Setting Levels of Ambition for the NHS Outcomes Framework

A technical annex to support Developing our NHS care objectives: a consultation on the draft mandate to the NHS Commissioning Board

Chapter 3 (part 2): Preventing people from dying prematurely

DH INFORMATION READER BOX

Policy	Clinical	Estates
HR / Workforce	Commissioner Development	IM & T
Management	Provider Development	Finance
Planning / Performance	Improvement and Efficiency	Social Care / Partnership Working

Document Purpose	For Information
Gateway Reference	17770
Title	Setting Levels of Ambition for the NHS Outcomes Framework
Author	Department of Health
Publication Date	**4 July 2012**
Target Audience	For those interested in measuring outcomes
Circulation List	
Description	Developing our NHS care objectives: A consultation on the draft mandate explains that the Government will hold the NHS Commissioning Board to account for delivering improvements in health outcomes. This technical annex outlines the proposed methodology for setting levels of ambition against the NHS Outcomes Framework
Cross Ref	Delivering our NHS care objectives: a consulation on the draft mandate
Superseded Docs	
Action Required	N/A
Timing	
Contact Details	NHS Outcomes Framework team 601 Richmond House 79 Whitehall London SW1A 2NS
For Recipient's Use	

First published July 2012
Published to DH website, in electronic PDF format only.
www.dh.gov.uk/publications

Contents

Introduction

3.1 Part two of this chapter continues to set out our proposals for calculating a level of ambition for domain 1: Preventing people from dying prematurely. (The proposed methodology is summarised in the executive summary and explained in detail in chapter 2.)

3.2 In this chapter, we review available data for each of the improvement indicators in this domain. A 'notes' section highlights some aspects which may merit further consideration. The chapter illustrates a range of factors that may affect outcomes (we use the term 'drivers' to describe these). In some cases, we refer to findings from academic literature. Such citations are not intended to be a guide to clinical practice and should not be taken as official endorsement by the Department of Health.

3.3 We produce 'current practice projections' where data are available. The purpose of these projections is explained in the executive summary and in Chapter 2. They are not forecasts of performance – rather they represent benchmarks for assessing the likely NHS contribution to improving outcomes. After producing a projection, we then consider what scope there is for the NHS to improve outcomes measured by individual indicators within available resources.

3.4 Finally, sections 3 a and b provide examples of how these areas of possible improvement could be aggregated and used to inform a level of ambition that is set for each domain. It is important to note that this section is a partial assessment at this stage. It illustrates how we might set levels of ambition. We intend to quantify what might be possible to achieve at a national level. It would then be for the NHS Commissioning Board to decide how to meet that level of ambition.

3.5 Our partial assessment is based on building up a picture of what might be possible based on considering individual indicators. Our aim is to have a level of ambition that represents the goal of the domain as a whole – therefore we are clear that we may need to make some additional broader assumptions.

3.6 As indicated earlier in the document, this material is an analytical work in progress. It is being published in the interests of transparency, to outline our proposals, and to invite comments. Levels of ambition will be included in the final mandate.

(1) Domain 1: Overview and Metric of Incremental Progress

3.7 Domain 1, preventing people from dying prematurely, comprises two overarching indicators: “1a. Potential Years of Life Lost (PYLL) from causes considered amenable to health care” and “1b. Life expectancy at 75”, and seven improvement areas.

3.8 The improvement areas are of two sorts:

- Complementary Indicators. Neonatal mortality up to the age of 28 days is not included in the overarching indicator because cause of death is not classified by ICD-10 code for deaths up to 28 days after live birth. Therefore, it is not possible to measure separately those neonatal deaths that are considered amenable. Yet deaths up to 28 days and stillbirths, indicator 1.6.ii (Neonatal mortality and stillbirths), are increasingly amenable to healthcare, and therefore complement indicator 1a. Indicator 1.6.i (Infant mortality), a joint indicator with public health, is included to register the important contribution of the NHS to care of all infants up to one year old

- Sub-indicators. The first four improvement areas relate to particular diseases (Under 75 mortality rates from 1.1 cardiovascular disease, 1.2 respiratory disease, 1.3 liver disease, 1.4.i-vii five-year survival from colorectal, breast and lung cancer and under 75 mortality rate from cancer), which account for large portions of the disease burden amenable to health care. Progress in these outcomes therefore provides a useful initial analysis of what accounts for progress in the overarching indicators. In this case, the reason for inclusion of separate indicators is concern that poor outcomes for this group may reflect inequity. Note, however, that the exclusion of a condition from indicator 1a does not mean that there are no deaths for people with that condition that are amenable to NHS intervention. Where there is such amenability, to that extent these indicators are also complementary to the overarching indicators. Amenable outcomes under indicator 1.5, Excess under 75 mortality rate in adults with serious mental illness, and under the placeholder indicator 1.7 (which will measure excess mortality for people with Learning Disabilities), are also largely captured in overarching indicator 1a.

3.9 Together, the overarching indicators and the improvement indicators provide a picture of the NHS’s contribution to preventing people from dying prematurely.

3.10 The challenge is to construct a single aggregate metric of incremental progress in this Domain to allow a level of ambition to be formulated. To this end we must identify all outcome areas to which the NHS contributes improvement. To avoid duplication, sub-indicators should be included only to the extent that they exceed in scope the overarching and complementary indicators. Hence, to set levels of ambition for Domain 1, we require an approach that takes into account NHS contributions to progress in the following areas:

- 1a. All changes included. This also includes Life Year gains from improvements in outcomes captured by indicators 1.1, 1.2 and 1.4.i-vi, and by 1.5 and 1.7.
- 1b. All changes included.
- 1.3. All changes included: liver disease is not counted as amenable under the ONS definition (used for indicator 1a); nevertheless, some element of mortality is susceptible to improvement. This reflects incremental gains for those conditions whose deaths are only rarely amenable, and also the contribution that the NHS can make by encouraging healthy behaviours and uptake of screening options with contemporaneous impact, complementing public health services.
- 1.4.vii. All changes for cancers not considered amenable, i.e. excluding those captured by 1a.
- 1.6.i. All changes included EXCEPT those already captured by 1a (causes amenable for those aged 29 days and over). This includes Life Year gains from outcomes captured by 1.6.ii except stillbirths, which are excluded from Domain aggregation. (Stillbirths are regarded as too sensitive to coding changes and to shifts in practice in termination of pregnancy for use as a reliable indicator of NHS care. Monitoring of the trend is necessary to aid interpretation of changes in the neonatal mortality indicator.)

3.11 For each of these areas, the gain from improved outcomes can be characterised as a gain in

- Cohort life expectancy at birth

3.12 In each case, a common metric of incremental gain attributable to the NHS is available:

- Life years

3.13 Specifically:

- 1a. A reduction in the number of deaths from causes amenable to health care gives an extension of life to each beneficiary.
- 1b. An increase of life expectancy of those aged 75 attributable to improved NHS services can be assessed as a gain in life years by considering the gain for each year-group separately.
- 1.6.i. Reduced infant mortality gives additional life years to infants who would otherwise die. Multiplying the numbers of additional survivors by their life expectancy on survival gives the increase in life years.

- Other indicators: reduced mortality in other outcome areas that is not picked up in the above indicators would contribute life years according to the life expectancy of those whose death is avoided.

Projection methodology for Domain 1

3.14 For this Domain, where sufficient data was available, Age-Period-Cohort (APC) models have been used to forecast mortality. For a number of indicators, projections have been carried out using an Age Period Cohort technique. The methodology used is explained here and referenced at the appropriate places.

3.15 These models separate out three influences upon the mortality of each age group in a given period: the age of the group, the date at which the mortality takes place, and the birth period in which the group was born. The three influences capture distinct determinants of outcomes: respectively:

- age: the natural increased fragility associated with age,
- period: the impact of contemporaneous determinants of outcome – in particular the quality of healthcare services,
- cohort, the cumulative impact upon outcomes of life health behaviours and experiences, which vary systematically with birth period.

3.16 To the extent that modelling robustly distinguishes these effects, projections based upon the quality of current NHS care is simplified.

3.17 Although the models are applied to all ages, the projected mortality rates for the younger age groups are calculated using the average of the last three data points, i.e. the last 15 years.

3.18 Age-specific mortality rates are provided in 5 year age bands, so the models are structured around cohorts of 5 years. Hence the projected rates are also for 5 year periods: 2011-2015 and 2016-2020. Annual figures are presented by assuming a linear progression in rates, with the projected figures being reached in the middle of each period (2013 and 2018).

3.19 It is not possible to estimate APC models directly due to the linear dependence between age, period and cohort. Numerous solutions to this problem have been proposed, one of which is the Intrinsic Estimator. The Intrinsic Estimator uniquely determines coefficients without requiring a user-imposed constraint on their values, and is both unbiased and efficient[1] . The STATA apc_ie package was used to estimate all the results published here.

[1] "Trends in U.S adult chronic disease mortality, 1960-1999: Age, period and cohort variations" Yang Yang, Demography, vol.45 no.2 (May 2008)

3.20 Whilst having estimates of the age and cohort variables improves the robustness of projections, it is still necessary to estimate future period effects as well as the value for new cohorts. Additional cohort coefficients are projected based on recent trends. The choice of predicted cohort coefficients is however of little importance, as they only affect the youngest age groups where mortality rates are low.

3.21 Although numerous factors have a contemporaneous effect on the outcomes monitored, it is reasonable to assume that the quality of treatment is of major importance. In the absence of alternative explanations, we therefore presume that period effects are determined by the NHS, and so our Current Practice Projection uses a period effect that is kept constant at the current level. Population figures are taken directly from the ONS mid-year population forecasts.

3.22 The robustness of this methodology will be tested further during the consultation period. This will involve an examination of the Intrinsic Estimator through comparisons with alternatives such as Constrained Generalized Linear Estimators. The use of natural splines will be looked into as a solution to potentially over fitting the data. We can also explore truncating the data and estimating the omitted period. Further work will also be done into determining the optimal methodology for projecting period and cohort effects. For the former, it may be possible to model the period effects themselves against possible NHS and external contemporaneous drivers of outcome. We will also consider further whether the current practice projections collectively capture the impacts of relevant drivers including obesity, alcohol and smoking.

(2) Domain 1: Indicator Trends, Explanations, Projections and Scope for Improvement

3.23 This section sets out for each indicator or set of indicators:

a) Recent Trends and Explanations

b) Current Practice Projections

c) Scope for Improvement by Indicator

3.24 The analysis is predicated upon consideration of the influence of drivers of outcome. On the basis of our understanding of the relative contribution of different factors to these outcomes, current-practice projections for each indicator can be made on the assumption that the quality of the NHS contribution to outcomes is maintained at the same level as in the base-year, 2012-13 (see discussion in Chapter 2, section ii).

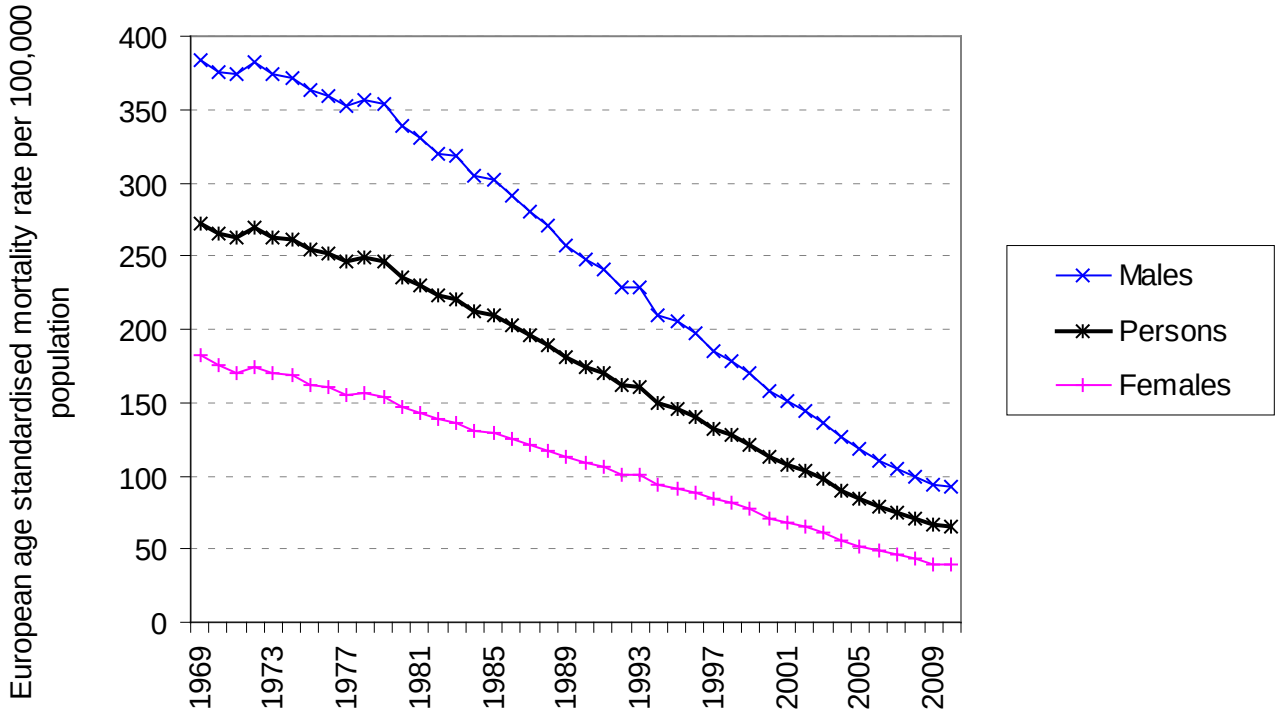
1.1 – Under 75 mortality rate from cardiovascular disease

Outcome sought	Reduced premature mortality from cardiovascular disease
Indicator definition	European age-standardised mortality rate from cardiovascular disease, ages under 75, per 100,000 population

(a) Indicator 1.1: Recent Trends and Explanations

3.105 The mortality rate for all under 75 deaths from cardiovascular disease (CVD) fell by 2.2% between 2009 and 2010, from 66.1 to 64.7 deaths per 100,000 population. The fall was greater for females (2.6%) than for males (2.0%). The average annual decline over the 10-year period to 2010 was 5.4% for males and 6.0% for females. In 2010, the rate for males was 2.4 times the rate for females, and this ratio represents a slight increase from 2001, when the male rate as 2.2 times the female rate.

Figure 1.1.a – Under 75 mortality rate from CVD by sex (rate per 100,000 population)



Source: Office for National Statistics, DH

Table 1.1.a Under 75 mortality rate from CVD by sex (per 100,000 population)

	Males	Females	Persons
1969	383	182	272
1970	376	175	266
1971	374	171	263
1972	382	174	269
1973	374	170	263
1974	372	168	261
1975	364	162	255
1976	359	160	252
1977	352	155	246
1978	357	156	249
1979	354	154	247
1980	339	146	235
1981	330	142	229
1982	320	139	223
1983	318	137	221
1984	305	131	212
1985	301	129	210
1986	292	125	203
1987	281	121	196
1988	271	117	189
1989	257	113	180
1990	248	109	174
1991	241	106	169
1992	229	101	161
1993	228	101	161
1994	210	94	149
1995	205	91	145
1996	197	89	141
1997	186	84	133
1998	178	82	128
1999	170	77	122
2000	158	71	113
2001	151	68	108
2002	144	65	103
2003	137	62	98
2004	126	55	90
2005	118	52	84
2006	111	49	79
2007	105	46	74
2008	100	44	71
2009	94	40	66
2010	92	39	65

Source: Office for National Statistics, DH

Breakdown by condition

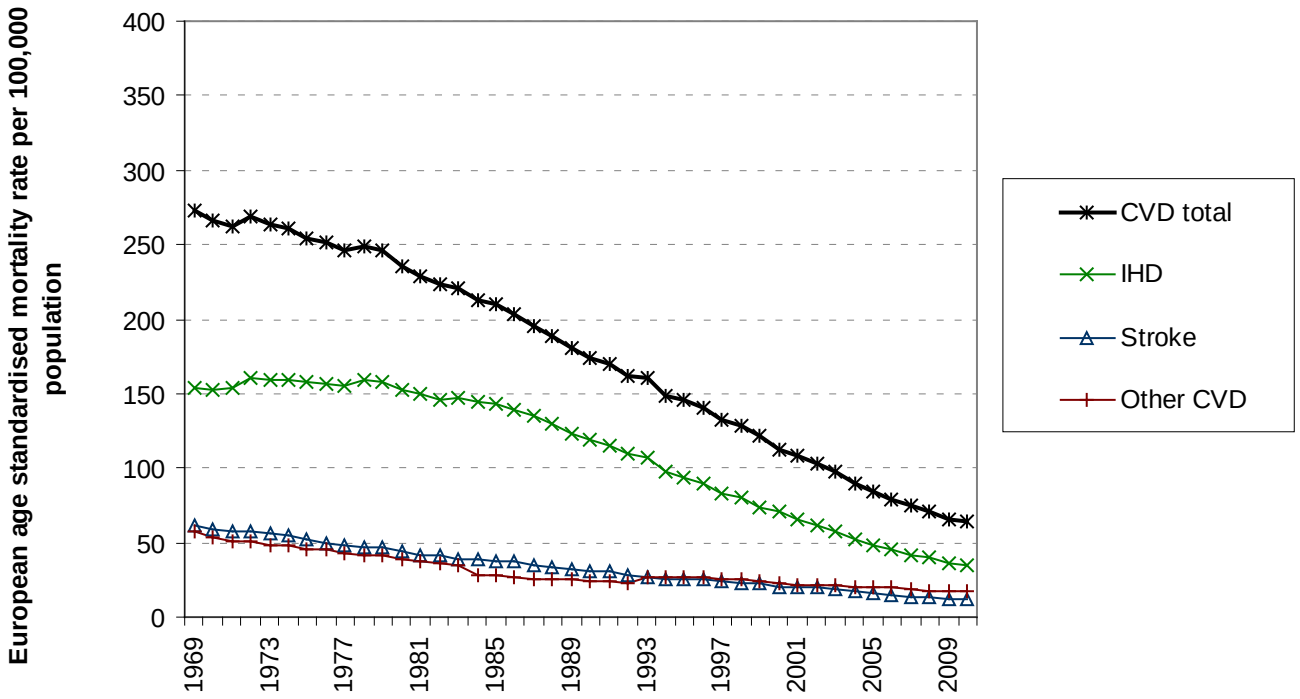
3.106 Deaths from ischaemic heart disease (IHD) and stroke made up 54.3% and 18.3% of all under 75 deaths from CVD in 2010, respectively. Both of these conditions are considered 'amenable' under the ONS definition of avoidable mortality, of which amenable mortality is a sub-category. Only 13.4% of under 75 deaths from other CVD conditions are from causes considered 'amenable'. The average annual decline in under 75 deaths from IHD was 6.8% over the 10-year period to 2010, compared to 5.1% for stroke and only 2.2% for 'other CVD' conditions.

3.107 For IHD and stroke, as well as 'other CVD' conditions, males have higher mortality rates than females. For IHD in particular, in 2010 the mortality rate for males was more than three times higher than the female mortality rate.

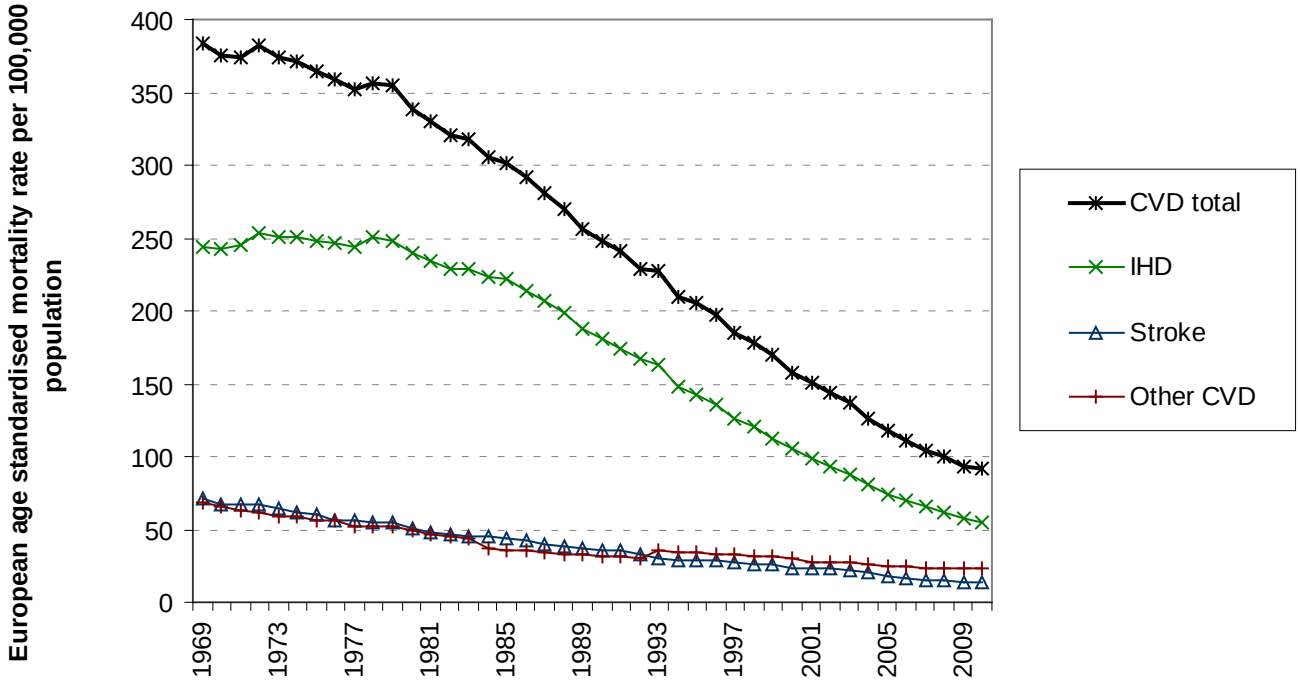
3.108 This difference could be due to women developing CVD at later ages, being relatively 'protected' when pre-menopausal, and because they tend to smoke less than men.

Figure 1.1.b – Under 75 mortality rate from CVD conditions, England

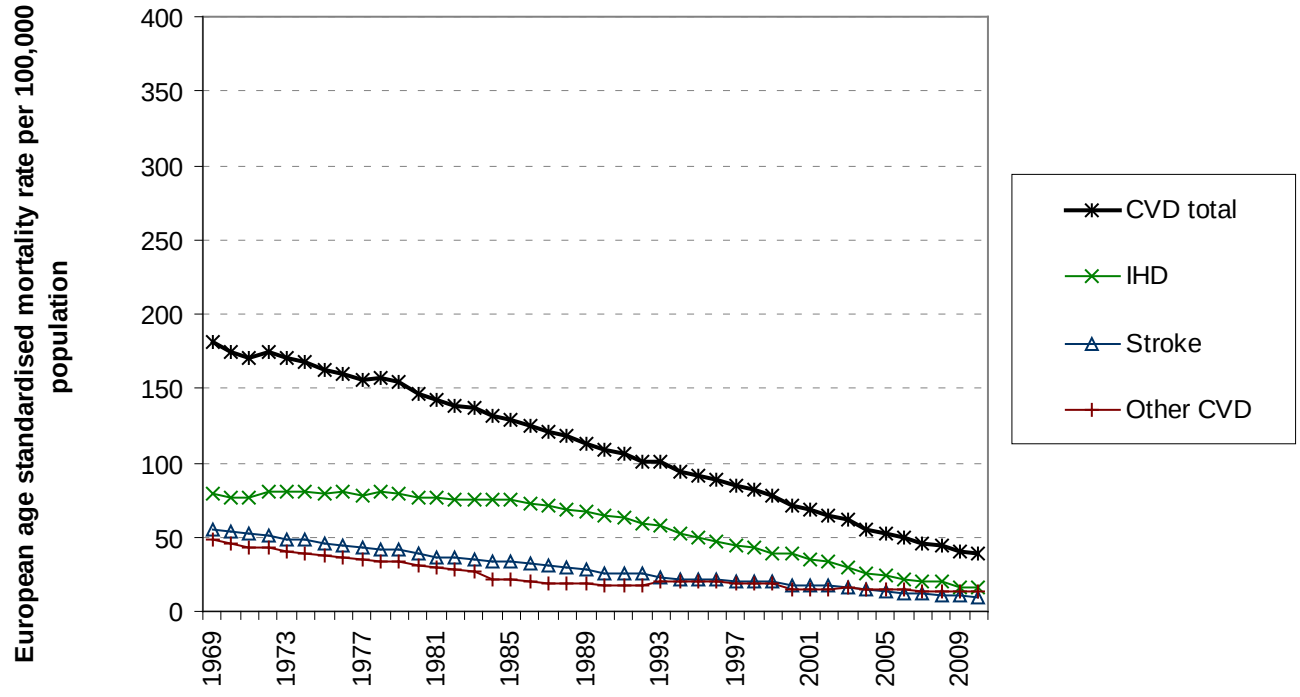
Persons



Males



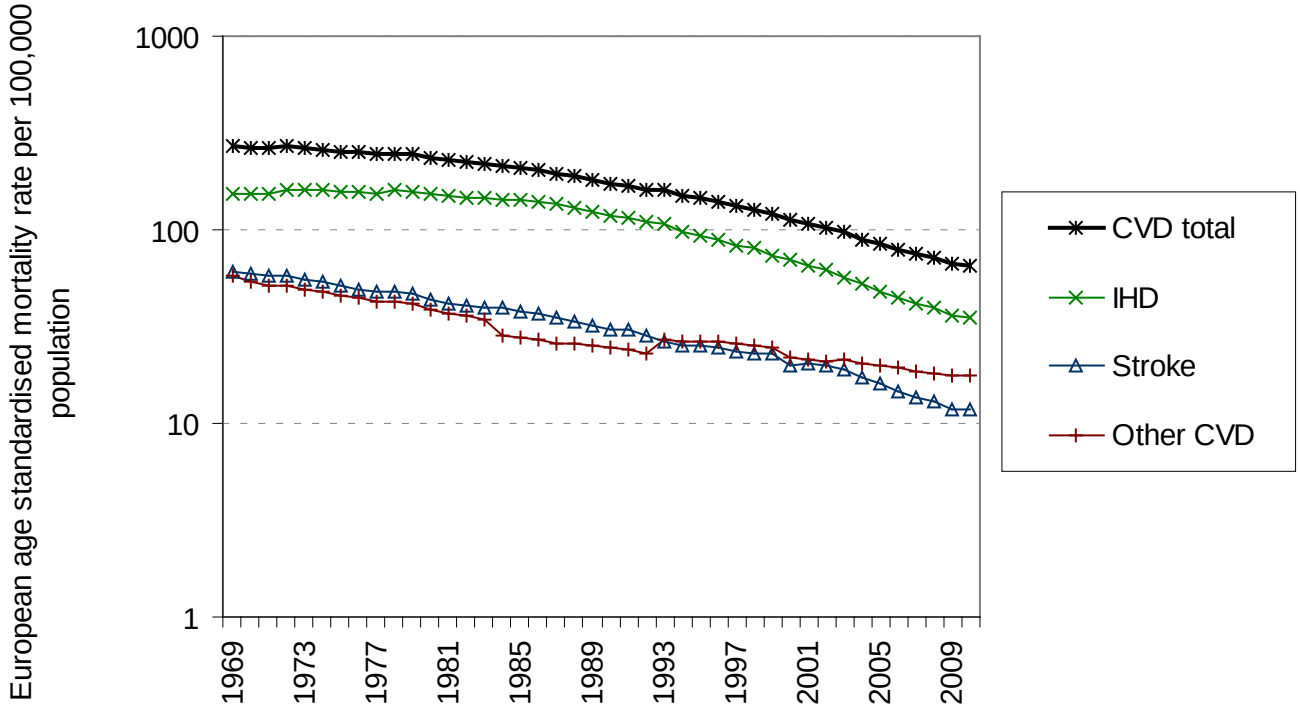
Females



Source: Office for National Statistics, DH

3.109 An alternative chart is shown below, using a logarithmic scale to show more clearly comparisons of change over time (lines with the same rate of change over time will be parallel):

Figure 1.1.c – Under 75 mortality rate from CVD conditions, England, persons (logarithmic scale)



Source: Office for National Statistics, DH

Table 1.1.b Under 75 mortality rate from CVD (per 100,000 population)

	Males				Females				Persons			
	CVD total	IHD	Stroke	Other CVD	CVD total	IHD	Stroke	Other CVD	CVD total	IHD	Stroke	Other CVD
1969	383	244	71	68	182	79	54	49	272	154	61	57
1970	376	243	68	65	175	77	53	45	266	152	59	54
1971	374	245	67	63	171	76	52	42	263	153	58	51
1972	382	254	67	62	174	81	50	43	269	160	58	51
1973	374	250	64	59	170	81	49	40	263	159	56	49
1974	372	251	62	59	168	81	48	39	261	159	54	48
1975	364	248	60	56	162	80	45	37	255	157	52	46
1976	359	247	57	56	160	80	44	37	252	157	49	45
1977	352	244	55	53	155	78	43	34	246	155	48	43
1978	357	250	55	52	156	81	42	34	249	159	47	42
1979	354	247	55	52	154	79	41	33	247	157	47	42
1980	339	239	51	49	146	77	39	31	235	152	44	39
1981	330	235	48	47	142	76	37	29	229	150	42	37
1982	320	228	47	46	139	75	36	28	223	146	41	36
1983	318	229	45	44	137	75	34	27	221	147	39	35
1984	305	223	46	37	131	75	34	22	212	144	39	29
1985	301	222	44	36	129	75	33	21	210	144	38	28
1986	292	214	43	35	125	73	32	20	203	139	37	27
1987	281	207	40	34	121	71	31	19	196	135	35	26
1988	271	199	38	34	117	69	30	19	189	130	34	26
1989	257	187	37	33	113	67	28	19	180	123	32	25
1990	248	181	35	32	109	64	26	18	174	119	30	25
1991	241	174	35	31	106	63	26	17	169	115	30	24
1992	229	167	33	30	101	59	25	17	161	110	29	23
1993	228	163	30	35	101	57	23	20	161	107	27	27
1994	210	147	29	34	94	52	22	20	149	97	25	26
1995	205	142	29	34	91	50	22	20	145	94	25	27
1996	197	135	28	33	89	47	22	20	141	89	25	26
1997	186	126	27	32	84	44	21	19	133	83	24	26
1998	178	120	26	31	82	43	20	19	128	80	23	25
1999	170	112	27	31	77	39	20	18	122	74	23	24
2000	158	105	23	30	71	39	17	15	113	71	20	22
2001	151	99	24	28	68	35	18	15	108	66	21	21
2002	144	93	23	28	65	33	17	14	103	62	20	21
2003	137	88	22	27	62	29	16	16	98	57	19	22
2004	126	80	20	26	55	26	15	15	90	52	17	20
2005	118	75	18	25	52	24	14	15	84	48	16	20
2006	111	69	17	25	49	22	13	14	79	45	15	20
2007	105	65	16	24	46	20	12	14	74	42	14	19
2008	100	62	15	23	44	19	11	13	71	40	13	18
2009	94	57	14	23	40	17	10	13	66	36	12	18
2010	92	55	14	23	39	16	10	13	65	35	12	18

Source: Office for National Statistics, DH

Breakdown by region

3.110 CVD mortality rates improved in each region between 2001 and 2010. Table 1.1.c shows the average annual declines between 2001 and 2010 in each region, with the greatest average annual decline (6.4%) in the North East and the least (5.2%) in the East Midlands and East of England.

Table 1.1.c Average annual decline by region (%)

	Average Annual Decline 2001-2010	CVD mortality rate per 100,000 population, 2010
North East	6.4	71.0
North West	5.3	79.8
Yorkshire and The Humber	5.3	72.6
East Midlands	5.2	65.4
West Midlands	6.0	66.8
East of England	5.2	57.6
London	5.4	68.2
South East	5.4	53.9
South West	5.6	53.4
England	5.5	64.7

Source: NHS Information Centre

3.111 While the absolute gap between the regions with the highest and lowest mortality rates narrowed between 2001 and 2010, the relative gap widened.

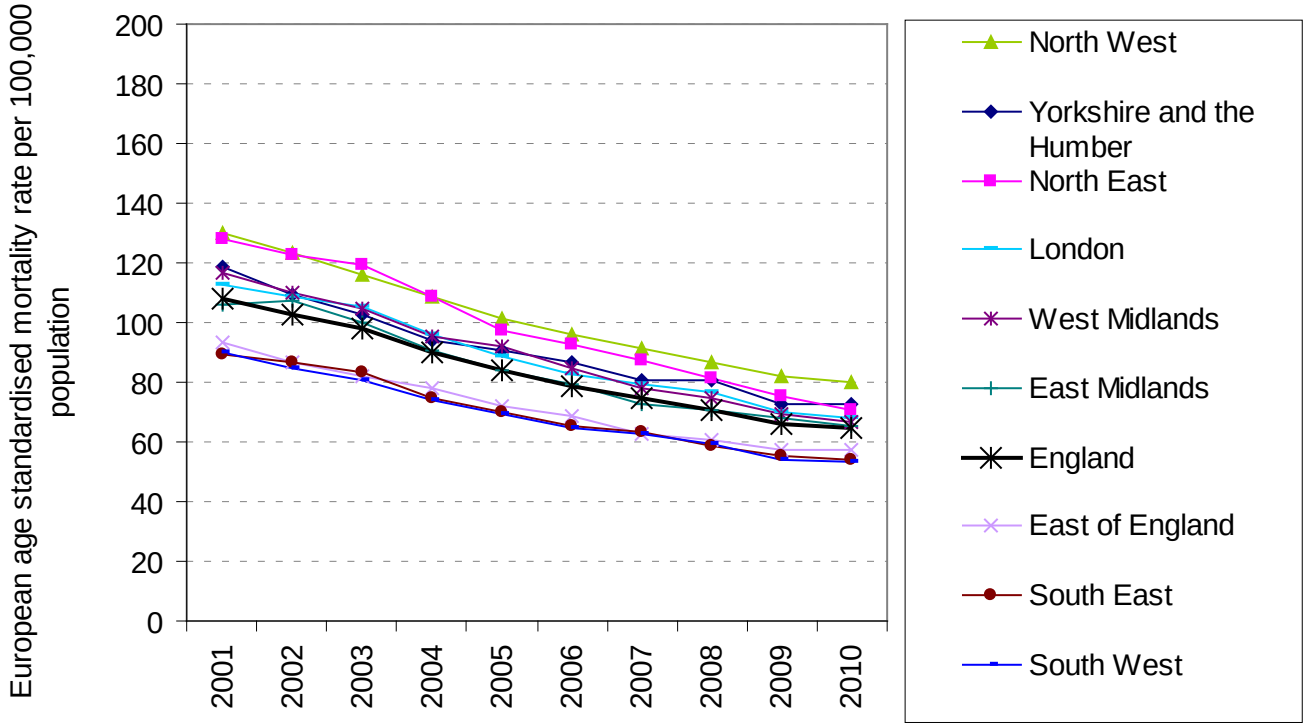
3.112 In 2001, the highest rate (129.7 deaths per 100,000 population, in the North West) was 45.3% higher than the lowest rate (89.3 deaths per 100,000 population, in the South East), while in 2010 this gap had increased to 49.3%, with the highest rate again in the North West and the lowest in the South West (79.8 and 53.4 deaths per 100,000 population, respectively).

3.113 This increase in the relative gap between the highest and lowest rates was driven by an increase in the relative gap for females, from 52.1% in 2001 to 65.5% in 2010. For males the relative gap decreased slightly from 42.9% in 2001 to 42.4% in 2010.

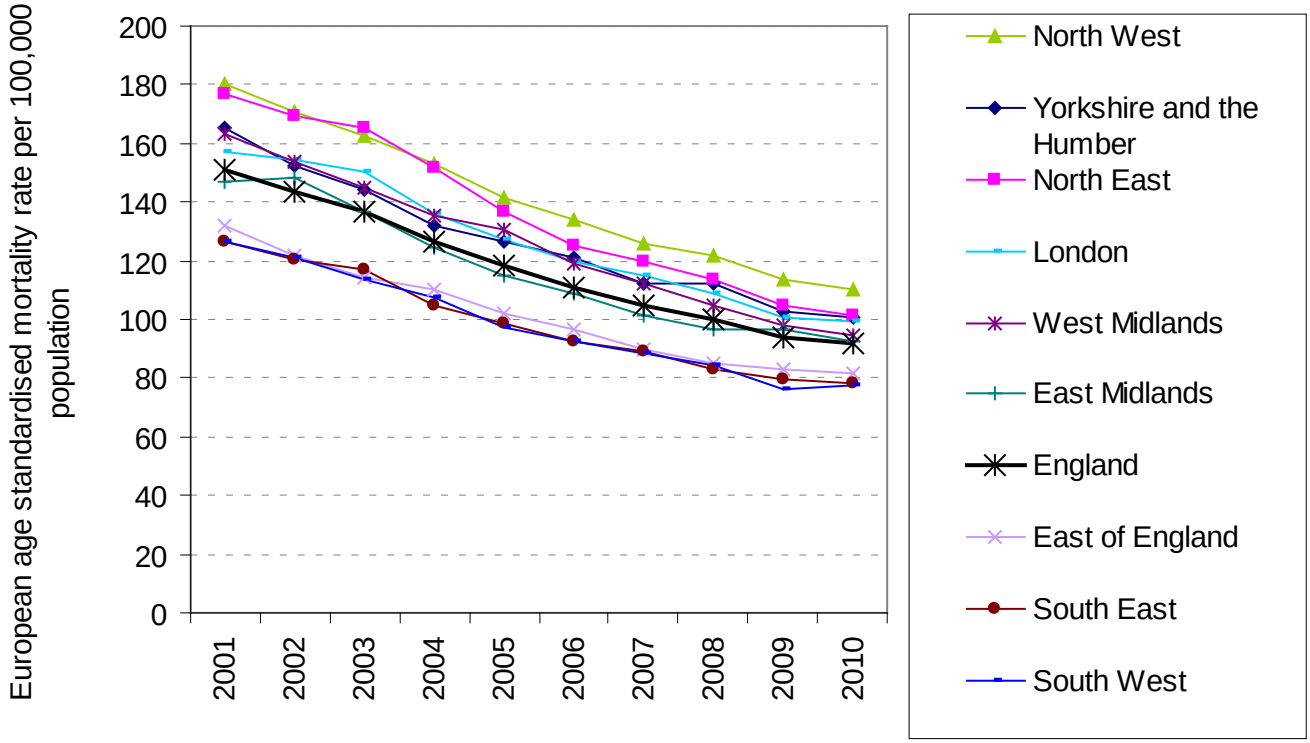
3.114 The East of England, South East and South West all reported better outcomes than the England average for males and females throughout the decade to 2010.

