional fractions	108,899	235,347	342,257	450,570
	fractions per million	35.4	37.7	39.7	41.7
	Treatments	7,682	16,602	24,143	31,784

51. The additional lives saved and the QALYs gained have been modelled as follows:

		2011/12	2012/13	2013/14	2014/15
Option 3	Additional patients living 10 years	278	602	941	1296
	Total QALY gain	1390	3009	4707	6480
	Monetised QALYs (£m)	83	181	282	389
	Estimated access ratio	37%	40%	42%	44%

Brief summary of approach to costs and benefits

52. It has been assumed that on average the current radiotherapy machine could offer an additional 1,662 fractions per year to treat patients. To release this extra capacity, an extra £20,000 per machine per year would be required to ensure servicing and upgrades are carried out outside normal working schedules. Briefly, the NAO has drawn attention to the utilisation of linacs, which is low in England. An average throughput of 8,700 patients per machine has been assumed. Costs have been modelled on estimated partial variable costs (radiotherapy is not currently funded via tariff). It has been assumed that half of the average staff time per fraction will be required for additional fractions, as staff time also has a fixed element per machine.

53. Benefits are variable, as radiotherapy is sometimes given as a treatment, and sometimes for palliative care. It is assumed that there are patients who could benefit from radiotherapy as a curative treatment (usually in addition to surgery), who are currently not receiving it. It is assumed that, in tandem to the releasing of extra radiotherapy capacity, additional treatments will be commissioned in line with best practice guidelines. In the absence of detailed knowledge of which patients are currently being offered radiotherapy and at what stage of the disease, it is impossible to predict with a high degree of certainly what will be the benefits of incrementally offering additional patients a course of radiotherapy.

54. The additional benefits that radiotherapy adds to the chances of survival for breast cancer patients have been estimated at 3%[1]. For the benefits calculations in this impact assessment, it is assumed that the majority of the benefits from radiotherapy will have been achieved with the 37% of patients already receiving the treatment. It is also assumed that the incremental benefits will reduce as the number of patients approaches 52%.

percentage of patients treated with radiotherapy	0-25%	25-35%	35-45%	45-52%
Additional 10 year survival	25%	15%	3%	1%

55. Fuller background and details for these and other calculations are attached at Annex B.

RADIOTHERAPY - PROTON BEAM THERAPY

56. The National Radiotherapy Advisory Group reported in 2007 that an increased uptake of new technologies was required to ensure best outcomes for patients. One of the technologies it recommended was Proton Beam Therapy (PBT). Because of its very precise nature, PBT can avoid damage to critical tissues near the tumour. The strongest clinical case for PBT relates to children and young people with brain tumours.

57. While facilities are developed in England to treat 1500 patients per annum, patients are referred overseas for treatment. A "high priority" list of cancers has been identified but it is recognised that there is limited capacity to treat patients overseas and that travelling for treatment will not always be appropriate. A clinical reference panel advises on individual cases.

58. To date, the numbers of patients for the "high priority" list of cancers being treated overseas has grown slower than originally anticipated, but there are indications that growth is accelerating. The latest figures anticipate that growth will continue and will reach a steady state of 400 patients per year being treated by a 2013/14.

59. PBT is included for completeness, but is not currently expected to differ between the options in this IA. The costs included in all options and the assumption on the number of patients who will be referred overseas for treatment are set out below. Benefit estimates (eg QALYs) are not yet available for PBT for adults from the literature.

Costs (£m)	2010/11	2011/12	2012/13	2013/14	2014/15
		Year 1	**Year 2**	**Year 3**	**Year 4**
Est. No. of patients	60	120	250	400	400
Costs	£5.0	£9.0	£18.5	£29.6	£29.6
Increase over baseline		£4.0	£13.5	£24.6	£24.6

60. Despite proton beam therapy having been used clinically to treat cancer for over three decades, clinical evidence of the benefits of the treatment is still scarce. Because the main benefit of PBT is to patients with rare and particularly difficult to treat tumours, comparative clinical trial evidence is very difficult to obtain.

61. An analysis carried out by the Department of Health has suggested that the lifetime benefits of reduced side effects in children treated with PBT, compared to conventional radiotherapy, could be monetised at £48,000. This included the saving from reduced subsequent treatment costs and the lifetime benefit of reduced risk of impairments, such as deafness and reduced IQ.

62. Further work is being undertaken to build a fuller cost benefit case for expanding PBT, and will be published in Spring 2011 as part of an outline business case for the NHS provision of PBT.

[1] Shafiq J., Delaney G. & Barton M. B., (2007) An evidence-based estimation of local control and survival benefits of radiotherapy for breast cancer, Radiotherapy and Oncology, 84, 11-17

CANCER SCREENING

63. The CRS set out a series of projects to investigate improvements to existing screening programmes and to roll out extensions to some of these. These projects are now either completed or are in the implementation phase.

64. The existing programmes currently being rolled out are:

    - the Bowel Cancer screening programme for those aged 70-74 (phased rollout completing in 2013/14)
    - the Breast Cancer Screening programme for those aged 47-49 and 71-73 (randomised trial for one age group until 2014/15, full rollout completed in 2016)

Option 1

65. This assumes that the existing programmes would be maintained, and the extensions being rolled out would not expand beyond those locations that are implemented.

66. This option incurs no increase in costs over existing expenditure and delivers no QALY benefits.

Option 2

67. This assumes that the existing programmes and the extensions being rolled out would be implemented. It is also assumed that a new programme to implement bowel screening, using flexible sigmoidoscopy as a one-off screening, would commence with two pilot years followed by three phased implementation years.

68. Additional project costs for the first 4 years over the 2010/11 baseline are:

Option 2	*2010/11*	*2011/12*	*2012/13*	*2013/14*	*2014/15*
COSTS (£m)	**Year 0**	**Year 1**	**Year 2**	**Year 3**	**Year 4**
Breast expanded age range	£12.00	£0.00	£0.00	£0.00	£0.00
Bowel expanded age range	£17.00	£6.00	£17.00	£23.00	£23.00
Flexi Sig	0.00	£4.50	£4.00	£20.75	£30.50
Total Costs	**£29.00**	**£10.50**	**£21.00**	**£43.75**	**£53.50**

69. Expected benefits from these projects expressed in QALYs are:

	2010/11	*2011/12*	*2012/13*	*2013/14*	*2014/15*
BENEFITS (QALYs)					
Breast expanded age range	510	513	513	519	531
Flexi Sig	0	0	0	9,002	18,293
Bowel Cancer Screening	19,448	23,485	23,788	14,150	11,830
Total Benefits	**19,958**	**23,997**	**24,301**	**23,670**	**30,654**

70. Additional project costs over the 2010/11 baseline are then £85m in total for each of years 5 to 10; cost savings of £20m, £40m, and £60m are expected in years 8, 9, and 10 respectively (and £200m cost savings ultimately).

Option 3

71. This is as per Option 2 with the addition of HPV triage.

72. Additional project costs for the first 4 years over the 2010/11 baseline are:

Option 3	2010/11		2011/12	2012/13	2013/14	2014/15
Costs (£m)	**Year 0**		**Year 1**	**Year 2**	**Year 3**	**Year 4**
Breast expanded age range	£12.00		£0.00	£0.00	£0.00	£0.00
Bowel expanded age range	£17.00		£6.00	£17.00	£23.00	£23.00
Flexi Sig	0.00		£4.50	£4.00	£20.75	£30.50
HPV Triage	£5.00		£3.00	£4.51	-£0.75	-£0.75
Costs	**£34.00**		**£13.50**	**£25.51**	**£43.00**	**£52.75**
Minor project costs/changes	£5.00		-0.70	-0.71	-0.49	-0.54
Total Costs	**£39.00**		**£12.80**	**£24.80**	**£42.50**	**£52.20**

73. Additional project costs over the 2010/11 baseline are then £84.3m in total for each of years 5 to 10. Cost savings of about £20m per annum are expected from year 3 to 8, which then increase and reach a maximum of about £80m in year 10.

74. Benefits for Option 3 are the same as for Option 2, as we have not assumed any benefits for HIV triage.

Breast Cancer Screening

75. The current NHS Breast Screening Programme offers three yearly breast cancer screening by mammography to women between the ages of 50 and 70. In 2008-09, 1.8 million women were screened within the programme in England, and over three quarters of women aged 53 to 70 had been screened at least once in the previous three years[2]. Since the programme began in 1988, an estimated 130,000 cancers have been detected, and experts estimate the programme saves 1,400 lives every year[3].

76. This Outcomes Framework for Cancer proposes the continuation of the randomisation of the extension of the age band of women being screened to include ages 47 – 49, and 71 – 73. "Randomisation" in this context means that women are not being randomised individually, but by "batch". A batch may be one GP practice, or part of a practice (depending on size), or a group of smaller practices, or defined by postcode. The randomisation project will be run over two three-year screening rounds starting in 2010/11 and will reach full roll out by 2015/16. Based on data from the current programme, roll-out of the age extensions is estimated to cost £12m per year for the first screening round, increasing to £24m per year at full roll-out after 2015-16, if the randomisation project shows that screening in these age groups is clinically and cost-effective.

77. The calculation of benefits was based on data from a ScHARR report. (The SCHARR report can be found at http://www.cancerscreening.nhs.uk/breastscreen/nhsbsp-appraisal-47-49.pdf, and covers both age extensions. The authors also published *"A rapid-response economic evaluation of the UK NHS Cancer Reform Strategy breast cancer screening program extension via a plausible bounds approach."* In Madan J, Rawdin A, Stevenson M, Tappenden P. Value Health. 2010 Mar;13(2):215-21. Epub 2009 Oct 29).

78. The report looked into the cost effectiveness of breast cancer screening in women aged 47 – 49 and 71 – 73. The report suggests that breast cancer screening may be cost effective, with an average incremental cost per QALY of about £27,000 for the younger group, and about £11,000 for the older group.

79. The report found that benefit from screening the younger age group would be about 17 QALYs per 10,000 women screened, and about 33 QALYs per 10,000 women screened in the older age group. Based on this, and ONS population projections for the age bands, total QALYs gained was calculated. Assuming that in keeping with the current programme about 24% of women in the relevant age group are screened in each year, applying a valuation of £60,000 per QALY, and discounting at 1.5%, the net present value of total benefits from the extension is estimated at about £490m. The results are however sensitive to any disutility experienced due to false positive test results particularly by the younger age group.

80. These results (the base case) were shown to be sensitive to any disutility experienced due to false positive test results. As specific estimates of such effects are difficult to determine, short-term anxiety was defined in terms of QALYs lost and a range of values (0 to 0.05 QALYs lost per false

[2] Breast Screening Programme, England 2009-09, ONS/NHS Information Centre, February 2010

[3] Screening for Breast Cancer in England: past and Future, Advisory Committee on Breast Cancer Screening, February 2006

positive case) was explored. This showed that, beyond 0.028 QALYs per false positive result, the expected impact of screening on the health of the cohort was negative, and the intervention would not be cost-effective at any threshold. ,At 0.02 QALYs, the probability that the intervention is cost-effective for the younger cohort falls to 1.1% at a threshold of £20,000 per QALY.

81. It can also be argued that false negative test results will have some psychological effect, which should also be included. This was not fully explored in the research, and the impact is not clear.

82. There is an ongoing controversy between reputable figures as to the relative benefits of screening versus harms (primarily due to overdiagnosis and consequent over-treatment, rather than just worry caused by false positives). Nevertheless, most experts around the world consider that there is ample evidence that breast screening reduces deaths from this disease, and there is evidence that screening reduces the necessity for invasive treatment such as mastectomy. The Advisory Committee on Breast Cancer Screening (ACBCS) considers all new evidence relating to breast screening, and estimates breast screening saves 1,400 lives each year in England. Screening is about striking the right balance of risk and benefit, and most experts believe the evidence shows that reducing screening would cost the lives of many women.

83. A paper published earlier this year by Duffy et al (J Med Screen 2010; 17:25-30) suggested that the benefit of mammographic screening in terms of lives saved is greater in absolute terms than the harm in terms of overdiagnosis. Between 2 and 2.5 lives are saved for every overdiagnosed case. However, a study by the Nordic Cochrane Centre came to the opposite view.

84. An invited review by Klim McPherson (BMJ 10, 340 (June 24 2010)) weighs up the balance between these contrasting views. Rather than coming down firmly on either side of the debate, Prof McPherson's article concludes by calling for a synthesis of all relevant evidence, e.g. by NICE.

85. We note that the NHS Breast Screening Programme now operates a policy of informed choice for women about whether or not to accept their screening invitation. The leaflet sent with every invitation for screening has recently been revised, and now reflects the controversies by referring to potential over-diagnosis and Ductal Carcinoma In Situ (DCIS).

86. The calculations in the IA use the ACBCS view as the baseline case. However the randomisation studies from the BCSP extensions will enable the scientific review of the balance of evidence regarding benefits and harms, and the calculations here will be reviewed, in the light of the results.

87. The National Screening Committee advises ministers on screening policy. In undertaking this role, it will review new evidence on screening as it emerges or develops. That new evidence might change previous advice regarding an existing programme, or provide new advice regarding the introduction of a new programme (or not to introduce a new programme).

Bowel Cancer Screening

Faecal Occult Blood Testing (FOBT)

88. The NHS Bowel Cancer Screening Programme began in 2006 using the FOB test offering biennial screening targeted at men and women of ages 60 – 69. The programme has been successful with full roll out achieved in July 2010 and is estimated to achieve a 16% reduction in mortality. This strategy proposes a continuation of the extension to the age group to include 70 – 74 year olds. Based on data from the current programme, the full roll out cost of the age extension is estimated at £40m per annum. Roll out is expected to increase from about 60% in 2011/12 (£23m), to 90% in the second year 2012/12 (£34m), and will reach its maximum at £40m from 2013/14 onwards.

Flexible Sigmoidoscopy (Flexi-sig)

89. Studies have shown that flexi-sig, used as a once only intervention between the ages 50 – 69, can be an even more cost effective screening intervention, that is capable of generating financial savings and improved outcomes over the course of an individual's lifetime, compared to no screening. Flexi-sig is therefore a viable alternative to FOB testing.

90. The National Screening Committee (NSC) has considered the research evidence and the SCHARR report, and has approved the pilots. The plan is that the NSC will take an *evaluation report* before considering full roll out. The research evidence is strong, and the pilots are mainly

intended to test out the practicalities of a national implementation. Given the size of the pilot, to some extent it will validate (or otherwise) research findings and ScHARR's appraisal.

91. Pilots will be run over two years from 2011/12 at an estimated cost of £4.5m in year 1 and £4m in years 2. Rollout will begin in 2013/14 and is expected to reach 30% by the end of that year, 60% in the second year and 100% in the third year 2015/16 at an estimated full roll out cost of £50m per year. Research evidence suggests that a reduction in the incidence of cancer and treatment costs can be expected as roll out of the programme progresses. It is estimated that after full roll out is achieved, saving could eventually be in the region of £200m per annum. This will however take at least 5 years to begin to materialise, and would be at modest levels initially.

92. Furthermore, a recent re-appraisal by ScHARR suggests that flexi-sig as a once only intervention at age 54 offered the greatest gain in life years (0.0941) and QALYs (0.0829) per person compared with no screening. Based on this, and using population projection to calculate annual entry into the programme, expected coverage and uptake, total QALY gains was calculated for the FOB test age extension (70 – 74 years), and the flexi-sig intervention for individuals at age 55.

93. We have not been able to find any research on disutility or QALY losses from bowel cancer screening, eg disutility of false positives. It is likely to be analogous to the discussion on breast cancer screening (above) with similar arguments. The effects are expected to be small in relation to the benefits. We would expect the disutility for FS to be smaller than for FOBt, given the greater sensitivity and specificity of FS.

94. In the medium-term, the screening programme will be providing both FOBt and FS, as these are for different age groups. Given the phased roll out of FS, the different age groups covered & the two year cycle of FOBt, the earliest there will be an overlap will be 2018/19, and for some people it will be three years later (end of 2021/22). As above, the interaction between the two programmes will need to be understood before any decision on FOBt is taken. For the IA, it is a good working assumption that both programmes will be running throughout.

95. Net present value of benefits from FOB testing for ages 70 – 74 is estimated at about £8.5bn, while for flexi-sig estimated benefits are about £13.5bn.

Cervical Screening – HPV Triage

96. This strategy proposes the use of HPV testing as a triage for women with mild or borderline smear test results. During the implementation costs are expected to be slightly higher due to the women who are already on the old systems' pathways, whilst at the same time testing is following the new scheme. After this transition in years one and two, the new service costs will have reached a steady state and are expected to be £4.25m per year. The benefits in terms of cost savings are expected to be significant. The proposed test is simpler, more targeted, and would significantly reduce the need for repeat testing, and is therefore expected to yield significant net savings of up to £16m per annum. The new test will not place individuals receiving it at any form of disadvantage; rather it improves patient experience by providing a better targeted service.

INPATIENT MANAGEMENT PROGRAMME

97. In the CRS it was anticipated that growth in expenditure would need to continue until 2012/13 in order to secure the service improvements and expected financial benefits from the programme.

98. The CRS set out to reduce bed days and improve patient care. The extra costs (rising to £122.8m in 2012/13 above the funding allocated in 2010/11) were designed to cover replacement costs for alternative treatment, community rehabilitation, telephone monitoring, and radiotherapy and chemotherapy treatment in non-residential settings.

99. Overall, the policy was net cost saving. However, savings from reducing inpatient bed days are now factored into QIPP and do not depend on this additional funding so, based on current variations across hospitals, these are now considered to be sustainable without the need for additional growth in funding beyond 2010/11.

100. An indication of the value of potential savings is given by the considerable variation across PCTs in the number of inpatient admissions and the average length of stay of these admissions. Analysis undertaken by NAO for their recent report *Delivering the Cancer Reform Strategy* estimated that 532,000 bed days (£106m) could be saved each year if all PCTs matched the average of the best performing quartile of PCTs in the number of inpatient admissions per new cancer diagnosis. It was also estimated that 566,000 bed days (£113m) could be saved if all PCTs matched the average length of stay of the best performing quartile. It should be noted that these savings are not strictly additive, as there is likely to be a small overlap between the two sources of savings.

101. The level of inpatient savings is not expected to vary between the options considered in this impact assessment. However, the issue is considered for completeness, and is relevant to QIPP considerations.

102. The most recent DH analysis on expected inpatient savings is included in Annex B.

EARLIER DIAGNOSIS

103. It is now generally agreed that the most important reasons for lower survival rates in England compared with other European countries are low public awareness of the signs and symptoms of cancer, delays in people presenting to their doctors, and patients having more advanced disease at diagnosis. The two week cancer referral pathway reduces the delays to treatment once a patient presents with a range of cancer type symptoms. A key task for earlier diagnosis is to permit better differentiation of early stage symptoms for patients for whom the two week referral pathway is not appropriate.

104. We know that generally the earlier a cancer is diagnosed, the greater the chance that it can be treated successfully. However, the biggest gains will be obtained by increasing the proportion of patients who are first diagnosed with an earlier stage cancer that will respond better to treatment designed to control the disease locally. Detecting cancers earlier, but still at the same stage, appears to be of little benefit (so that any improvement in post-diagnosis survival would be essentially be due only to lead time bias). Treatment costs might well rise without increasing the life expectancy of the patient. If this were frequently to be the case, the benefits of earlier diagnosis would be significantly reduced.

105. As part of the CRS, the National Awareness and Early Diagnosis Initiative (NAEDI) was established in 2008. The aim of the initiative is to improve the public's awareness of the signs and symptoms of cancer, encourage those with symptoms to seek help earlier than they currently do and support primary care in diagnosing cancer earlier – leading to earlier stage at diagnosis and improved outcomes for patients.