Figure 1.1.d Under 75 mortality rate from CVD by region (per 100,000 population)

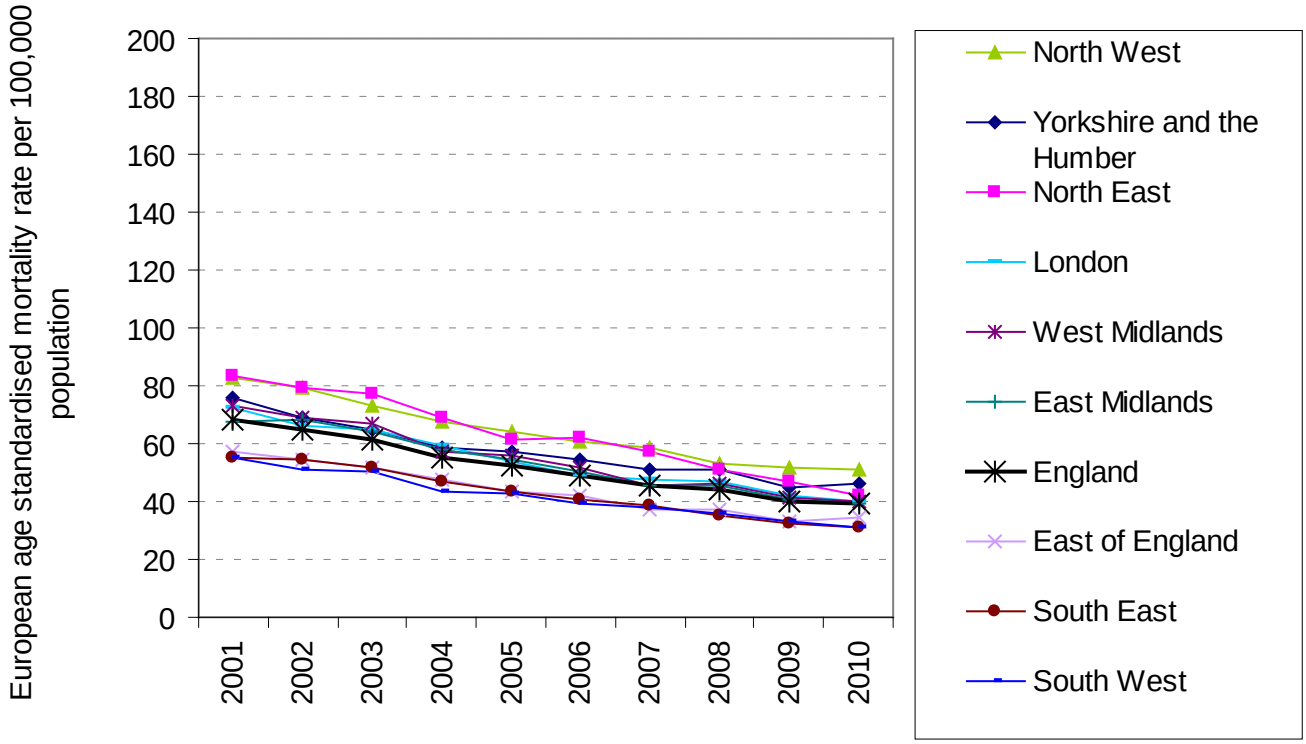
Persons



Males



Females



Source: NHS Information Centre

Table 1.1.d Under 75 mortality rate from CVD by region (per 100,000 population)

Persons										
	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
2001	128	130	119	106	117	93	113	89	90	108
2002	122	123	109	107	110	87	108	86	85	103
2003	119	116	103	100	105	82	105	83	81	98
2004	109	109	94	90	95	78	96	75	74	90
2005	98	102	91	84	92	72	89	70	69	84
2006	93	96	87	79	85	69	83	66	65	79
2007	88	91	81	73	78	63	79	63	63	74
2008	81	87	81	71	75	60	76	58	59	71
2009	75	82	73	68	69	57	70	55	54	66
2010	71	80	73	65	67	58	68	54	53	65
Males										
	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
2001	176.8	180.6	165.4	146.6	163.1	132.0	156.8	126.4	126.8	150.8
2002	169.4	170.7	152.3	148.6	153.4	121.5	154.5	120.7	121.3	143.7
2003	165.6	162.4	144.1	137.0	144.9	114.6	150.0	116.7	113.4	136.6
2004	151.8	153.0	132.0	124.4	135.3	110.4	136.3	105.1	107.5	126.5
2005	136.5	141.6	126.7	115.1	130.7	102.0	127.1	98.9	97.1	118.0
2006	125.4	133.8	121.0	109.0	119.2	96.9	120.0	92.2	92.5	110.8
2007	119.9	125.8	112.0	101.5	112.4	89.9	114.8	89.3	88.7	104.7
2008	113.3	121.9	112.4	96.6	104.9	85.3	108.7	83.3	84.4	99.8
2009	104.8	113.8	102.9	96.3	97.9	82.7	101.0	79.8	76.4	93.8
2010	101.5	110.5	100.5	92.8	94.7	81.9	99.3	78.1	77.6	91.9
Females										
	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
2001	83.6	82.8	75.8	67.9	73.2	57.1	72.4	54.9	55.4	68.1
2002	79.3	79.2	69.1	68.5	69.1	54.5	66.5	54.8	51.0	64.8
2003	77.0	72.8	64.7	64.4	67.1	52.0	64.6	51.8	50.6	61.6
2004	69.0	67.5	58.8	57.9	57.3	47.3	59.3	46.6	43.2	55.4
2005	61.5	64.3	56.9	54.3	55.9	43.8	53.8	43.3	42.9	52.2
2006	62.4	60.9	54.7	50.7	51.8	41.9	48.9	40.8	39.2	49.1
2007	57.4	58.4	51.0	45.6	45.6	37.5	47.4	38.7	38.2	45.8
2008	51.0	53.3	51.0	45.4	46.3	36.9	47.0	35.2	35.6	43.8
2009	47.2	51.6	44.5	40.6	41.6	33.2	42.2	32.5	32.8	40.0
2010	42.4	50.8	46.1	39.0	40.2	34.5	40.0	31.3	30.7	39.0

Source: NHS Information Centre

Breakdown by cohort

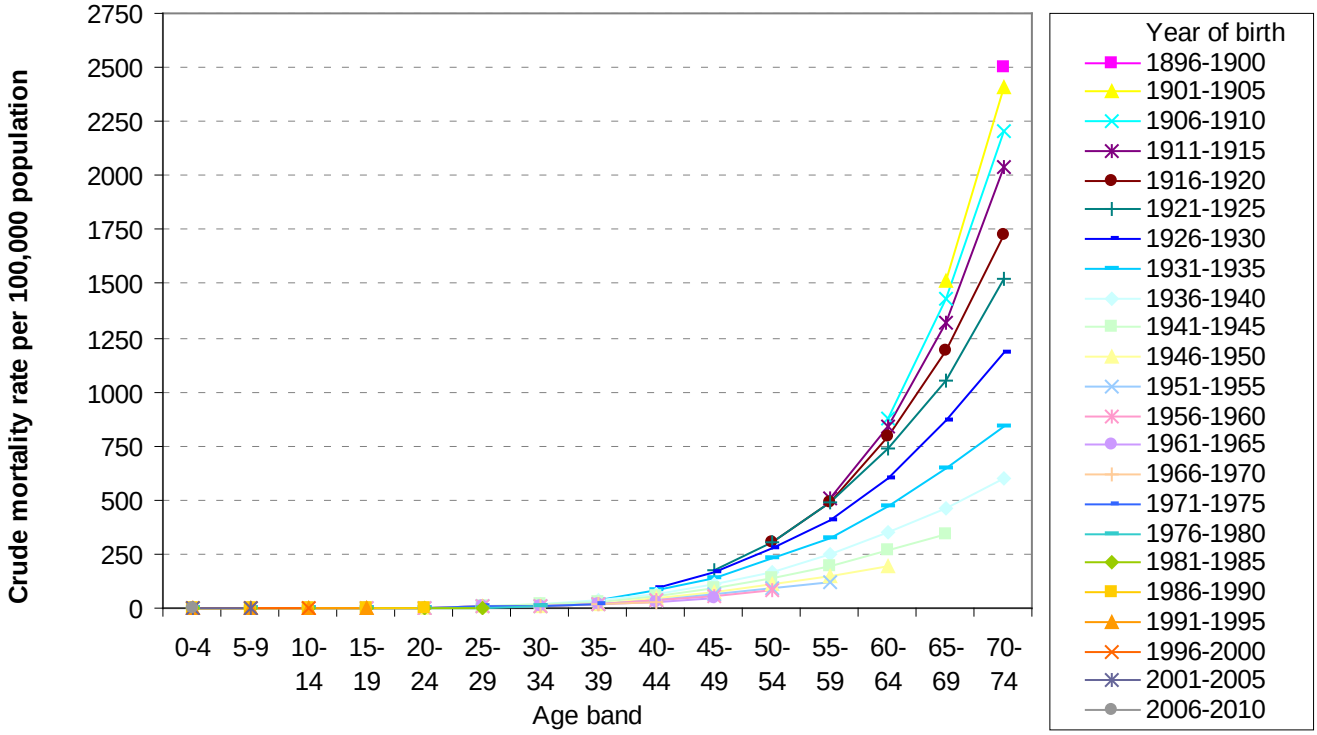
3.115 An age cohort is a group of people born in the same period. An example of a cohort would be those born between 1956 and 1960 (part of the “baby boomers” cohort).

Possibly as a consequence of different health-related behaviours and experiences, the age-specific mortality rates of different cohorts can, and do, vary.

3.116 By using cohorts (grouping people according to when they were born), the age-specific mortality rates of a cohort can be compared to the age-specific mortality rates of other cohorts at selected ages.

3.117 This is done below, using five-year birth cohorts from 1896 and five-year bands for age-specific crude mortality rates, for persons.

Figure 1.1.e Mortality rate from CVD by cohort (per 100,000 population)



Source: Office for National Statistics, DH

Table 1.1.e Mortality rate from CVD by cohort (per 100,000 population)

Year of birth	1896-1900	1901-1905	1906-1910	1911-1915	1916-1920	1921-1925	1926-1930	1931-1935	1936-1940	1941-1945	1946-1950	1951-1955	1956-1960	1961-1965	1966-1970	1971-1975	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010
0-4															3	3	4	3	2	3	3	2	2
5-9														1	1	1	1	1	1	1	0	1	
10-14													1	1	1	1	1	1	1	1	1		
15-19												3	2	2	2	2	2	2	2	2			
20-24											4	4	4	3	3	4	3	3	2				
25-29										9	7	7	6	5	6	5	4	4					
30-34									17	15	12	10	8	10	8	8	8						
35-39								40	35	29	22	21	17	17	16	15							
40-44							89	80	68	54	42	39	33	31	27								
45-49						176	167	143	115	88	73	64	56	47									
50-54					302	309	277	227	169	137	111	92	79										
55-59				510	492	485	409	323	250	195	146	125											
60-64			872	837	796	735	597	475	355	263	197												
65-69		1,514	1,429	1,317	1,193	1,055	866	650	460	340													
70-74	2,503	2,409	2,204	2,038	1,723	1,525	1,178	842	602														

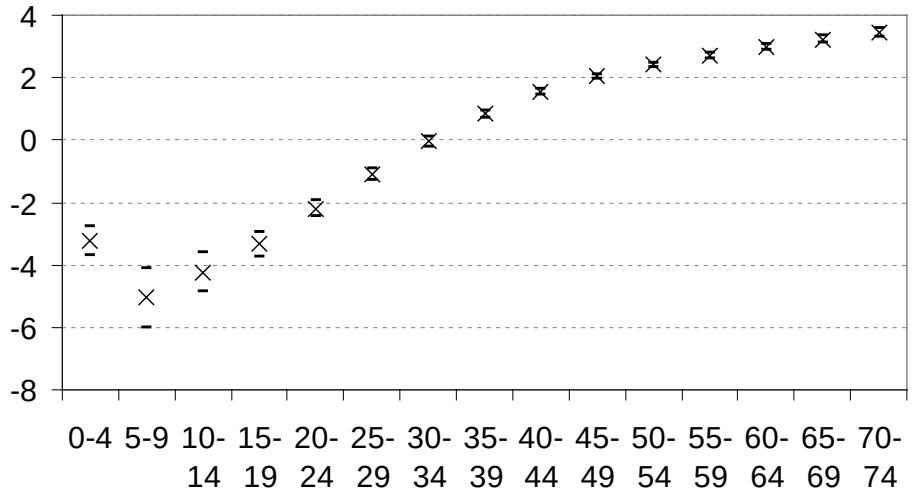
Source: Office for National Statistics, DH

3.118 From the age band 25-29 upwards, almost all successive cohorts have mortality rates that are lower than all previous cohorts.

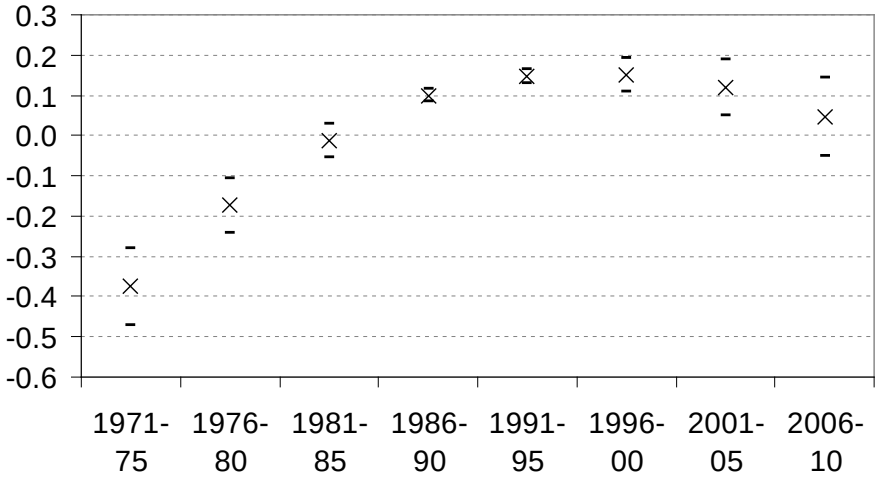
3.119 Age-Period-Cohort (APC) analysis has been applied to IHD, stroke and other CVD. APC Modelling attempts to attribute changes in mortality to the three factors listed in the name. Cohort effects capture those characteristics common to people born at roughly the same time that affect their susceptibility to illness and robustness in recovery. Such characteristics are distinguished by the fact that the factors determining them affect only those people of a particular age group. They are more likely therefore to be determined during peoples' formative years (including in utero). Age effects capture the morbidity consequences of how old an individual is, whilst the period effect captures all contemporaneous factors affecting the entire population at risk, such as the quality of healthcare provision.

3.120 The following charts show the estimated coefficients for each age group, time period and birth cohort – which can be interpreted as showing their relative contribution to mortality rates. The coefficients for each of the three factors respectively sum to 0, meaning that a value for a specific factor with a coefficient above zero has contributed positively to mortality rates. 95% confidence intervals are presented to demonstrate the differing levels of uncertainty around each factor.

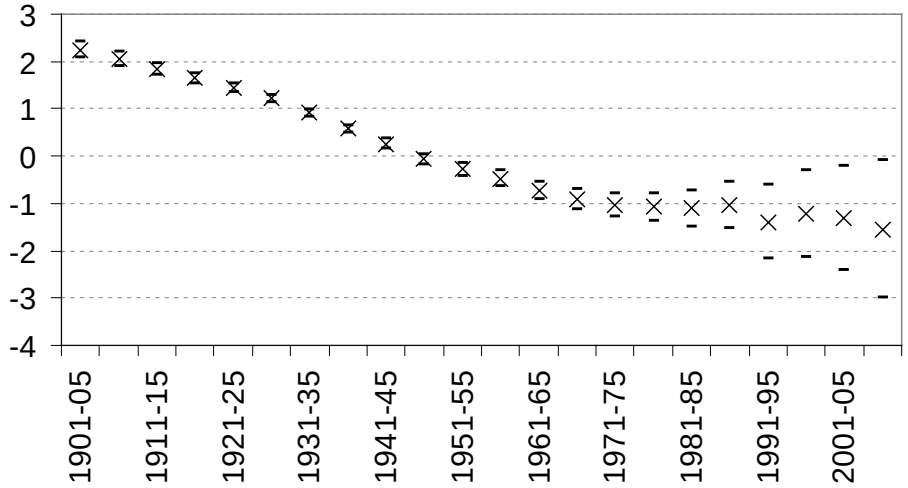
IHD – persons - Age effect coefficients



IHD – persons - Period effect coefficients



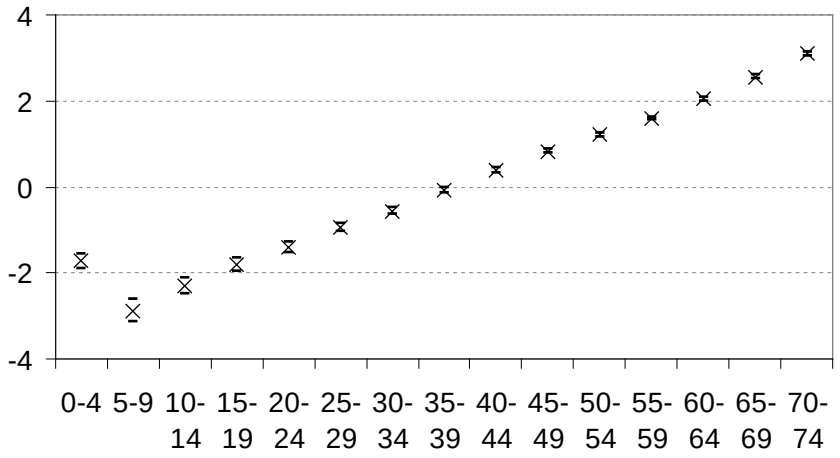
IHD – persons - Cohort effect coefficients



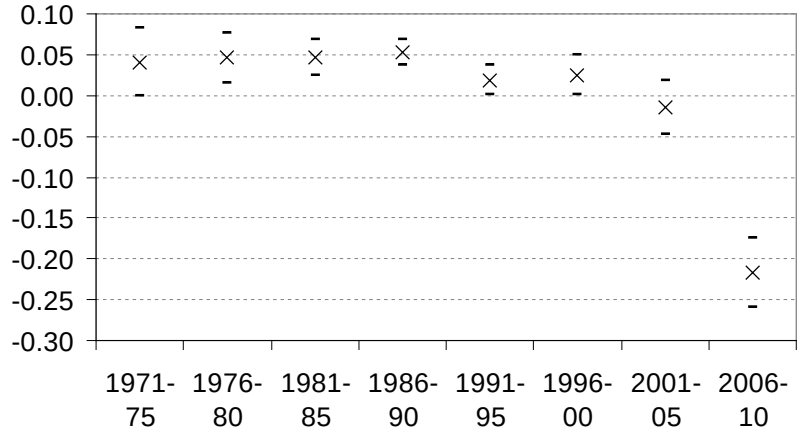
Summary

The cohort effect is at its maximum at the start of the period, 1901-05. Subsequent cohorts have progressively enjoyed lower mortality, though the improving trend is less evident in recent cohorts. Period effects show a deteriorating trend till the turn of the twenty-first century, since when an improving trend appears to be established (though confidence intervals are wide).

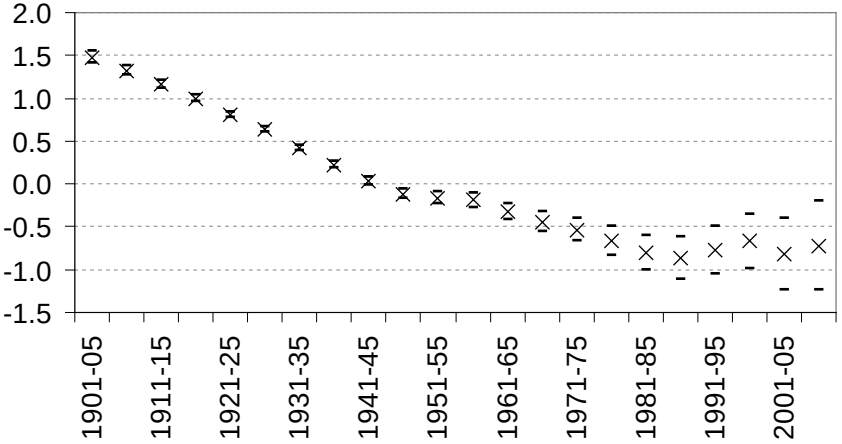
Stroke – persons - Age effect coefficients



Stroke – persons - Period effect coefficients



Stroke – persons - Cohort effect coefficients



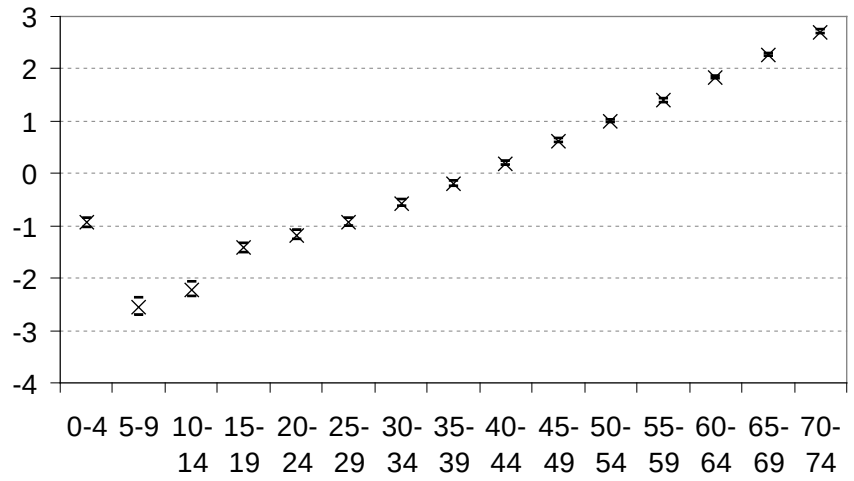
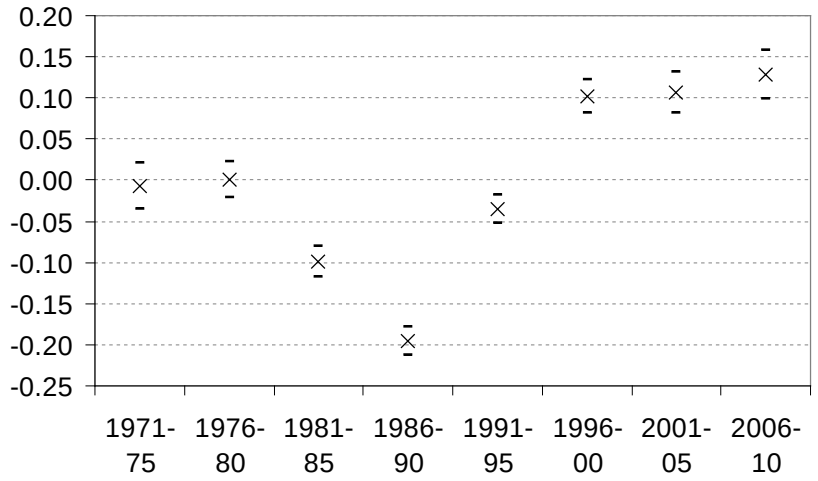
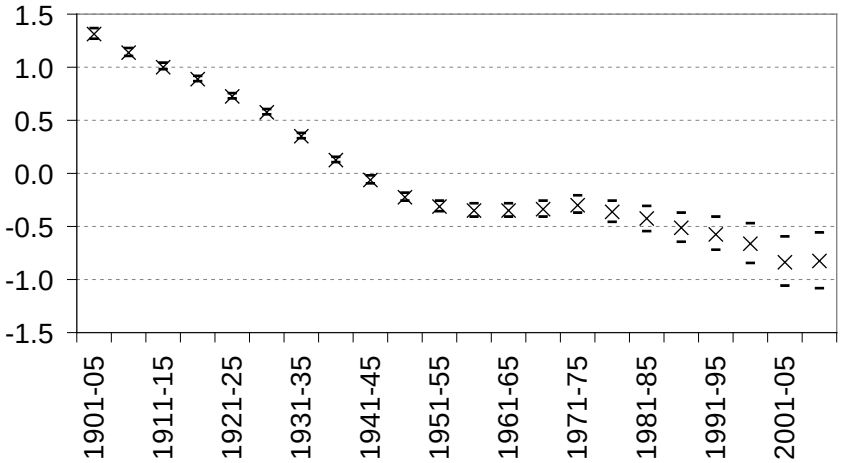
Summary

The cohort effect is at its maximum at the start of the period, 1901-05. Subsequent cohorts have progressively enjoyed lower mortality, though the improving trend is not evident in recent cohorts.

The sharp improvement in the effect of period on stroke mortality recently may be attributable to an improvement in the quality of NHS service following a National Audit Office (NAO) report in 2005.

The National Stroke Strategy (published December 2007) was a comprehensive response to the concerns raised in the 2005 NAO report, and in 2010, the NAO reported that patients' care and outcomes had started to improve.

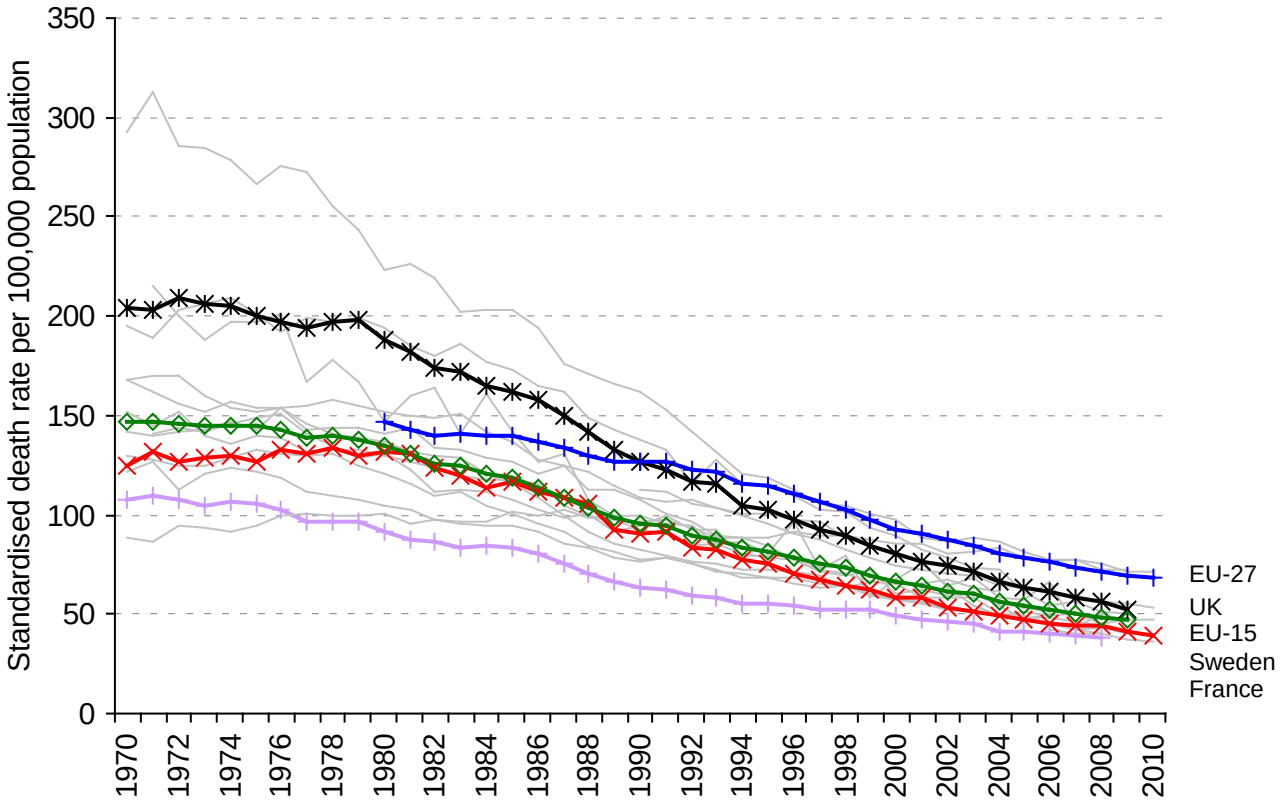
Between 2007 and 2009, the proportion of hospitals that met key clinical requirements had risen and more patients were receiving thrombolysis.

Other CVD – persons - Age effect coefficients	*Other CVD – persons - Period effect coefficients*
	
Other CVD – persons - Cohort effect coefficients	Summary
	The cohort effect is at its maximum at the start of the period, 1901-05.

International position

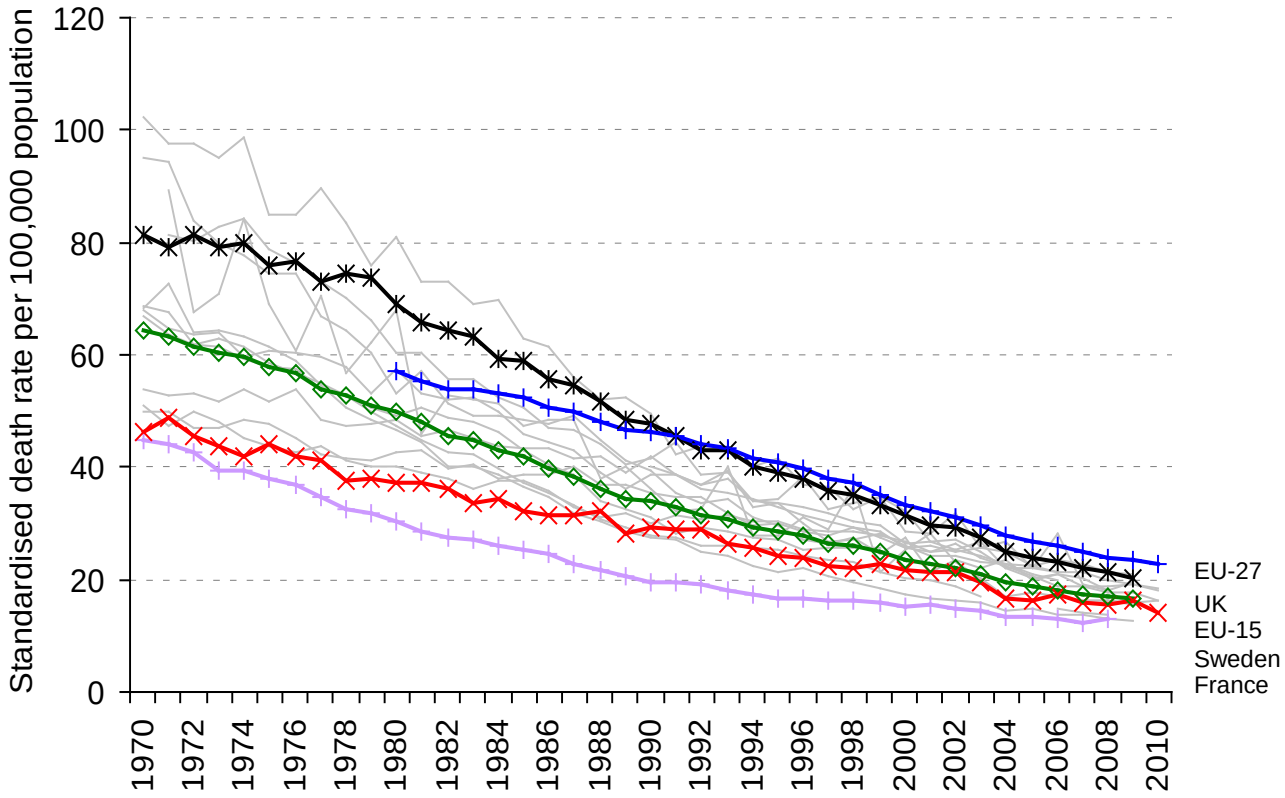
3.121 The closest international comparison for this indicator is of under 65 mortality from CVD. England's rate has fallen more sharply than the average rate of the countries who were European Union members before May 2004 (EU-15), but in 2009 was still worse than this average rate. Between 1999 and 2008, the most recent 10-year period for which comparisons are available, the average annual decline was 4.5% in the UK (4.4% for male and 4.7% for female), compared to 3.7% in the EU-27, 3.8% in Sweden, 4.0% in the EU-15 and 3.0% in France (EU-27 refers to the 27 member states of the European Union). In 2009, the England rate for females was 21.8% higher than the EU-15 rate, relatively higher than that for males (12.0% higher).

Figure 1.1.f - Male premature mortality from all circulatory diseases
Aged under 65 years, England, EU-15 countries and selected averages



Source: WHO Health for All

Figure 1.1.g - Female premature mortality from all circulatory diseases



Source: WHO Health for All

Notes:

3.122 There are a number of question arising from the data:

- What has been responsible for driving the down trend, and will these factors continue to reduce the CVD mortality rate?
- What has caused the greater rate of decline in the North East?
- Some regions consistently have the lowest CVD mortality rates in England. How do they do this?

Drivers of this indicator

KEY DRIVERS	
Blood pressure	Linked to this is salt and alcohol consumption – there is a very strong association between blood pressure and elevated CVD risk. In a meta-analysis of trials, a modest treatment-induced fall in diastolic BP of 5–6 mm Hg was associated with reductions in fatal and non-fatal stroke (38%), and fatal and non-fatal heart attacks (16%) within several years. Reducing salt intake by 3g per day has recently been projected to reduce the annual number of new cases of CHD by 60,000 to 120,000, stroke by 32,000 to 66,000, and myocardial infarction by 54,000 to 99,000 and to reduce the annual number of deaths from any cause by 44,000 to 92,000 in the US[1]. The Cochrane database systematic review suggested behavioural change interventions in hypertensives had a strong effect - OR of 0.78 (95% CI 0.68-0.89).
Cholesterol/ triglycerides	With one exception, meta-analyses have unanimously confirmed that cholesterol lowering, whether by diet or diet and drugs, decreases CHD risk. The decrease has been estimated to be around 25% for a 10% decrease in cholesterol (equivalent to 0.6 mmol/l on average), achieved after the first two years of treatment.
Chronic kidney disease (CKD)	CKD is very prevalent and has a strong association with CVD risk, especially with increasing age. The confounding effect of diabetes and hypertension will need careful consideration. Again this a multifaceted driver, with the keys aspects being better control of diabetes and hypertension (responsible for the vast majority of nephropathy in the UK) to prevent CKD, and proper treatment and management of cardiovascular risk factors in those with established disease. Hazard ratios were 1.55 (95% CI 1.02-2.35) for Stage 1 disease, up to 4.29 (95% CI 1.78-10.32) for Stage 4 disease[2].
Diabetes	There is a clear association between diabetes and the risk of developing CVD, with the risk increasing with duration of disease and disease control. The risk of developing CVD is two to four times higher in those with diabetes, and 65% of diabetics die from CVD. The UK Prospective Diabetes study and the Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications studies showed that intensive glucose control reduced CVD event risk by 42% and risk of heart attack, stroke or death from CVD by 57%[3]. There are associated improvements in CVD outcomes by targeted blood pressure and cholesterol control in diabetics[4]. The Cochrane database systematic review suggested behavioural change interventions in diabetics had a strong effect - OR of 0.71 (95% CI 0.61-0.83).
Tobacco use	There is very strong evidence that tobacco use is associated with increased CVD risk. Although there is no trial evidence demonstrating benefits from smoking cessation following the onset of coronary disease, observational data suggest that the risk of recurrent disease is reduced by 50% within one year of stopping, and a favourable effect on mortality is sustained for more than a decade. The Cochrane database systematic review suggested behavioural change interventions (smoking cessation) had a limited effect - OR of 0.87 (95% CI 0.75-1.00).
OTHER DRIVERS	
Alcohol consumption	Systematic reviews of cohort and case control studies show a 'J' shaped relationship between alcohol consumption and CHD risk of mortality and morbidity. The degree of reduction in risk of coronary events following light or moderate drinking is small but significant (RR=0.80, 95% CI 0.78 to 0.83). This is supported by some evidence of improved lipid profiles with regular drinking in moderation. Conversely, binge drinking has been found to have associations with a poorer lipid profile, and adverse effect on systolic blood pressure and increased risk of thrombosis.