Basis of calculation of costs and benefits for earlier diagnosis

106. The basis of these costs is work commissioned by DH from Frontier Economics [http://www.frontier-economics.com], modelling the costs and benefits of earlier diagnosis for 5 of the most common cancers. The analysis in this IA focuses on three of those cancers, namely colorectal, breast and lung cancers.

107. The models suggest that earlier diagnosis will result in better outcomes for patients in terms of significantly better survival rates. However, this will require a substantial increase in testing costs (many more patients will need to be tested to diagnose cancer at earlier stages. The maximum benefit will be achieved if there is an overall reduction in the proportion of patients first diagnosed with late stage cancers (which have a poor prognosis) and a corresponding increase in the proportion of patients diagnosed at an early disease stage (for which local control is possible). A key objective of earlier diagnosis is to reduce the number of patients who are first diagnosed with a cancer which is unlikely to respond to curative treatment. This should reduce high number of patients who are first diagnosed with cancer following an emergency admission to hospital with a late stage of the disease. More detail on the modelling and assumptions used is included in Annex B.

Key conclusions from the modelling

108. Two of the main conclusions from the Frontier modelling work are that:

- Earlier diagnosis is both effective and cost-effective. Earlier diagnosis can potentially make a significant contribution to improved outcomes for cancer patients (better survival rates), and should be generally cost-effective.
- While earlier diagnosis should be cost-effective, it does not appear to be cost-saving. It requires large increases in testing and in direct treatment costs. Treating patients for a middle stage cancer with curative intent is generally more costly than a very early stage of the disease or palliative treatment for late stage cancers. The modelling indicates that the cost per life-year saved is in the range of £2,000-£6,000 for the three cancers included in this analysis (i.e. colorectal, breast, and lung).

109. This model assumes that all improvements in post-diagnosis survival represent genuine improvements in life expectancy, rather than the effect of lead time bias. This is clearly unrealistic, so the benefit calculations presented here should be seen as maxima. Although it is difficult to disentangle the real from the apparent effects of earlier diagnosis, preliminary calculations suggest that correcting for lead time bias might diminish the ongoing benefits of earlier diagnosis (once the system has reached its new steady state) by roughly 20% for breast cancer, 25% for colorectal and 60% for lung cancer, giving an overall reduction in cost-effectiveness of the order of 35%. These are substantial reductions, but would leave the cost effectiveness of the proposed policy well within the accepted threshold. Nevertheless, this is an area in which firmer evidence, and further analysis, would be highly beneficial.

Breakdown of interventions and expenditure for earlier diagnosis

110. Four principal areas are associated with earlier diagnosis:

- More diagnostic tests for cancer. We plan to improve access to tests from primary care, minimising the extra burden on secondary care clinicians, and have costed for the majority of the extra tests needed to be commissioned from primary care. There will be some need for extra tests in secondary care due to the increased numbers of patients diagnosed, and these are also represented in the model.
- Increased treatment costs. Modelling shows that initially (approximately in the first 5 years) treatment costs for cancer will rise – reflecting the need to 'clear the back-log' and get to a stage where many patients are being diagnosed early. After this period treatment costs overall will fall slightly.
- Work to change behaviour around early presentation – campaigns and local interventions to raise symptom awareness and encourage earlier presentation.
- Support to GPs to diagnose cancer earlier, including support on when to commission and how to interpret diagnostic tests.

111. The estimated costs for implementation of the proposed early diagnosis work, including the planned data collection work discussed later in this document, for the first four years are :

	2011/12	**2012/13**	**2013/14**	**2014/15**
Total	**£ 33,000,000**	**£ 136,000,000**	**£ 146,700,000**	**£ 198,300,000**

112. We have estimated that this will provide the following approximate benefits in terms of life-years saved, and additional 5-year survivors:

	2011/12	**2012/13**	**2013/14**	**2014/15**
ACTIVITY				
Primary Care Tests	152,640	363,780	574,920	1,241,280

Benefits Estimated				
Number of additional life-years (approximate estimate) Note: Life-years not gained in specific year, but over patient lifetimes.	Low numbers – set up	53,297	55,723	68,954
Additional 5-year survivors at steady state.		2,689	2,771	3,414

INFORMATION COLLECTION

113. There are three strands relating to data collection within *Outcomes Framework for Cancer*:
    - increasing routinely available staging data
    - collecting data on proportion of cancers diagnosed through an emergency route
    - collecting data about GP requesting of certain diagnostic tests.

114. The costs outlined in this section have been incorporated into the overall costs for Earlier Diagnosis outlined above.

Routinely available staging data

115. This will not be a new cost and can be delivered through efficiencies.

Collecting data on proportion of cancers diagnosed through an emergency route

116. It is assumed that collection of this data can be delivered by making changes to the Cancer Waiting Times database, subject to the necessary approvals. Costs of this approach are estimated to be around £0.5m over 3 years.

Collecting data about GP requesting of certain diagnostic tests

117. A key means of improving outcomes for cancer patients is through earlier diagnosis. Option 3 proposes significant investment in extra diagnostic test activity for primary care for the following tests:
    - Chest x-ray
    - Non-obstetric ultrasound
    - Flexible sigmoidoscopy
    - Colonoscopy
    - MRI brain

118. A new database would be required for this, which would involve an initial set-up cost of around £1.5m. Following implementation in 2012/13, there would then be a smaller ongoing cost for central delivery, likely to be around £0.13m per year.

119. There is no monetary benefit to collecting the data. The benefits are that GPs and commissioners will be able to benchmark usage of diagnostic tests, as well as checking whether

GPs are, along with their use of the 2-week urgent referral pathway, checking out suspicious symptoms appropriately.

WORKFORCE

120. Workforce costs in the provision of the proposed radiology, screening and earlier diagnosis services are included in the policy costings. However, a workforce supply risk exists, as a suitably qualified workforce is essential in order to implement the *Outcomes Framework for Cancer* and to realise its benefits.

Radiotherapy

121. The increase in radiotherapy treatment proposed in options 2 & 3 will require corresponding increases in the size of the radiotherapy workforce which comprises therapeutic radiographers, nurses, radiotherapy physics staff and clinical oncologists. A particular risk exists over the specific skills of therapeutic radiographers. However, assuming the additional fractions per machine are provided more efficiently so that the ratio of staff to fractions decreases (reflecting the reduction in variable cost from £102 to £50 used in the costing analysis), the required increase in radiographers looks reasonable, when compared with supply projections produced by the Workforce Review Team.

Screening

122. The changes to screening will have mixed effects on demand for staff. The CRS set ambitious targets for increasing breast cancer screening, which in the Outcomes Strategy have been changed to reduce demand for staff in the first 3 years from the planned level under the CRS. In addition, HPV triage will reduce demand for staff due to the reduction in repeat testing for cervical cancer patients. These reductions in staff demand are countered by the introduction of flexible sigmoidoscopy. Overall, screening programmes are not expected to increase demand for staff.

Earlier Diagnosis

123. The increase in demand for Primary Care tests will require an increase in staff to carry out the tests. Option 3 would require approximately 550 more staff by 2014/15, across a range of disciplines, estimated as follows:

Staff group	2011/12	2012/13	2013/14	2014/15
Radiographer	12	30	48	119
Radiologist (consultant)	12	30	47	119
Ultrasonographer	6	15	25	61
Nurse (band 4)	12	24	37	37
Nurse (band 5)	47	97	148	147
Technician	12	24	37	37
Endoscopist (consultant / nurse consultant / GP)	14	29	45	44

124. The biggest risk is probably in the radiographer and radiologist staff groups:

- There are around 2,200 FTE consultant radiologists in the workforce as of Sep '09, and around 150 more p.a. planned for the SR period (potentially less). These new trainees were already going to be trained before the Cancer Strategy, so they reflect underlying workforce demand from the service. There is a risk of increased radiologist demand versus what's coming out of the training pipeline. This will mean that NHS organisations will need to look at flexible use of their workforce, and potentially reducing the radiologist workforce less than planned.

- There were around 12,000 FTE diagnostic radiographers in the workforce as of Sep '09, and an estimated 1,100 p.a. going into undergraduate training. Again, this reflects underlying demand and retirements etc from the workforce. It may well be that with improved labour productivity via QIPP etc the extra ~120 FTE demand can be absorbed.

125. There is less risk with the other staff groups, as they appear to be more generic (i.e., it might be possible to use displaced staff etc to meet the extra demand).

Summary and preferred option with description of implementation plan

126. Option 3 is recommended as it provides a significant improvement in the health outcomes for a large number of people each year (as demonstrated by the QALY benefit calculations). The expenditure proposed is judged as affordable within the current economic climate.

127. Many of the measures included in *Improving Outcomes: A Strategy for Cancer* are effectively support initiatives to assist poor performers to get up to the standard of the higher performers, or to provide national support (for instance, better information from existing data). To deliver this support, it is assumed that existing cancer national teams and cancer networks will continue to exist through the transition period as described in *Improving Outcomes: A Strategy for Cancer*. These costs are already in expenditure allocations in 2010/11 and are common to each option, so are therefore not set out in the Cost statements and Discounted Cash Flows. During the transition period, decisions on the future provision of support will need to be taken under the new system arrangements.

Administrative burden and policy savings calculations

128. The costs of developing, monitoring and evaluating the strategy within the public sector are included within the budget(s) for the implementation of the strategy set out above. No administrative burdens are believed to be imposed on the private sector or the charity sector from the strategy.

129. The collection of diagnostic activity data to monitor if suspicious symptoms are being appropriately investigated might add a small additional burden on NHS providers. The reissued 2010/11 Operating Framework has given a clear indication that the NHS will not need in the future to focus on centrally set process driven targets but will be held to account the outcomes achieved. The fundamental review of data returns should lead to a reduced process data burden for the NHS, which should in-turn offset the additional burden created by the new diagnostic activity data.

Wider impacts

Statutory equality duties

130. An Equality Impact Assessment has been conducted as part of the development of the Strategy covering issues including; human rights, race, disability and gender. This assessment is also available as a separate document and will be published separately alongside the Impact Assessment.

I:\HSDCT\CRS Review 2010\Equality

Economic impacts

131. Implementation of the Strategy will have no negative impact on competition or small firms.

Environmental impacts and sustainable development

132. The potential impact of the Strategy on the environment, including on greenhouse gas emissions has been considered. The main impact is on human resources and so has little greenhouse gas effects. None of the areas of slight potential impact, such as linear accelerator bunkers, seem to have a significant or clearly one-way effect on greenhouse gas emissions and so have not been valued.

Social impacts

133. No significant adverse impact has been found in relation to rural issues or the justice system. Human rights issues are covered within the separate Equality Impact Assessment

134. The Strategy *is* expected to have positive impacts on health and well-being, no impact on broader social, economic and environmental living conditions (such as housing, transport, education etc), and no adverse impact on individuals' ability to improve their own health and wellbeing. The change in demand for or access to health and social care services is analysed in *Improving Outcomes: A Strategy for Cancer,* this impact assessment and its supporting Equality Impact Assessment.

Annexes

Annex 1 should be used to set out the Post Implementation Review Plan as detailed below. Further annexes may be added where the Specific Impact Tests yield information relevant to an overall understanding of policy options.

Annex 1: Post Implementation Review (PIR) Plan

A PIR should be undertaken, usually three to five years after implementation of the policy, but exceptionally a longer period may be more appropriate. If the policy is subject to a sunset clause, the review should be carried out sufficiently early that any renewal or amendment to legislation can be enacted before the expiry date. A PIR should examine the extent to which the implemented regulations have achieved their objectives, assess their costs and benefits and identify whether they are having any unintended consequences. Please set out the PIR Plan as detailed below. If there is no plan to do a PIR please provide reasons below.

Basis of the review: [The basis of the review could be statutory (forming part of the legislation), i.e. a sunset clause or a duty to review , or there could be a political commitment to review (PIR)];

The National Audit Office might seek to review this policy around three years after publication, as they have with both the Cancer Plan (published in 2000) and the Cancer Reform Strategy (published in 2007). Assuming NAO do propose to undertake a review, the PIR will aim to complement the scope & objective of that review to avoid duplication whilst providing an appropriate level of scrutiny. This will be in accordance with the accepted good practice for an Outcomes Strategy at the time of commissioning the study.

Review objective: [Is it intended as a proportionate check that regulation is operating as expected to tackle the problem of concern?; or as a wider exploration of the policy approach taken?; or as a link from policy objective to outcome?]

See comment in “Basis of the Review”

Review approach and rationale: [e.g. describe here the review approach (in-depth evaluation, scope review of monitoring data, scan of stakeholder views, etc.) and the rationale that made choosing such an approach]

See comment in “Basis of the Review”

Baseline: [The current (baseline) position against which the change introduced by the legislation can be measured]

Within the Strategy, discussion of the various input and output measures along with outcomes expected mostly includes details of the current position. Where this is not the case the current position is summarized and more details are available via established data collections (mostly published information)

Success criteria: [Criteria showing achievement of the policy objectives as set out in the final impact assessment; criteria for modifying or replacing the policy if it does not achieve its objectives]

The Strategy sets out a series of input and output measures, many for implementation at a local level. Ultimately success will be judged on the outcomes achieved, eg 1 and 5 year survival rates; and a level of ambition for these will be set by Ministers in the NHS Commissioning Board’s mandate ? and for PHE?

Monitoring information arrangements: [Provide further details of the planned/existing arrangements in place that will allow a systematic collection systematic collection of monitoring information for future policy review]

The Strategy sets out plans for an annual progress report . There is a clear objective driving the strategy and, at a lower level, there are a number of proxy measures outlined within the Strategy.

Reasons for not planning a review: [If there is no plan to do a PIR please provide reasons here]

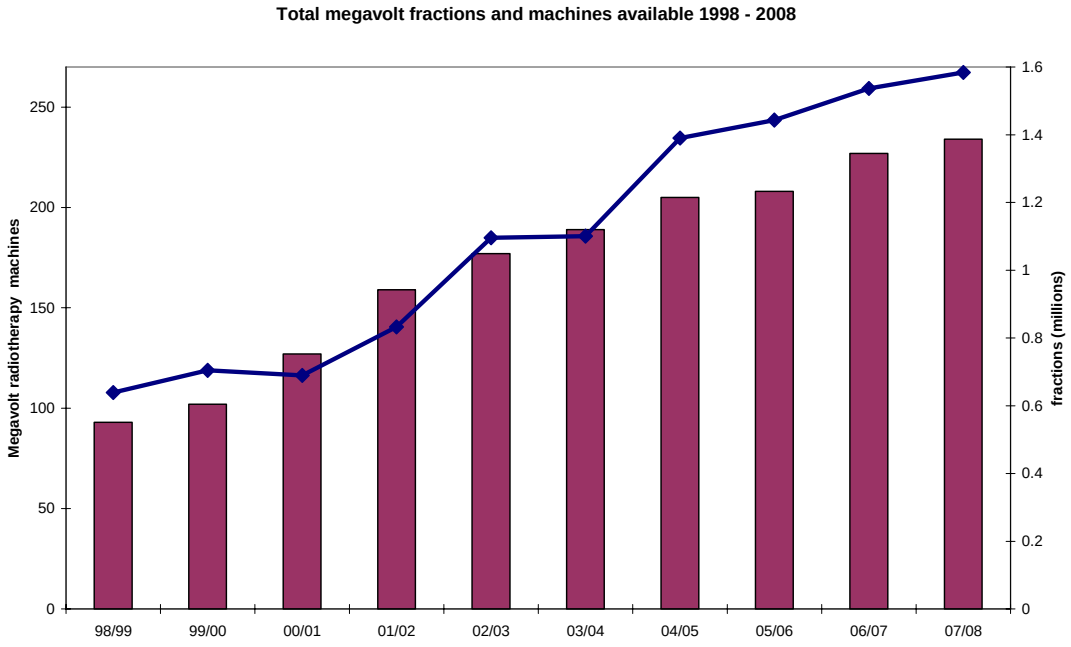
Not applicable

Annex 2 - DETAILED EVIDENCE BASE

RADIOTHERAPY

Background

1. Radiotherapy together with surgery and chemotherapy are the three principle ways of treating cancer. Of the three approaches, surgery is the most effective single approach but radiotherapy is also important in it own right and as an adjunct to other treatments. Additionally radiotherapy has a major role in palliative care.
2. Radiotherapy is highly cost effective. It is estimated that that radiotherapy accounts for around £325m (5%) of £6bn the NHS spends annually on cancer care. It currently delivers around 125,000 treatments per year.
3. The Cancer Plan (2000) identified radiotherapy capacity as a major bottleneck in the treatments of patients. Firstly, the low capacity of the NHS to deliver radiotherapy compared to other countries limited the percentage of new of patients who could benefit from the treatment. Secondly, those who were offered radiotherapy usually had to wait an unacceptably long time before treatment commenced, possibly leading to a detrition in their condition and lastly the equipment used tended to be old and not offer the best possible outcome.
4. This resulted in a major investment programme, which saw the installed base of megavolt radiotherapy machines, and fractions delivered more than double in over the decade. The access times also dropped to levels which are now deemed acceptable.



5. The Cancer Reform Strategy (2007) wished to go further by increasing the access rate to radiotherapy still further. It outlined an ambitious plan to expand radiotherapy capacity by a further 40% to enable England to reach access rates comparable with the best in the world.
6. A new radiotherapy linear accelerator has a capital cost of between £1m - £1.5m, depending on the sophistication of the accuracy of delivery system. A further £1.5m capital is required to build the vast concrete bunker to house a new accelerator system. This further expansion of radiotherapy capacity was to be funded in part by rebalancing cancer spending away from in-patient care towards better treatments and early detection.

7. A linear accelerator has a useful life of ten years after which it will need to be replaced, usually with a machine of a higher specification.

Current situation

8. In 2010: 1,618,391 fractions were delivered from 230 fully operational linear accelerators. This is a 43% increase in the fractions delivered over a ten year period, and a 55% increase in the number of radiotherapy machines.
9. There are 16 linear accelerators which are due to become fully operational in the near future.
10. International modelling suggests that 52% of cancer patients should receive radiotherapy to maximise clinical benefit. This is achieved in parts of Europe and indeed in the South and South East of England with access rates of 49%. However, in parts of the North of England access is low at 25%, and overall across England it is only around 37%.
11. The 52% clinical access figure has not yet been shown to meet the cost/benefit threshold used by NICE, and can be viewed as an aspiration rather than a benchmark at this stage.
12. The incidence of new cancers is rising. Simple demographic projections would suggest that new cases will grow by 0.7% (around 2000 patients) per year over the next decade. More complex modelling of demographic and diseases profiles is being undertaken to improve the estimate of cancer incidence by type and stage, which will most likely revise this simple estimate upwards.
13. In order to close the cancer mortality gap between England and benchmark countries, radiotherapy capacity will have to be increased still further to (i) meet the demand from growing incidence (ii) increase the average radiotherapy access rates and (iii) ensure local variation is for clinical rather than access reasons.
14. The NAO have drawn attention the utilisation rate of the current installed radiotherapy capacity is low. A linear accelerator should have a maximum capacity of around 11,000 fractions per year. To account for scheduled and un-scheduled loss of capacity plus the average spare capacity needed to enable timely access of new patients, an average throughput of 8,700 patients per year is acceptable. In 2010 the national average was 7,036 fractions per machine, again with wide regional variation. The best 10 centres averaged 9003 fractions per linear accelerator whereas the worst 10 achieved 5,083 per machine.