Dietary habits	Multiple confounders exist in the evidence for CVD, as people who eat a healthy diet are much more likely to be physically active, or of higher socio-economic status. It is therefore very difficult to tease out specific effects that can be attributed to certain dietary habits. Nonetheless, SIGN (Scottish Intercollegiate Guidelines Network) guidelines have shown limited (Grade C) evidence using two systematic reviews of cohort studies to support reduced CHD event rates from increased vegetable (risk ratio 0.77) and fruit (risk ratio 0.86) consumption, and 15% reduced relative risk of CHD in those consuming high levels of fruit and vegetables compared to those consuming low levels (equivalent to a four-fold increase in fruit and doubling of vegetables) in another. A Cochrane review on the effect of reduction or modification of dietary fats for at least six months found a trend towards protection from cardiovascular mortality (rate ratio 0.91, 95% CI 0.77 to 1.07), and significant protection from cardiovascular events (rate ratio 0.84, 95% CI 0.72 to 0.99), though this effect was non-significant if studies at high risk of bias were removed. Trials with at least two years of follow up provided stronger evidence of protection against cardiovascular events (rate ratio 0.76, 95% CI 0.65 to 0.90). The reviewers concluded that there is a small but potentially important reduction in cardiovascular risk with a reduction or modification of dietary fat intake, seen particularly in trials of longer duration. Furthermore, NICE have a specific twelve point guidance on how public health policy should limit dietary intake for cardiovascular benefit.
Hormone replacement therapy (HRT)	There is good evidence that early menopause and lack of oestrogen is a risk factor for progression to CVD. There is conflicting evidence regarding the role of HRT in increasing or decreasing this risk. A recent review article has found growing evidence to support the 'timing hypothesis', which suggests that menopausal hormonal therapy could increase the risk of CVD if started late after menopause, but may produce beneficial cardiovascular effects in younger women during the perimenopausal period[6].
Mitigation of social isolation, socio-economic status, deprivation and gender	There is a body of animal evidence that shows that chronic stress and lower social status, including lack of control of life decisions, causes atherosclerosis[7]. Michael Marmot's work has focused this in human populations, though it is complex, and is difficult to place the magnitude of effect[8]. The Whitehall study suggested that the lowest versus highest employment grade was associated with increased CHD mortality (age adjusted hazard ratio 1.56, 95% CI 1.2, 2.1). Assessing these factors and their affect on overall mortality from CHD will be very difficult.
Obesity	There is robust evidence that obesity is associated with under 75 years survival from CVD, with increased odds of CVD as follows: men – 1.46 [1.20-1.77]; women – 1.64 [1.37-1.98][9]. The time lags associated with no intervention will reflect the duration of time that population levels of weight reduction are seen. Note that this does not include obesity per se, and should reflect centripedal obesity and waist circumference as key elements. Non-centripedal obesity is not as strongly associated with CVD risk.
Physical activity	There is good evidence that increased physical activity is associated with a reduction in CVD risk, but again it is difficult to remove these benefits from those seen with a reduction in the above risk factors. Nonetheless, the SIGN guidelines found evidence that after controlling for all other risk factors, a 50% reduction in the risk of coronary events was seen.
Prevalence of co-morbidities	There are several comorbidities that influence CVD risk. There is limited evidence that Hepatitis C is associated with CVD risk - patients with HCV monoinfected, nonobese, naïve and non diabetic have an intermediate cardiovascular risk, as measured by the Framingham score[11]. With regards to other chronic infections, HIV and use of highly active antiretroviral therapy (HAART) is much more likely to cause CVD through mitochondrial disturbances. See the following article for detailed discussion of different associations with infectious agents[12].
Transient ischaemic attack interventions	These include antiplatelet therapy, control of hypertension and hypercholesterolaemia, and as such will be difficult to extrapolate independently from the treatment of the main risk factors[13]. Secondary prevention may be more aggressive than in the absence of TIAs, but this will be difficult to tease out.
Vaccination rates	Flu vaccination for at risk individuals has recently been associated with a reduction in CVD mortality[14]. It has been seen in prior studies, suggesting a 20% reduction in deaths due to myocardial infarction in over 40s[15].

References

1. Bibbins-Domingo K et al. Projected Effect of Dietary Salt Reductions on Future Cardiovascular Disease. NEJM 2010;362:590-99

2. De Angelantonio E et al. Chronic kidney disease and risk of major cardiovascular disease and non-vascular mortality: prospective population based cohort study. BMJ 2010;341:c4986.

3. Nathan DM et al. Intensive diabetes management and CVD in patients with Type 1 DM. NEJM 2005;353(25):2643-2653.

4. Adler AI et al. Association of systolic blood pressure with macrovascular and microvascular complications of Type 2 DM. BMJ 2000;321(7258):412-419.

5. Cregler LL. Cocaine: the newest risk factor for cardiovascular disease. Clin Cardiol 1991;14(6):449-56

6. Reslan OM, Khalil RA. Vascular Effects of Estrogenic Menopausal Hormone Therapy. Rev Recent Clin Trials 2011 Aug 25. [Epub ahead of print]

7. Shively CA, Register TC, Clarkson TB. Social Stress, Visceral Obesity, and Coronary Artery Atherosclerosis in Female Primates. Obesity 2009;17(8):1513–1520.

8. Steptoe A, Marmot M. Socioeconomic status and coronary heart disease: a psychological perspective. From: Waite, Linda J (Ed) Ageing, Health and Public Policy: Demographic and Economic Perspectives. Population Council, New York, 2004.

9. Wilson PW et al. Overweight and obesity as determinants of cardiovascular risk: the Framingham experience. Arch Intern Med 2002;162(16):1867-72.

10. Wang CH et al. Chronic hepatitis B infection and risk of atherosclerosis-related mortality: A 17-year follow-up study based on 22,472 residents in Taiwan. Atherosclerosis 2010;211(2):624-9.

11. Oliveira CP et al. Effects of Hepatitis C virus on cardiovascular risk in infected patients: A comparative study. Int J Cardiol. 2011 Jul 22. [Epub ahead of print]

12. Rosenfeld ME, Campbell LA. Pathogens and atherosclerosis: update on the potential contribution of multiple infectious organisms to the pathogenesis of atherosclerosis. Thromb Haemost 2011;106(5):858-67.

13. Amarenco et al. Coronary heart disease risk in patients with stroke or transient ischaemic attack and no known coronary heart disease: findings from the Stroke Prevention by Aggressive Reduction in Cholesterol Levels (SPARCL) trial. Stroke 2010 Mar;41(3):426-30.

14. Loomba RS et al. Influenza Vaccination and Cardiovascular Morbidity and Mortality: Analysis of 292 383 Patients. J Cardiovasc Pharmacol Ther 2011 Dec 14. [Epub ahead of print]

15. Siriwardena AN, Gwini SM, Coupland CA. Influenza vaccination, pneumococcal vaccination and risk of acute myocardial infarction: matched case-control study. CMAJ 2010;182(15):1617-23.

Health care contribution:

3.123 The prompt diagnosis and effective management of cardiovascular conditions and treatments to reduce the re-occurrence of cardiovascular disease events and to prevent or to slow the process of chronic conditions.

3.124 It has been estimated (Capewell et al, 2004) that in the last decade 71% of the IHD mortality reduction has been due to improvements in risk factors (particularly smoking cessation), 42% to “treatments” (drug therapy, PCI etc.). However, these have been offset by a parallel increase in diabetes, and obesity and lack of physical exercise are estimated to have produced a 13% negative trend.

(b) Indicator 1.1: Current Practice Projections

3.125 For IHD, stroke and other CVD, respectively sufficient data is available, so Age-Period-Cohort (APC) models have been used to project cardiovascular disease mortality. For the use of this technique in projections, and the assumptions used, see discussion in the Overview to Domain 1 at the beginning of this Chapter. The results are displayed in table 1.1.f and figure 1.1.h.

3.126 Age-specific mortality rates are provided in 5 year age bands, so the models are structured around cohorts of 5 years. Hence the projected rates are also for 5 year periods: 2011-2015 and 2016-2020. Annual figures are presented by assuming a linear progression in rates, with the projected figures being reached in the middle of each period (2013 and 2018).

3.127 It is not possible to estimate APC models directly due to the linear dependence between age, period and cohort. Numerous solutions to this problem have been proposed, one of which is the Intrinsic Estimator. The Intrinsic Estimator uniquely determines coefficients without requiring a user-imposed constraint on their values, and is both unbiased and efficient[2] . The STATA apc_ie package was used to estimate all the results published here.

3.128 Whilst having estimates of the age and cohort variables improves the robustness of projections, it is still necessary to estimate future period effects as well as the value for new cohorts. Additional cohort coefficients were projected based on recent trends, and (where possible) information on external drivers. The choice of predicted cohort coefficients is however of little importance, as they only affect the youngest age groups (where mortality rates are low).

3.129 Although numerous factors have a contemporaneous effect on CVD mortality, it is reasonable to assume that the quality of treatment is of major importance. In the absence of alternative explanations, we therefore presume that period effects are determined by the NHS, and so our ‘current practice projection’ uses a period effect that is kept constant at the current level, for both IHD and other CVD. For stroke, however, the period effect increased in relative importance in 2006-10, contributing more than before to below average mortality rates. As we have not been able to confirm the cause of this relative increase (although it may well be due to the 2007 Stroke Strategy), the period effect was projected at the level of the exponentially smoothed mean of the 1971-75 to 2006-10 period effects (-0.15). The slight increase in the stroke mortality rate in 2013 results, at least in part, from the way the period effect was calculated. Population figures are taken directly from the ONS mid-year population forecasts.

[2] “Trends in U.S adult chronic disease mortality, 1960-1999: Age, period and cohort variations” Yang Yang, Demography, vol.45 no.2 (May 2008)

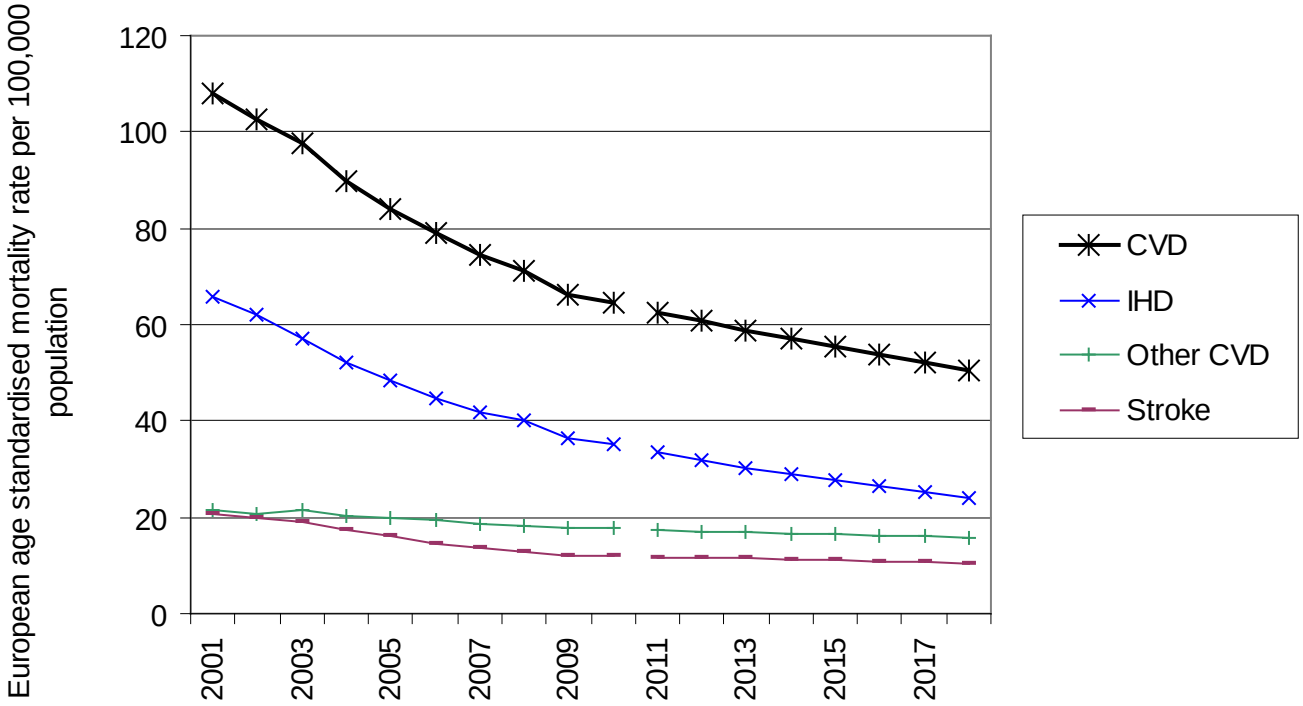
3.130 The robustness of this methodology will be tested further during the consultation period. This will involve an examination of the Intrinsic Estimator through comparisons with alternatives such as Constrained Generalized Linear Estimators. The use of natural splines will be looked into as a solution to potentially over fitting the data. Further work will also be done into determining the optimal methodology for projecting period and cohort effects. For the former, it may be possible to model the period effects themselves against possible NHS and external contemporaneous drivers of outcome.

Table 1.1.f Current practice projection for under 75 CVD mortality rate, persons (per 100,000 population)

	IHD		Stroke		Other CVD		CVD	
	Actual	Projection	Actual	Projection	Actual	Projection	Actual	Projection
2001	66.0		20.5		21.4		107.9	
2002	62.0		20.0		20.8		102.8	
2003	57.2		18.9		21.6		97.8	
2004	52.1		17.2		20.4		89.7	
2005	48.3		15.9		19.8		84.0	
2006	44.9		14.6		19.5		79.0	
2007	42.0		13.7		18.7		74.4	
2008	40.1		12.9		18.0		71.0	
2009	36.4		11.9		17.8		66.1	
2010	35.1		11.8		17.7		64.7	
2011		33.5		11.8		17.4		62.7
2012		31.9		11.7		17.1		60.7
2013		30.3		11.6		16.8		58.7
2014		29.1		11.3		16.6		57.1
2015		27.8		11.1		16.4		55.4
2016		26.6		10.9		16.2		53.7
2017		25.4		10.7		16.0		52.0
2018		24.1		10.5		15.8		50.4

Source: Office for National Statistics, DH

Figure 1.1.h Current practice projection for under 75 CVD mortality rate, persons (per 100,000 population)



Source: Office for National Statistics, DH

(c) Indicator 1.1: Scope for Improvement

3.131 The NHS Atlas of Variation tool suggests that there could be further scope for improving this outcome by reducing regional variation. Several current and planned policy initiatives are aimed at improvements in this outcome within current resources.

3.132 The aim of the forthcoming CVD strategy is to improve outcomes for those with or at risk of cardiovascular disease. As part of its development, the scope for improvement in delivering better outcomes will be considered. More work is needed in this area and over the next few months, taking into account the feedback we have already received from stakeholders on the CVD outcomes strategy and from this consultation exercise. In the meantime, some examples of where improvements could be made include:-

- better management of hypertension. There is a strong association between hypertension and elevated CVD risk - for example, it has been estimated that controlling blood pressure accounted for 9% of the reduction in CHD mortality between 1980 and 2000. Research suggests that behavioural change interventions have a strong effect on people with high blood pressure. There is however considerable under-identification of people with hypertension and, for many of those identified, there are considerable numbers whose hypertension is untreated and uncontrolled.

- better management of cholesterol. There is a strong evidence that cholesterol lowering decreases CHD risk. While considerable progress has been made in reducing the proportion of people at risk of CVD as a result of high cholesterol, there is scope to do more, particularly among men. Recent research has shown that use of statins reduces CVD events even for those at low risk. There is a serious under diagnosis of people with familial hypercholesterolaemia, and it is likely that many lives could be saved if the NICE guidelines were fully implemented

- better management of atrial fibrillation. About 12,500 strokes per year are thought to be directly attributable to atrial fibrillation. We know that many GP practices are now proactively identifying and managing patients with atrial fibrillation, but more lives could be saved if this approach was adopted across the country

- extending coverage of cardiac rehabilitation. Heart patients who do not take part in cardiac rehabilitation are 25% more likely to die in the following 2-5 years, but 60% of patients who need it do not have access to it.

3.133 It is further estimated that there are 24,000 excess deaths each year in people with diagnosed diabetes (National Diabetes Audit Mortality Analysis 2007-08 published in 2011 by the NHS Information Centre)This compares to some 5,000 for whom diabetes is the direct cause of death e.g diabetic ketoacidosis. These are not therefore deaths from diabetes but deaths from those with diabetes. There is scope for better diabetes care to contribute towards a reduction in such mortality, however analysis is needed of the extent of avoidable or preventable mortality for this group.

1.2 – Under 75 mortality rate from respiratory disease

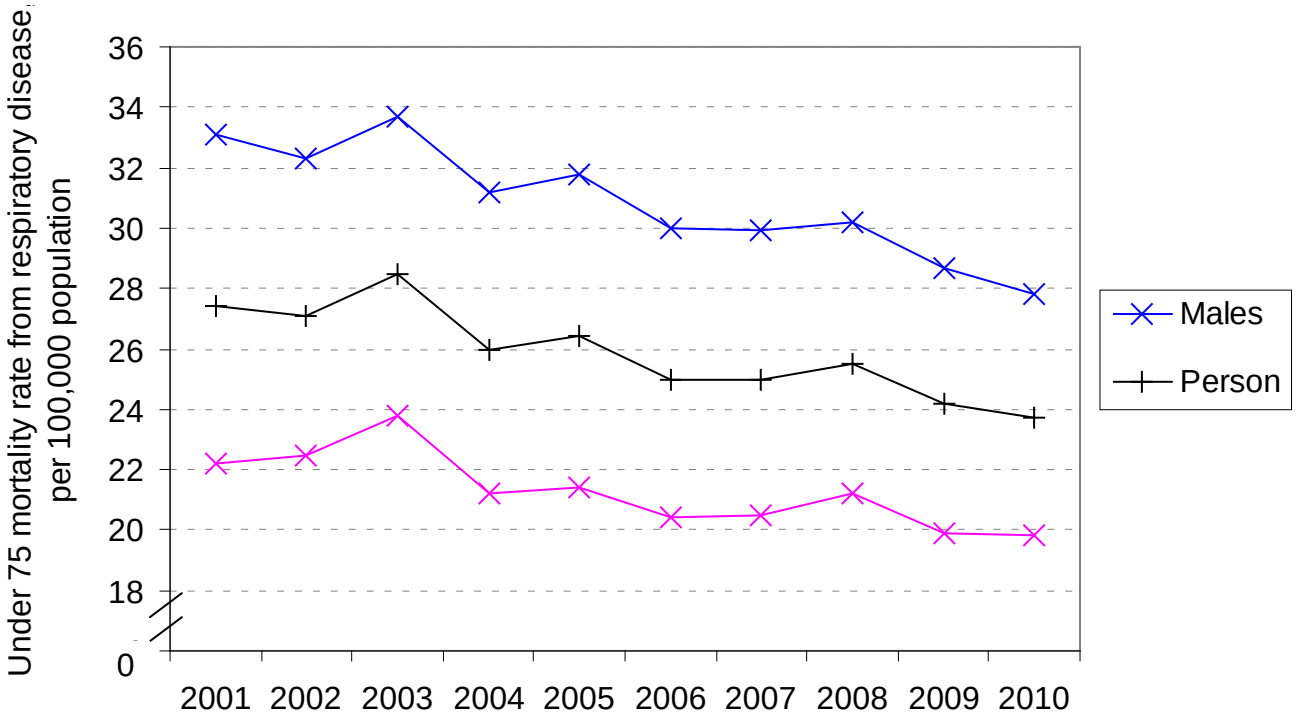
Outcome sought	Reduced premature mortality from respiratory disease
Indicator definition	European age-standardised mortality rate from respiratory disease, ages under 75, per 100,000 population

(a) Indicator 1.2: Recent Trends and Explanations

3.134 The under 75 mortality rate from respiratory disease fell by 2.0% between 2009 and 2010, from 24.15 to 23.65 deaths per 100,000 population.

3.135 Respiratory disease mortality fell gradually from 2001-2010, with some year-to-year fluctuation and an average annual decline of 1.6%. The peak visible in 2003 is probably attributable, at least in part, to extremely hot and dry weather conditions, which led to photochemical ozone production over large parts of the UK and Europe[3] . There has been a slightly faster reduction in male mortality compared to female mortality, albeit from a higher base.

Figure 1.2.a – Under 75 mortality rate from respiratory disease (per 100,000 population)



Source: NHS Information Centre

3.136 This indicator is likely to have a cohort effect. However, the time series is too short for cohort analysis (see below).

[3] http://uk-air.defra.gov.uk/reports/cat05/0408161000_Defra_AQ_Brochure_2004_s.pdf

Table 1.2.a – Under 75 mortality rate from respiratory disease (rate per 100,000 population)

Year	Males	Females	Persons
2001	33.1	22.2	27.4
2002	32.3	22.5	27.1
2003	33.7	23.8	28.5
2004	31.2	21.2	26.0
2005	31.8	21.4	26.4
2006	30.0	20.4	25.0
2007	29.9	20.5	25.0
2008	30.2	21.2	25.5
2009	28.7	19.9	24.2
2010	27.8	19.8	23.7
Average Annual Change 2001-2010	-1.9%	-1.3%	-1.6%

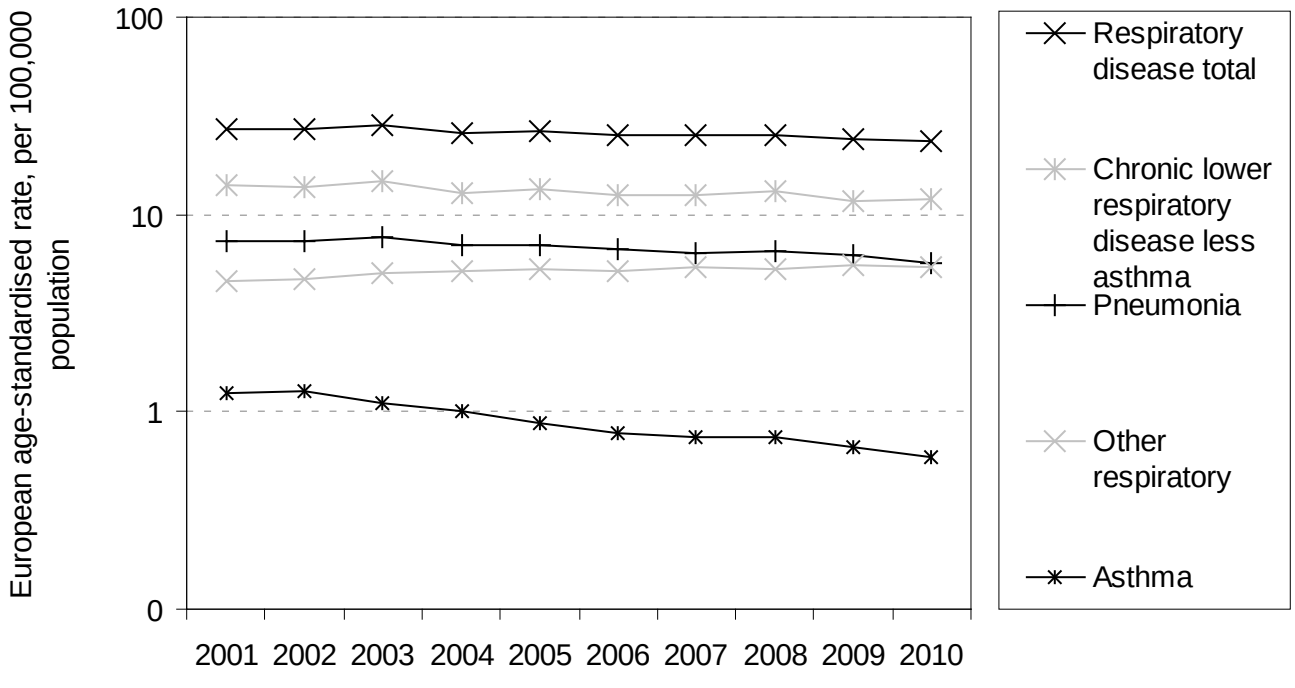
Source: NHS Information Centre

Breakdown by condition

3.137 The mortality rate for most conditions has reduced over the period, with the exception of Other Respiratory (acute lower respiratory infections (4%), lung diseases due to external agents (4.8%), 'other' respiratory diseases (15%)). The biggest reduction has been for asthma.

3.138 It is not clear why asthma has improved more quickly than other respiratory conditions. Explanatory factors could include the publication of NICE and SIGN guidelines and updates from 2003, and increased prescribing (see below).

Figure 1.2.b – Under 75 mortality rate from respiratory conditions, England, logarithmic scale



Source: NHS Information Centre

Note that this graph and Figures 1.2.c and 1.2.d are presented using a logarithmic scale.

Table 1.2.b Under 75 mortality rate from respiratory conditions (per 100,000 population)

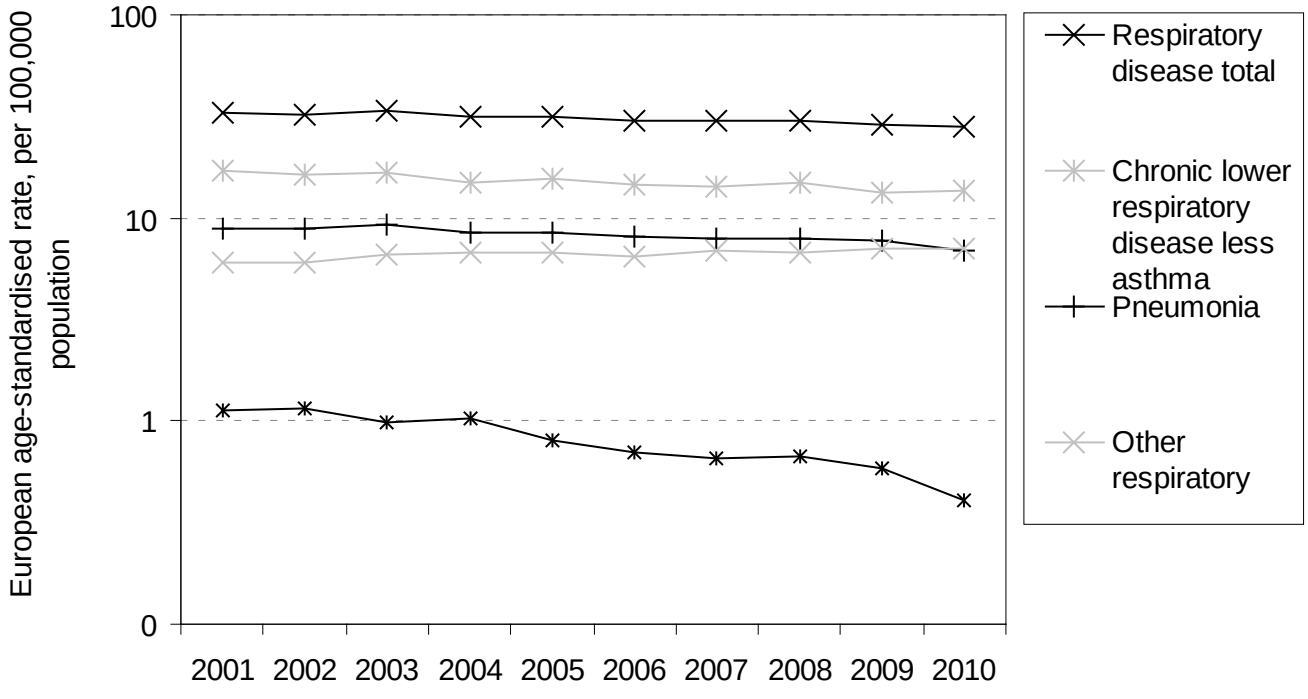
	J00-J99	J45-J46	J40-J44, J47	J12-J18	
	Respiratory disease total	Asthma	Chronic lower respiratory disease less asthma	Pneumonia	Other respiratory
2001	27.3	1.2	14.2	7.3	4.5
2002	27.1	1.3	13.8	7.3	4.8
2003	28.5	1.1	14.7	7.7	5.0
2004	26.0	1.0	12.8	7.0	5.2
2005	26.4	0.9	13.3	7.0	5.2
2006	25.0	0.8	12.4	6.6	5.1
2007	25.0	0.7	12.4	6.4	5.4
2008	25.5	0.7	13.0	6.5	5.3
2009	24.1	0.7	11.7	6.3	5.5
2010	23.7	0.6	11.9	5.7	5.5
Average Annual Change 2001-2010	-1.6%	-8.0%	-2.0%	-2.7%	2.1%

Source: NHS Information Centre

Breakdown by condition and gender

3.139 The patterns are similar for males and females, except that mortality for respiratory conditions fell more quickly for males than females. This is likely to be due to a faster reduction in smoking rates for males, from a higher rate.

Figure 1.2.c – Under 75 mortality rate from respiratory conditions, males, England, logarithmic scale



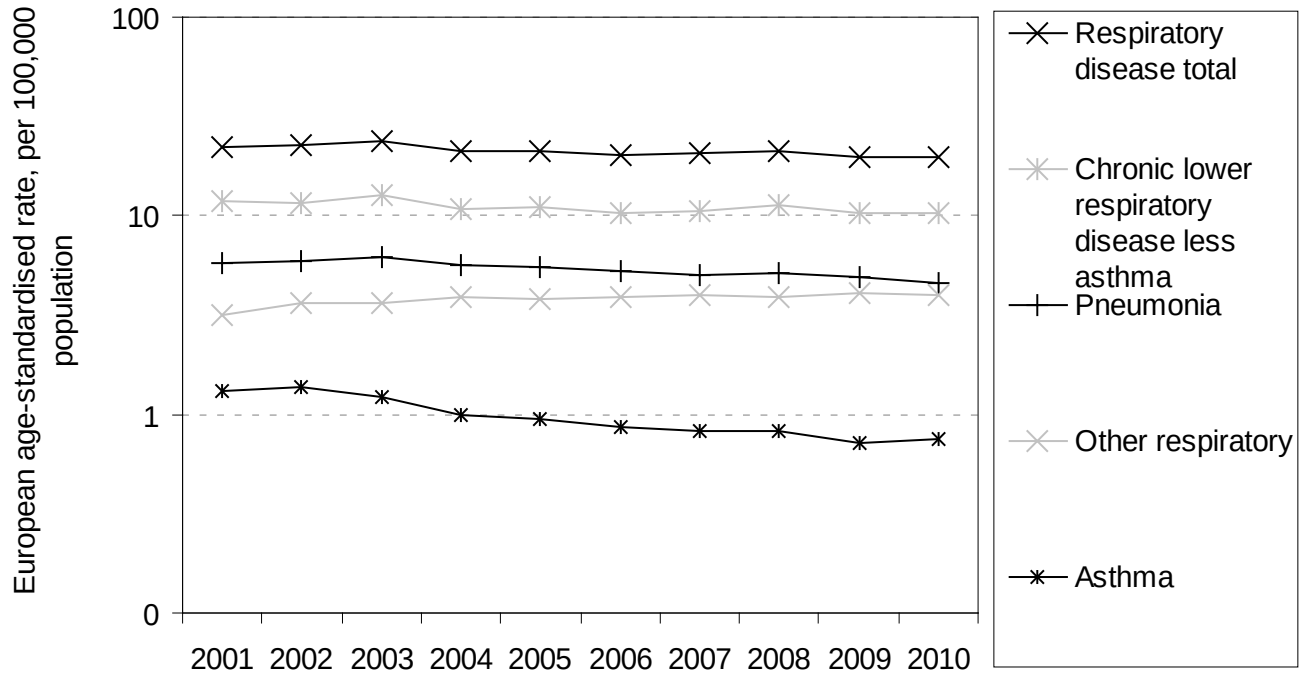
Source: NHS Information Centre

Table 1.2.c Under 75 mortality rate from respiratory conditions, males, England (per 100,000 population)

	J00-J99	J45-J46	J40-J44, J47	J12-J18	
	Respiratory disease total	Asthma	Chronic lower respiratory disease less asthma	Pneumonia	Other respiratory
2001	33.1	1.1	16.9	8.9	6.1
2002	32.3	1.2	16.2	8.9	6.0
2003	33.7	1.0	16.9	9.3	6.5
2004	31.2	1.0	15.1	8.4	6.7
2005	31.8	0.8	15.6	8.6	6.8
2006	30.0	0.7	14.6	8.1	6.5
2007	29.9	0.7	14.3	7.9	7.0
2008	30.2	0.7	14.9	7.8	6.8
2009	28.7	0.6	13.3	7.7	7.1
2010	27.8	0.4	13.5	6.9	7.0
Average Annual Change 2001-2010	-1.9%	-10.7%	-2.5%	-2.8%	1.6%

Source: NHS Information Centre

Figure 1.2.d – Under 75 mortality rate from respiratory conditions, females, England, logarithmic scale



Source: NHS Information Centre

Table 1.2.d Under 75 mortality rate from respiratory conditions, females, England (per 100,000 population)

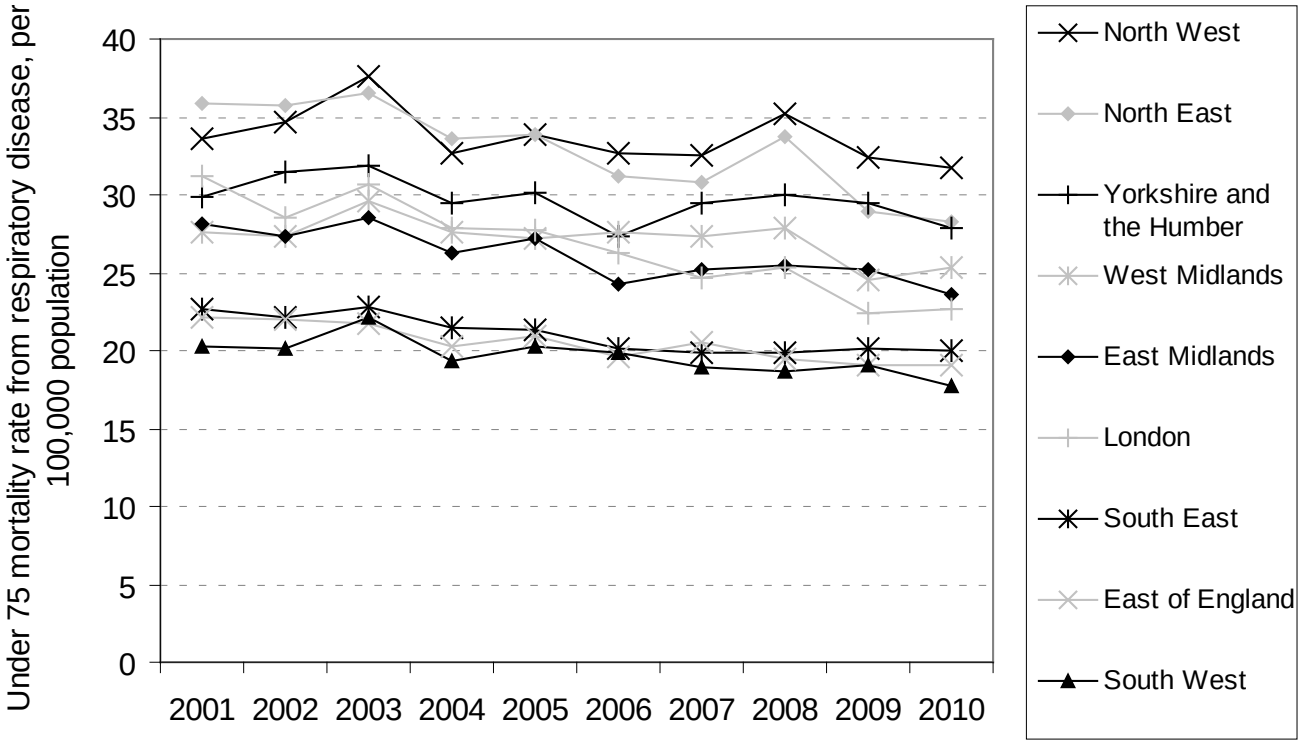
	J00-J99	J45-J46	J40-J44, J47	J12-J18	
	Respiratory disease total	Asthma	Chronic lower respiratory disease less asthma	Pneumonia	Other respiratory
2001	22.1	1.3	11.8	5.8	3.1
2002	22.5	1.4	11.6	5.9	3.6
2003	23.8	1.2	12.7	6.2	3.6
2004	21.2	1.0	10.8	5.6	3.9
2005	21.4	1.0	11.2	5.5	3.8
2006	20.4	0.9	10.4	5.2	3.9
2007	20.5	0.8	10.7	5.0	4.0
2008	21.2	0.8	11.3	5.2	3.9
2009	19.9	0.7	10.2	4.9	4.1
2010	19.8	0.8	10.4	4.6	4.0
Average Annual Change 2001-2010	-1.2%	-6.1%	-1.4%	-2.6%	2.7%

Source: NHS Information Centre

Breakdown by region

3.140 Mortality from respiratory disease follows the North-South divide, with the South East, East and South West displaying noticeably lower rates over the entire decade. In 2010, under 75 mortality from respiratory disease was 79.7% higher in the North West than the South West. This likely captures a variety of the effects outlined in the drivers section, including different smoking rates and the impact of socio-economic status.

Figure 1.2.e Under 75 mortality rate from respiratory disease, per 100,000 population, by region



Source: NHS Information Centre

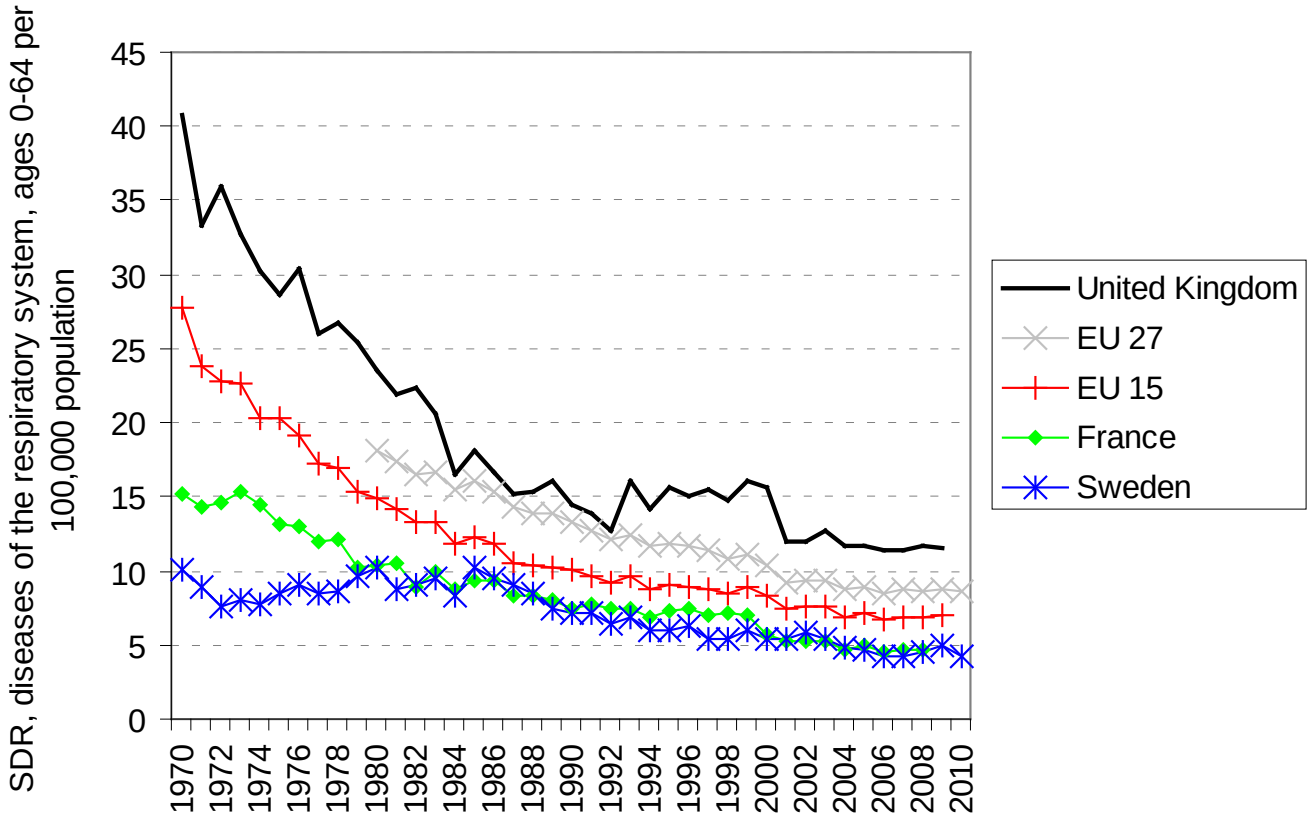
Table 1.2.e Under 75 mortality rate from respiratory disease, per 100,000 population, by region

	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
2001	35.8	33.6	29.8	28.1	27.6	22.1	31.3	22.7	20.3	27.4
2002	35.7	34.7	31.5	27.3	27.3	22.0	28.5	22.2	20.1	27.1
2003	36.5	37.6	31.8	28.5	29.6	21.7	30.7	22.8	22.2	28.5
2004	33.7	32.7	29.4	26.2	27.7	20.3	27.9	21.5	19.4	26.0
2005	33.9	33.8	30.2	27.2	27.2	20.9	27.8	21.3	20.2	26.4
2006	31.3	32.7	27.3	24.3	27.6	19.6	26.3	20.1	19.8	25.0
2007	30.8	32.5	29.4	25.2	27.3	20.6	24.7	19.9	19.0	25.0
2008	33.8	35.2	30.0	25.5	27.9	19.5	25.3	19.8	18.7	25.5
2009	29.0	32.4	29.4	25.1	24.5	19.1	22.3	20.2	19.1	24.1
2010	28.2	31.8	27.8	23.6	25.3	19.0	22.7	20.0	17.7	23.7
Average Annual Change 2001-2010	-2.6%	-0.6%	-0.8%	-1.9%	-1.0%	-1.7%	-3.5%	-1.4%	-1.5%	-1.6%

Source: NHS Information Centre

3.141 Whilst the average annual decline for the UK data presented here may initially appear significantly different to the indicator level figure, they are in fact consistent. The first reason for this is the lack of 2010 UK data - if we look at under 65 mortality for England we see a significant decline from 2009 to 2010, which is picked up by our indicator but not by this UK series. The further factor is the difference in age ranges covered, as there have been considerable declines in respiratory mortality for 65-74 year olds over the past decade.

Figure 1.2.f - Standardised Death Rate, diseases of the respiratory system, ages 0-64, per 100,000 population



International position

3.142 International data are not available for under 75 mortality from respiratory disease. However, WHO data are available for under 65 respiratory disease mortality, and serve as a suitable proxy. There are particular coding issues with respiratory disease, so comparisons should be made with caution.

3.143 In 2010, the UK's premature mortality rate from all respiratory diseases was more than twice as high as in France or Sweden, and considerably higher than the EU-15 average. The steep decline in rates seen since the 1970s has levelled off in recent decades across Europe and in the UK. However, the gap between the UK and the EU-15 average has hardly changed for many years.

Notes:

3.144 There are a number of questions that arise from the respiratory disease mortality data:

- What factors explain the overall trends observed in the different diseases of the respiratory system?
- In particular, what accounts for the improved trend in Asthma, and is it likely to be extended?

3.145 Tobacco and recent guidance are proffered as explanations of recent declines in mortality, but these should be tested in light of wider evidence on drivers of outcomes.

Drivers of this indicator

Socio-economic status	Socio-economic status has a strong and well documented effect on respiratory mortality. It is closely related to occupational risk and tobacco use, but also acts through separate channels such as poor housing conditions.[1]
Environmental factors (e.g. air quality, radon gas)	Studies have found that exposure to traffic related air pollution increases the risk of developing COPD[2] and asthma.[3]
Occupational risk (e.g. carcinogens)	Exposure to materials found in certain working environments increases the risks of developing or exacerbating both COPD and asthma. Items such as coal dust and asbestos are especially potent risk factors for respiratory disease.[4]
Prevalence of co-morbidities	Co-morbidities such as CVD and lung cancer are major causes of death from advanced COPD, and are the leading cause of mortality for mild to moderate cases.[5]
Immigration	To the extent that immigration may be related to socio-economic status and the quality of housing, it can be seen as a driver for COPD.
Genetics (especially Alpha-1 Antitrypsin deficiency)	Alpha-1 Antitrypsin deficiency is strongly linked to early onset COPD, especially amongst smokers, and is a risk factor for asthma.[6]
Tobacco use	Tobacco use is the most important factor in determining respiratory mortality. The relationship is discussed in more detail below.
Illicit drug use	Studies have found that smoking cannabis may increase the risk of developing COPD beyond that caused by just smoking cigarettes.[7]
Physical activity	Studies have found a correlation between obesity and asthma in children, with paediatric obesity-associated asthma displaying identifying characteristics that differ from atopic asthma.[8]
Vaccination rates	Pneumococcal conjugate vaccine (PCV) and pneumococcal polysaccharide vaccine (PPV) protect against a variety of strains of pneumococcal bacteria.[9]
Quality of care received whilst living at home or in residential care	Home care treatments have been found to be effective in the long-term treatment of COPD patients, in terms of reducing hospitalisation and mortality.[10]
Medication compliance	Medication compliance is a serious issue for respiratory diseases, with a significant reduction in the efficacy of treatment in cases of underuse, overuse and improper use.[11]
Mitigation of social isolation	Studies have found social isolation to be a significant predictor of mortality.[12]

References

1. Socioeconomic status and chronic obstructive pulmonary disease, Prescott & Vestbo, Thorax 1999;54:737-741 doi:10.1136/thx.54.8.737

2. Chronic obstructive pulmonary disease and long-term exposure to traffic-related air pollution: a cohort study. Andersen, Am J Respir Crit Care Med. 2011 Feb 15;183(4):455-61. Epub 2010 Sep 24.

3. Traffic-related air pollution and the development of asthma and allergies during the first 8 years of life. Gehring, Am J Respir Crit Care Med. 2010 Mar 15;181(6):596-603. Epub 2009 Dec 3.

4. http://www.cdc.gov/niosh/programs/resp/risks.html

5. Mortality in COPD: role of comorbidities, D.D. Sin, Eur Respir J 2006; 28: 1245–1257

6. http://www.lunguk.org/you-and-your-lungs/conditions-and-diseases/alpha-1-antitrypsin-deficiency

7. Marijuana and chronic obstructive lung disease: a population-based study, Wan C Tan, CMAJ April 14, 2009 vol. 180 no. 8 814-820

8. Obesity associated asthma in children: A distinct entity. Rastogi, D, CHEST, April 2012 vol. 141 no. 4 895-905

9. http://www.nhs.uk/conditions/ Pneumococcal-immunisation/Pages/Introduction.aspx

10. Long term home care programmes may reduce hospital admissions in COPD with chronic hypercapnia, Clini E, ERJ August 1, 1996 vol. 9 no. 8 1605-1610

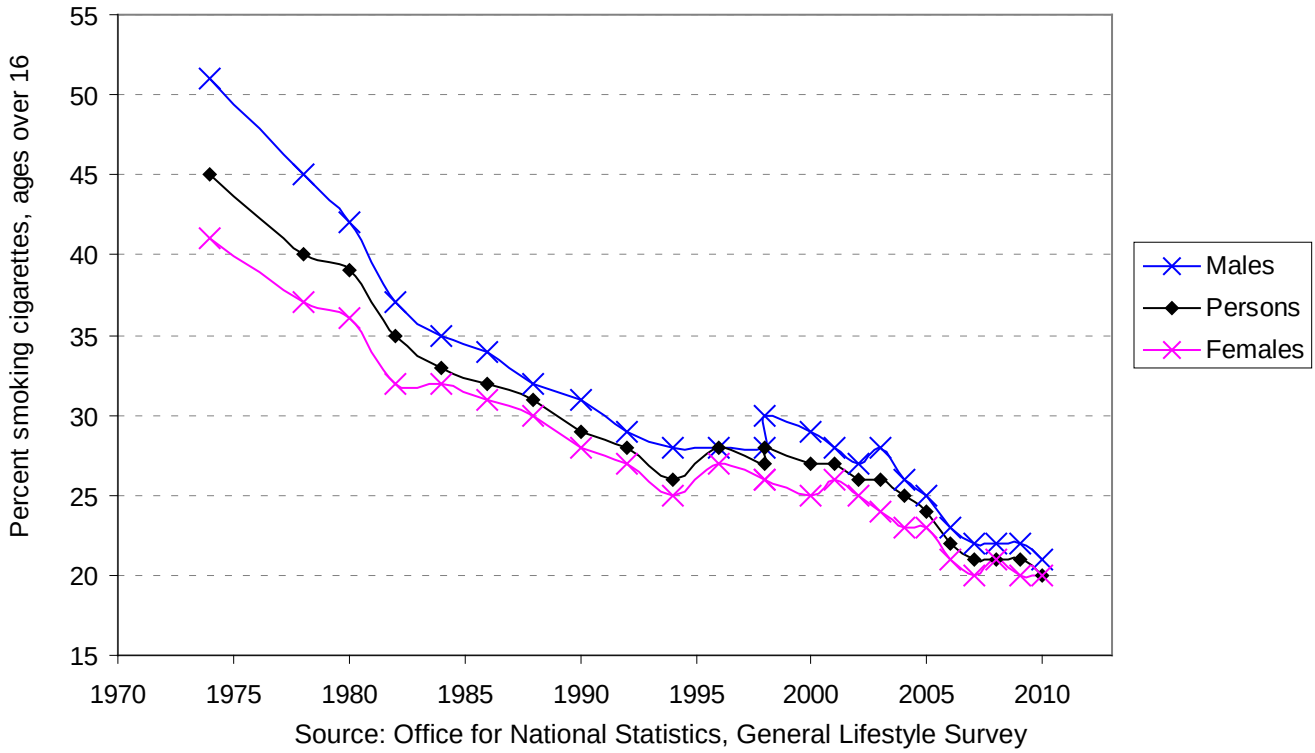
11. Medication adherence issues in patients treated for COPD, Restrepo R, Int J Chron Obstruct Pulmon Dis. 2008 September; 3(3): 371–384.

12. Gender and mortality following hospitalisation for COPD, Fahim A, Thorax 2011; 66: 1009

Tobacco use

3.146 The link between tobacco use and respiratory disease is well established. In England in 2010, around 36% of all deaths from respiratory disease of adults aged 35 and over were attributable to smoking.[4] Trends in smoking rates are therefore highly influential in determining the outcome of this indicator. Figure 1.2.g shows that rates have fallen for both men and women since the 1970s, although they have remained fairly constant since 2007. As both current and past smoking are important determinants of respiratory mortality, we are likely to see the continued benefit of past falls in the future, but without sustained declines, there will be less downward pressure on respiratory mortality.

Figure 1.2.g Percent smoking cigarettes, ages over 16[5]



Healthcare contribution

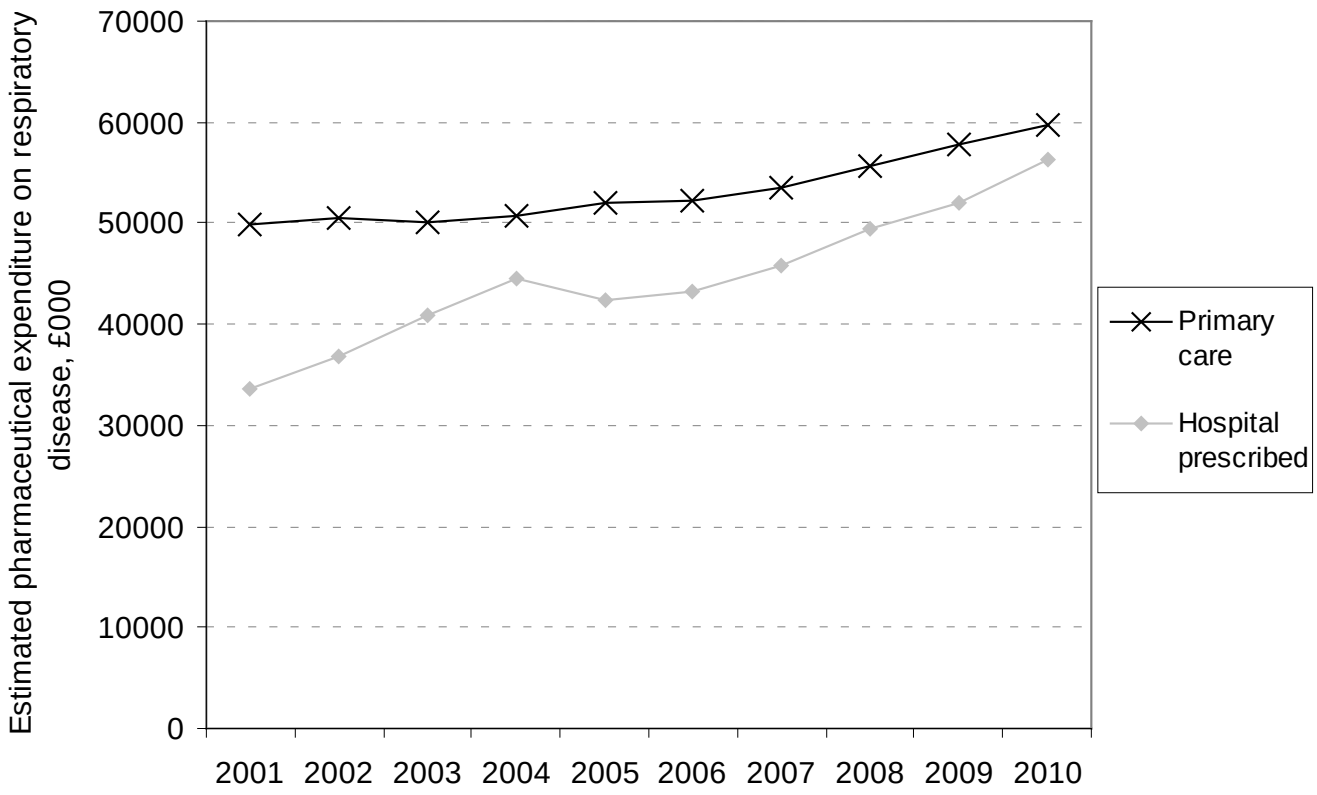
3.147 Early and accurate diagnosis, optimal pharmacology, physical interventions, prompt access to specialist respiratory care, structured hospital admission and appropriate provision of home oxygen.

Pharmacology

3.148 Expenditure on medication for respiratory disease has increased in nominal terms (i.e. not adjusted for inflation) over the past decade, both in primary care and for hospital prescriptions. Real expenditure will not have increased as quickly. Driving the increase has been an increase in expenditure on bronchodilators since 2006, and an increase in corticosteroids and other systemic drugs over the 10-year period.

[4] Statistics on smoking: England, 2011 NHS Information Centre
[5] There is a discontinuity in the data at 1998 where figures move from being unstandardised to standardised.

Figure 1.2.h Pharmaceutical expenditure on respiratory disease, £000s



3.149 Further investigation is required to test the contribution of pharmaceutical spending on the improvement in outcomes for most respiratory conditions over the last ten years.

(b) Indicator 1.2: Current Practice Projections

Methodology

3.150 The projections displayed in Table 1.2.g and Figure 1.2.i were arrived at by the following methodology:

- The linear trend observed over the previous 10 years was extended to 2018 using linear regression in view of the dominance of external drivers in determining outcomes, and the expected persistence of the positive impacts of these drivers. The data for 2003 was excluded from the regression, as the extreme weather conditions experienced that year mean that the outlier could distort the projection.
- The projection is done at an aggregated level as the trends for individual conditions are all linear, thus removing the need to estimate them separately.
- This trend is expected to continue because:

- The historic decline in smoking rates is expected to continue (see Chapter 3) and so continue to reduce the incidence of and mortality from respiratory diseases.
- Increased provision of medication through primary care reflects a general trend towards better management of conditions, which should reduce mortality for succeeding cohorts with maintained quality of NHS services.

- A tolerance interval is added to this projection by adding the standard deviation of the residuals to the predicted values.

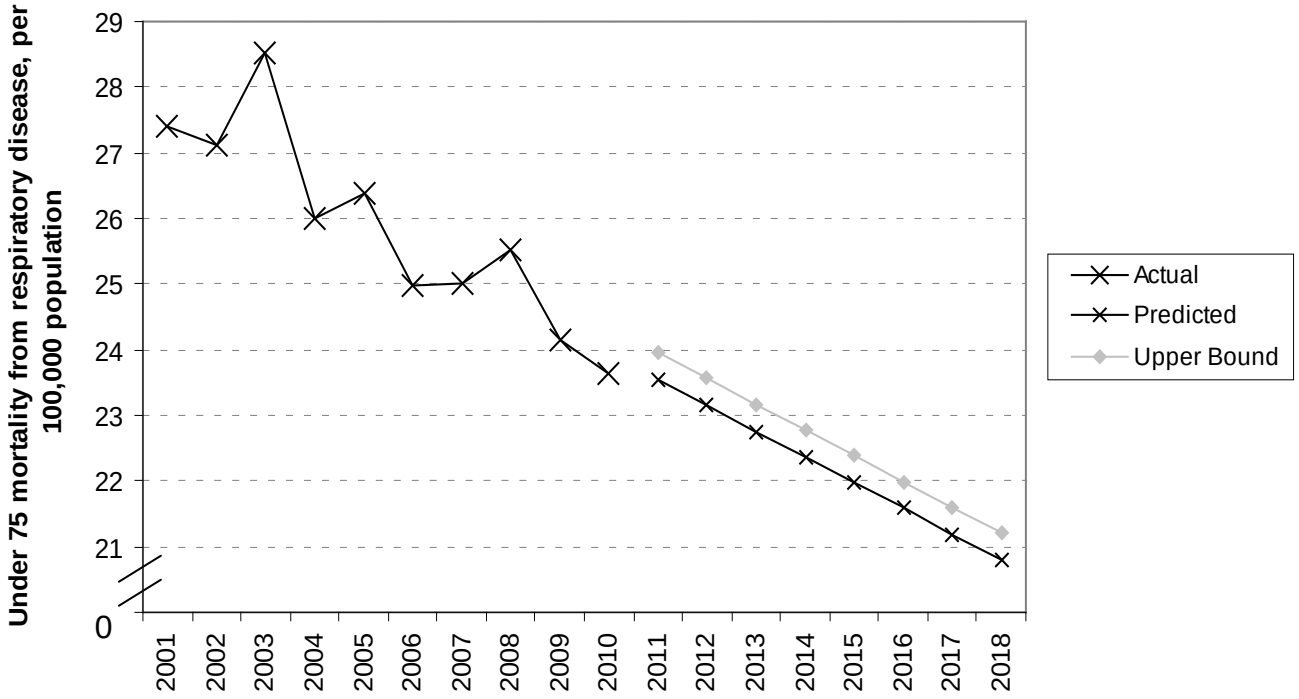
Results

Table 1.2.g Current practice projection for under 75 mortality from respiratory disease, rate per 100,000 population

Year	Actual	Predicted	Upper Bound
2001	27.39		
2002	27.13		
2003	28.51		
2004	25.99		
2005	26.38		
2006	24.98		
2007	25.01		
2008	25.53		
2009	24.15		
2010	23.65		
2011		23.54	23.95
2012		23.15	23.56
2013		22.75	23.17
2014		22.36	22.78
2015		21.97	22.39
2016		21.58	21.99
2017		21.19	21.60
2018		20.80	21.21

Source: NHS Information Centre, DH

Figure 1.2.i Current practice projection for under 75 mortality from respiratory disease, rate per 100,000 population



3.151 The spike in 2003 may have been due to the weather patterns in that year, in particular, an episode of summer smog.[6] These extreme weather conditions caused photochemical ozone production over large areas of UK and Europe. 2003 was notable both for very early (April) and late (September) summer smogs in the UK.

3.152 Using previously well-established medical data on the effects of ozone and PM10 on human health, it has been estimated that between 423 and 769 of the excess deaths were associated with elevated concentrations of these pollutants. This represents between 21% and 38% of the total excess deaths recorded during this period.

3.153 A large proportion of these deaths would be respiratory, although some would be in the over 75 age group, which are not included in this indicator.

(c) Indicator 1.2: Scope for Improvement

3.154 The scope for improvement for this indicator is yet to be determined, and further work will go into this during the consultation period. Better practices to be explored include the wider take up of pulmonary rehabilitation following COPD exacerbation.

[6] http://uk-air.defra.gov.uk/reports/cat05/0408161000_Defra_AQ_Brochure_2004_s.pdf

1.3 – Under 75 mortality rate from liver disease

Outcome sought	Reduced premature mortality from respiratory disease
Indicator definition	European age-standardised mortality rate from liver disease, ages under 75, per 100,000 population

(a) Indicator 1.3: Recent Trends and Explanations

3.155 The mortality rate for all under 75 deaths from liver disease increased by 2.3% from 2009 to 2010, from 14.4 to 14.7 deaths per 100,000 population. The increase was greater for males (2.6%) than for females (2.0%).

3.156 Between 2001 and 2010, the under 75 mortality rate from liver disease increased by an average of 1.9% per year, 2.2% for males and 1.5% for females.

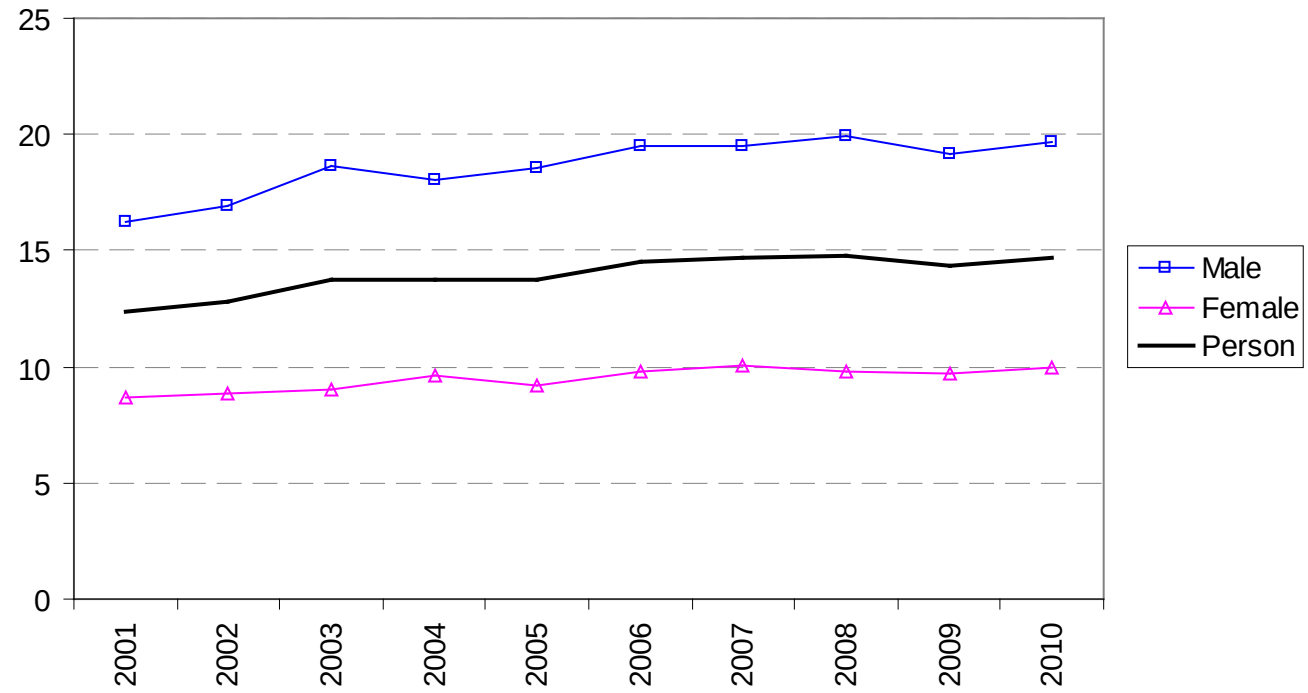
3.157 Prior to 2010, the death rate from liver disease in females fell for two consecutive periods, 2007-2008 and 2008-2009. From 2008 to 2009, the death rate fell for both males and females, for the first time since 2001. Between 2001 and 2010, the mortality rate has remained almost twice as high for males compared to females.

Table 1.3.a - Under 75 mortality rate (per 100,000 population) from liver disease, England, males, females and persons

Year	Male	Female	Person
2001	16.3	8.7	12.4
2002	16.9	8.9	12.8
2003	18.6	9.0	13.7
2004	18.0	9.6	13.7
2005	18.5	9.2	13.8
2006	19.5	9.8	14.5
2007	19.5	10.1	14.7
2008	19.9	9.8	14.8
2009	19.2	9.7	14.4
2010	19.7	9.9	14.7

Source: Office for National Statistics, NHS Information Centre

Figure 1.3.a – Under 75 mortality rate (per 100,000) from liver disease, England, males, females and persons



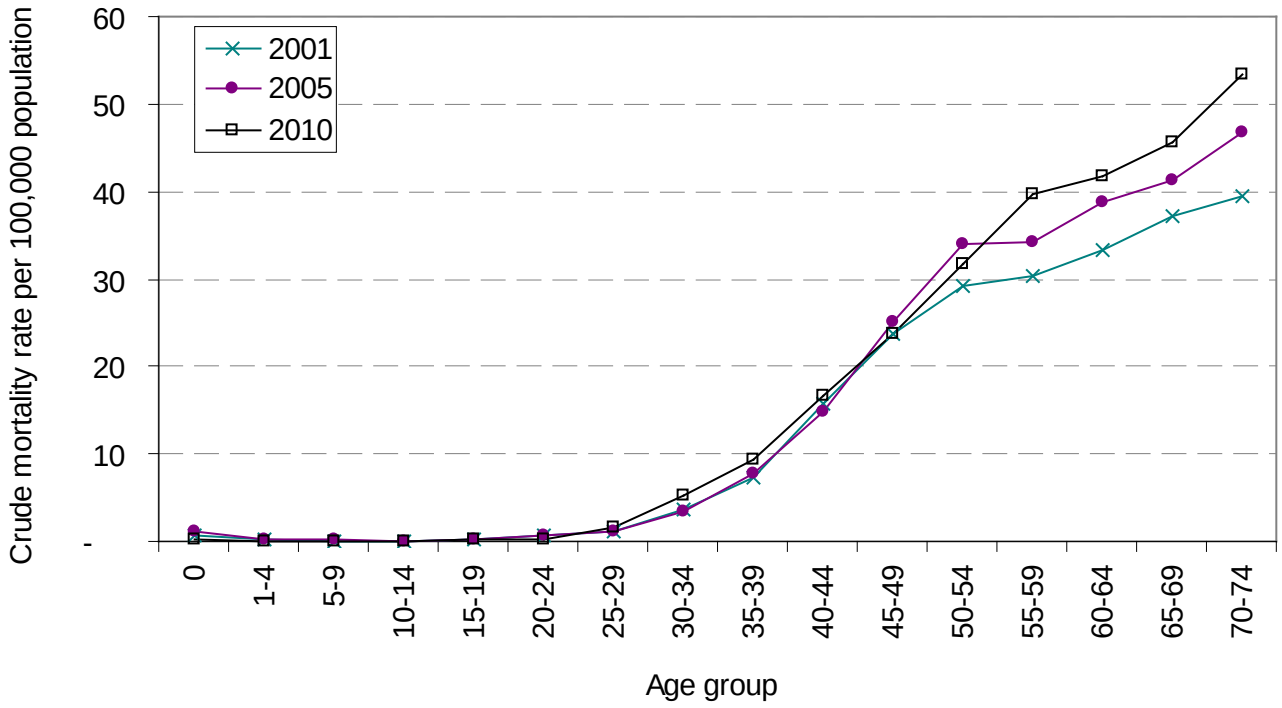
Source: Office for National Statistics, NHS Information Centre

Breakdown by age

3.158 The mortality rate for liver disease increases with age, as shown in Figure 1.3.b below. The effect of age on liver disease mortality is the same for males and females.

3.159 In 2010, the mortality rate for 45–54 year olds was below the rate in 2005, however the rate for persons aged 55 and over has been increasing since 2001.

Figure 1.3.b – Under 75 mortality rate from liver disease by age group, persons, England

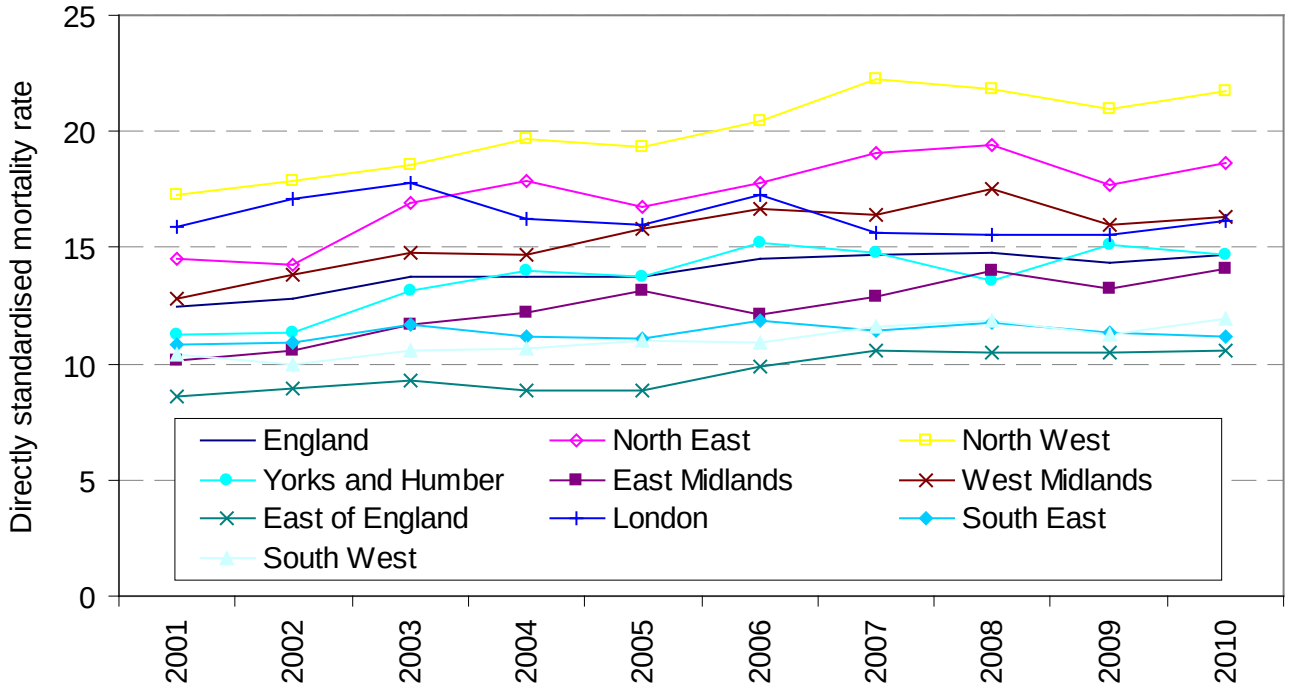


Source: Office for National Statistics, NHS Information Centre

Breakdown by geography

3.160 Over the period 2001 to 2010, the North West Government Office Region has consistently had the highest under 75 mortality rate from liver disease in England. Mortality rates in the North West and North East have grown faster than the national average over the time period. The East of England has consistently had the lowest mortality rates, but the average annual increase in mortality rates (2.3%) has been greater than the national average (1.9%). The lowest levels of growth have been in London (0.2%) and the South East (0.4%).

Figure 1.3.c – Under 75 mortality rate from liver disease, England Government Office Regions, persons



Source: Office for National Statistics, NHS Information Centre

Breakdown by condition

3.161 Cancer of the liver accounts for approximately 20% of all deaths from liver disease. In the majority of cases, liver cancer develops from cirrhosis of the liver.

3.162 The mortality rate from liver cancer has increased by an average of 4.1% per year between 2001 and 2010.

Table 1.3.b - Under 75 mortality rate (per 100,000) from cancer of the liver, England, males, females and persons

Year	Males	Females	Persons
2001	2.7	1.4	2.0
2002	2.8	1.4	2.1
2003	3.1	1.3	2.2
2004	3.1	1.5	2.3
2005	3.2	1.5	2.3
2006	3.4	1.5	2.4
2007	3.4	1.7	2.5
2008	3.7	1.7	2.6
2009	3.7	1.8	2.7
2010	3.9	2.0	2.9

Source: Office for National Statistics, DH

Chronic liver disease

3.163 Chronic liver disease includes alcoholic liver disease, cirrhosis or fibrosis of the liver and chronic hepatitis. Chronic liver disease accounts for 67% of all deaths from liver disease.

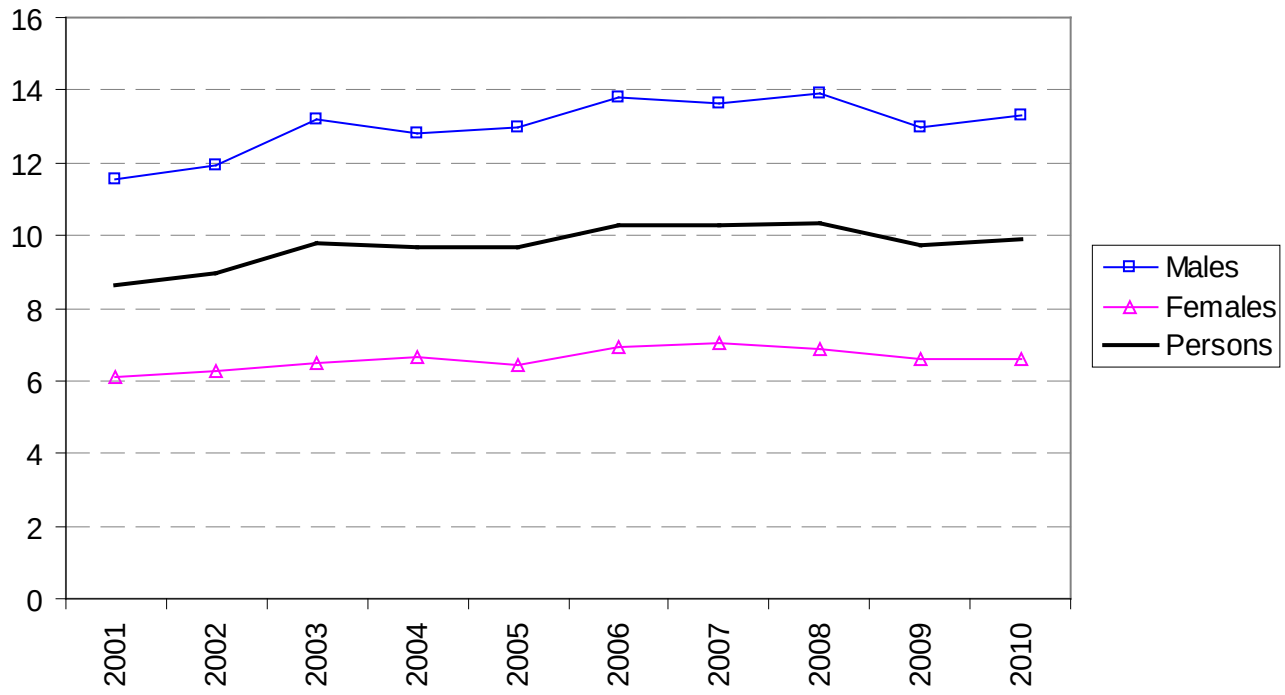
3.164 The under-75 mortality rate from chronic liver disease has increased by an average of 1.5% each year between 2001 and 2010.

Table 1.3.c - Under 75 mortality rate (per 100,000) from chronic liver disease, England, males, females and persons

Year	Males	Females	Persons
2001	11.6	6.1	8.6
2002	11.9	6.3	8.9
2003	13.2	6.5	9.8
2004	12.8	6.7	9.7
2005	13.0	6.4	9.7
2006	13.8	6.9	10.3
2007	13.6	7.1	10.3
2008	13.9	6.8	10.3
2009	13.0	6.6	9.7
2010	13.3	6.6	9.9

Source: Office for National Statistics, DH

Figure 1.3.d - Under 75 mortality rate from chronic liver disease, England, males, females and persons



Source: Office for National Statistics, DH

Other diseases of the liver

3.165 " Other disease of the liver " captures all deaths associated with liver disease not classified as chronic or cancer. This group accounts for 13% of all deaths from liver disease. The proportions of deaths by type of liver disease are consistent for both males and females.