Options

Option 1 – do nothing

15. The do nothing option assumes that 246 linear accelerators are fully functional over the period 2011/12 to 2020/21, and that machines are replaced when they become 10 years old. The demand for radiotherapy rises by 0.7% per year and the access rate is maintained at 37%. Over the period, the demand growth is absorbed by increasing the fractions per machine from 7,067 to 7,587 over 10 years. The extra activity is funded at the standard rate. Waiting times remain at the currently acceptable level

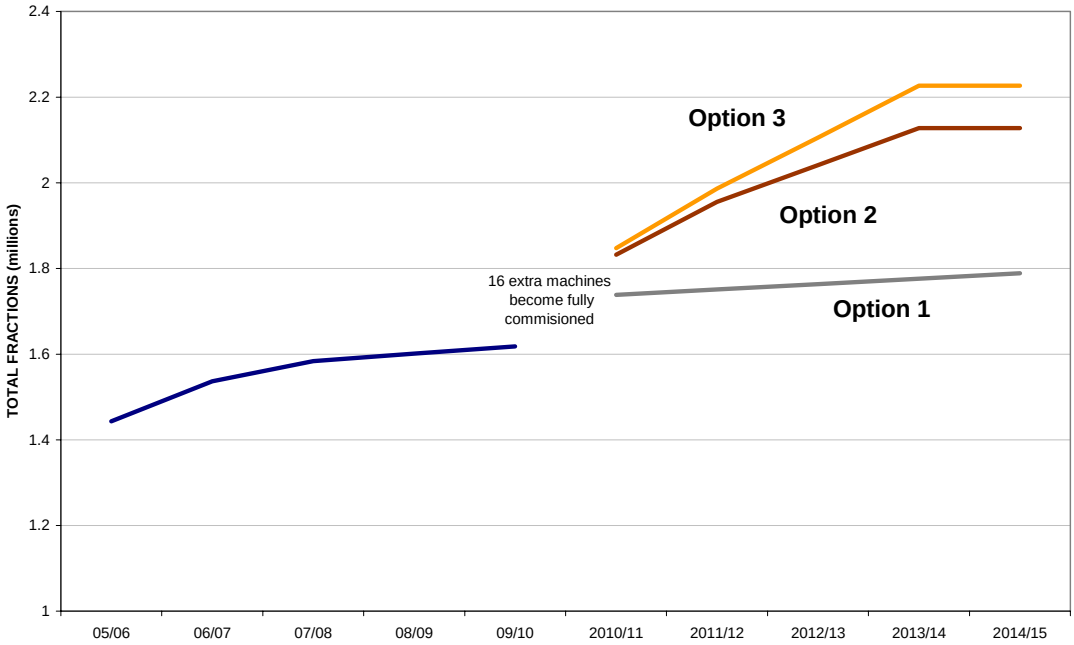
Option 2 – increase overall average capacity to 8,700 factions/year in 246 linear accelerators

16. In this option, we assume that the overall average fractions per machine can be raised incrementally over the SR period to 8,700/year, while holding the overall number of machines constant at 246. Machines are replaced on a 10 year cycle. The time from referral to start of treatment is maintained or improved at current levels.

	2011/12	**2012/13**	**2013/14**	**2014/15**
Average fractions per machine per year	7500	8000	8350	8700

Option 3 – Option 2 plus increase the number of linear accelerators by 12 over the SR period in areas which currently have long travel distances to the nearest radiotherapy centre.

17. This option assumes that, in addition to the overall capacity constraint to radiotherapy, travel distance also acts as an additional disincentive to some patients. This means that a higher proportion of additional patients will have a stronger indication that radiotherapy will be beneficial than in option 2.



Costs

18. Currently radiotherapy is not funded via a tariff.
19. The average cost per fraction for all types of radiotherapy is £128.55, and for radiotherapy (excluding brachytherapy) is £120.41.
20. This figure may under estimate the full cost of each fraction, as a number of the additional linear accelerators acquired in the past decade were partially or wholly funded by charitable donations. For this work, we have assumed the cost per faction is £150 broken down as £102 as direct cost and £48 for the cost of servicing the capital loan over a 10 year period at 3.5%.
21. The per faction for new machines is assumed to be £102 plus the cost or servicing the capacity which is recalculated as the volume of the machine goes up over the SR period.
22. To increase the capacity of the of existing 246 machines will involve a number of strands of more effect working. Reducing the number of breakdowns and moving servicing to where ever possible to out-of-hours will increase the time linear accelerators are available to treat patients. It has been assumed that an additional £5m per year will necessary to fund more efficient in-hours service. Some additional staff availability will also need to release the extra capacity. It has been assumed that each extra fraction above 7,067 will cost an additional £50 (half the estimated variable cost).

23. The following table gives a summary of the costs of the two options over the SR period.

		2011/12	2012/13	2013/14	2014/15
Option 2	**Cost (£millions)**	**£11**	**£17**	**£22**	**£26**
	Additional fractions	93,899	204,347	277,857	351,370
	fractions per million	35.1	37.2	38.5	39.8
	Treatments	6,624	14,415	19,600	24,786

Option 3	**Cost (£millions)**	**£13**	**£22**	**£32**	**£42**
	Additional fractions	108,899	235,347	342,257	450,570
	fractions per million	35.4	37.7	39.7	41.7
	Treatments	7,682	16,602	24,143	31,784

Benefits

24. Most of the large scale benefits studies of radiotherapy were based on treatments given in the 1970's. In one study in Canada, it was estimated that over one in four people given radiotherapy would survive more that 10 years with a single linear accelerator contributing to more than 5730 person years annually[1].
25. Survival gain from a cross section of patients was estimated to be 16% higher with RT compared to without, at a hospital in Australia for patients treated between 1980 and 1993[2]. The cost per life year gained was estimated to be $7,186.
26. Calculating additional benefits from adding radiotherapy existing treatment pathways usually involves constructing survival benefits trees, which consider treatment options at different stages of specific cancers.
27. It was the benefits tree approach which enabled Delaney[3] to estimate that, for the profile of 22 cancer types in the Australian population, 52% of patients should receive radiotherapy as part of the course of treatment.
28. In the absence of detailed knowledge of which patients are currently being offered radiotherapy and at what stage of the disease, it is impossible to predict with a high degree of certainly what will be the benefits of incrementally offering additional patients a course of radiotherapy.
29. The additional benefits that radiotherapy adds to the chances of survival for breast cancer patients has been estimated at 3%[4]. For the benefits calculations in this impact assessment, it is assumed that the majority of the benefits from radiotherapy will have been achieved with the 37% of patients already receiving the treatment. It is also assumed that the incremental benefits will reduce as the number of patients approaches 52%.

percentage of patients treated with radiotherapy	0-25%	25-35%	35-45%	45-52%
Additional 10 year survival	25%	15%	3%	1%

[1] Glazebrook G. A. (1992) Radiation therapy: a long term cost benefit analysis in North American region, Clin Oncol (R Coll Radiol), Sept; 4(5): 302-5.

[2] Barton M.B, Langlands A.O, Gebski V, & Manderson C, (1996) Radiation therapy: long term benefits analysis in Australia, Annu Meet Int Soc Technol Assess Health Care, 12 : 38.

[3] Delaney, G. Jacob, S.,Featherstaone, C., & Barton., M (2005) The role of radiotherapy in cancer treatment, Cancer, Sept 15, Volume 104, Number 6

[4] Shafiq J., Delaney G. & Barton M. B., (2007) An evidence-based estimation of local control and survival benefits of radiotherapy for breast cancer, Radiotherapy and Oncology, 84, 11-17

30. A benefit matrix has been synthesised for this impact assessment and will be used and tested with a sensitivity analysis to demonstrate net benefit in option 2 and 3.

31. The additional lives saved and the QALYs gained for option 2 and option 3 have been modelled as follows

		2011/12	2012/13	2013/14	2014/15
Option 2	Additional patients living 10 years	199	432	588	744
	Total QALY gain	994	2162	2940	3718
	Estimated access ratio	37%	39%	40%	42%

Option 3	Additional patients living 10 years	278	602	941	1296
	Total QALY gain	1390	3009	4707	6480
	Estimated access ratio	37%	40%	42%	44%

Sensitivity analysis

32. The sensitivity analysis is used to test the robustness of the benefits of the case, given the uncertainty in the benefits from increasing assess to radiotherapy incrementally.

33. The base case assumes the extra patients treated with the expansion of existing radiotherapy capacity could on average expect a 3% increased chance of living an extra 10 years and gaining 5 QALYs. This additional benefit would cost £6,634 per QALY. Only if the benefit were reduced to an additional 1% of patients gaining 10 years and 5 QALYs would the cost per QALY come close to the £25,000 per QALY threshold.

Option 2	5%	4%	3%	2%	1%
Cost per QALY	3,980	4,975	6,634	9,951	19,902

Option 3	5% + 9.5%	4% + 8.5%	3% + 7.5%	2% + 6.5%	1% + 5.5%
Cost per QALY	4,013	4,809	5,997	7,965	11,857

34. In option 3, the base case again assumes a 3% extra chance of living 10 years and gaining 5 QALYs for the expansion of existing capacity. However the new capacity is assumed to reduce the barriers to patients, who would normally expect to have an increased probability of benefits of treatment, but who are not willing or are unable to travel to current treatment centres. For the additional patients who are treated in the new capacity, the benefits have been assumed to be 7.5%, ie will gain an extra 10 years of life on average. In this case, the sensitivity analysis looks at the chances of extra life years for both old and new capacity together. All the cases tested are below the £25,000 QALY threshold.

Palliative care

35. It has already been stated that radiotherapy plays a major role in palliative care. Any benefits from additional radiotherapy not with a curative intent are in addition to the benefits assumed here but have not been valued.

Preferred option

36. Option 3 is the preferred option as it gives a greater benefit cost ratio than option 2, and brings the access rate closer to the theoretical access rate.

CANCER SCREENING

Flexible sigmoidoscopy (FS)

37. The basis for the calculation of costs is

- Pilots @ 5 centres (1 per hub) over 24 months covering about 5% of national population.
- Pilots will undertake 15000 flexi-sigs (FS) pa @ £150 each (a nurse-led diagnostic) plus 700-750 follow-up colonoscopy's pa @ £500 each.
- Pilots will screen people once at some point in their 50's, probably 55.
- Start roll out phase in April 2013 & get to 30% by end of 2013/14 (30% costs to allow for local start ups plus one-off national costs to start programme).
- Move to 60% by end of 2014/15 (60% costs to allow for start ups).
- Move to full implementation in 2015/16 (£50m pa).
- Note: as FS reduces the incidence of bowel cancer by reducing incidence by 23%, savings from not having to diagnose and treat patients could save £200 million a year (ScHARR model estimated bowel cancer costs of NHS £1 billion a year). There are also enormous physical, psychological and financial savings for the patients.
- Assumption 1 is that this benefit will not start until after the IA period.
- Assumption 2 For FS Pilot and rollout, these figures have been calculated assuming similar activity and clinical yield in the NHS setting to that experienced in the FS trial.