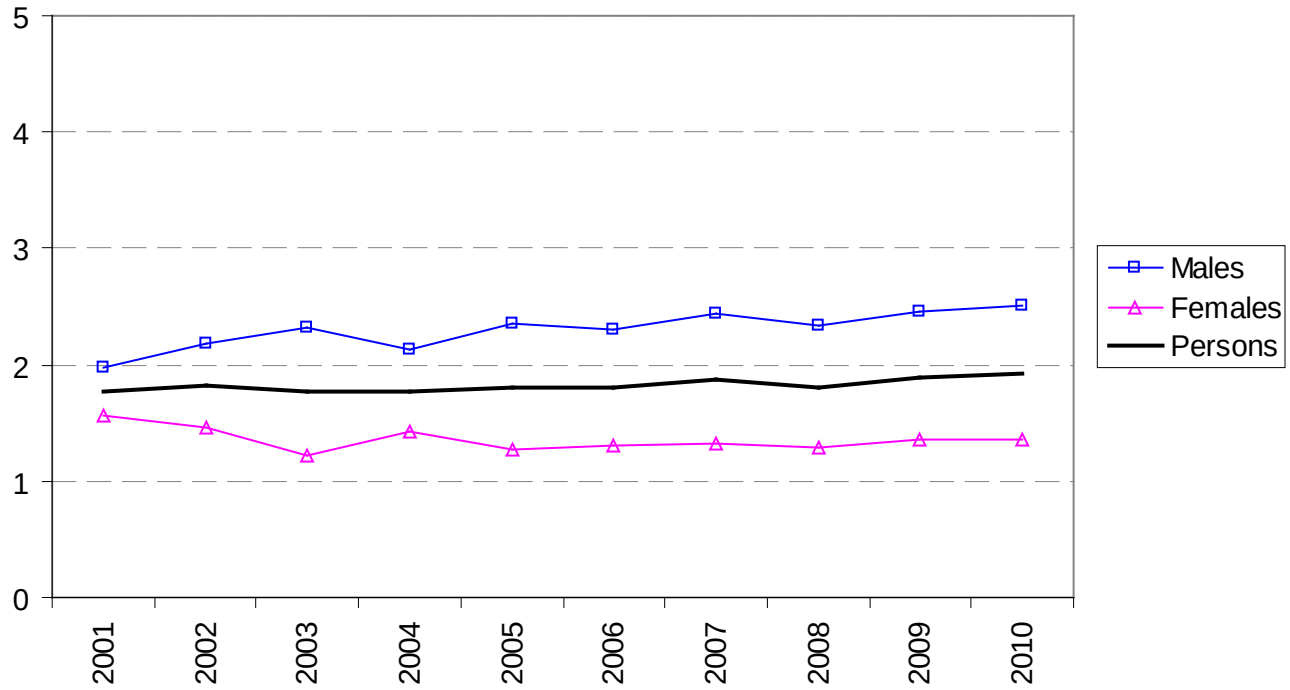
3.166 Deaths from other liver diseases have increased by an annual average of 2.7% between 2001 and 2010 for males, the female rate has declined by an average of 1.6% per year.

Table 1.3.d - Under 75 mortality rate (per 100,000) from other diseases of the liver, England, males, females and persons

Year	Males	Females	Persons
2001	2.0	1.6	1.8
2002	2.2	1.5	1.8
2003	2.3	1.2	1.8
2004	2.1	1.4	1.8
2005	2.4	1.3	1.8
2006	2.3	1.3	1.8
2007	2.4	1.3	1.9
2008	2.3	1.3	1.8
2009	2.5	1.4	1.9
2010	2.5	1.4	1.9

Source: Office for National Statistics, Information Centre, DH

Figure 1.3.e - Under 75 mortality rate from other diseases of the liver, England, males, females and persons



Source: Office for National Statistics, Information Centre, DH

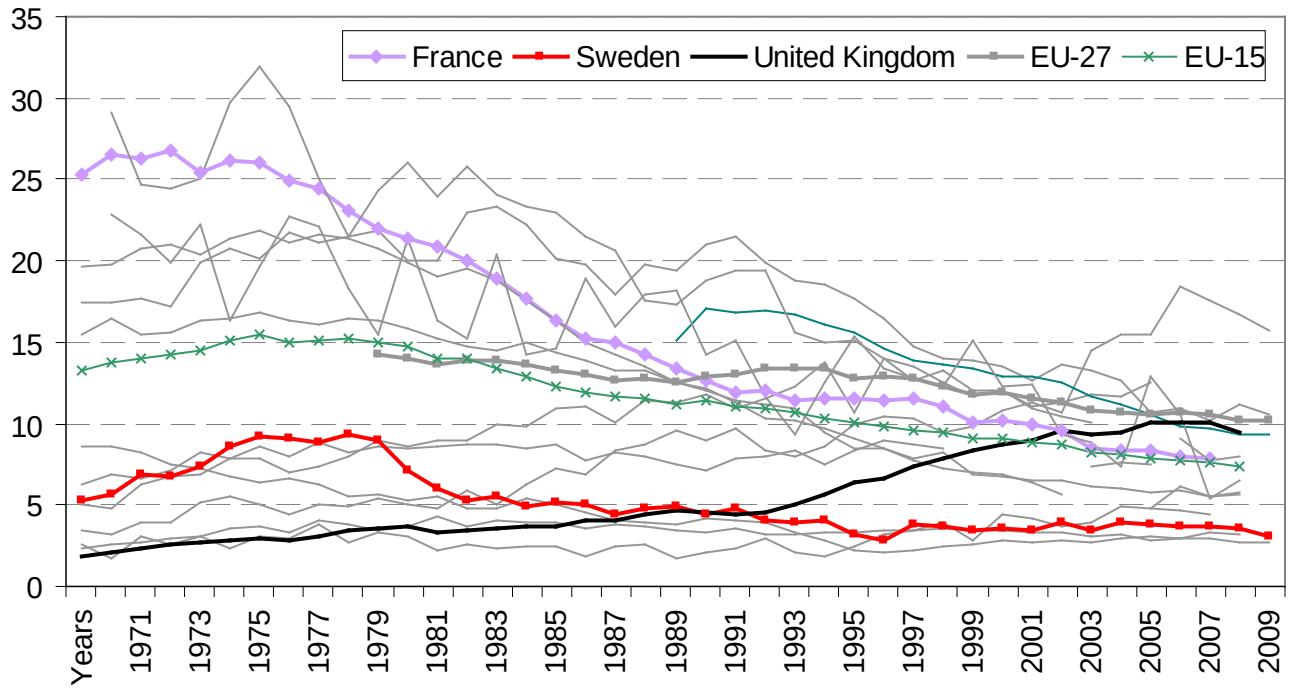
International position

3.167 The closest international comparison for this indicator is under 65 mortality from chronic liver disease and cirrhosis. The World Health Organisation (WHO) reports this indicator for the UK and other European countries. Chronic liver disease and cirrhosis is a narrower definition of liver disease than the more comprehensive measure of all liver disease mortality used in the NHS and Public Health Outcomes Frameworks as reflected above [7]. In England, chronic liver disease and cirrhosis accounts for approximately two-thirds of all deaths from liver disease.

3.168 Over the most recent 10-year period the UK mortality rate has increased by an average of 1.5% per year. Over the same period, the mortality rate in Sweden and France [8] and the EU-15 average has fallen. The UK mortality rate was consistently below the EU-15 average until 2001. Due to the UK's increasing mortality rate, and the reduction in the average of the EU-15, in 2009 the gap in mortality rates between the UK and EU-15 had fallen to two percentage points.

[7] WHO Health for all uses ICD-10 codes K70, K73 and K74. The list of ICD-10 codes used in the Outcomes Frameworks is available as an annex to this document.
[8] No 2009 data available for France. Average annual mortality rate for chronic liver disease and cirrhosis in France 2001 to 2008 was -3.3%.

Figure 1.3.f - Premature mortality from chronic liver disease and cirrhosis

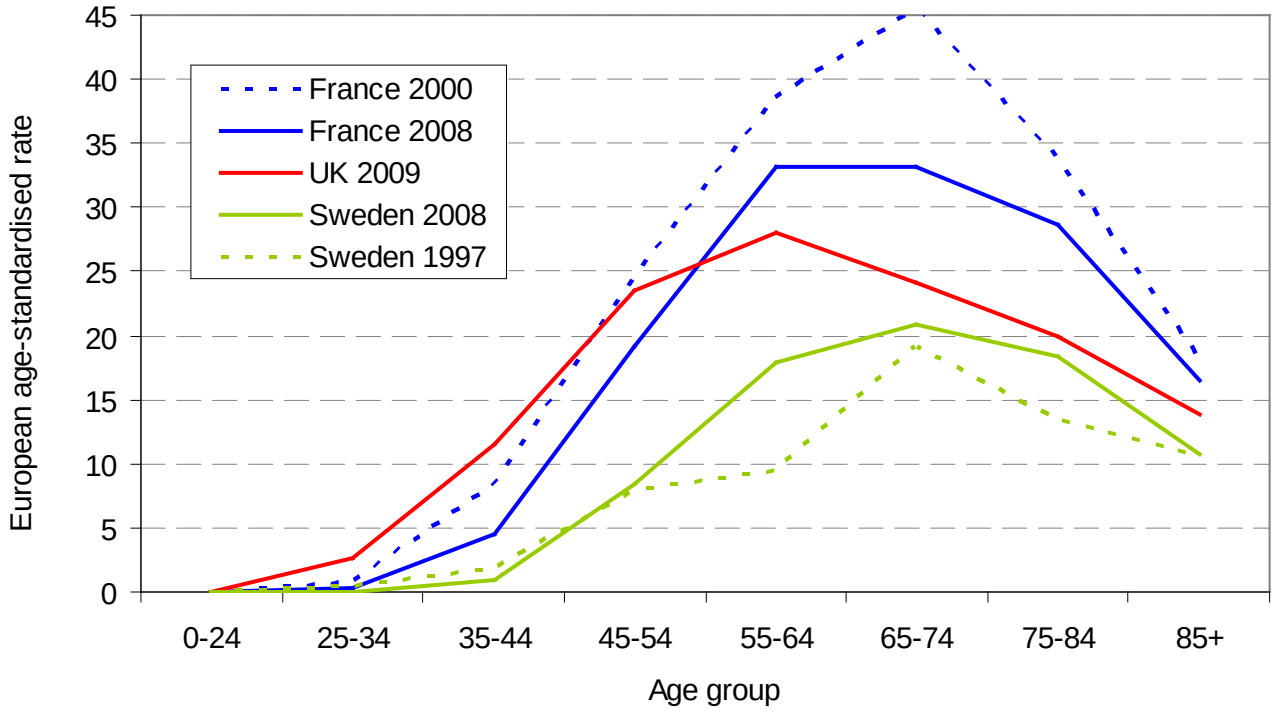


Source: WHO Health for All

3.169 Disaggregating premature mortality from chronic liver disease and cirrhosis by age band highlights differences between the UK and comparator countries. In France and Sweden, the age group 65-74 has the highest mortality rate per head of population, in the UK, the highest rate is amongst people aged 55-64.

3.170 The peak in mortality rates in the UK among persons aged 55-64 only applies to chronic liver disease and cirrhosis deaths. When including cancer and other liver disease, the mortality rate increases with age, and is highest among people aged 70-74 (see Figure 13.b). Liver cancer most often develops from liver disease, and in older age groups liver cancer accounts for a greater proportion of deaths from liver disease.

Figure 1.3.g Mortality from chronic liver disease and cirrhosis, 1997 to 2009, by age band



Source: WHO European Detailed Mortality Database

Notes:

3.171 There are a number of questions that arise from the liver disease mortality data:

- What factors explain the overall trend in liver disease mortality and what has caused the rate to flatten off since 2006?
- Why is the mortality rate for individuals aged 45-54 lower in 2010 than 2005, but higher for other age groups?
- Why is the geographical (strategic health authority level) variation in liver disease mortality increasing over time?
- Why is the mortality rate in the UK worsening while there are improvements in other countries?
- Why does the peak in mortality rates for chronic liver disease and cirrhosis occur at younger ages than in other countries?

Drivers of this indicator

External drivers

3.172 All risk factors for liver disease are higher in men than women. Alcohol is the major risk factor for liver disease. Availability of alcohol is a major factor in the increasing trend in the number of deaths from alcoholic liver.

3.173 Projections from the Health Protection Agency (HPA) also suggest that Hepatitis C will be an increasing contributory factor as prevalence increases. In the USA, obesity related fatty liver disease is over-taking alcohol as the main cause of liver disease, and we expect to see England follow this trend.

Other drivers are listed below:

External drivers	
Illicit drug use	Current or previous injecting drug users (IDUs) are at the greatest risk of acquiring Hepatitis C virus (HCV). The HPA report that 49% of IDUs in England are positive for HCV antibody.
Physical activity	In children, sedentary activity patterns may contribute to liver damage.
Ethnicity/ immigration	The WHO reports that Hepatitis B is endemic in China and other parts of Asia, with 8-10% of adults chronically infected. Infection is mostly acquired in childhood. Chronic infection is also identified in the Amazon and southern parts of eastern and central Europe. Between 2% and 5% of the general population in the Middle East and Indian sub-continent is chronically infected. (http://www.who.int/mediacentre/factsheets/fs204/en/)
Health and social care drivers	
Quality of social care in hospitals and that supports early discharge	Social care is important in aiding discharge from hospital and is likely to contribute to reductions in admissions.
Quality of care whilst living in a home or residential care	The provision of high quality care can avoid the detrimental effects of malnutrition on the outcomes of liver disease.
Mitigation of social isolation	Social isolation is a driver because of the association with excess alcohol and illicit drug use.
Other external drivers	
Socio-economic status	Between 2001 and 2009 the average annual number of liver disease deaths was higher among the most deprived IMD quartiles (National End of Life Care Intelligence Network).

(b) Indicator 1.3: Current Practice Projections

Methodology

3.174 The projections are derived from the methodology described below:

3.175 The default position was that the indicator would not change from the latest year's value. This position has been accepted for the group of "other liver diseases", because there is no strong, clear trend in the data series for both males and females between 2001 and 2010. The position has been rejected for the remaining two categories: chronic liver disease and liver cancer.

3.176 For Chronic liver disease sufficient data is available, so an Age-Period-Cohort (APC) model has been used to project mortality. For the use of this technique in projections, and the assumptions used, see discussion in the Overview to Domain 1 at the beginning of this Chapter. The results are displayed in Table 1.3.e and Figure 1.3.h.

3.177 Most liver disease is lifestyle or life choice related and the implications of such long term behaviours (such as alcohol consumption and eating habits) are reflected in the cohort effects seen in liver disease. The cohort effects suggest a relative increase in the likelihood of dying from liver disease relative to all cohorts since 1931. Based on the data available, for males, the relative increase in risk for cohorts born in recent years has been reflected in the modelling by using a flat projection of the cohort effect seen in 1976. For females, an upward projection of cohort effects is used, reflecting the underlying data.

Liver Cancer

3.178 In approximately 95% of cases, liver cancer develops from cirrhosis of the liver, included in the list of chronic conditions. So, trends in liver cancer closely follow trends in chronic liver disease. The data for liver cancer exhibits an upward trend over the available time period (2001 to 2010), as seen in chronic liver disease. There is insufficient data to apply cohort modelling to liver cancer as for chronic conditions, so a linear trend has been projected.

Other liver diseases

3.179 A flat projection is used for other liver diseases. The annual rates are averaged by exponential smoothing (using a damping factor of 0.3), giving greater weight to more recent observations; this exponentially smoothed average is used as the "flat" projection.

Aggregated projections for liver disease

3.180 The European age standardised mortality rates derived from the methods described above are aggregated to produce overall mortality rates for liver disease for males, females and persons. The results are shown in Table 1.3.e and Figure 1.3.h below.

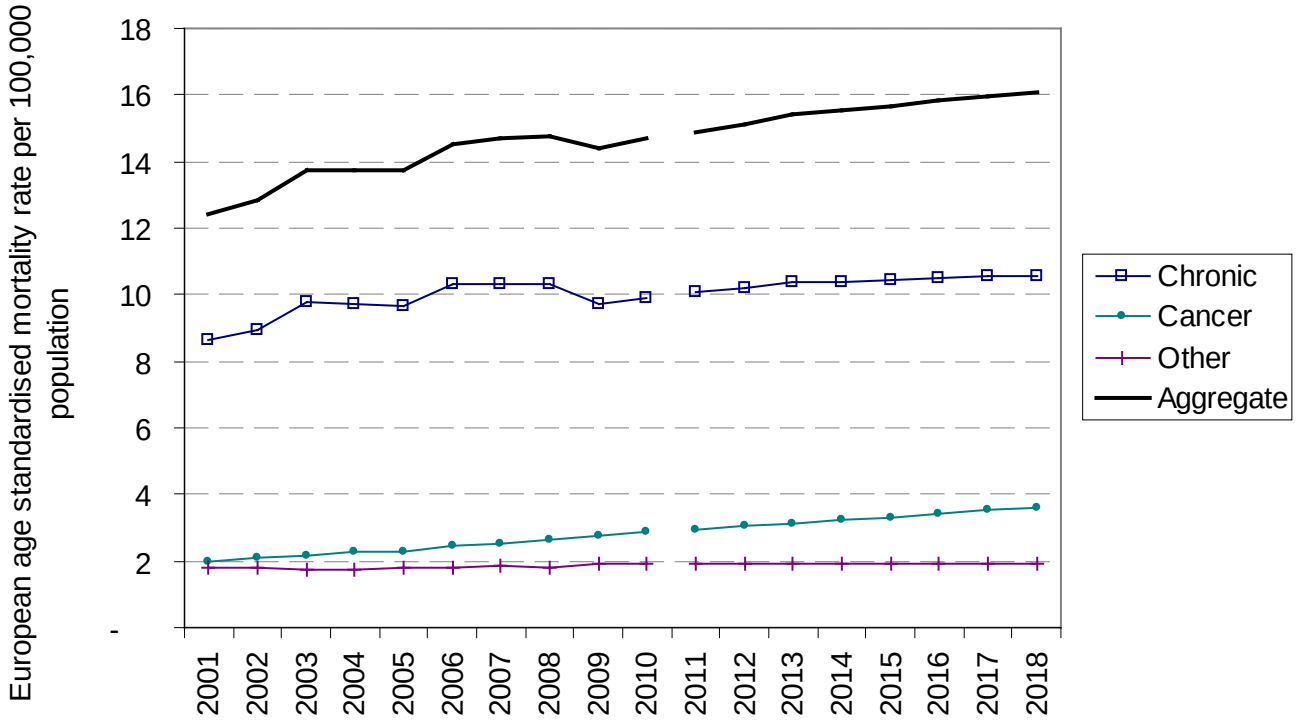
Results

Table 1.3.e Current practice projection, under 75 mortality rate (per 100,000) from liver disease, persons

Year	Chronic		Cancer		Other		Aggregate	
	Actual	Projection	Actual	Projection	Actual	Projection	Actual	Projection
2001	8.64		2.01		1.78		12.43	
2002	8.94		2.07		1.82		12.83	
2003	9.79		2.16		1.76		13.71	
2004	9.70		2.26		1.77		13.73	
2005	9.66		2.30		1.80		13.76	
2006	10.30		2.43		1.80		14.54	
2007	10.29		2.53		1.87		14.69	
2008	10.33		2.64		1.80		14.77	
2009	9.74		2.74		1.90		14.38	
2010	9.90		2.89		1.92		14.71	
2011		10.05		2.94		1.91		14.90
2012		10.21		3.03		1.91		15.15
2013		10.36		3.13		1.91		15.40
2014		10.40		3.22		1.91		15.54
2015		10.45		3.32		1.91		15.68
2016		10.49		3.42		1.91		15.82
2017		10.53		3.51		1.91		15.96
2018		10.57		3.61		1.91		16.10

Source: Office for National Statistics, Information Centre, DH

Figure 1.3.h Current practice projection, under 75 mortality rate (per 100,000) from liver disease, persons



Source: Office for National Statistics, Information Centre, DH

(c) Indicator 1.3: Scope for Improvement

3.181 This section considers whether there is scope for further improvement in this outcome indicator, to affect the deterioration of the indicator as reflected in the current practice projection.

3.182 Most liver disease can be considered life-style of life choice related, with some genetic and ethnic pre-disposition. So, most common causes of liver disease, with the exception of most childhood liver diseases, are avoidable.

3.183 Several current and planned policy initiatives are likely to lead to improvements in this outcome within current resources. The forthcoming liver outcomes strategy is aimed at improving liver disease outcomes, and so in the longer term should reduce premature mortality from liver disease.

3.184 Excessive alcohol is the major risk factor for liver disease. Initiatives in the recently published Alcohol Strategy (March 2012) offer potential scope for improvement in liver disease outcomes.

3.185 Analysis by the School of Health and Related Research (ScHARR) at the University of Sheffield suggests that implementing a minimum price of 40p per unit of alcohol would reduce alcohol related deaths by 1,180 per year, after 10 years.

3.186 Recent analysis published in The Lancet [9]identifies a reasonable target for England (and Wales), to reduce alcohol-related liver deaths over 20 years, to the mortality rates in the best performing countries internationally. Achieving this target represents a best case scenario, with the government implementing effective alcohol policy.

3.187 Healthy Lives, Healthy People: a call to action on obesity in England offers further potential scope for improvement in liver disease. The strategy places responsibility with local authorities to develop and implement evidence-based interventions. Examples of regional initiatives to influence obesity rates include brief advice through Making Every Contact Count, implementing a protocol for surgery for obese individuals and introducing staff competencies for behaviour change.

3.188 Hepatitis C is a key driver of under 75 liver disease mortality. NICE recently approved two new drugs for the second-line treatment of hepatitis C[10] . NICE determined these drugs to be cost-effective for the treatment of Hepatitis C, recognising that cost-effectiveness varies according to the patient's condition and whether they have previously received treatment. In all sensitivity analyses for Boceprevir the manufacturer's Incremental Cost Effectiveness Ratio (ICER) remained below £20,000 per QALY gained for all groups except treatment-naïve patients with compensated cirrhosis. For Telaprevir the ICERs were consistently below £18,000.

[9] http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2812%2960244-X/fulltext
[10] http://guidance.nice.org.uk/TA253, http://guidance.nice.org.uk/TA252

Table 1.3.f ICD-10 code classifications for liver disease mortality

ICD-10 Classification	
Code	**Description**
Chronic liver disease and cirrhosis	
K70	Alcoholic liver disease
K73	Chronic hepatitis, not elsewhere classified
K74	Fibrosis and cirrhosis of liver
Cancer of the liver	
C22	Malignant neoplasm of liver and intrahepatic bile duct
Other liver disease	
K72	Hepatic failure, not elsewhere classified
K75	Other inflammatory liver diseases
K76	Other diseases of liver
K77	Liver disorders in diseases classified elsewhere
B15	Acute hepatitis A
B16	Acute hepatitis B
B17	Other acute viral hepatitis
B18	Chronic viral hepatitis
B19	Unspecified viral hepatitis
I81	Portal vein thrombosis
I85	Oesophageal varices
T864	Liver transplant failure and rejection

1.4.i,ii – One- and five-year survival from colorectal cancer

Outcome sought	Reduced years of life lost from colorectal cancer
Indicator definition	One and five-year relative survival[11] for adults suffering from colorectal cancer (ratio of observed survival and survival expected if cancer patients had the same background mortality as the general population)

(a) Indicator 1.4.i,ii: Recent Trends and Explanations

3.189 The one- and five-year survival rates from colorectal cancer have improved from the cohort of patients diagnosed during 1998-2002 to those diagnosed during 2005-2009. The rate of improvement in survival rates has increased over the period.

3.190 The cancer survival rates presented are based on cohorts of patients diagnosed within five-year periods. The diagnosis periods overlap, so progress and projections are measured using rolling average survival rates over time.

One-year survival from colorectal cancer

3.191 One-year survival from colorectal cancer has increased by one percentage point for both males and females between the latest reporting periods. One-year survival increased from 73.9% for males diagnosed during 2004-2008[12] to 75.0% for those diagnosed during 2005-2009. For females, one-year survival increased from 73.0% to 74.0%.

3.192 From the diagnosis period 1998-2002 to the latest diagnosis period, 2005-2009, one-year survival has increased by 4.2 percentage points for males (from 70.8% to 75.0%) and 3.6 percentage points for females (from 70.4% to 74.0%) The average improvement in one-year survival over the period has been 0.6 percentage points for males and 0.5 for females.

Table 1.4.i.a – One-year survival rate from colorectal cancer by sex

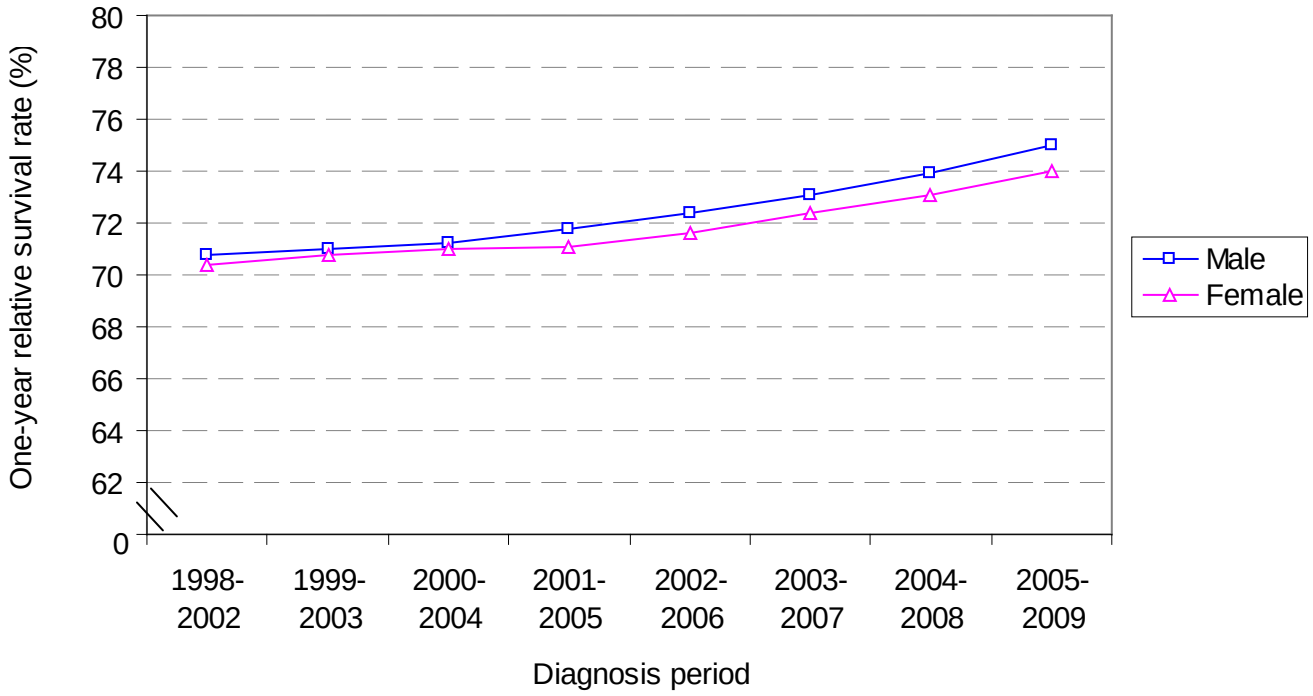
Diagnosis period	Male	Female
1998-2002	70.8	70.4
1999-2003	71.0	70.8
2000-2004	71.2	71.0
2001-2005	71.8	71.1
2002-2006	72.4	71.6
2003-2007	73.1	72.4
2004-2008	73.9	73.1
2005-2009	75.0	74.0

Source: Office for National Statistics, NHS Information Centre

[11] The relative survival is an estimate of the probability of survival from the cancer alone. Source: ONS Statistical Bulletin, http://www.ons.gov.uk/ons/dcp171778_240942.pdf

[12] Due to relatively small sample sizes, survival rates are calculated for a five year diagnosis period to ensure sufficiently robust calculations.

Figure 1.4.i.a – One-year survival rate from colorectal cancer by sex



Source: Office for National Statistics, NHS Information Centre

Five-year survival from colorectal cancer

3.193 There have been larger increases in the five-year survival rate than the one-year survival rate over the period.

3.194 Five-year survival from colorectal cancer has increased by more than one percentage point for both males (1.5) and females (1.2) between the latest reporting periods. Five-year survival increased from 52.7% for males diagnosed during 2004-2008 to 54.2% for those diagnosed during 2005-2009. For females, five-year survival increased from 54.4% to 55.6%.

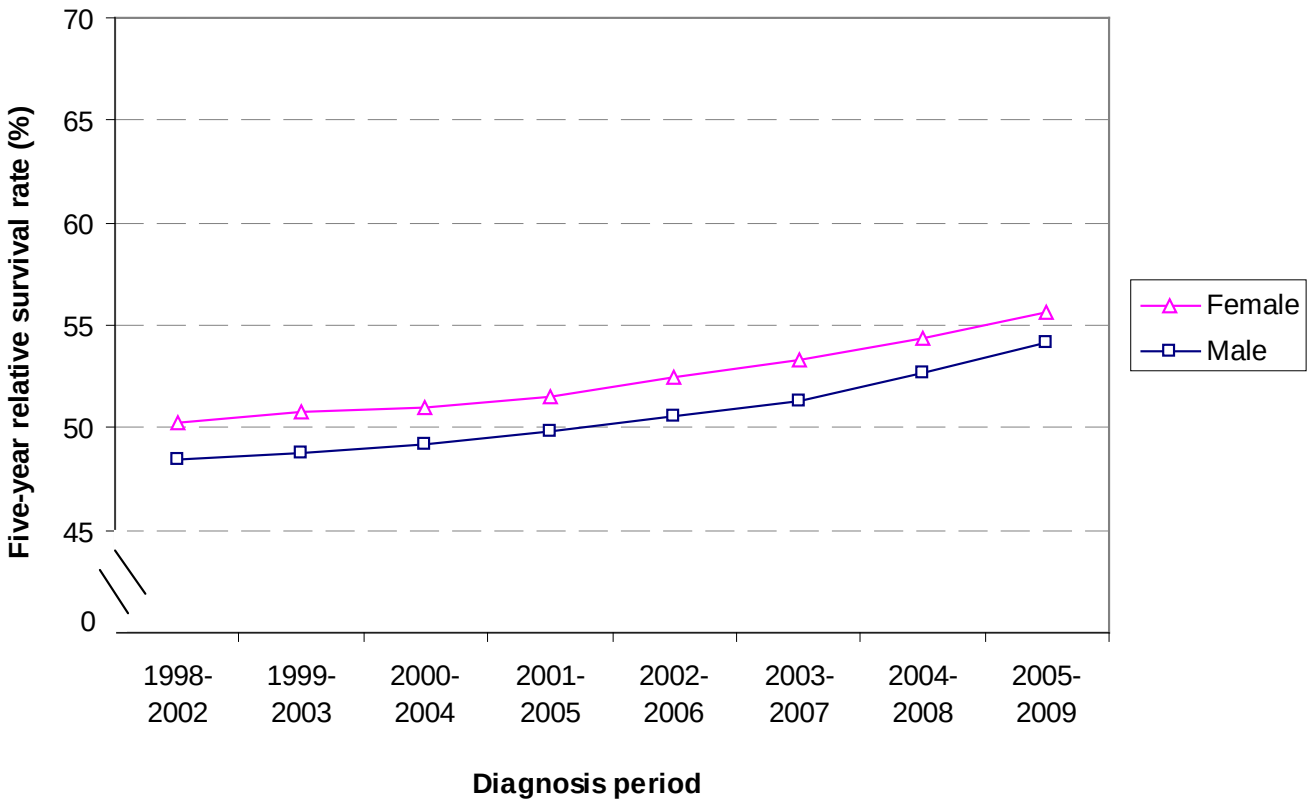
3.195 From the diagnosis period 1998-2002 to the latest diagnosis period, 2005-2009, five-year survival has increased by 5.7 percentage points for males (from 48.5% to 54.2%) and 5.4 percentage points for females (from 50.2% to 55.6%) The average improvement in five-year survival over the period has been 0.8 percentage points for males and females.

Table 1.4.i.b – Five-year survival rate from colorectal cancer by sex

Diagnosis period	Male	Female
1998-2002	48.5	50.2
1999-2003	48.8	50.8
2000-2004	49.2	51
2001-2005	49.8	51.5
2002-2006	50.6	52.5
2003-2007	51.3	53.3
2004-2008	52.7	54.4
2005-2009	54.2	55.6

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.i.b – Five-year survival rate from colorectal cancer by sex



Source: Office for National Statistics, NHS Information Centre

Breakdown by age

3.196 One-year survival from colorectal cancer. There are distinct patterns in relative survival from colorectal cancer by age. Cancer survival is only measured for those over the age of 15 due to differences in the types and behaviour of cancer and responsiveness to treatment in young children.

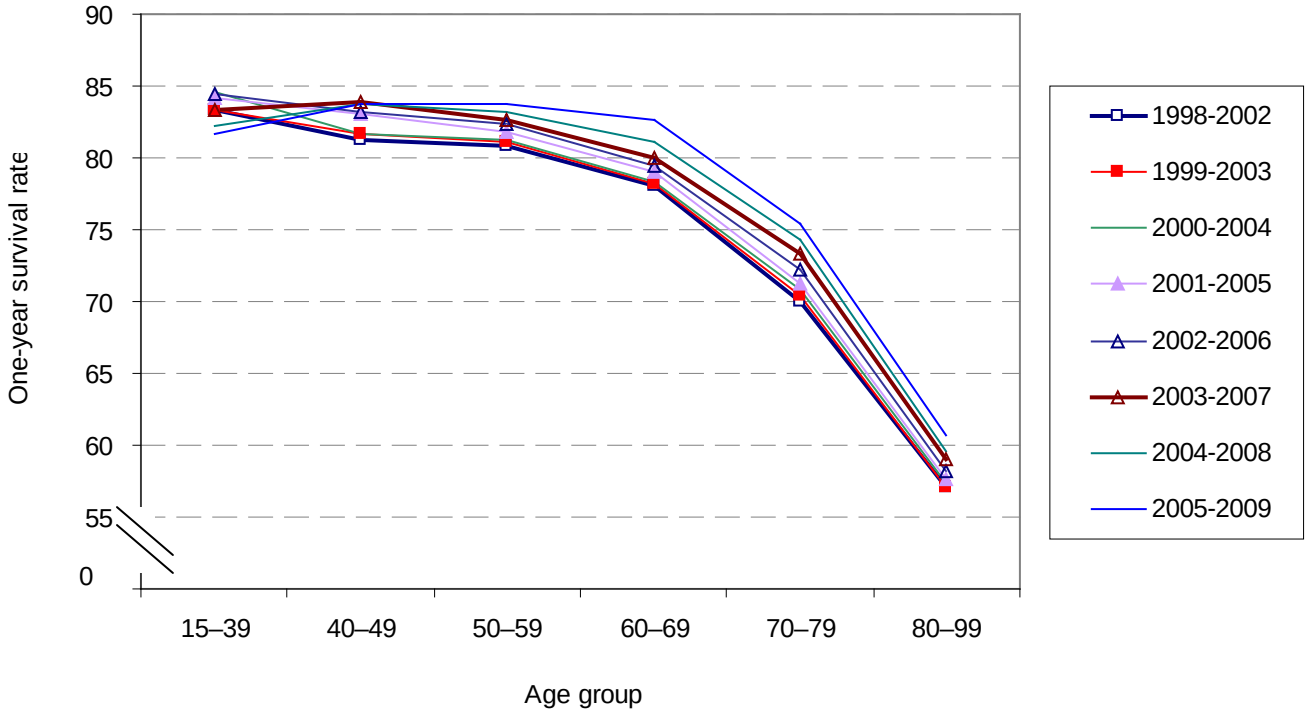
3.197 Although the age-standardised one-year survival rate for colorectal cancer has increased from the cohort of patients diagnosed during 1998-2002 to those diagnosed during 2005-2009, the rate has declined for males aged between 15 and 39. In addition, there was a small decline in the recent comparison periods, from 2004-08 to 2005-09, for females aged 40-49. In each of the other age groups, one-year survival rates have increased for both men and women.

Table 1.4.i.c – One-year survival rates for colorectal cancer, by age group, males

Male	15–39	40–49	50–59	60–69	70–79	80–99	All ages
1998-2002	83.3	81.2	80.8	78.1	70.1	57.2	70.8
1999-2003	83.3	81.6	81.2	78.2	70.4	57.0	71.0
2000-2004	84.6	81.7	81.3	78.4	70.8	57.3	71.2
2001-2005	84.2	83.0	81.8	79.1	71.2	57.7	71.8
2002-2006	84.5	83.2	82.4	79.5	72.3	58.2	72.4
2003-2007	83.3	83.8	82.7	80.0	73.3	59.0	73.1
2004-2008	82.3	83.7	83.1	81.1	74.3	59.6	73.9
2005-2009	81.7	83.7	83.7	82.6	75.4	60.7	75.0

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.i.c – One-year survival rates, colorectal cancer, by age group, males



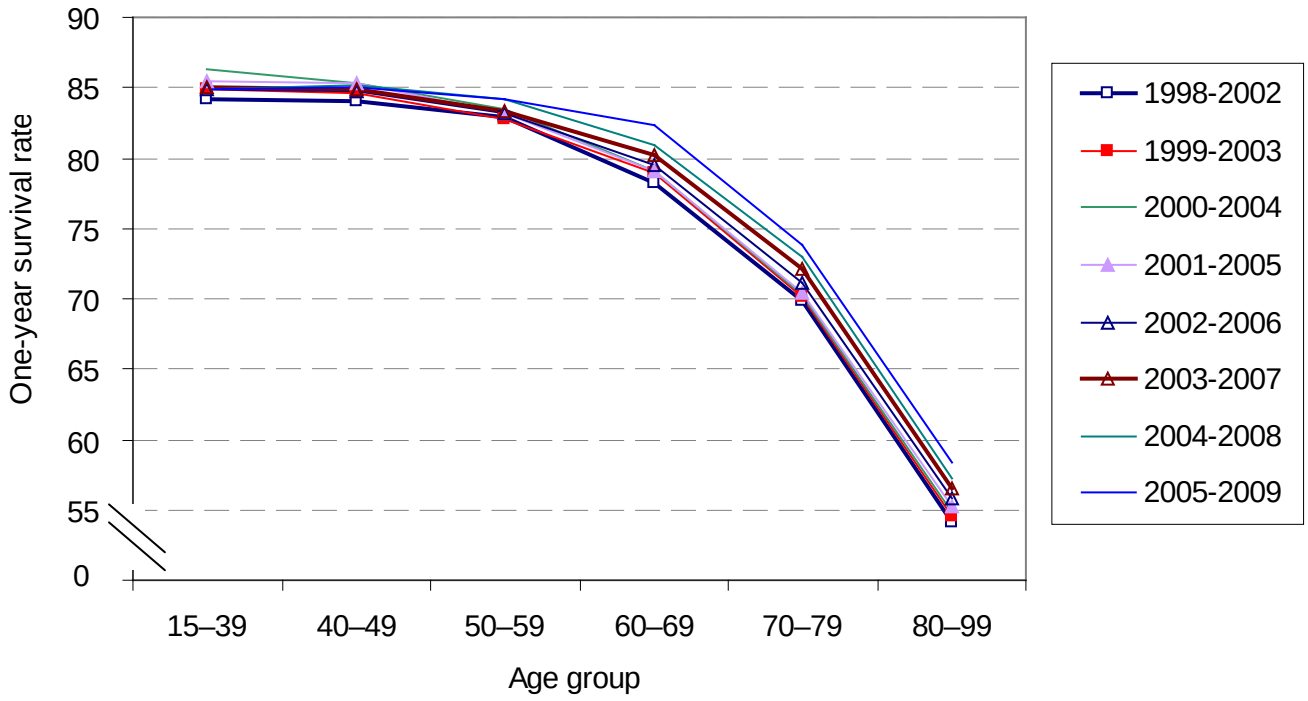
Source: Office for National Statistics

Table 1.4.i.d – One-year survival rates for colorectal cancer, by age group, females

Female	15–39	40–49	50–59	60–69	70–79	80–99	All ages
1998-2002	84.2	84.0	82.9	78.3	69.9	54.2	70.4
1999-2003	84.9	84.6	82.8	78.9	70.2	54.6	70.8
2000-2004	86.3	85.3	83.5	79.1	70.2	54.9	71.0
2001-2005	85.4	85.3	83.1	79.1	70.4	55.2	71.1
2002-2006	84.9	84.8	83.2	79.5	71.2	55.8	71.6
2003-2007	85.1	84.9	83.4	80.3	72.2	56.6	72.4
2004-2008	84.8	85.2	84.2	80.9	72.9	57.2	73.1
2005-2009	84.8	85.0	84.2	82.4	73.8	58.3	74.0

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.i.d – One-year survival rates for colorectal cancer, by age group, females



Source: Office for National Statistics

Five-year survival from colorectal cancer

3.198 Five-year relative survival is the ratio of survival in the cohort of patients diagnosed with cancer within a defined period and the survival that would have been expected if the cancer patients had only experienced the background mortality seen in the general population.

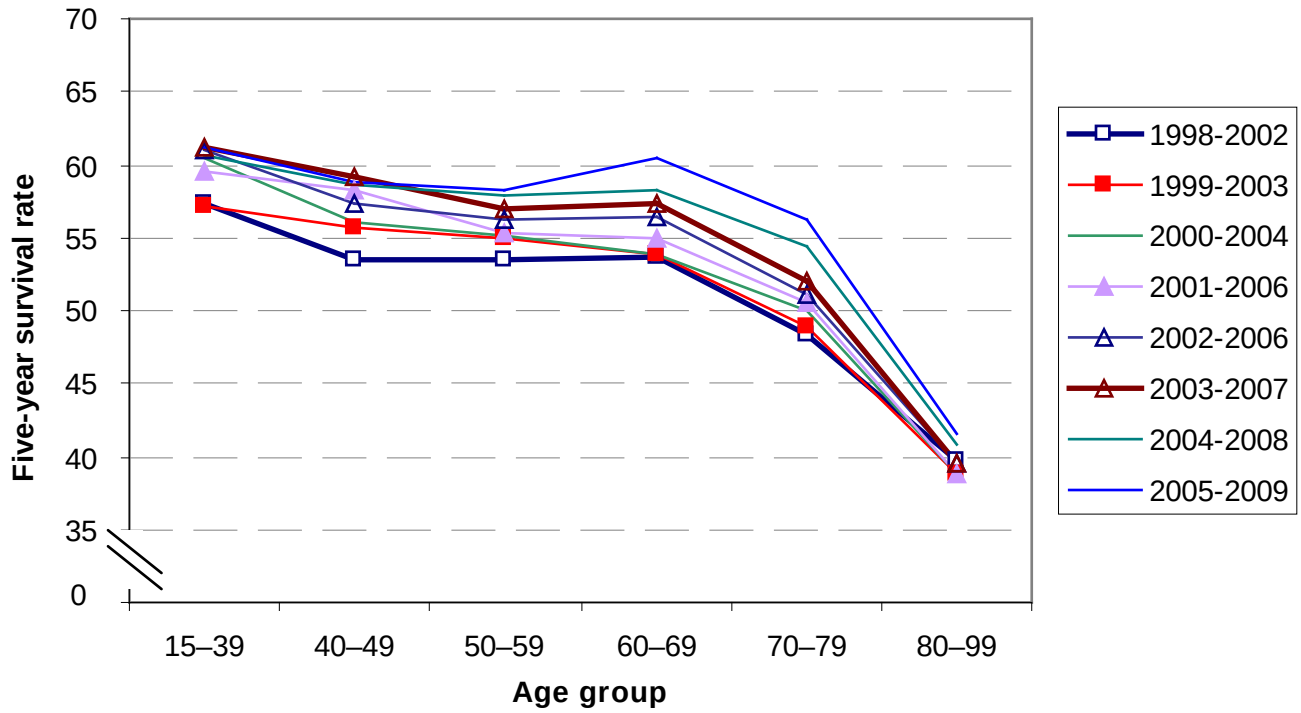
3.199 In the most recent diagnosis periods, males aged 60-69 have had higher survival rates than those in the other age groups, aside from the 15-39 age group. For both males and females diagnosed during 2005-2009, the survival rate of 60-69 year olds was higher than all other age groups above 40.

Table 1.4.i.e – Five-year survival rates for colorectal cancer, by age group, males

Male	15–39	40–49	50–59	60–69	70–79	80–99	All ages
1998-2002	57.3	53.4	53.4	53.6	48.3	39.7	48.5
1999-2003	57.2	55.8	54.9	53.8	48.9	38.8	48.8
2000-2004	60.5	56.0	55.1	53.8	50.0	38.8	49.2
2001-2005	59.6	58.3	55.3	55.0	50.5	38.8	49.8
2002-2006	60.9	57.4	56.3	56.3	51.2	39.5	50.6
2003-2007	61.2	59.2	57.0	57.3	51.9	39.6	51.3
2004-2008	60.6	58.6	57.8	58.3	54.3	40.8	52.7
2005-2009	61.1	58.8	58.3	60.5	56.2	41.6	54.2

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.i.e – Five-year survival rates for colorectal cancer, by age group, males



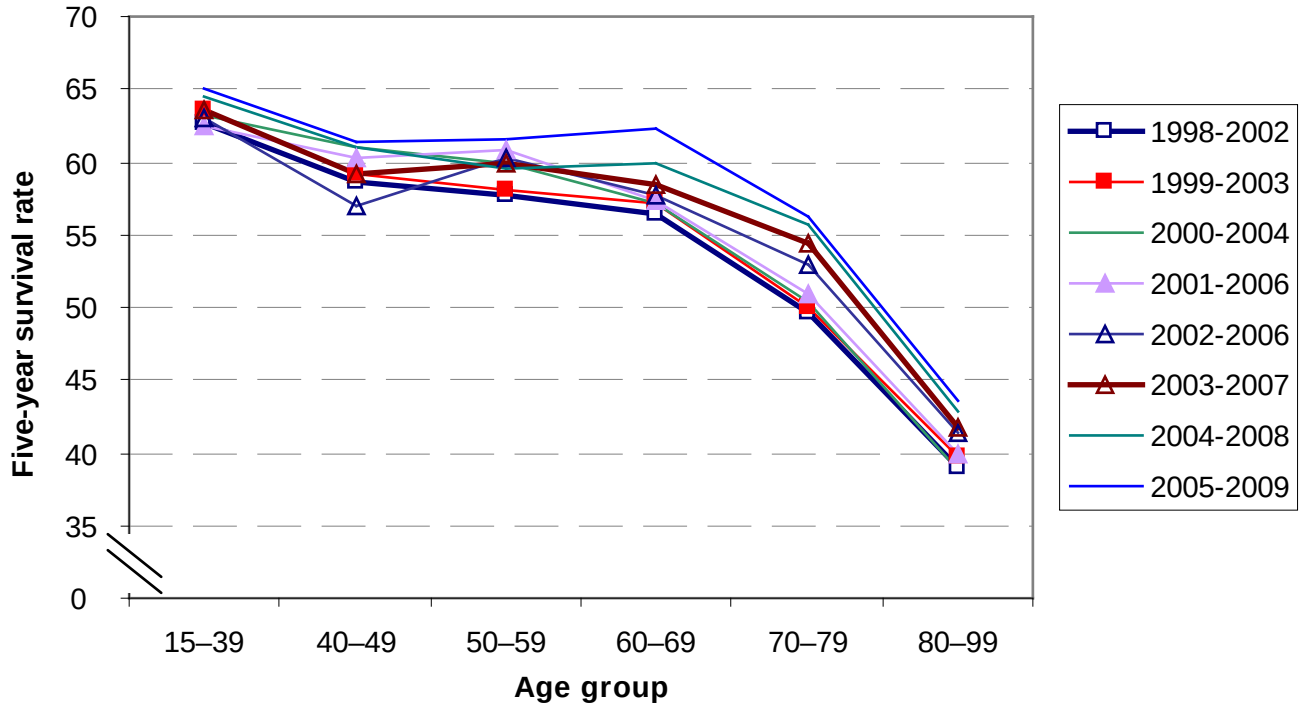
Source: Office for National Statistics

Table 1.4.i.e – Five-year survival rates for colorectal cancer, by age group, females

Female	15–39	40–49	50–59	60–69	70–79	80–99	All ages
1998-2002	62.7	58.7	57.7	56.4	49.5	39.0	50.2
1999-2003	63.6	59.2	58.1	57.2	50.0	39.8	50.8
2000-2004	63.2	61.0	60.0	57.1	50.5	38.8	51.0
2001-2005	62.4	60.3	60.8	57.4	51.0	39.8	51.5
2002-2006	63.0	57.0	60.2	57.7	52.9	41.3	52.5
2003-2007	63.5	59.2	60.0	58.4	54.4	41.7	53.3
2004-2008	64.4	61.0	59.6	59.9	55.7	42.8	54.4
2005-2009	65.1	61.3	61.5	62.3	56.2	43.5	55.6

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.i.e – Five-year survival rates for colorectal cancer, by age group, females



Source: Office for National Statistics

International position

3.200 The International Cancer Benchmarking Partnership (ICBP) has established a programme to investigate international cancer survival disparities. The six participating countries are identified as having "comparable wealth, universal access to health care and longstanding, high-quality, population based cancer registration" [13]. The six countries are: Australia, Canada, Denmark, Sweden, Norway and the UK. In addition, other than Denmark and the UK, they have been selected on the basis of having high cancer survival rates.

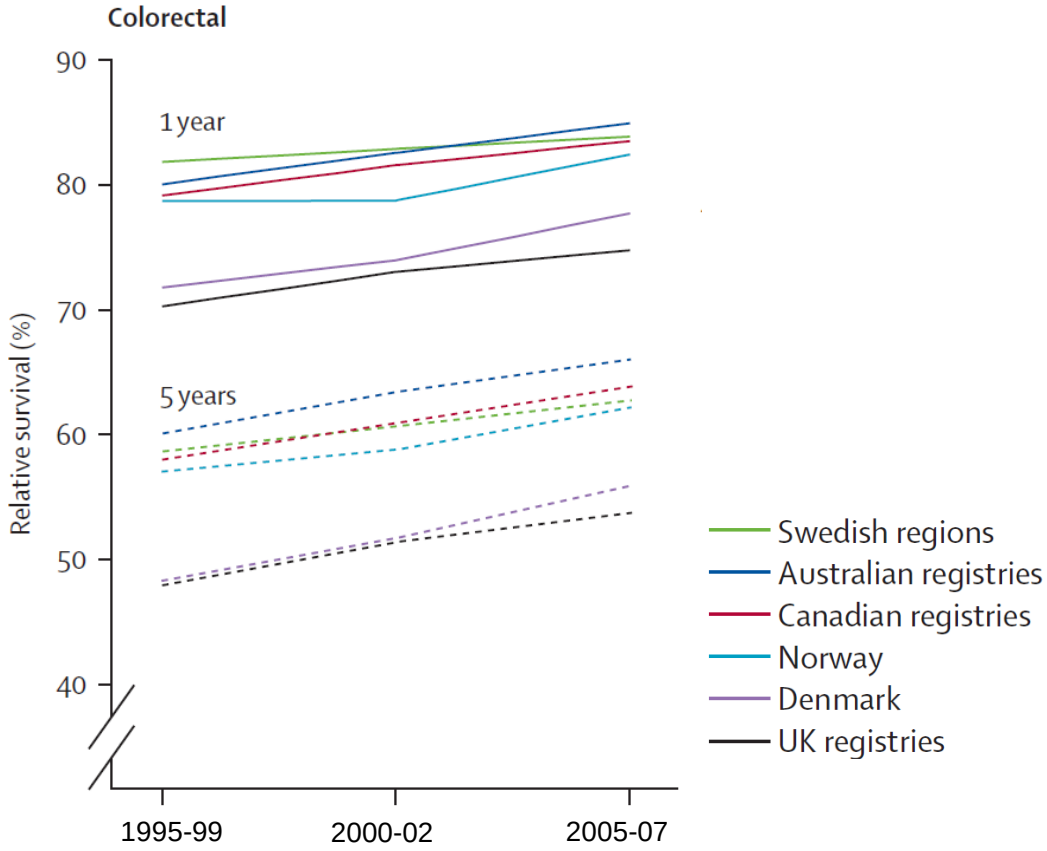
3.201 In December 2010, the ICBP reported one- and five-year relative survival rates for four cancers (colorectal, lung, breast and ovarian) across participating jurisdictions.

3.202 Over the three diagnosis periods considered, 1995-99, 2000-02 and 2005-07, the UK and Denmark consistently reported the lowest one- and five-year colorectal cancer survival rates. Survival rates increased across all countries over the period, so the difference in survival rates between the UK and the best performing countries did not decline.

[13] http://download.thelancet.com/pdfs/journals/lancet/PIIS0140673610622313.pdf?id=5bbe37e152166496:-7a4386c5:134f5042fcb:2b7e1326964060067

Figure 1.4.i.f – Age-standardised one and five year relative survival trends

1995-2007 ICBP participating countries

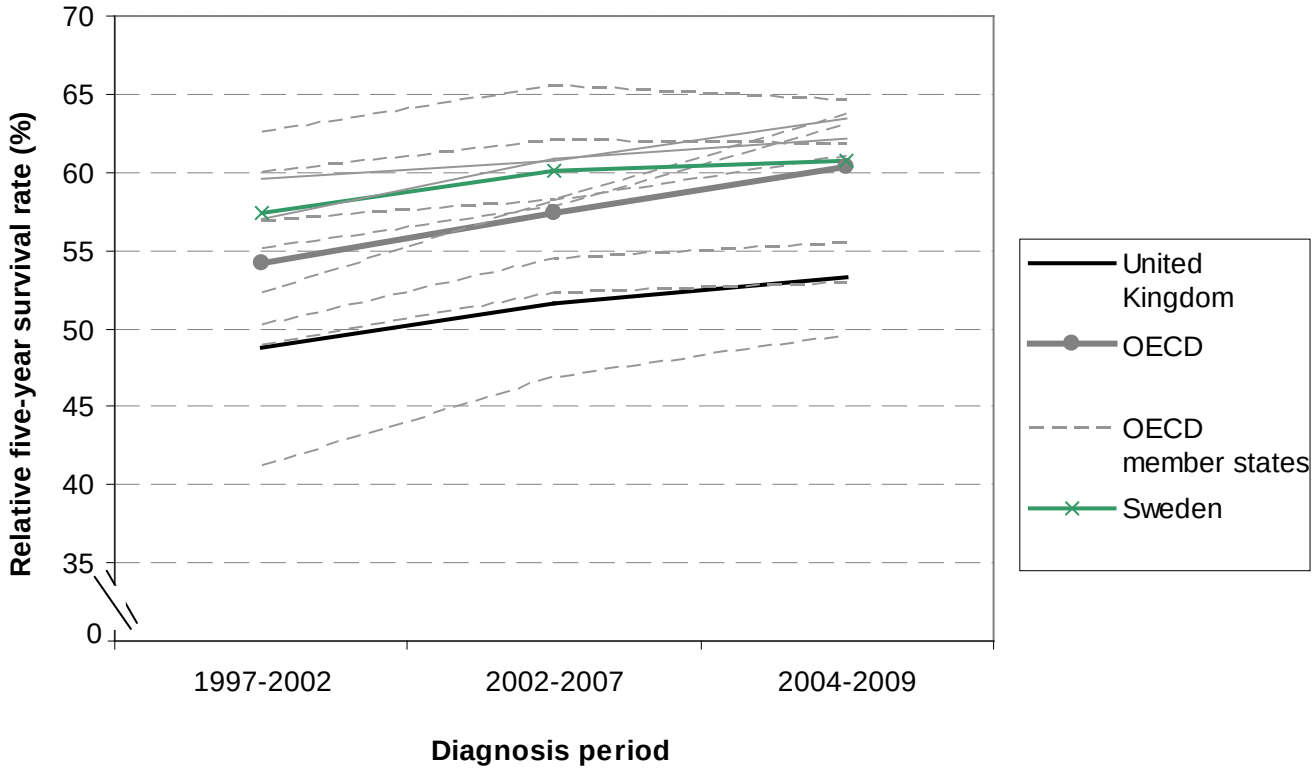


Source: Cancer survival in Australia, Canada, Denmark, Norway, Sweden and the UK, 1995-2007: an analysis of population based cancer registry data. M P Coleman et al. Lancet 2011; 377, 127-38

3.203 12 OECD member states reported five-year survival data over three recent sequential time periods: 1997-2002, 2002-2007 and 2004-2009 (or the nearest available periods). Of these countries, the United States has consistently reported the highest five-year survival rates, 65% in the period 2004-2009.

3.204 The Czech Republic and Ireland had lower five-year survival rates than the United Kingdom for the latest diagnosis period, 2004-2009.

Figure 1.4.i.g – Five-year survival rates for colorectal cancer
Selected OECD member states and averages, persons



Source: Health at a Glance, OECD Indicators

3.205 Survival is one of several cancer outcome measures, typically used to gauge the impact of the health system in treating cancer. Incidence defines the number of new cancer cases within a given time period and can be used to understand success in cancer prevention. Mortality rates reflect both survival and incidence.

3.206 Colorectal cancer accounts for around 14% of cancers in males and approximately 12% of cancers diagnosed in females.

3.207 Tables 1.4.i.f & g below shows incidence rates of colorectal cancer, by age, in 2009. Incidence increases with age and is higher amongst males than females at all ages.

Table 1.4.i.f – Age specific rates of newly diagnosed cases of colorectal cancer (per 100,000), 2009

	Directly standardised rate	
Age	Males	Females
15–39	2.9	2.5
40–49	16.3	15.2
50–59	60.2	42.2
60–69	197.6	118.1
70–79	350.5	215.3
80 & over	493.5	314.8

Source: Cancer Statistics Registrations, England, Series MB1 No. 40, 2009

Table 1.4.i.g – Directly age standardised Incidence and mortality rates (per 100,000) for colorectal cancer, England

Year	Incidence		Mortality	
	Males	Females	Males	Females
2001	54.5	35.5	54.5	35.5
2002	54.0	34.8	54.0	34.8
2003	54.4	34.6	54.4	34.6
2004	55.6	35.6	55.6	35.6
2005	56.0	36.3	56.0	36.3
2006	56.4	36.7	56.4	36.7
2007	56.4	37.5	56.4	37.5
2008	57.9	37.6	57.9	37.6
2009	57.3	37.6	57.3	37.6

Source: Office for National Statistics: Part of Bowel Cancer in England, 2009 release

Notes:

3.208 There are a number of questions that arise from colorectal cancer survival rates data:

- What is driving improvements in colorectal survival rates over time?
- There have been larger increases in the five-year survival rate for colorectal cancer than the one-year rate, does this mean that earlier diagnosis has not been improving as fast as treatment for colorectal cancer?
- Why have females over age 59 had a lower one-year survival rate than males in recent years, but a higher survival rate under age 59? Does the menopause have an effect?
- Why are one-year survival rates higher for males than females, but five-year survival rates are higher for females than males?
- Why has there been a reduction in survival rates over time for males aged 15-39 (there were improvements for all other age groups)?
- Why were there greater improvements in survival rates in Denmark than the UK from 2000-02 and 2005-07, as illustrated by the ICBP data?

Drivers of this indicator

3.209 A recent King's Fund report How to Improve cancer survival: Explaining England's relatively poor rates (June 2011)1 identified the four main areas that studies have focussed on in attempting to explain international differences in cancer survival:

- Stage at diagnosis and diagnostic delay
- Treatment factors
- Patient factors, including age and co-morbidities
- Tumour biology and physiological/biological factors

3.210 The risk factors for cancer incidence are well documented. The King's Fund identifies evidence that survival can be influenced by the same factors. As an example, several studies of colon cancer identified better survival chances for individuals undertaking moderate physical activity compared to those who are inactive.

3.211 A 2011 British Journal of Cancer supplement sought to estimate the percentage of cancers in the UK in 2010 that were the result of exposure to a set of major lifestyle, dietary and environmental risk factors. Table 1.4.i.h below shows the contribution of significant risk factors for colorectal cancer. The figures in the table represent the percentage of colorectal cancer cases attributable to each risk factor shown. The values cannot be summed together because cancers have multiple causes that exert their effect simultaneously.

Table 1.4.i.h Percentage of incident colorectal cancer cases in the UK in 2010 due to lifestyle and environmental factors

Exposure	% attributable	
	Male	Female
Tobacco	6.6	9.9
Alcohol	15.5	6.9
Excess red meat consumption*	24.8	16.4
Deficit in consumption of fibre^	10.2	14.6
Excess body weight	13.6	12.2
Inadequate Physical Exercise○	3	3.6
Infections	1.5	3.1
Radiation – ionising	1.1	2.2

Source: British Journal of Cancer (2011),105 S77-S81

*the relative risks of red meat consumption against a baseline of a diet that would contain no red meat.
^Deficit in the consumption of fibre from 23g per day as recommended by the Department of Health
○Level of physical exercise below 30 minutes on at least five days of the week (Department of Health recommendation)

Table 1.4.i.j Other drivers of colorectal cancer

1. Public health and social care drivers:
Illicit drug use
Screening programmes
Quality of social care
Quality of care whilst living at home or in residential care
Mitigation of social isolation
2. Drivers beyond NHS control:
Socio-economic status
Prevalence of co-morbidities
Previous cancer treatment

3.212 Recent trends in improvements in colorectal cancer survival rates are attributable to non-NHS factors. The application of good practice in the NHS to new cohorts of patients will contribute to continued improvements in survival rates in the short-term.

Possible sources of bias

3.213 Lead time bias: Lead time is the amount of time by which the diagnosis has been advanced by screening. This may artificially increase the survival time of cases detected by screening.

3.214 Length bias: Increased likelihood of a slow growing tumour that is unlikely to prove fatal being detected through screening. This may artificially improve survival analysis.

(b) Indicator 1.4.i,ii: Current Practice Projections Methodology

3.215 The projections in Table 1.4.i.k are informed by the methodology used by the London School of Hygiene and Tropical Medicine (LSHTM) to derive future estimates for cancer survival rates. This approach is used to estimate colorectal cancer survival up to the diagnosis period 2012-2016. The caveats that apply to interpreting the approach used by LSHTM are included at the end of this section. The cohort of patients diagnosed in 2012-2016 will be the last to include patients that are currently in contact with the system. A flat projection is used for subsequent cohorts of patients, reflecting the limitations of current practice alone in continuing to improve survival rates.

- Only the most recent data points that have been consistently defined are used for the projections
- The line of best fit through the last three diagnosis periods is used to estimate the trend in the data.
- The trend is extrapolated for future years, up to 2016. For later diagnosis periods, the projections are flat.

Results

3.216 Projections are made for diagnosis periods from 2006-2010 onwards, based on the latest available data, up to the diagnosis period 2005-2009.

Table 1.4.i.k Current practice projections for one-year survival from colorectal cancer

Year	Male			Female		
	Trend	Projection	Projection + P.I.	Trend	Projection	Projection + P.I.
2003-2007	73.1			72.4		
2004-2008	73.9			73.1		
2005-2009	75.0			74.0		
2006-2010		75.9	75.8		74.8	74.7
2007-2011		76.9	76.8		75.6	75.5
2008-2012		77.8	77.7		76.4	76.3
2009-2013		78.7	78.7		77.2	77.1
2010-2014		79.7	79.6		78.0	77.9
2011-2015		80.6	80.6		78.8	78.7
2012-2016		81.6	81.5		79.6	79.5
2013-2017		81.6	81.5		79.6	79.5
2014-2018		81.6	81.5		79.6	79.5

Figure 1.4.i.h Current practice projections for one-year survival from colorectal cancer

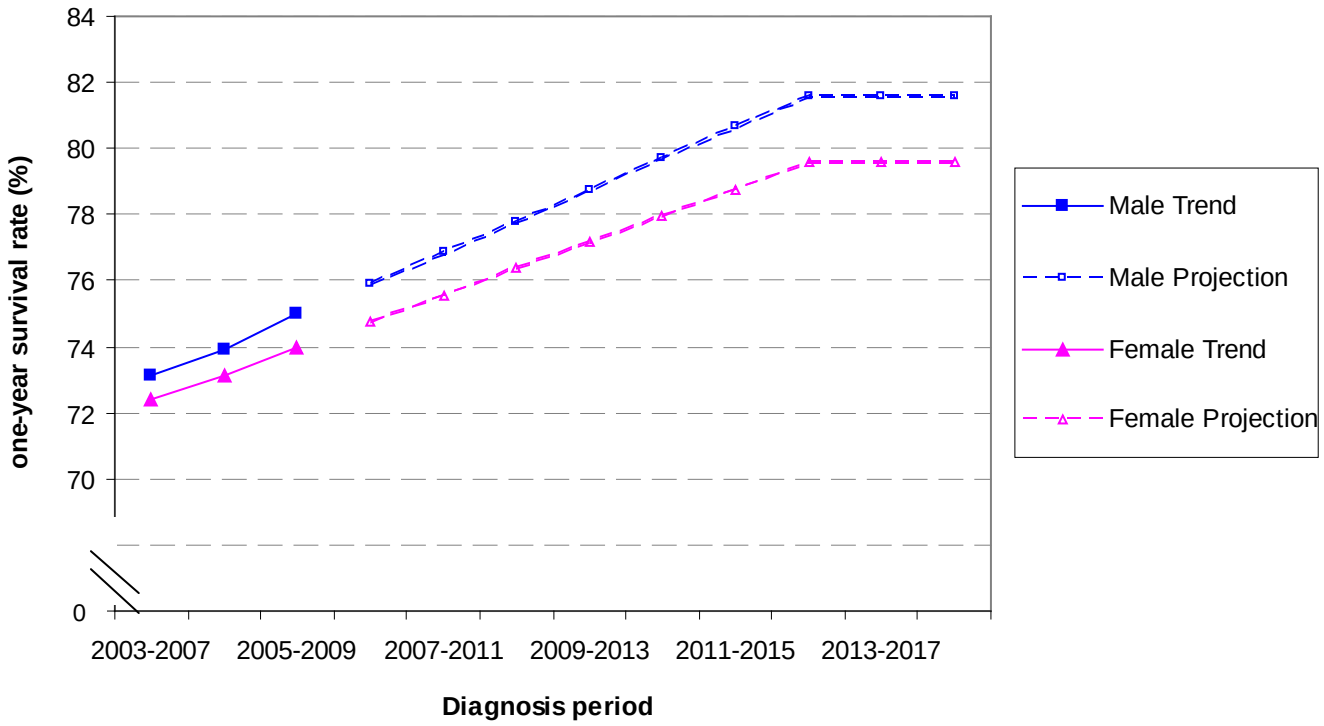
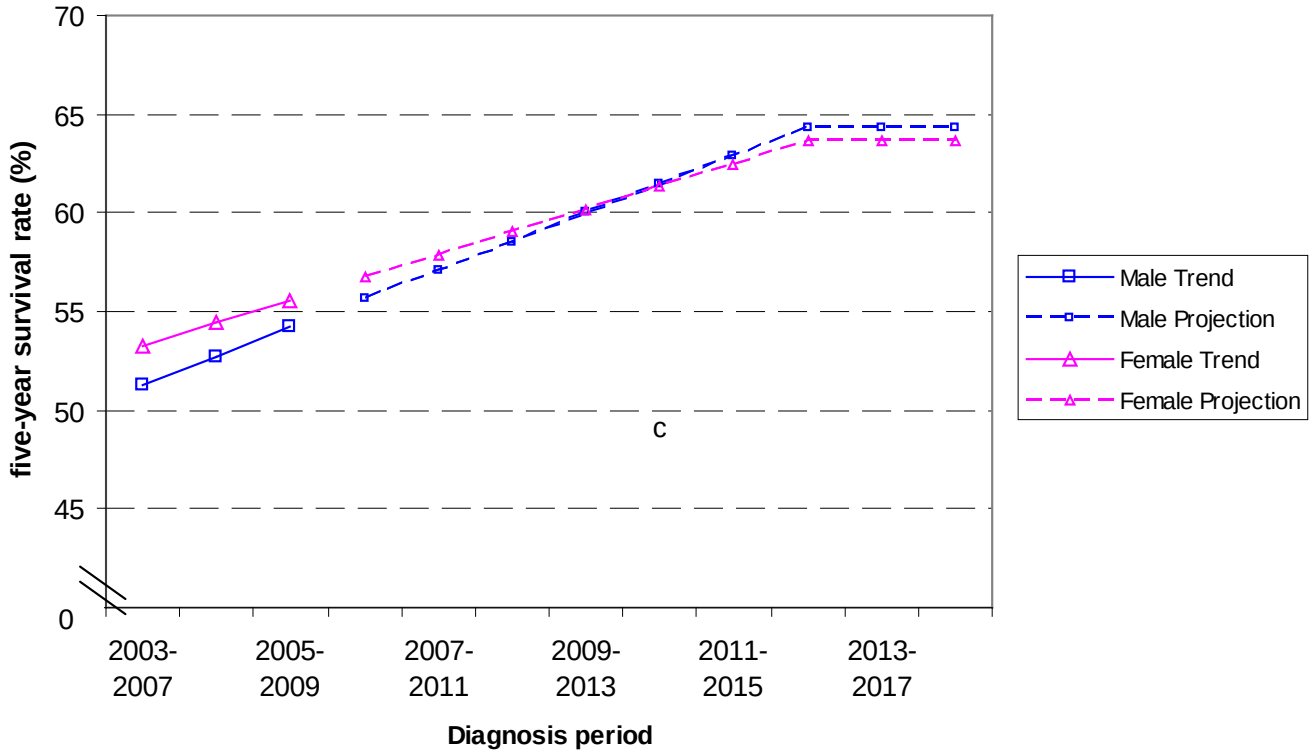


Table 1.4.i.l – Current practice projections for five-year survival from colorectal cancer

Year	Male			Female		
	Trend	Projection	Projection + P.I.	Trend	Projection	Projection + P.I.
2003-2007	51.3			53.3		
2004-2008	52.7			54.4		
2005-2009	54.2			55.6		
2006-2010		55.6	55.6		56.7	56.7
2007-2011		57.1	57.1		57.9	57.9
2008-2012		58.5	58.5		59.0	59.0
2009-2013		60.0	60.0		60.2	60.2
2010-2014		61.4	61.4		61.3	61.3
2011-2015		62.9	62.9		62.5	62.5
2012-2016		64.3	64.3		63.6	63.6
2013-2017		64.3	64.3		63.6	63.6
2014-2018		64.3	64.3		63.6	63.6

Figure 1.4.i.i – Current practice projections for five-year survival from colorectal cancer



3.217 The scientific consultants from the London School of Hygiene and Tropical Medicine draw attention to the following caveats that apply to their approach:

3.218 “Relative survival estimates for Australia, Sweden and Canada (“AUSWECAN”), and for England, were obtained by assuming a constant linear trend of five-year survival from the values observed for patients diagnosed during 2000-02 and 2005-07, and projecting this trend for the 7 years to 2012-14 (and 9 years to 2014-16). More reliable estimates would require development of complex “scenario” models to take into account the changes in survival due to the introduction of or wider access to new staging procedures, screening programmes and treatment. This could not be done within the time constraints required for these analyses. It would also require more complete and accurate data on stage at diagnosis, investigative procedures, screening programmes and treatment.”

(c) Indicator 1.4.i,ii: Scope for Improvement

3.219 Improvements in survival rates for colorectal cancer are reflected in progress in the under-75 cancer mortality rate. See Section C of indicator 1.4.vii for further information about improvements in cancer survival rates.

1.4.iii,iv – One- and five-year survival from breast cancer

Outcome sought	Reduced years of life lost from breast cancer
Indicator definition	One- and five-year relative survival for females suffering from breast cancer (ratio of observed survival and survival expected if cancer patients had the same background mortality as the general population)

(a) Indicator 1.4.iii,iv: Recent Trends and Explanations

3.220 The one- and five-year survival rates from breast cancer have improved from the cohort of patients diagnosed during 1994-1996 to those diagnosed during 2005-2009.

3.221 The cancer survival rates presented are based on cohorts of patients diagnosed within multi-year periods. The diagnosis periods overlap, so progress and projections are measured using rolling average survival rates over time.

One-year survival from breast cancer

3.222 There was little change in one-year survival from breast cancer from patients diagnosed during 2004-2008 (95.6%) to those diagnosed during 2005-2009 (95.8%).

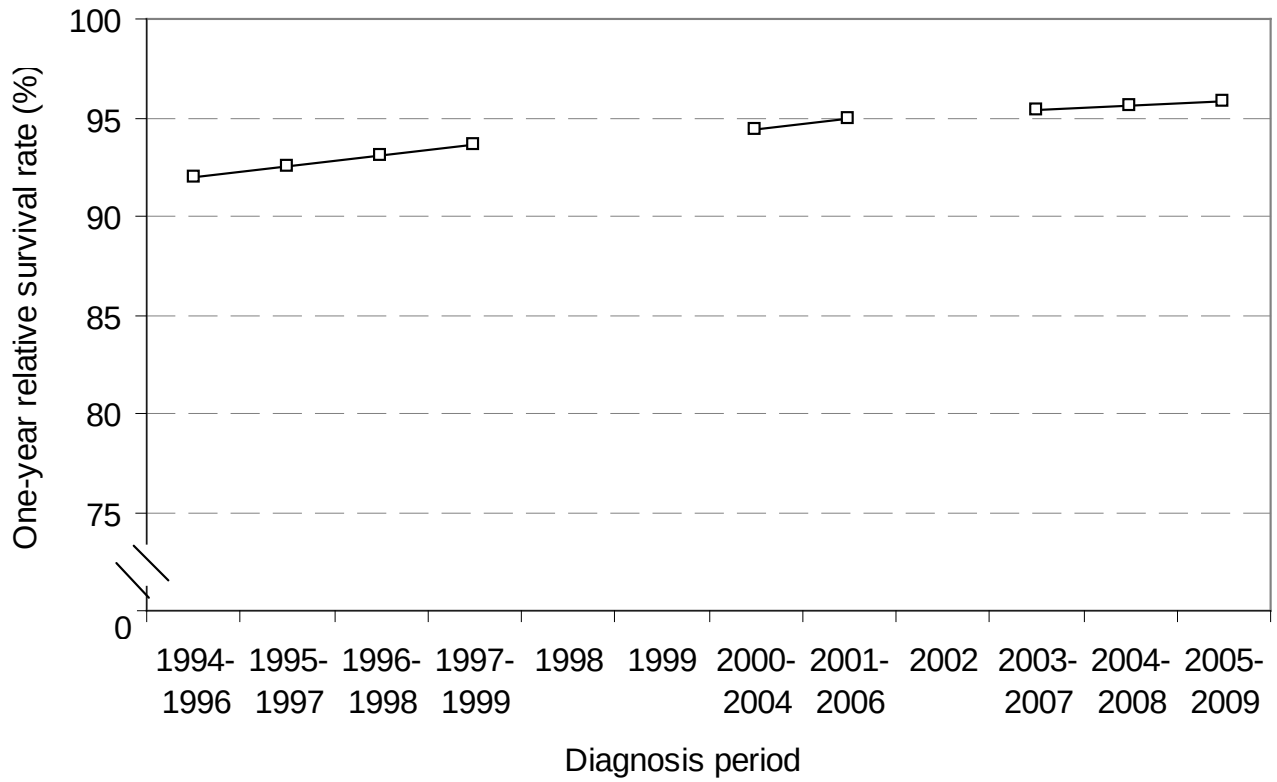
3.223 There are discontinuities in the national historic data, considering only the latest continuous time series (2001-2006 to 2005-2009), one-year survival from breast cancer improved by one percentage point, from 94.9% to 95.8%.