HPV Triage

38. The basis for the calculation of costs and savings is as follows:

	2011/12 **Year 1 (Implementation) (Note 5)**	2012/13 **Year 2 (Note 6)**	2013/14 **Year 3 (Note 6)**	2014/15 **Year 4 (Note 6)**	2015/16 **Year 5 (Note 6)**
Savings: (Note 7)					
Borderline and mild reduced repeat testing (Note 1)		£5,691,945.00	£5,691,945.00	£5,691,945.00	£5,691,945.00
Test of cure savings (Note 2)		£1,012,541.00	£14,464,870.00	£14,464,870.00	£14,464,870.00
Total gross savings	£0.00	£6,704,486.00	£20,156,815.00	£20,156,815.00	£20,156,815.00
Costs: (Note 7)					
Initial 12 month costs:					
Cytology labs	£7,000,000.00				
National Support	£1,000,000.00				
Ongoing:					
Borderline and mild HPV tests (Note 3)		£1,695,000.00	£1,695,000.00	£1,695,000.00	£1,695,000.00
Test of cure for women in follow up (Note 4)		£7,819,345.50	£2,550,000.00	£2,550,000.00	£2,550,000.00
Total costs	£8,000,000.00	£9,514,345.50	£4,245,000.00	£4,245,000.00	£4,245,000.00
Net savings	-£8,000,000.00	-£2,809,859.50	£15,911,815.00	£15,911,815.00	£15,911,815.00

Note 1: Assumes savings of 162,627 tests at £35 each based on the number of women invited in 2008/09 due to a previous abnormality
Note 2: Assumes a two thirds reduction in the 613,282 women in follow up after treatment having annual cytology in 2008/09. This gives a potential permanent saving of 413,282 tests at £35 each from year 3 onwards. In year 2 only small savings will be made as women are both tested and recalled.

Note 3: Assumes 113,000 new borderline and mild results tested for HPV at £15 each.
Note 4: Assumes HPV testing in year 2 for 85% of the 613,282 women in follow up after treatment having annual cytology in 2008/09 at £15 each.
In years 3 to 5 and thereafter it is assumed there will be tests for 85% of the 200,000 women at £15 each. 85% is used because in the study 15% of

women had abnormal results and would not be tested.

Note 5: In year 1 Triage 1st borderline and mild

Note 6: Year 2 onwards Triage all borderline and mild. Test of Cure all women in follow up post treatment

Note 7: 2010/11 costs for pilots(£5m) on Summary brought to zero on earlier sheet from 2011/12 except for National Support… COSTS & SAVINGS are to PCT Allocations

INPATIENT MANAGEMENT PROGRAMME

Introduction

39. Current provider-level variation in length of stay and bed-days provides a guide to the level of overall improvement that may be possible in future years. This is because of the potential for providers with longer lengths of stay to approach the performance of today's lowest, subject to considerations such as case mix. Firstly, for elective patients, the following analysis sets out the annual number of bed days that would be saved if average elective length of stay reached the 25th percentile of provider performance for 2009/10. Secondly, for emergency patients, it sets out the number of bed days that would be saved if the annual number of bed days per patient reached the 25th percentile of performance for 2009/10. Elective and emergency patients are treated separately because the Transforming Inpatient Care Programme aims to reduce the number of admissions in the case of emergencies, as well as reduction in length of stay.

40. Data are taken from version 135 of the Hospital Episode Statistics data for 2009/10, as processed by the National Cancer Services Analytical Team (NATCANSAT). Cancer episodes are identified as any patient whose first, second or third diagnosis code matches a specified list of cancer diagnosis codes6.

Time profile of potential savings

41. In both the elective and emergency calculations, the following time profile is assumed for movement towards the 25th percentile, as this would clearly take several years to achieve. The profile has bigger improvements in the earlier years (as has been the case with the original Cancer Reform Strategy), as we would expect successive improvements to become more challenging. Improvement to the 25th percentile would be achieved by 2015/16.

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Overall % of savings achieved by the end of the year	25%	45%	65%	80%	90%	100%

Potential elective bed day savings

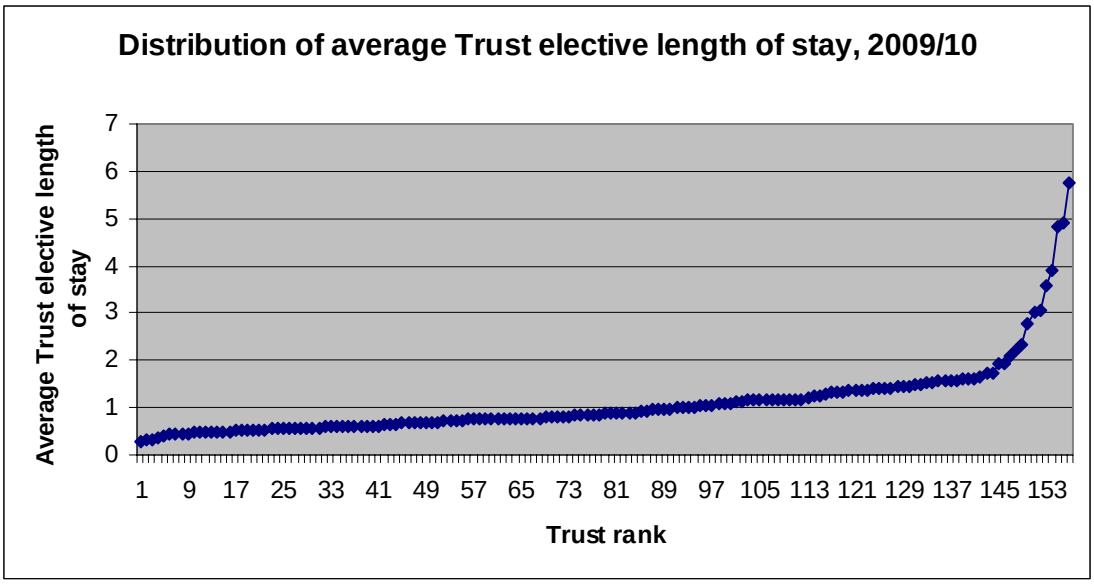
42. Providers with fewer than 1,000 elective episodes ('small providers') are excluded from the following elective calculations, as their average lengths of stay may not be representative because of the small sample size.

43. For those providers with more than 1,000 elective episodes, elective length of stay (LOS) is calculated for each provider using [provider's total elective cancer bed days] divided by [provider's number of elective cancer episodes]. Ultimately, the following statistics are identified for the elective episodes after making the exclusions:

Minimum average Trust elective LOS	0.27
25th percentile of average Trust elective LOS	0.62
50th percentile of average Trust elective LOS	0.87
75th percentile of average Trust elective LOS	1.34
Maximum of average Trust elective LOS	5.74
Number of average Trust elective LOS observations	157

[5] The 14th Final version is available in HES, but not yet for the NATCANSAT microsite.

[6] Cancer diagnosis codes (ICD-10): all C, all D0, all D4, plus D32, D33, D353, D354, D37, D38, D39.



44. If the average length of stay of all providers with more than 1,000 elective episodes were to reach the 25th percentile set out above, this would lead to a total of 1,070,516 elective bed days instead of the 1,630,451 elective bed days in 2009/10, i.e. a saving of 559,935 bed days.

45. To show the potential movement towards this new level, episode totals have been estimated from 2005/6 to 2009/10, assuming 4.57% compounded annual growth. This growth rate is based on historical growth in the last five years, and is projected forwards to 2015/16. Two bed days series are generated:

- The first series is a counterfactual (ie "Do Nothing" option), where average elective cancer length of stay is assumed to stay at the 2009/10 level of 1.03 days (including small providers).
- The second is an intervention series moving from this level in 2009/10 to the '25th percentile' level by 2015/16, but with small providers unchanged, giving a new average of 0.68 days by 2015/16.

46. Both series take account of the aforementioned growth in the number of episodes. The results are shown in the following table.

Elective cancer summary statistics, ie average length of stay, episodes, bed days and savings

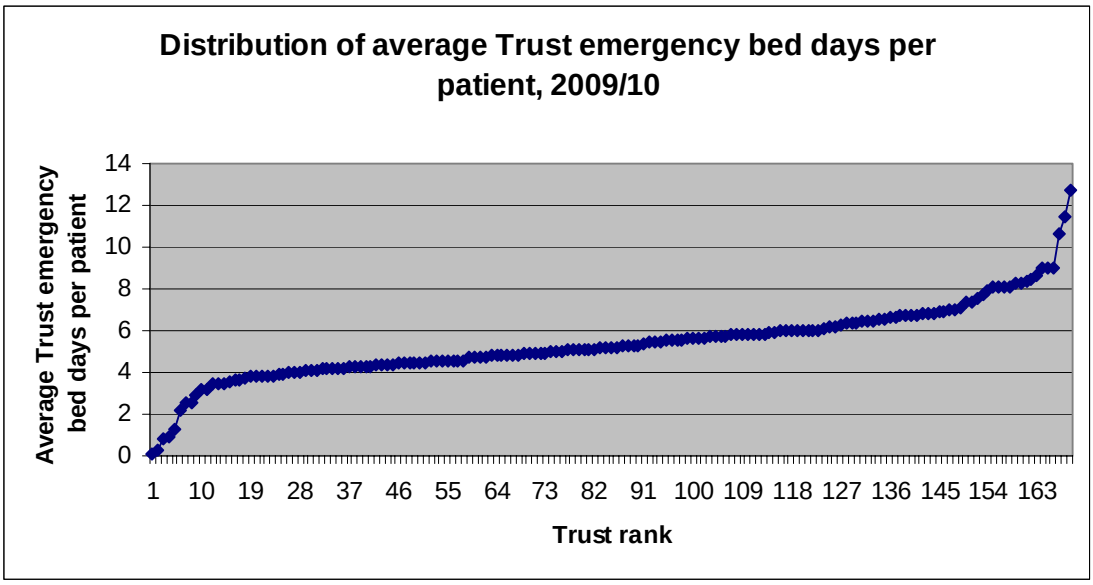
	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Counterfactual elective ALOS	1.03	1.03	1.03	1.03	1.03	1.03
Intervention elective ALOS	0.94	0.87	0.80	0.75	0.71	0.68
Elective episodes	1,653,573	1,729,199	1,808,284	1,890,986	1,977,471	2,067,911
Couterfactual elective bed days	1,705,020	1,782,999	1,864,545	1,949,820	2,038,995	2,132,249
Intervention elective bed days	1,558,634	1,507,454	1,448,332	1,414,129	1,408,781	1,399,985
Bed days saved compared to counterfactual	146,386	275,545	416,213	535,691	630,214	732,263
Monetised value of bed days saved (£million)	£44m	£83m	£125m	£161m	£189m	£220m
Bed days saved as % of counterfactual bed days	9%	15%	22%	27%	31%	34%

Potential emergency bed day savings

47. In this part of the calculation, providers with less than 250 unique patients are excluded; again, their average lengths of stay may not be representative because of the small sample size. Unique patients are identified through the Pseudo HESID field in Hospital Episode Statistics. Where a patient has attended more than one provider, they are equally apportioned between these providers rather than counted twice.