Table 1.4.iii.a – One-year survival from breast cancer, females

Diagnosis period	Female
1994-1996	92
1995-1997	92.5
1996-1998	93.1
1997-1999	93.6
2000-2004	94.4
2001-2006	94.9
2003-2007	95.4
2004-2008	95.6
2005-2009	95.8

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.iii.a One-year survival from breast cancer, England[14]



Source: Office for National Statistics, NHS Information Centre
Note: There are discontinuities on the x-axis.

Five-year survival from breast cancer

3.224 From the period 2004-2008 (84.2%) to 2005-2009 (85.1%), five-year survival from breast cancer increased by one percentage point.

3.225 There have been bigger increases in five-year survival than one-year survival over the period of available data. During the last four years of continuous data (from the diagnosis period 2001-2006 to 2005-2009), the five-year breast cancer survival rate has improved by three percentage points.

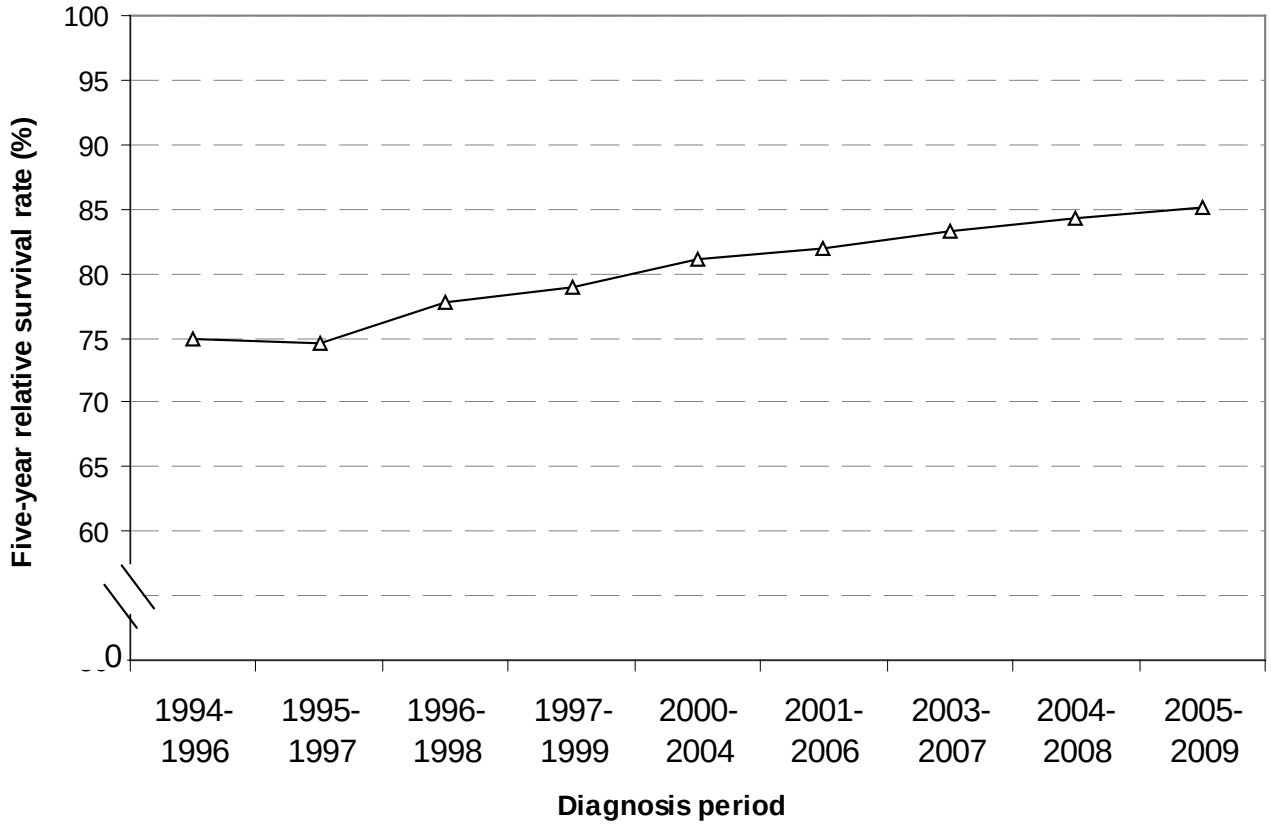
[14] The relative survival is an estimate of the probability of survival from the cancer alone. Survival is calculated from patients diagnosed over a period of time and followed up to a given date after this period. Source: ONS Statistical Bulletin, http://www.ons.gov.uk/ons/dcp171778_240942.pdf

Table 1.4.iii.b – Five-year survival from breast cancer, females

Diagnosis period	Female
1994-1996	74.9
1995-1997	74.6
1996-1998	77.8
1997-1999	78.9
2000-2004	81.1
2001-2006	82
2003-2007	83.3
2004-2008	84.2
2005-2009	85.1

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.iii.b – Five-year survival from breast cancer, females



Source: Office for National Statistics, NHS Information Centre
Note: There are discontinuities on the x-axis.

Breakdown by age

3.226 There are distinct patterns in relative survival from breast cancer by age. Women aged between 40 and 49 have the highest one-year survival rates from breast cancer. Five-year survival is highest amongst women aged 50-59.

3.227 Women aged 15-39 have a slightly lower one-year survival rate than those aged between 40 and 49. There is a difference of seven percentage points in the five-year survival rate between those aged 15-39 and 50-59.

Table 1.4.iii.c – One- year survival rates, breast cancer, by age group

Diagnosis period	15–39	40–49	50–59	60–69	70–79	80–99
2000-2004	97.0	98.0	98.0	96.0	92.0	83.0
2001-2006	98.0	98.0	98.0	97.0	92.0	85.0
2003-2007	98.1	98.2	98.1	97.4	93.0	85.9
2004-2008	98.1	98.4	98.1	97.6	93.3	86.5
2005-2009	98.1	98.4	98.2	97.7	93.7	87.2

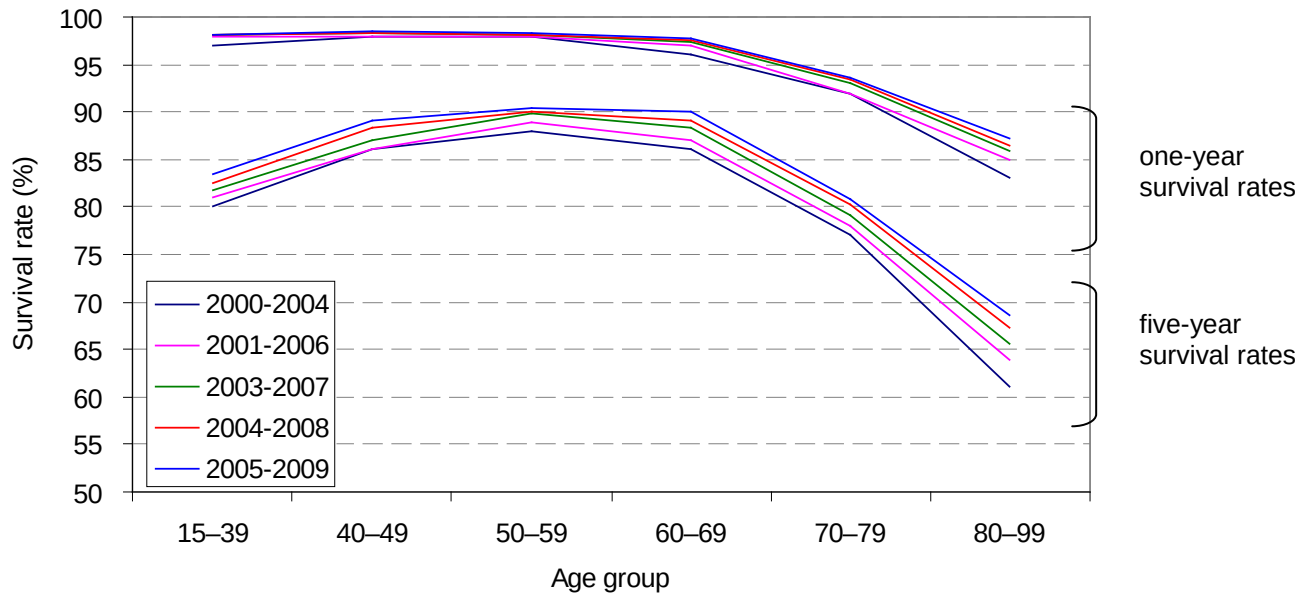
Source: Office for National Statistics, NHS Information Centre

Table 1.4.iii.d – Five- year survival rates, breast cancer, by age group

Diagnosis period	15–39	40–49	50–59	60–69	70–79	80–99
2000-2004	80.0	86.0	88.0	86.0	77.0	61.0
2001-2006	81.0	86.0	89.0	87.0	78.0	64.0
2003-2007	81.8	87.0	89.8	88.3	79.1	65.5
2004-2008	82.6	88.3	90.0	89.1	80.2	67.3
2005-2009	83.5	89.1	90.4	90.1	80.9	68.5

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.iii.b – One- and five-year survival rates, breast cancer, by age group



Source: Office for National Statistics, NHS Information Centre

International position

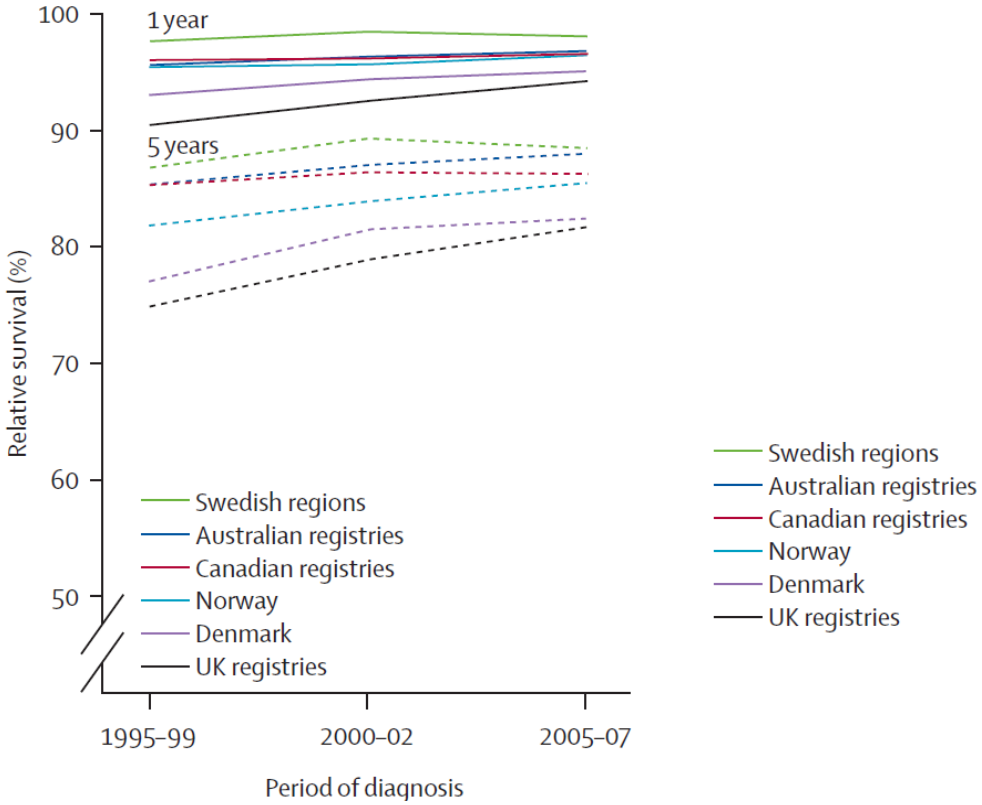
3.228 The International Canner Benchmarking Partnership (ICBP) has established a programme to investigate international cancer survival disparities. The six participating countries are identified as having "comparable wealth, universal access to health care and longstanding, high-quality, population based cancer registration" [15]. For all countries other than the UK and Denmark they were also selected for having very good cancer survival rates. The six countries are: Australia, Canada, Denmark, Sweden, Norway and the UK.

3.229 In December 2010 the ICBP, reported one and five-year relative survival rates for four cancers (colorectal, lung, breast and ovarian) across participating jurisdictions.

3.230 Sweden reports the highest one and five-year survival rates for breast cancer. The five-year survival rate in the UK and Denmark improved more than the other countries observed.

[15] http://download.thelancet.com/pdfs/journals/lancet/PIIS0140673610622313.pdf?id=5bbe37e152166496:-7a4386c5:134f5042fcb:2b7e1326964060067

Figure 1.4.iii.d – Age-standardised one and five year relative survival trends, breast cancer, 1995-2007



Source: Cancer survival in Australia, Canada, Denmark, Norway, Sweden and the UK, 1995-2007: an analysis of population based cancer registry data. M P Coleman et al. Lancet 2011; 377, 127-38

3.231 Comparisons can be made with other countries using five-year survival data for a subset of OECD member countries. Most countries have survival rates over 80%. Survival rates have increased in all countries reported between 1997-2002 and 2004-2009 (or nearest available period).

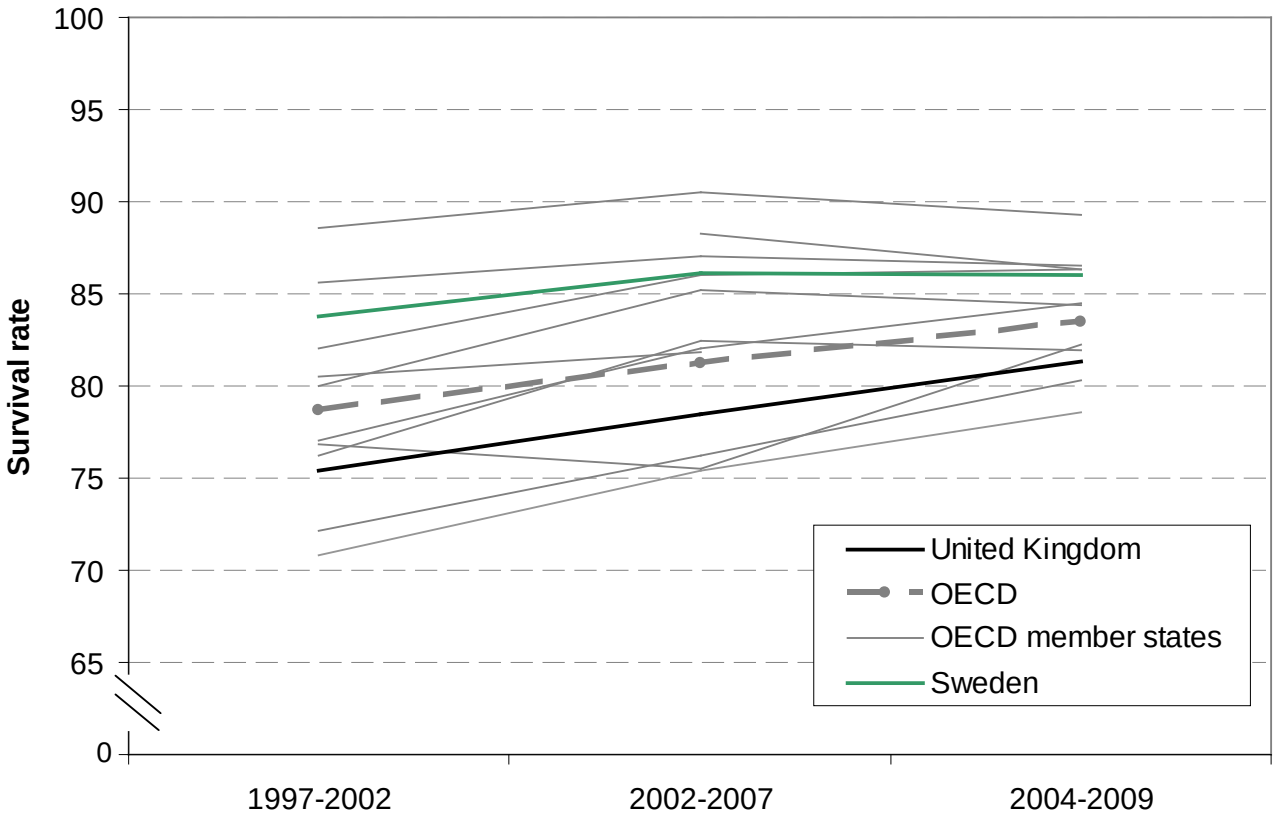
3.232 For patients diagnosed during 2004-2009, the UK has the third lowest five-year survival rate of OECD countries with data available. The five-year survival rate in the UK, however, has been improving faster than the OECD average.

3.233 The OECD highlights variations in the implementation of screening programmes and different improvement rates between middle aged and older patients as possible causes of survival rate differences between countries[16] .

[16] Health at a Glance 2011: OECD indicators, http://www.oecd-ilibrary.org/sites/health_glance-2011-en/05/05/02/index.html?contentType=/ns/StatisticalPublication,/ns/Chapter&itemId=/content/chapter/health_glance-2011-48-en&containerItemId=/content/serial/19991312&accessItemIds=&mimeType=text/html

Figure 1.4.iii.e – Five-year relative survival rate, breast cancer

UK, Sweden, and OECD average (17countries submitting data)



Source: Health at a Glance: OECD indicators

Note: Where data is not available for the period stated, data for the nearest available period is used.

Context: cancer incidence, survival and mortality

3.234 Survival is one of several cancer outcome measures, typically used to gauge the impact of the health system in treating cancer. Incidence defines the number of new cancer cases within a given time period and can be used to understand success in cancer prevention. Breast cancer incidence increases with age as shown in Table 1.4.iii.e below. Mortality rates reflect both survival and incidence.

3.235 Breast cancer is the most commonly diagnosed cancer in females and accounts for 31% of female cancer cases.

Table 1.4.iii.e – Age specific rates (per 100,000) of newly diagnosed cases of breast cancer, females, 2009

Age	Directly standardised rate
15–39	21
40–49	161
50–59	274
60–69	373
70–79	337
80+	424

Source: Cancer Statistics Registrations, England, Series MB1 No. 40, 2009

3.236 In 2009, breast cancer incidence was at the same rate as in 2003, the mortality rate has fallen over the same period as shown in Table 1.4.iii.f below.

Table 1.4.iii.f – Directly age standardised Incidence and mortality rates (per 100,000) for breast cancer, England

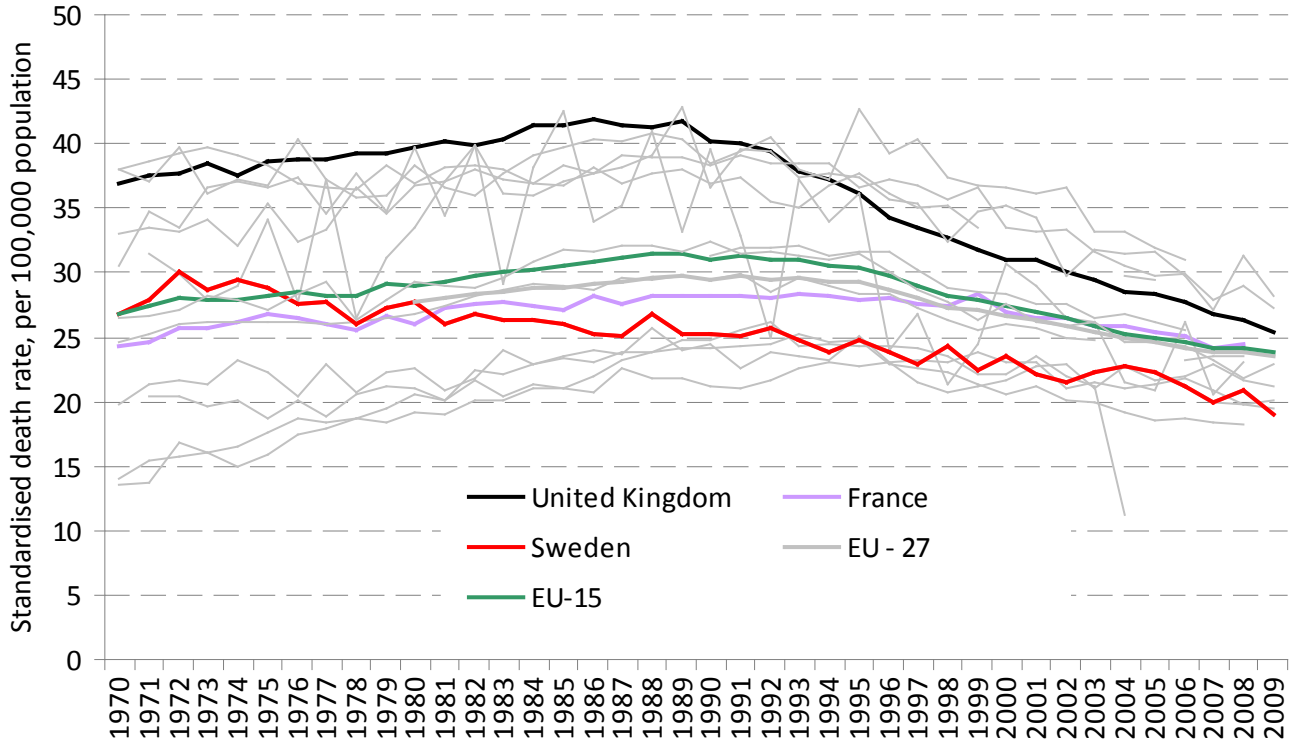
Year	Incidence	Mortality
2000	117	31
2001	118	31
2002	118	30
2003	124	29
2004	124	28
2005	126	28
2006	125	28
2007	123	27
2008	126	26
2009	124	25

Source: Cancer Statistics Registrations, England, Series MB1 No. 40, 2009

3.237 The World Health Organisation (WHO) produces international comparisons for standardised death rates (SDR) for breast cancer. Data is available for the UK, but not England alone.

3.238 Death rates reflect both incidence and survival. The improvements in survival rates identified above are associated with a declining death rate for the UK. Between 1999 and 2009, the SDR for the UK declined from 32 to 25 per cent, a fall of 20%. This change is greater than experienced across the EU-15 average and Sweden (no data available for France 2009).

Figure 1.4.iii.f – Standardised death rate (SDR) malignant neoplasm, female breast, per 100,000 population, UK, EU-15 countries and selected averages



Source: WHO Health for All

Notes:

3.239 There are a number of questions that arise from breast cancer outcomes data:

- Why do breast cancer survival rates not adhere to the general trend of better outcomes among younger populations?
- Why do women aged 40-49 have the highest one-year survival rates, but women aged 50-59 have the highest five-year survival rates?
- What has caused the larger increases in survival among females aged 80 and over than other age groups from diagnoses during 2001-2006 to 2005-2009?
- Are there specific health care initiatives that have caused five-year survival rates to increase faster than one-year survival rates?
- Breast cancer mortality has been declining while incidence rates have been increasing, can specific health care improvements be attributed to improved mortality rates?

Drivers of this indicator

3.240 A recent King's Fund report How to Improve cancer survival: Explaining England's relatively poor rates (June 2011)[17] identified the four main areas that studies have focussed on in attempting to explain international differences in cancer survival:

- stage at diagnosis and diagnostic delay;
- treatment factors;
- patient factors, including age and co-morbidities;
- tumour biology and physiological/biological factors.

3.241 The risk factors for cancer incidence are well documented. The King's Fund identifies evidence that survival can be influenced by the same factors.

3.242 A 2011 British Journal of Cancer supplement sought to estimate the percentage of cancers in the UK in 2010 that were the result of exposure to a set of major lifestyle, dietary and environmental risk factors. Table 1.4.iii.g below shows the contribution of significant risk factors for breast cancer. The figures in the table represent the percentage of female breast cancer cases attributable to each risk factor shown. The values cannot be summed together because cancers have multiple causes that exert their effect simultaneously, so when a cause is identified it is likely not to be the only one.

Table 1.4.iii.g – Percentage of incident breast cancer cases in the UK in 2010 due to lifestyle and environmental factors

Exposure	% attributable
Alcohol	6.4
Excess body weight	8.7
Inadequate physical exercise○	3.4
Exposure to Post-menopausal hormones	3.2
Radiation - ionising	0.9
Occupation^	4.6
Sub-optimal breast-feeding*	3.1

Source: British Journal of Cancer (2011),105 S77-S81
○Level of physical exercise below 30 minutes on at least five days of the week (Department of Health recommendation)
^Exposure to carcinogenic agents, mixtures or circumstances encountered in occupational settings (example, asbestos)
*Optimum: breast feeding of all live-born children for six months

[17] http://www.kingsfund.org.uk/publications/cancer_survival.html

Table 1.4.iii.h – Other drivers of breast cancer

Tobacco use
Illicit drug use
Poor diet
Screening programmes
Prevention, early identification and management of risk factors, including:
Cholesterol
Blood pressure
Diabetes
Chronic kidney disease
Hepatitis B & C
Quality of social care in hospitals and that supports early discharge
Quality of care whilst living at home or in residential care
Mitigation of social isolation
Appropriate use of:
NSAIDs
Statins
Oral contraceptives
Other external drivers:
Socio-economic factors
Environmental factors
Prevalence of co-morbidities
Previous cancer treatment

3.243 Recent trends in improvements in breast cancer survival rates are attributable to non-NHS factors. The application of good practice in the NHS to new cohorts of patients will contribute to continued improvements in survival rates in the short-term.

(b) Indicator 1.4.iii,iv: Current Practice Projections Methodology

3.244 The projections in Table 1.4.iii.i are informed by the methodology used by the London School of Hygiene and Tropical Medicine (LSHTM) to derive future estimates for cancer survival rates. This approach is used to estimate breast cancer survival up to the diagnosis period 2012-2016. The caveats that apply to interpreting this approach are included in section (b) of indicators 1.4.i, ii. The cohort of patients diagnosed in 2012-2016 will be the last to include patients that are currently in contact with the system. A flat projection is used for subsequent cohorts of patients, reflecting the limitations of current practice alone in continuing to improve survival rates.

- Only the most recent data points that have been consistently defined are used for the projections.
- The line of best fit through the last three diagnosis periods is used to estimate the trend in the data.
- The trend is extrapolated for future years, up to 2016. For later diagnosis periods, the projections are flat.

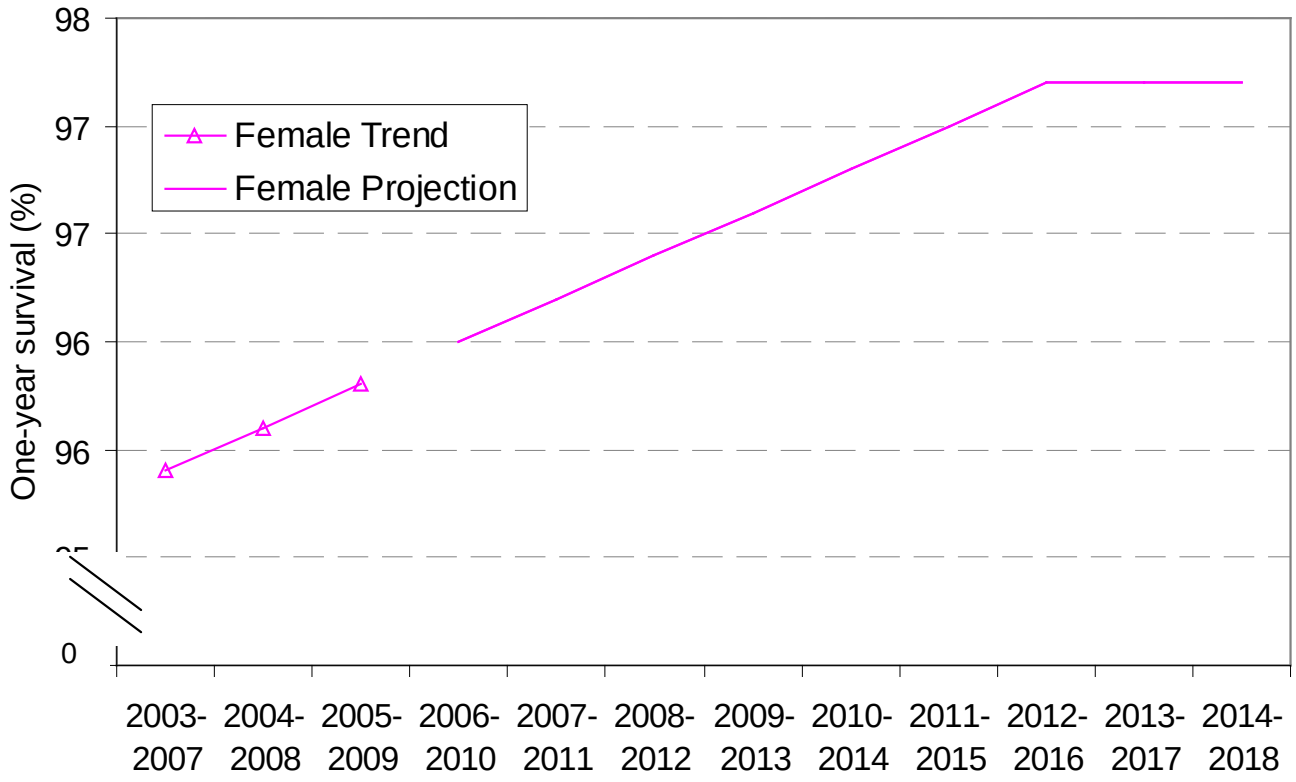
Results

Table 1.4.iii.i – Current practice projections: one-year survival rate, breast cancer

Year	Female		
	Trend	Projection	Projection + P.I .
2003-2007	95.4		
2004-2008	95.6		
2005-2009	95.8		
2006-2010		96.0	96.0
2007-2011		96.2	96.2
2008-2012		96.4	96.4
2009-2013		96.6	96.6
2010-2014		96.8	96.8
2011-2015		97.0	97.0
2012-2016		97.2	97.2
2013-2017		97.2	97.2
2014-2018		97.2	97.2

Source: Office for National Statistics, NHS Information Centre, DH

Figure 1.4.iii.g – Current practice projections: one-year survival rate, breast cancer



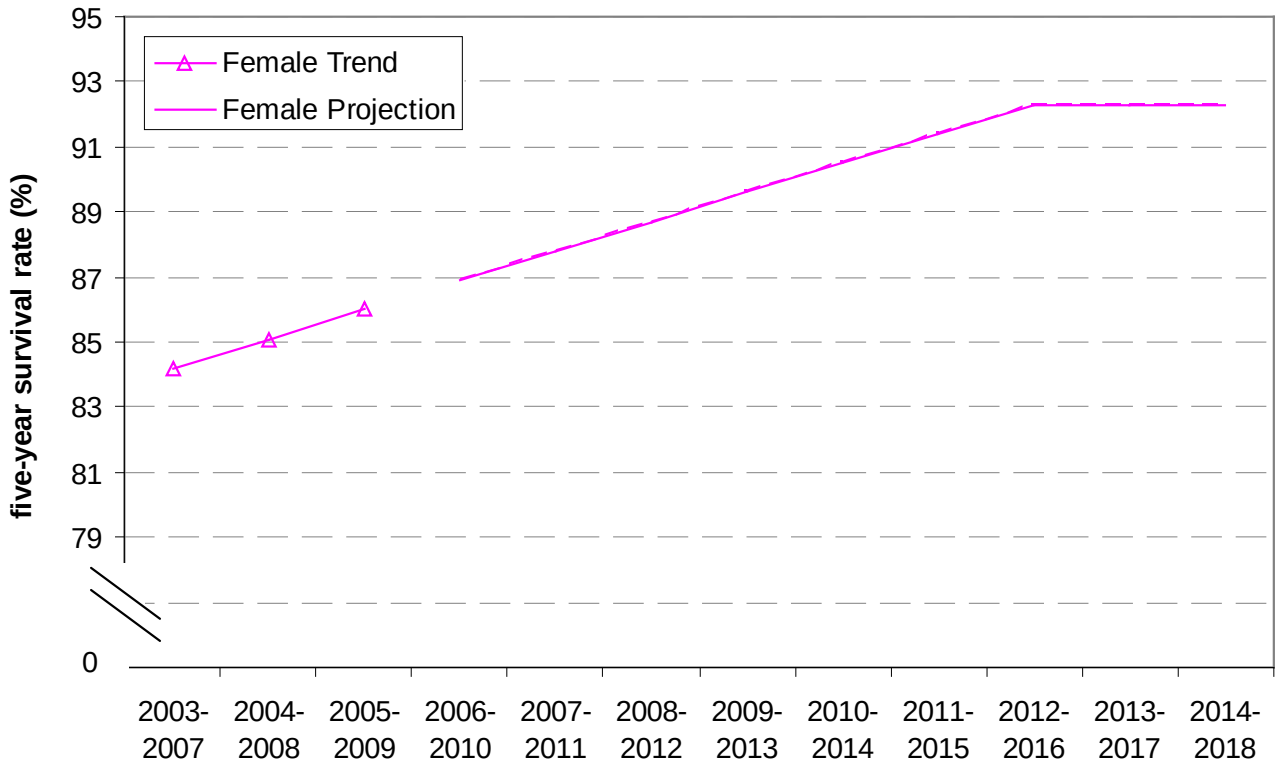
Source: Office for National Statistics, NHS Information Centre, DH

Table 1.4.iii.j – Current practice projections: five-year survival rate, breast cancer

	Female		
Year	Trend	Projection	Projection + P.I.
2003-2007	83.3		
2004-2008	84.2		
2005-2009	85.1		
2006-2010		86.0	86.0
2007-2011		86.9	86.9
2008-2012		87.8	87.8
2009-2013		88.7	88.7
2010-2014		89.6	89.6
2011-2015		90.5	90.5
2012-2016		91.4	91.4
2013-2017		91.4	91.4
2014-2018		91.4	91.4

Source: Office for National Statistics, NHS Information Centre, DH

Figure 1.4.iii.h – Current practice projections: five-year survival rate, breast cancer



Source: Office for National Statistics, NHS Information Centre, DH

(c) Indicator 1.4.iii,iv: Scope for Improvement

3.245 Improvements in survival rates for breast cancer are reflected in progress in the under-75 cancer mortality rate. See Section C of indicator 1.4.vii for further information about improvements in cancer survival rates.

1.4.v,vi – One- and five-year survival from lung cancer

Outcome sought	Reduced years of life lost from lung cancer
Indicator definition	One- and five-year relative survival for adults suffering from lung cancer (ratio of observed survival and survival expected if cancer patients had the same background mortality as the general population)

(a) Indicator 1.4.v,vi: Recent Trends and Explanations

3.246 The one- and five-year survival rates from lung cancer have improved from the cohort of patients diagnosed 1994-1996 to those diagnosed during 2005-2009.

One-year survival from lung cancer

3.247 One-year survival for males diagnosed during 2005-2009 was 29.4%, 0.7 percentage points higher than for those diagnosed during 2004-2008 (28.7%). One-year survival is higher for females, and increased by more over the same period: one-year survival for females diagnosed during 2005-2009 was 33%, an increase of 1.1 percentage points from 2004-2008 (31.9%).

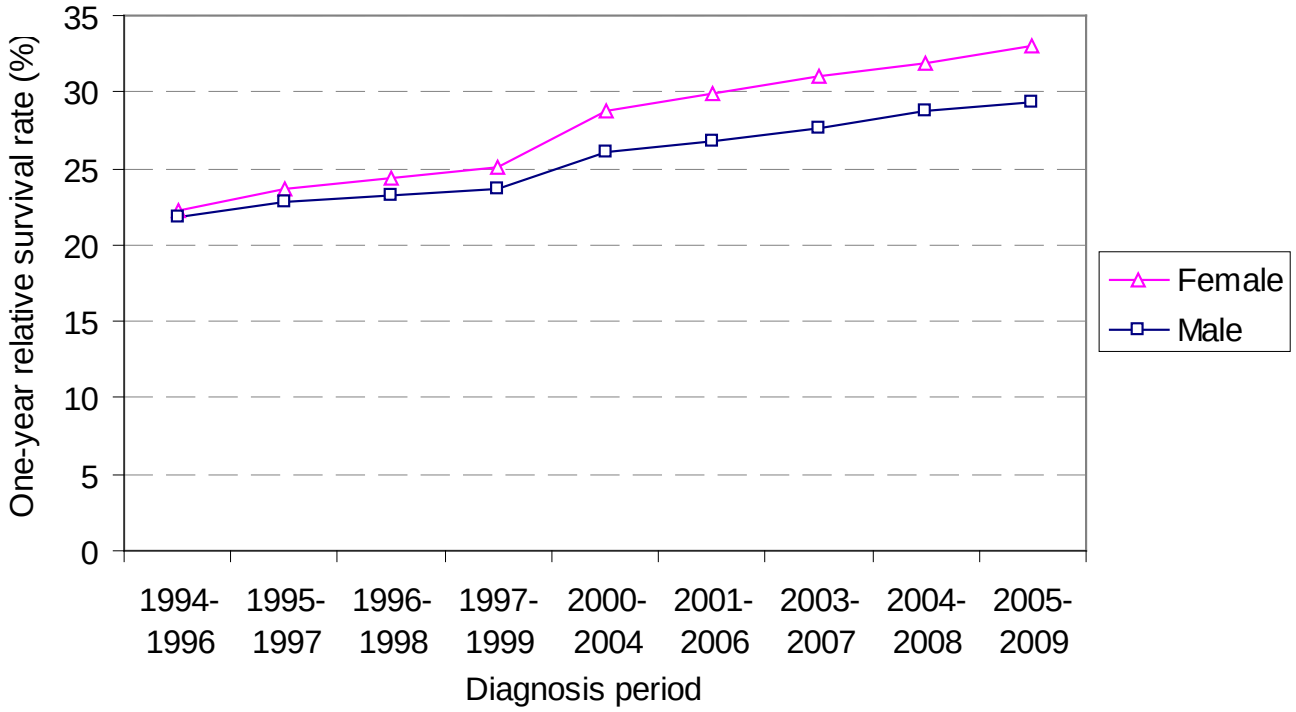
3.248 Although data has been collected since 1994, discontinuities in the time-series mean comparisons cannot be made over the full time period. Considering only the latest continuous time period, diagnoses during 2001-2006 to 2005-2009, one-year survival has increased by 2.6 percentage points for males and 3.1 percentage points for females.