48. For those providers with more than 250 unique patients, the number of emergency cancer bed days per patient over the year is calculated by [provider's total emergency cancer bed days] divided by [provider's unique number of cancer patients]. The following statistics are identified after making the exclusions:

Minimum average Trust emergency bed days/pt	0.09
25th percentile of average Trust emergency bed days/pt	4.33
50th percentile of average Trust emergency bed days/pt	5.18
75th percentile of average Trust emergency bed days/pt	6.26
Maximum of average Trust emergency bed days/pt	12.69
Number of average Trust emergency bed days/pt observations	169



49. If all providers with more than 250 unique patients were to reach the 25th percentile set out above, this would lead to a total of 2,467,978 emergency bed days instead of the 2,906,950 emergency bed days in 2009/10, i.e. a saving of 438,972 bed days.

50. To show the potential movement towards this new level, English cancer registration totals (annual numbers of new cancers) were obtained from 1999 to 20087, showing 1.6% compounded annual growth. This growth rate is projected forwards to 2015/16 for the number of patients. Again, two bed days series are generated:

- The first series is a counterfactual, where the average annual number of emergency cancer bed days per patient is assumed to stay at the 2009/10 level of 5.11 days (including small providers).
- The second is an intervention series moving from this level in 2009/10 to the '25th percentile' level by 2015/16, but with small providers unchanged, giving a new average of 4.34 days by 2015/16.

51. Both series take account of the stated growth in the number of patients. The results are shown in the following table.

	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Counterfactual emergency bed days/patient	5.11	5.11	5.11	5.11	5.11	5.11
Intervention emergency bed days/patient	4.92	4.76	4.61	4.49	4.42	4.34
No. of patients	577,878	587,124	596,518	606,062	615,759	625,611
Counterfactual emergency bed days	2,953,461	3,000,717	3,048,728	3,097,508	3,147,068	3,197,421
Intervention emergency bed days	2,841,962	2,796,808	2,749,480	2,723,310	2,719,360	2,714,586
Bed days saved compared to counterfactual	111,499	203,909	299,248	374,198	427,708	482,835
Monetised value of bed days saved (£million)	£33m	£61m	£90m	£112m	£128m	£145m
Bed days saved as % of counterfactual bed days	4%	7%	10%	12%	14%	15%

Additional remarks

52. We note that the NAO report, "Delivering the Cancer Reform Strategy", estimated that approximately £113 million could be saved through reducing variations in length of stay. That estimate was based on every PCT achieving the same length of stay for inpatient admissions as

[7] Office for National Statistics, Cancer Registrations (England). See http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=7720&Pos=2&ColRank=1&Rank=160

the average for the best performing quartile. This is considerably more ambitious than our benchmark of the top quartile itself. Our estimates also take into account savings against future growth in cancer need due to population growth and aging.

53. Reduced length of stay can be achieved by increased use of day cases as well as shortening inpatient length of stay.

54. Estimates of savings are derived by comparing against what would have happened without further reductions in average bed days per patient. They are not necessarily cash savings.

EARLIER DIAGNOSIS

55. There will be three areas where particular work is needed:
    - Better GP access to diagnostics
    - Public behaviour change around early presentation
    - Support to GPs

Better GP access to diagnostics

56. The focus of this work is on a number of selected tests, which the Cancer Diagnostics Advisory Board (a panel of experts to support the development of work on diagnostic access) identified as priority areas for improving earlier diagnosis:
    - Chest x ray: to support diagnosis of lung cancer
    - Non-obstetric ultrasound: to support diagnosis of ovarian cancer
    - Flexi sigmoidoscopy/colonoscopy: to support diagnosis of colorectal cancer
    - MRI brain: to support diagnosis of brain cancer.

57. Other tests, such as CT scanning, have not been included, as they are not considered to be a first test for primary care to have access to. There may also be supplementary tests to assess the primary cancer from the secondary care setting, which CT for example may come under.

58. The model uses a bottom-up approach, starting with an estimate of the number of extra tests that GPs are likely to need to request, and applying a number of assumptions to estimate the likely overall cost.

Assumptions

59. The model uses the following assumptions:
    - The additional numbers of tests that the 'average' full-time equivalent GP is likely to request are shown in the following table. There are approximately 36,000 GPs in England. A steer on the approximate level of required additional activity was provided by the National Cancer Director and the national clinical leads for imaging and endoscopy.

Assumed additional demand from GPs for tests for possible cancer

Test	No. of additional tests
Chest X-ray	20 per year
NOU	10 per year
Flexi-Sig/ Colonoscopy	10 per year
MRI Brain	1.5 per year

- The model assumes that the extra activity will be delivered via a traditional service delivery model (GP referral to, and test performed in, secondary care), with each test carrying a cost equivalent to the (non-mandatory) tariff as follows:

Assumed tariff cost per test

Test	Tariff for non-urgent referral
Chest X-ray	£50
NOU	£60
Flexi-Sig	£300
Colonoscopy	£500
MRI Brain	£200

60. Workforce costs are included within the tariff.

- Given the large assumed increases in GP referrals, it will take time for the NHS to gear up and be in a position to deliver the extra activity. A phased implementation is assumed, as shown in the following table:

Assumed phasing of delivery of extra tests

Test	*2011/12*	*2012/13*	*2013/14*	*2014/15*
Chest X-ray	10%	25%	40%	100%
NOU	10%	25%	40%	100%
Flexi-Sig	10%	20%	30%	40%
Colonoscopy	10%	25%	40%	100%
MRI Brain	10%	25%	40%	100%

61. For four out of the five tests, it is assumed that the full increase in activity can be delivered by 2014/15. For flexi-sig, advice from clinical leads suggests it could take longer than this to get up to the required levels. A slower implementation is therefore assumed for this test.

- It is assumed that all capital / equipment costs will be met through the tariff payments.
- Most of the costs of tests for colorectal cancer are for flexi-sig. However, based on advice from the National Cancer Director and the national clinical leads, it is also assumed that 10% of the additional flexi-sig activity is substituted for colonoscopy, and that a further 10% of the remaining flexi-sig tests will require a colonoscopy as a secondary procedure.
- It is assumed that the roll out of the flexi-sig screening programme will reduce the extra demand for GP referrals for symptomatic testing by 50% for 2014/15 onwards.
- The model does not include estimates of any additional staff training costs, and does not consider the possible knock-on effect on the numbers and costs of urgent two-week pathways.

Outputs

62. The following tables show the outputs of the model in terms of the estimated extra activity and associated costs over the next four years:

Estimated increase in GP requested tests, 2011/12 to 2014/15

Test	*2011/12*	*2012/13*	*2013/14*	*2014/15*
Chest X-ray	72,000	180,000	288,000	720,000
NOU	36,000	90,000	144,000	360,000
Flexi-Sig	32,400	64,800	97,200	64,800
Colonoscopy	6,840	15,480	24,120	42,480
MRI Brain	5,400	13,500	21,600	54,000

Estimated cost of extra GP requested tests, 2011/12 to 2014/15

Test	***2011/12***	***2012/13***	***2013/14***	***2014/15***
Chest X-ray	£3,600,000	£9,000,000	£14,400,000	£36,000,000
NOU	£2,160,000	£5,400,000	£8,640,000	£21,600,000
Flexi-Sig	£9,720,000	£19,440,000	£29,160,000	£19,440,000
Colonoscopy	£3,420,000	£7,740,000	£12,060,000	£21,240,000
MRI Brain	£1,080,000	£2,700,000	£4,320,000	£10,800,000
Total	£19,980,000	£44,280,000	£68,580,000	£109,080,000

Public behaviour change around early diagnosis

63. A shift in public behaviour is needed for people to present earlier to primary care with symptoms that might be cancer. This enables earlier diagnosis, leading to improved outcomes.

64. The IA assumes that NAEDI will continue with campaigns and local initiatives on this issue, building on this year's successes.

65. The money allocated against this item would be split into national campaign work and locally commissioned interventions (according to local cancer priorities). The exact split will be finalised following the evidence of the effectiveness of national and local initiatives in 10/11.

Supporting GPs to diagnose cancer earlier

66. NAEDI has work under way to support GPs to achieve earlier diagnosis, piloting risk assessment tools for GPs, improving the information available to GPs to assess their performance, and funding GP leaders to support other GPs in diagnosing cancer earlier. In addition, GPs will need support during the roll out of the diagnostic access, and we will look at different ways to provide this, through development and provision of tools, guidance and potentially training (e.g. on-line learning modules).

What evidence do we have that these interventions will achieve earlier diagnosis?

67. We have a range of evidence, such as:

    - Evidence from a range of different local campaigns, e.g. the Doncaster 'Cough Campaign', which encouraged residents to visit their GP and ask for a chest x-ray if particular symptoms persisted and the importance of early diagnosis; or the healthy communities collaborative, which used volunteers to encourage people to visit their doctors with symptoms from a range of cancers.
    - International evidence to support the benefits of access to non obstetric ultrasound.
    - Dr Willie Hamilton's work on helping GPs with a risk assessment tool for those presenting symptoms in primary care.

68. Further evidence is being collected – eg through our International Cancer Benchmarking Project – and will also be collected as the earlier diagnosis work progresses. We recognise that some of the evidence base for interventions is not strong, but we need to test different approaches in order to identify the best approaches.

EARLIER DIAGNOSIS MODELLING for NAEDI

69. The Frontier models for NAEDI were set up to answer the question: "What is the likely impact on NHS costs and patient outcomes of earlier diagnosis?"

70. The specific questions addressed by this piece of work are:

    - How would the costs to the NHS change if certain cancers (see below) were detected and diagnosed appreciably earlier than is currently the norm (ie according to current survival curves)?
    - How would the benefits to individuals change if certain cancers (see below) were detected and diagnosed appreciably earlier than is currently the norm?

71. The work has focussed on five cancers: breast, colo-rectal, lung, prostate and skin (melanoma). The modelling seeks to examine the impact that earlier detection and diagnosis would have on survival curves and on downstream costs and benefits. For example, what would be the impact on treatments costs and overall costs if more patients are diagnosed at stages I and II rather than III and IV. Does earlier diagnosis simply shift costs to earlier stages or does it avoid particular costs entirely?

72. The key feature of these models is that all inputs and activity are modelled by stage of diagnosis.

73. Consequently, the key assumptions or drivers in the models include the following:

    - Current costs of life-time treatment by stage of diagnosis
    - Costs of diagnosis (costs of tests, and assumptions about diagnostic pathways)
    - Current survival rates by stage
    - Distribution of incidence by stage in base-line
    - Future distribution of incidence by stage (assumptions vary)
    - Annual discount rate of 3.5% applied to future costs and benefits to calculate present values.

Key conclusions from the modelling

74. For these cancers generally, the modelling found that earlier diagnosis is generally cost-effective, but not cost-saving. If people are diagnosed earlier, either through screening programmes or through their general practice, the main benefit is a substantial improvement in health outcomes. There is not a cost reduction, rather an increase in NHS costs (large increase in testing costs generally offset by a modest reduction in treatment costs). The modelling does not include the costs of the NAEDI interventions themselves, but these are expected to be very modest compared to testing and treatment costs.

75. The pattern of costs from the Frontier models is shown in the following table:

Year	***11/12***	***12/13***	***13/14***	***14/15***
Additional Costs from Frontier models				
Colorectal, breast and lung (£m)		£345	£472	£325
New phasing		39.4% of Yr 1 (2012/13)	18% of Yr 2 and 18% of Yr 1	18% of Yr 3, 18% of Yr 2 and 18% of Yr 1
Phased costs, reduced to SR	£ 33	£136.00	£146.70	£198.30

76. The £33m in 2011/12 was selected as an initial starting point. The first line (Earlier Diagnosis (in full)) is based simply on the Frontier modelling for NAEDI. It effectively assumes that a major shift in earlier diagnosis (to the best possible incidence distribution by stage) can be achieved in about 3 years. This is clearly unrealistic, due to both the challenges of expecting patients to present earlier and to supply constraints (equipment and staff for testing). Estimating the costs and benefits during the transition period is difficult

77. Consequently some phasing of the NAEDI models was assumed, i.e. that the increase in activity assumed in the first year (2012/13) would be spread over about four years (40%, 18%, 18%), and that the increase in subsequent years would be spread over five or more years (18% each year). The resulting expenditure is the final line.

78. Key sources of data

Table 2: Unit Costs of diagnosis

Unit Costs	Original costs of diagnosis[8]		Costs of diagnosis, updated for inflation	
Cancer Type	**Initial Test**	**Further Tests**	**Initial Test**	**Further Tests**
Colorectal cancer	11.7	411.6	14	477
Breast cancer	45.5	323.0	46	342
Lung cancer	63.0	379.0	65	439
Prostate cancer	46.0	315.2	47	354
Melanoma cancer	92.8	177.1	107	180

Table 3: Lifetime Treatment Costs by Stage of Cancer

CANCER TYPE AND STAGE	COST[9]
Colorectal Cancer	
Stage A	£9,121
Stage B	£13,918
Stage C	£21,604
Stage D	£13,344
Unknown	£14,496
Breast Cancer	
Excellent prognosis	£8,767
Good	£9,945
Moderate	£11,098
Poor	£13,173
Lung Cancer	
Stage I	£7,135
Stage II	£7,135
Stage III	£6,720
Stage IV	£4,689
Prostate cancer	
Localised	£8,982
Locally advanced and metastatic	£5,905
Melanoma cancer	
Stage 1	£1,373
Stage 2	£3,340
Stage 3	£4,822
Stage 4	£5,302
Unknown	£4,872

[8] Costs as shown in source documents

[9] Costs are estimated for 2009 by Frontier Economics, based on source studies (see Annexes 3-8). Costs are estimated lifetime costs by stage of diagnosis.

Table 4: Number of people tested for one diagnosed with cancer

	Tests	Colorectal cancer	Breast cancer	Lung cancer	Prostate cancer symptom-matic	Melanoma
Symptomatic	People tested through initial test who then need other tests	NA	1 in 3 (4)	1 in 7 (3)	1 in 3 (7)	1 in 5 (3)
	People tested through other tests who are diagnosed with cancer	1 in 20 (2)	1 in 7 (2)	1 in 3 (3)	1 in 5 (7)	1 in 2 (9)
Screened	People tested through initial test who need other tests	1 in 20 (1)	1 in 20 (5)	NA	NA	NA
	People tested through other tests who are diagnosed with cancer	1 in 20 (1)	1 in 7 (6)	NA	NA	NA
Aware patients	People tested through initial test who need other tests	NA	1 in 8 (3)	1 in 18 (3)	1 in 3 (7)	1 in 5 (10)
	People tested through other tests who are diagnosed with cancer	1 in 20 (3)	1 in 7 (2)	1 in 3 (3)	1 in 5 (7)	1 in 2 (10)

Sources

(1) "Bowel cancer screening" The Facts NHS Cancer Screening Programme
(2) Frontier assumption that this rate is equal to the one among screened population
(3) Frontier assumption given other rates
(4) "The accuracy of "one-stop" diagnosis for 1110 patients presenting to a symptomatic breast clinic"
(5) Cancerhelp.org
(6) Statistic provided by expert (Julietta Patnik)
(7) "Symptomatic diagnosis of prostate cancer in primary care: a structured review", William Hamilton and Deborah Sharp
(8) "Population-based prostate-specific antigen testing in the UK leads to a stage migration of prostate cancer"
(9) 2006 study from Sheffield (Westbrook et al 2006) quoted in " Skin conditions in the UK: a healkth care needs assessment" from Julia Shoffield
(10) Frontier range of lower-bound to upper bound scenarios

Model limitations

79. The model does not answer the question about how we can achieve earlier diagnosis, due to the limited evidence to date about NAEDI interventions. The model makes some simplifying assumptions about how quickly earlier diagnosis can be achieved, and about the transition, which is assumed to be very quick. That is why the results from the Frontier modelling have been phased over several years.

80. The model is not a financial model, ie it is not set up to provide financial forecasts for the NHS or for NHS organisations. It does not model explicitly or take into account resources, eg equipment, capital, staff, etc. It does not address explicitly the issue of capacity.

81. Under some circumstances earlier diagnosis may identify the disease sooner than would have been the case but does not lead to increased longevity. This lead time bias has the possibility of improving the survival time of the patient and increasing the lifetime costs of treatment but not extending life expectancy. An estimation has been made by how much the benefits would have to be reduced if lead-time bias was evident in the early diagnosis policy implementation. Total life years gained at steady state could be reduced by around 20% for breast, 25% for colorectal and

60% for lung giving an overall reduction of 35%. Cost effectiveness ratios are still well under the threshold.

INFORMATION COLLECTION

82. A key means of improving outcomes for cancer patients is through earlier diagnosis. Option 3 proposes significant investment in extra diagnostic test activity for primary care for the following tests:
    - Chest x-ray
    - Non-obstetric ultrasound
    - Flexible sigmoidoscopy
    - Colonoscopy
    - MRI brain
83. Hospital Episode Statistics (HES) enables detailed analysis of endoscopy activity (including flexible sigmoidoscopy and colonoscopy), the majority of which takes place in an inpatient setting. However, nationally consistent data on the use of imaging tests is currently less rich. Data from Radiology Information Systems does not flow into the Secondary Uses Service (SUS), and does not therefore feed through into HES. The existing DM01 and KH12 central returns collect aggregate data on waiting times for imaging tests. However, more detailed data is required to inform the strategy on GPs' use of chest x-ray, non-obstetric ultrasound and brain MRI scans, including the following data items:
    - Patient age
    - Patient sex
    - Body area of test
    - GP referrer.
84. Such data would be collected quarterly and fed back to GPs and commissioners, enabling them to benchmark usage of diagnostic tests and to check whether GPs are, along with their use of the 2-week urgent referral pathway, checking out suspicious symptoms appropriately.
85. Collecting such data would require the following steps:
    - review of RISs to identify existing commonality of data across systems
    - review of existing national data standards
    - national dataset design
    - approval process for data standards / data mandate (ISB/ROCR)
    - implementation of national data extraction mechanism / process.
86. The collection of diagnostic activity data, to monitor if suspicious symptoms are being appropriately investigated, will add an additional burden on NHS providers. The reissued 2010/11 Operating Framework has given a clear indication that the NHS will not need in the future to focus on centrally set process driven targets, but will be held to account for the outcomes achieved. The fundamental review of data returns should lead to a reduced process data burden for the NHS, which should in-turn offset the additional burden created by the new diagnostic activity data.