Table 1.4.v.a – One-year relative survival, lung cancer, England

Diagnosis period	Males	Females
1994-1996	21.8	22.3
1995-1997	22.8	23.6
1996-1998	23.3	24.4
1997-1999	23.7	25.1
2000-2004	26.1	28.8
2001-2006	26.8	29.9
2003-2007	27.7	31
2004-2008	28.7	31.9
2005-2009	29.4	33

Source: Office for National Statistics, NHS Information Centre, DH

Figure 1.4.v.a – one-year relative survival for lung cancer by sex



Source: Office for National Statistics
Note: There are discontinuities on the x-axis.

Five-year survival from lung cancer

3.249 Five-year survival from lung cancer has been improving but rates remain below 10% in the latest diagnosis period (2005-2009), 8.2% for men and 9.3% for women.

3.250 Male five-year survival rates have increased by 1.3 percentage points, from 6.9% to 8.2% over the fully continuous time period (2001-2006 to 2005-2009). The same comparison cannot be made for females as data for the latest years have not been standardised[18] .

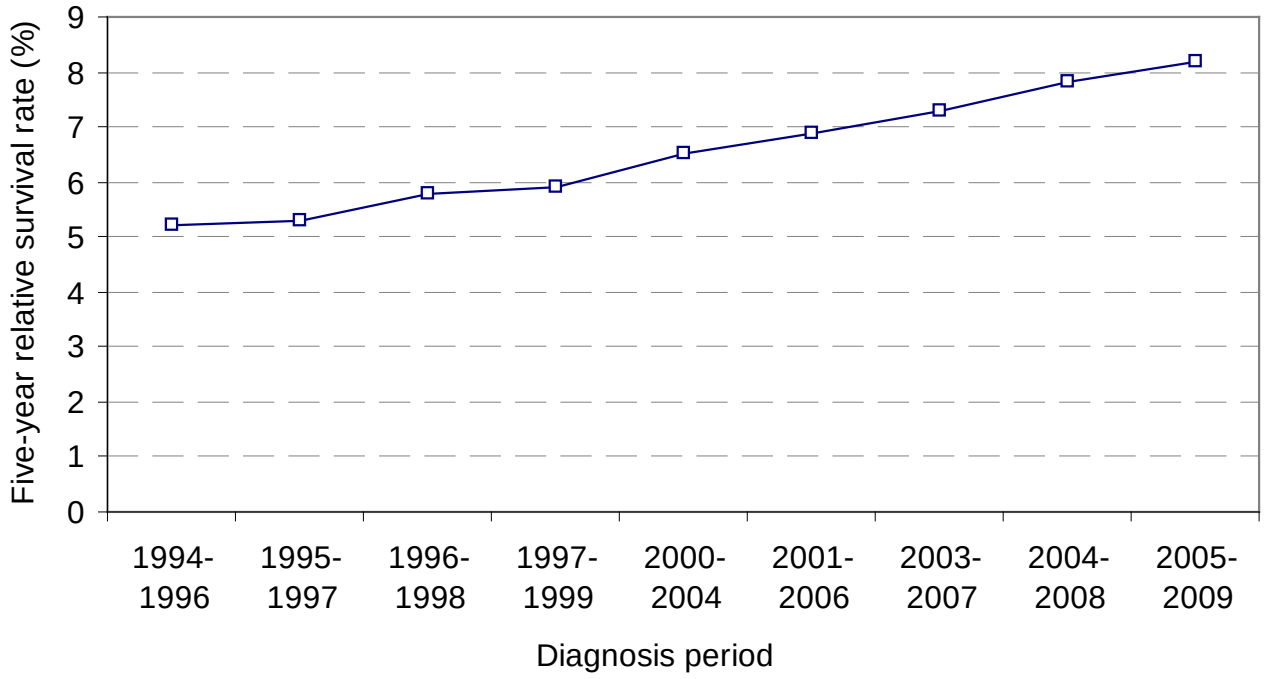
[18] Low numbers of deaths in the 15-39 age-group were insufficient to calculate age-standardised percentages for diagnosis periods since 2003-2007.

Table 1.4.v.b – five-year relative survival from lung cancer, males (age-standardised rate)

Diagnosis period	Males
1994-1996	5.2
1995-1997	5.3
1996-1998	5.8
1997-1999	5.9
2000-2004	6.5
2001-2006	6.9
2003-2007	7.3
2004-2008	7.8
2005-2009	8.2

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.v.b – five-year relative survival from lung cancer, males (age-standardised rate)



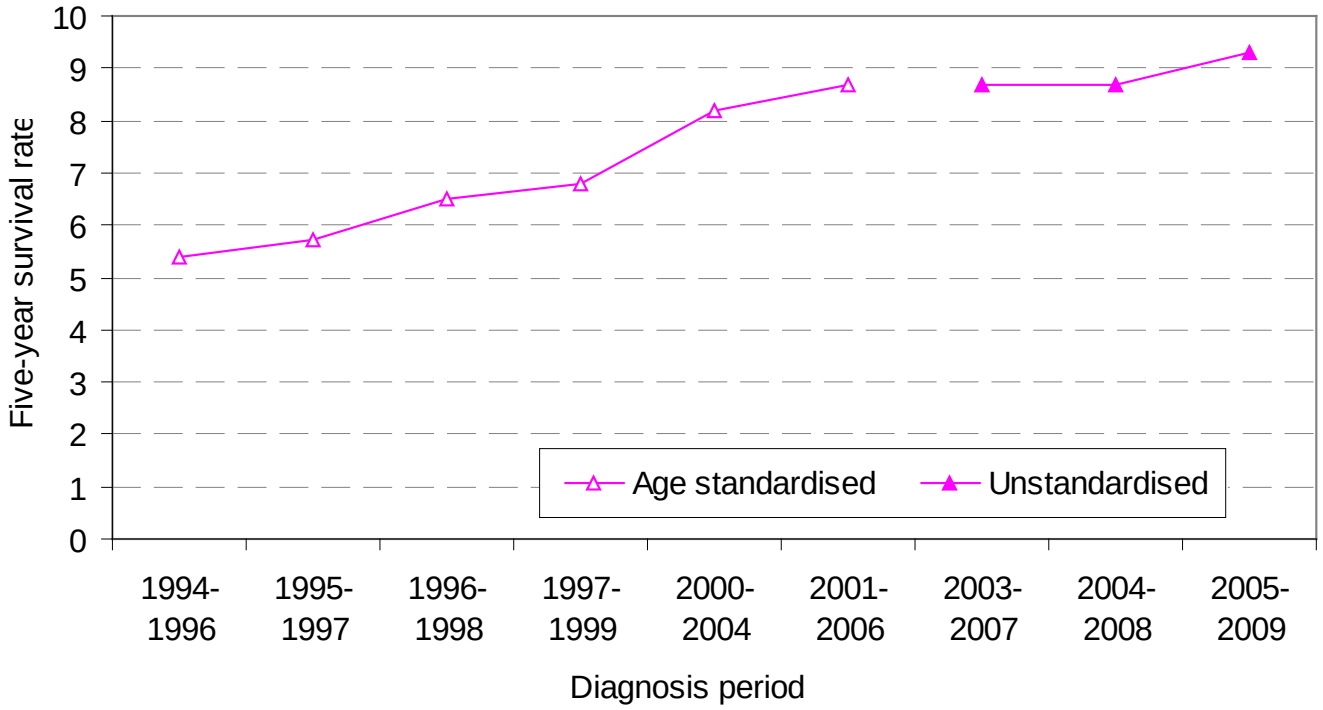
Source: Office for National Statistics, NHS Information Centre
Note: There are discontinuities on the x-axis.

Table 1.4.v.c – five-year relative survival from lung cancer, females

Diagnosis period	Females
1994-1996	5.4
1995-1997	5.7
1996-1998	6.5
1997-1999	6.8
2000-2004	8.2
2001-2006	8.7
2003-2007	8.7
2004-2008	8.7
2005-2009	9.3

Note: Data for females diagnosed since 2003-2007 (inclusive) are not age standardised.

Figure 1.4.v.c – five-year relative survival from lung cancer, females



Source: Office for National Statistics
Note 1: There are discontinuities on the x-axis.
Note 2: Data for females diagnosed since 2003-2007 (inclusive) are not age standardised.

Breakdown by age

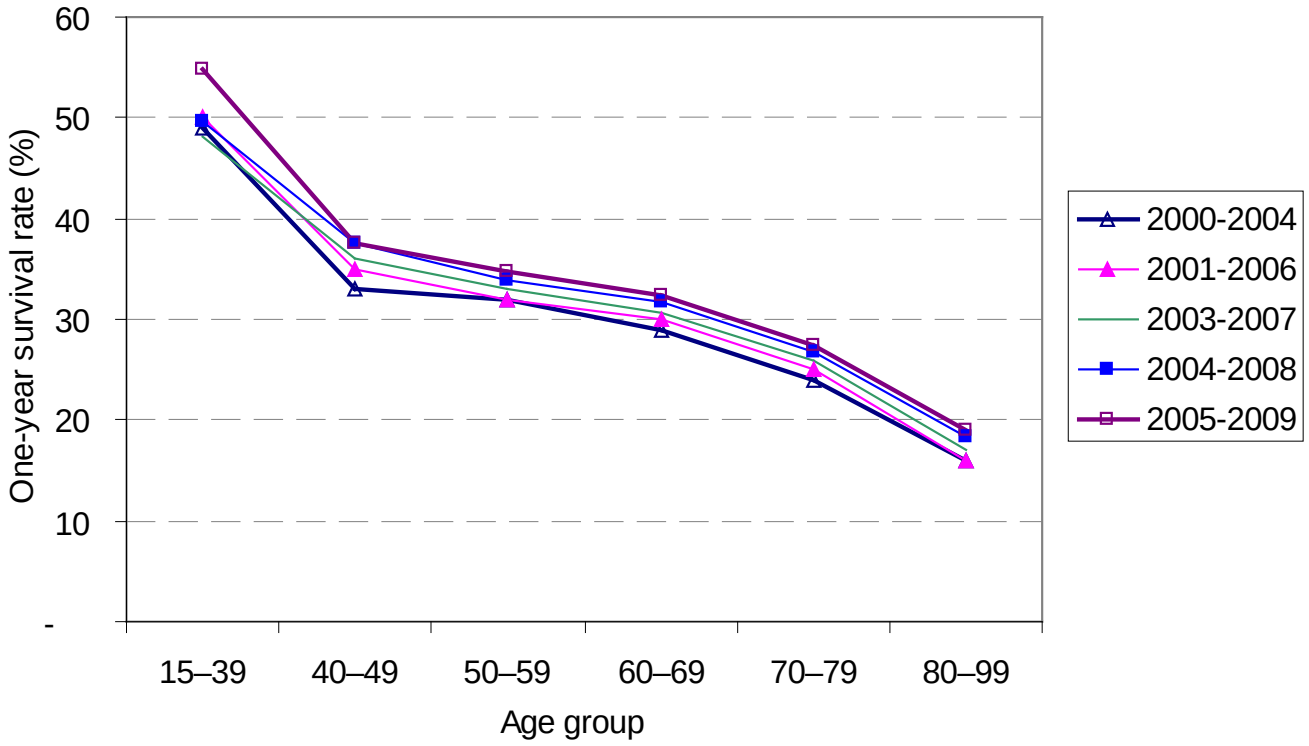
3.251 **One-year survival from lung cancer.** As with the general patterns for cancer survival by age, one-year survival rates for lung cancer are higher among younger patients with lower survival among the elderly, even after taking into account the higher background mortality in older patients. The difference in survival rates between those aged 15-39 and the 40-49 age group is more marked than the gap in survival rates between any other age groups.

Table 1.4.v.d – one-year relative survival from lung cancer by age group, males

Male	15–39	40–49	50–59	60–69	70–79	80–99	All ages
2000-2004	49.0	33.0	32.0	29.0	24.0	16.0	26.1
2001-2006	50.0	35.0	32.0	30.0	25.0	16.0	26.8
2003-2007	48.1	36.0	33.0	30.7	25.9	17.1	27.7
2004-2008	49.5	37.5	33.9	31.7	26.8	18.4	28.7
2005-2009	54.9	37.5	34.6	32.4	27.5	18.9	29.4

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.v.d – one-year relative survival from lung cancer by age group, males



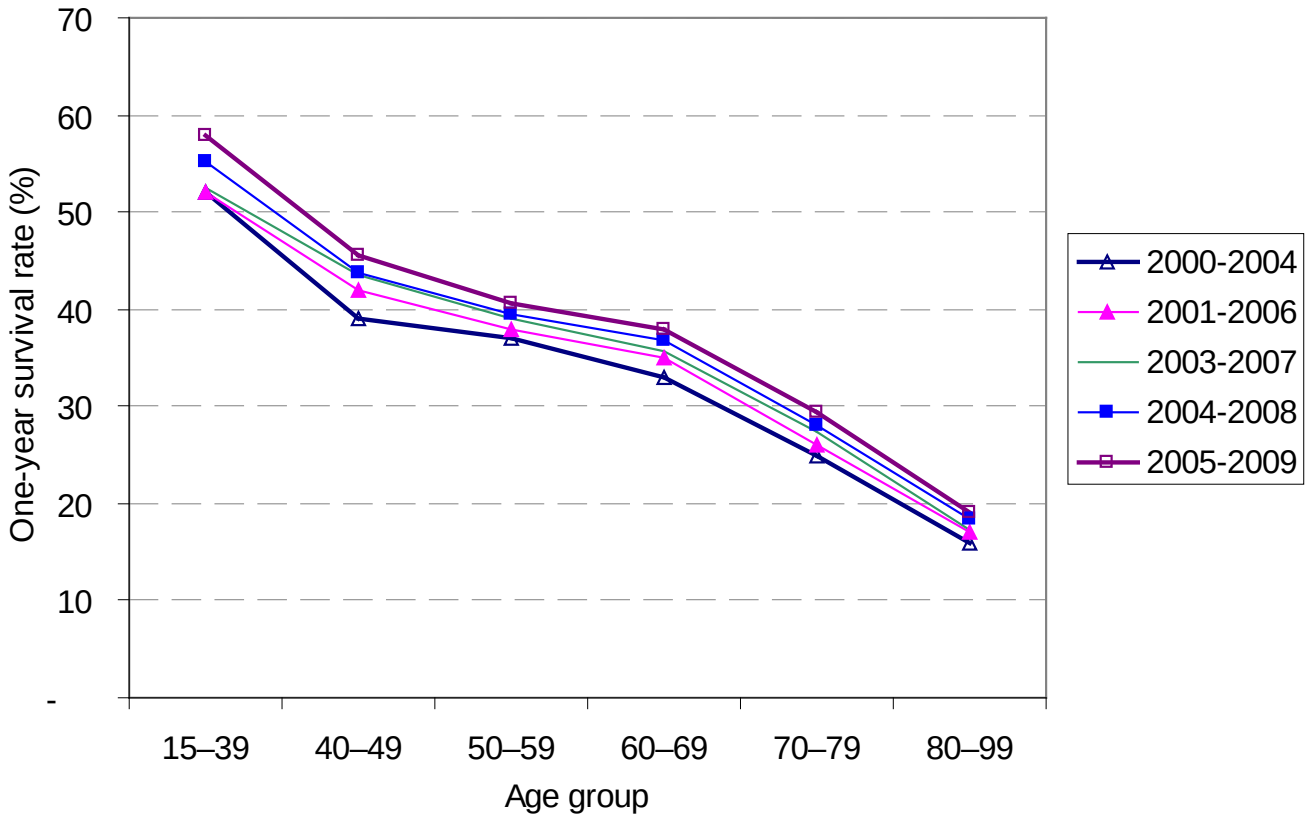
Source: Office for National Statistics

Table 1.4.v.e – one-year relative survival from lung cancer by age group, females

Female	15–39	40–49	50–59	60–69	70–79	80–99	All ages
2000-2004	52.0	39.0	37.0	33.0	25.0	16.0	28.8
2001-2006	52.0	42.0	38.0	35.0	26.0	17.0	29.9
2003-2007	52.5	43.6	39.0	35.6	27.5	17.3	31.0
2004-2008	55.1	43.7	39.6	36.7	28.1	18.5	31.9
2005-2009	57.8	45.4	40.7	37.8	29.5	19.1	33.0

Source: Office for National Statistics

Figure 1.4.v.e – one-year relative survival from lung cancer by age group, females



Source: Office for National Statistics

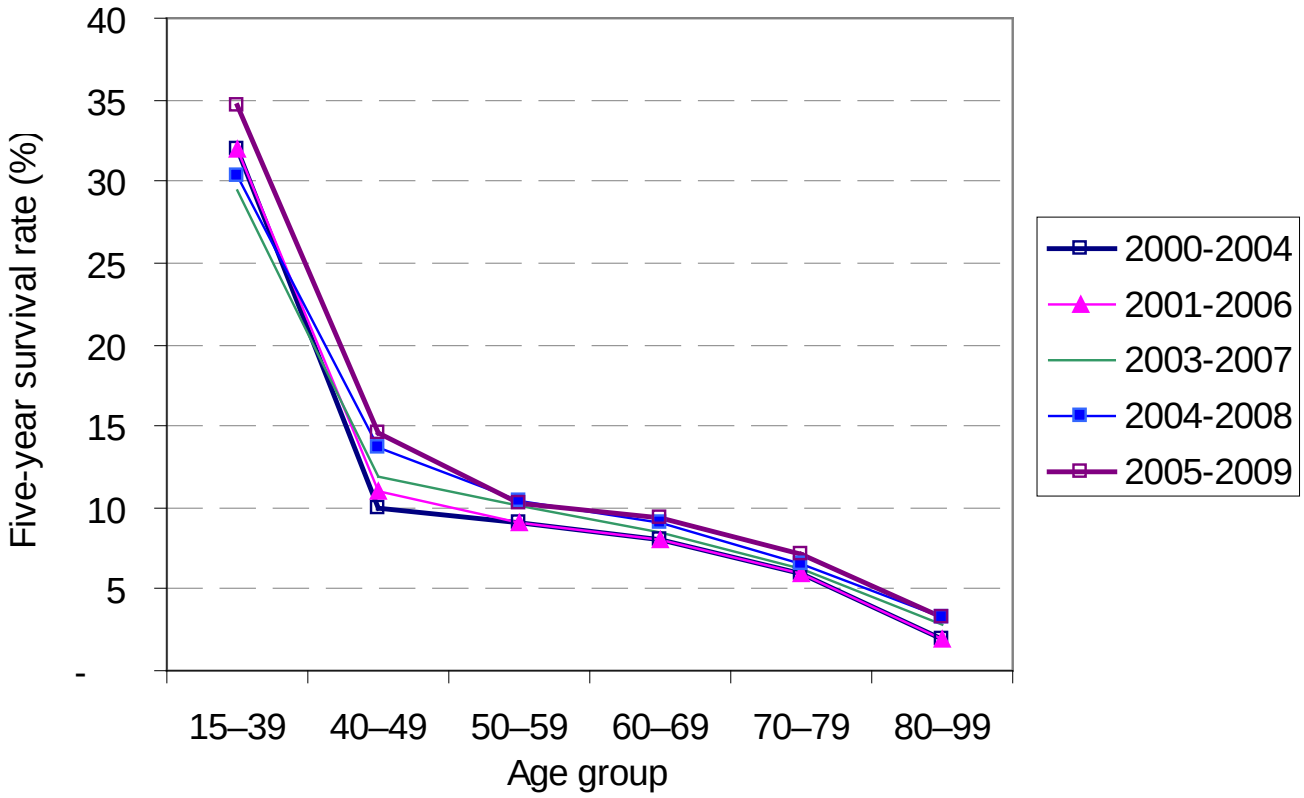
3.252 **Five-year survival from lung cancer.** The pattern of age related one-year survival rates is replicated for five-year survival. The difference in survival rates between those aged 15-39 and 40-49 is greater than for one-year survival. For males, the survival rate for those aged 15-39 is more than twice as high as five-year survival for those aged 40-49.

Table 1.4.v.f – one-year relative survival from lung cancer by age group, males

Male	15–39	40–49	50–59	60–69	70–79	80–99	All ages
2000-2004	32.0	10.0	9.0	8.0	6.0	2.0	6.5
2001-2006	32.0	11.0	9.0	8.0	6.0	2.0	6.9
2003-2007	29.5	11.9	10.1	8.4	6.2	2.9	7.3
2004-2008	30.3	13.6	10.4	9.1	6.6	3.3	7.8
2005-2009	34.7	14.6	10.2	9.4	7.1	3.3	8.2

Source: Office for National Statistics, NHS Information Centre

Figure 1.4.v.f – one-year relative survival from lung cancer by age group, males



Source: Office for National Statistics

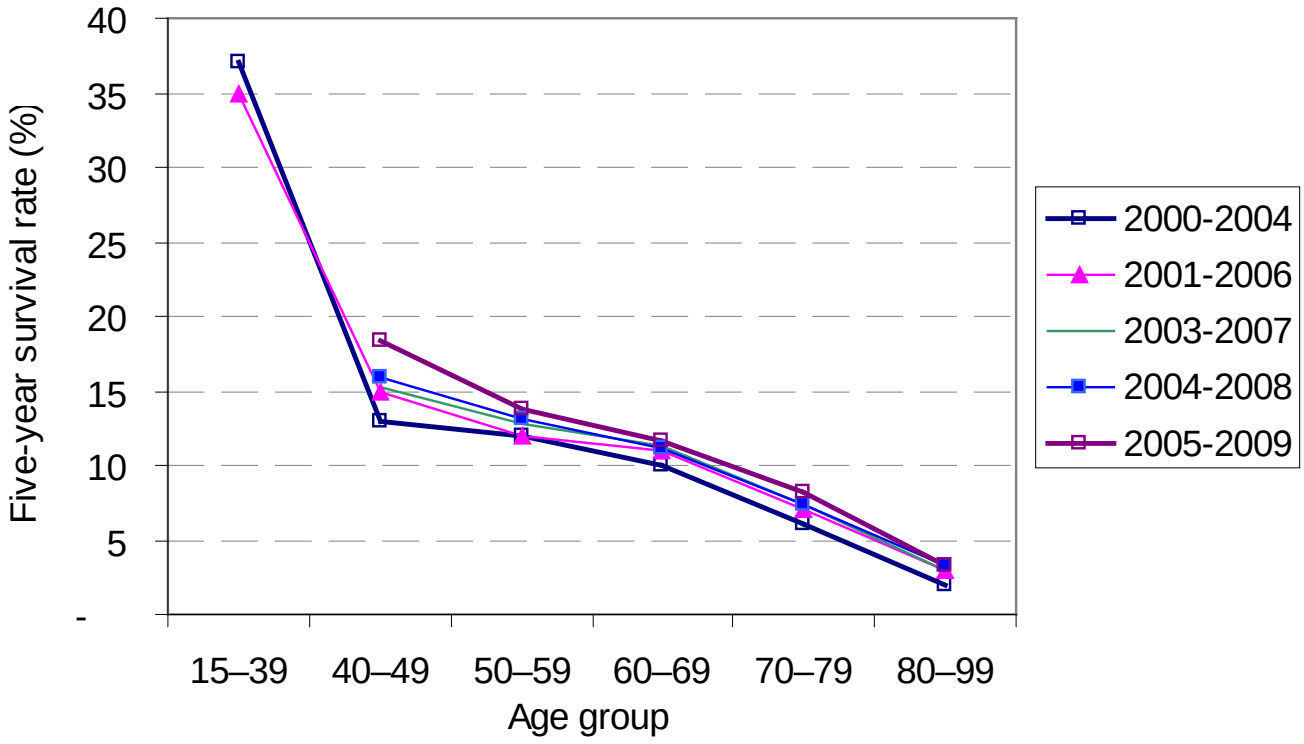
3.253 It is not currently possible to estimate the five-year survival rate for females aged 15-39 due to the small numbers of deaths in this age group.

Table 1.4.v.g – one-year relative survival from lung cancer by age group, females

Female	15–39	40–49	50–59	60–69	70–79	80–99	All ages
2000-2004	37.0	13.0	12.0	10.0	6.0	2.0	8.2
2001-2006	35.0	15.0	12.0	11.0	7.0	3.0	8.7
2003-2007		15.3	12.8	11.4	7.4	3.0	8.7
2004-2008		16.0	13.1	11.1	7.4	3.3	8.7
2005-2009		18.3	13.7	11.7	8.3	3.3	9.3

Source: Office for National Statistics, NHS Information Centre
Note: insufficient data to calculate survival rates for females aged 15-39 from 2003-2007

Figure 1.4.v.g – one-year relative survival from lung cancer by age group, females



Source: Office for National Statistics

International position

3.254 The International Cancer Benchmarking Partnership (ICBP) has established a programme to investigate international cancer survival disparities. The six participating countries are identified as having "comparable wealth, universal access to health care and longstanding, high-quality, population based cancer registration"[19] . The six countries are: Australia, Canada, Denmark, Sweden, Norway and the UK.

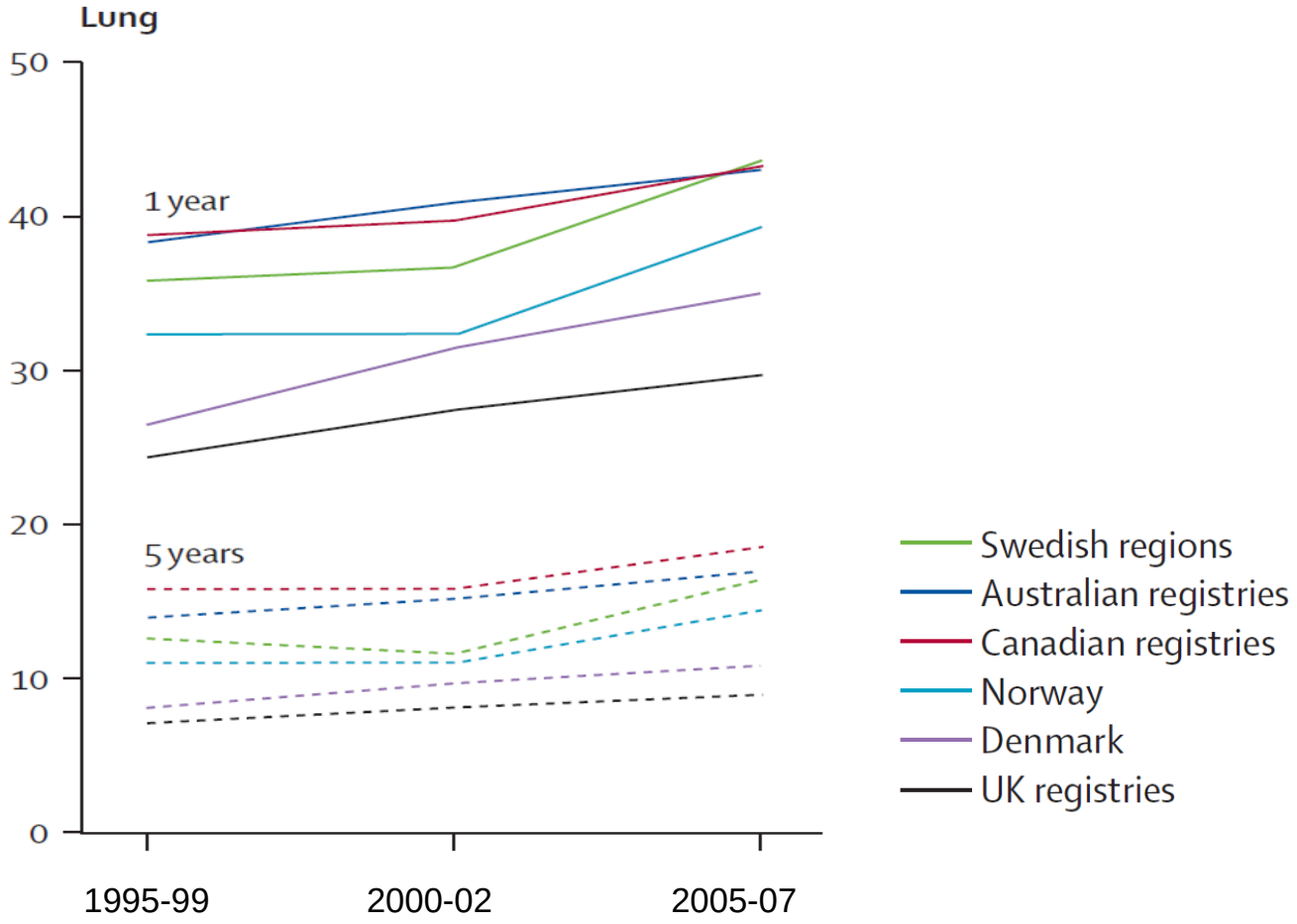
3.255 In December 2010 the ICBP, reported one and five-year relative survival rates for four cancers (colorectal, lung, breast and ovarian) across participating jurisdictions.

3.256 Australia, Sweden and Canada report the highest one- and five- year survival rates for lung cancer. The difference in survival rates between the UK and the country with the highest survival rates in each time period has declined from 1995 to 2005.

[19] http://download.thelancet.com/pdfs/journals/lancet/PIIS0140673610622313.pdf?id=5bbe37e152166496:-7a4386c5:134f5042fcb:2b7e1326964060067

Figure 1.4.v.h – one and five year relative survival from lung cancer

1995-2007, ICBP participating countries



Source: Cancer survival in Australia, Canada, Denmark, Norway, Sweden and the UK, 1995-2007: an analysis of population based cancer registry data. M P Coleman et al. Lancet 2011; 377, 127-38

Context: cancer incidence, survival and mortality

3.257 Survival is one of several cancer outcome measures, typically used to gauge the impact of the health system in treating cancer. Incidence defines the number of new cancer cases within a given time period and can be used to understand success in cancer prevention. Mortality rates reflect both survival and incidence.

3.258 Lung cancer accounts for 15% of newly diagnosed cases of cancer in males and 12% of new cases in females.

3.259 Table 1.4.v.h below shows incidence rates of lung cancer, by age, in 2009. Incidence increases with age and is higher amongst males than females, except for the age group 40-49.

Table 1.4.v.h Age specific rates (per 100,000 population) of newly diagnosed cases of lung cancer, 2009

Age	Directly standardised rate	
	Males	Females
15–39	1.0	0.8
40–49	10.4	11.9
50–59	58.4	50.8
60–69	190.7	132.2
70–79	384.2	237.9
80 and over	533.4	266.5

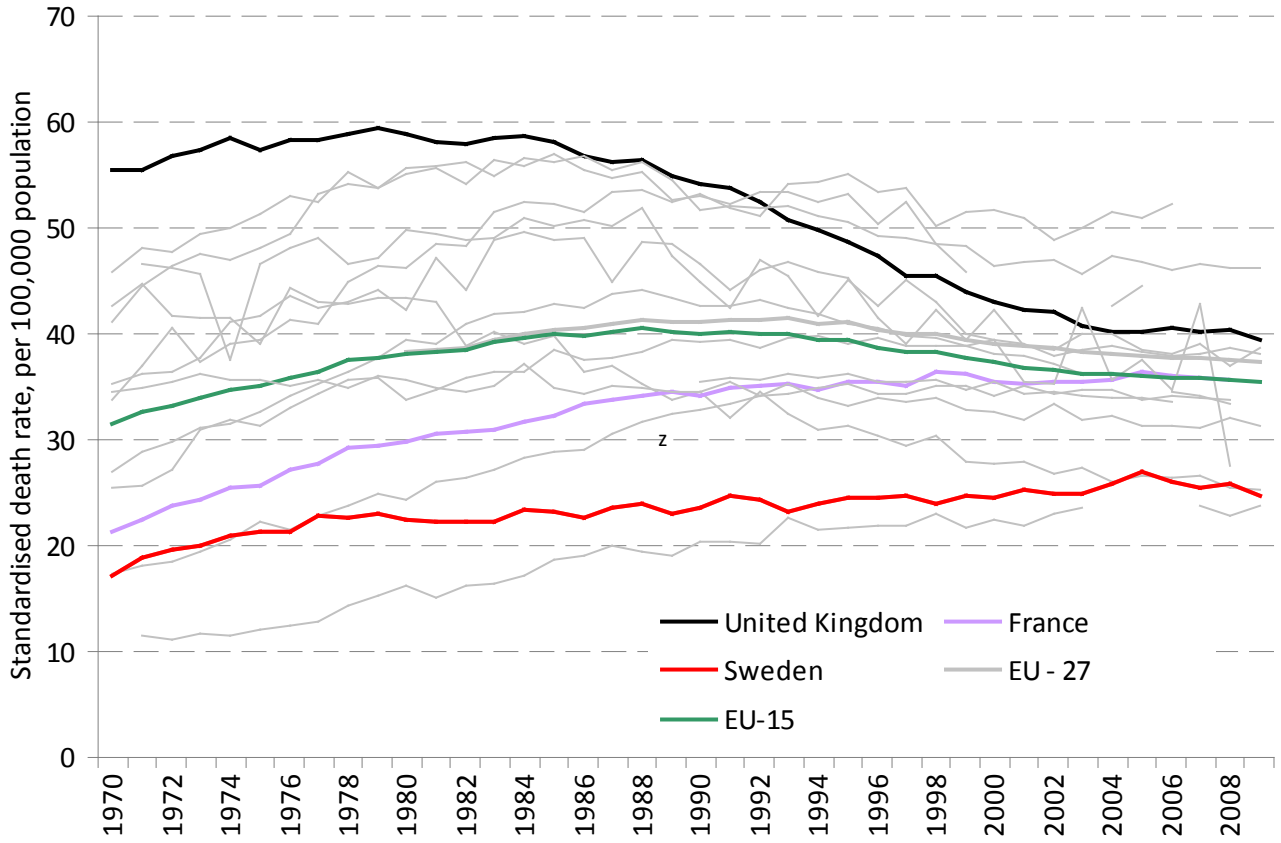
Source: Cancer Statistics Registrations, England, Series MB1 No.40, 2009

3.260 The World Health Organisation (WHO) produces international comparisons for standardised death rates (SDR) for breast cancer. Data is available for the UK, but not England alone.

3.261 Death rates reflect both incidence and survival. The improvements in survival rates identified above are associated with a declining death rate for the UK. Death rates from lung cancer have narrowed across EU member countries over time. The UK has higher reported death rates from lung cancer than the EU average but the difference is narrowing over time. Sweden has consistently reported lung cancer mortality rates below the EU average. The SDR for lung cancer in Sweden in 2009 was 25%, compared to 39% in the UK.

Figure 1.4.v.i – Standardised death rate (SDR) trachea, bronchus, lung cancer- persons (per 100,000 population)

UK, EU-15 countries and selected averages



Source: WHO Health for All

Notes:

3.262 There are a number of questions that arise from lung cancer survival rates data:

- Why is there a significant reduction in survival rates between the 15-39 and 40-49 age groups?
- Between the cohort of patients diagnosed during 2001-2006 and those diagnosed during 2005-2009, one-year survival has improved most for those aged 15-39, why has the biggest improvement been seen in this age group?
- The difference between male and female incidence rates increases with age, what is driving this result?

Drivers of this indicator

3.263 A recent King's Fund report How to Improve cancer survival: Explaining England's relatively poor rates (June 2011) [1] identified the four main areas that studies have focussed on in attempting to explain international differences in cancer survival:

- Stage at diagnosis and diagnostic delay
- Treatment factors
- Patient factors, including age and co-morbidities
- Tumour biology and physiological/biological factors

3.264 The risk factors for cancer incidence are well documented. The King's Fund identifies evidence that survival can be influenced by the same factors.

3.265 A 2011 British Journal of Cancer supplement[2] sought to estimate the percentage of cancers in the UK in 2010 that were the result of exposure to a set of major lifestyle, dietary and environmental risk factors. Table 1.4.v.i below shows the contribution of significant risk factors for lung cancer. The figures in the table represent the percentage of lung cancer cases attributable to each risk factor shown. The values cannot be summed together because cancers have multiple causes that exert their effect simultaneously.

Table 1.4.v.i Percentage of incident lung cancer cases in the UK in 2010 due to lifestyle and environmental factors

Exposure	% attributable	
	Male	Female
Tobacco	87.3	83.6
Deficient intake of fruit & vegetables*	8.5	9.3
Radiation - ionising	4.2	5.4
Occupation^	20.5	4.3

Source: British Journal of Cancer (2011),105 S77-S81

* deficient intake defined as consumption of fruit and vegetables lower than 5x80g or 400g per day (Department of Health recommendation)

^Exposure to carcinogenic agents, mixtures or circumstances encountered in occupational settings (example, asbestos)

Table 1.4.v.j Other drivers of lung cancer

1. Public health and social care drivers
Radon gas
Industrial carcinogens
Physical activity
Diet
Alcohol consumption
2. Other external drivers
Previous cancer treatment

3.266 Recent trends in improvements in lung cancer survival rates are attributable to non-NHS factors. The application of good practice in the NHS to new cohorts of patients will contribute to continued improvements in survival rates in the short-term.

(b) Indicator 1.4.v,ii: Current Practice Projections Methodology

3.267 The projections in Tables 1.4.v.k and 1.4.v.l are informed by the methodology used by the London School of Hygiene and Tropical Medicine (LSHTM) to derive future estimates for cancer survival rates. This approach is used to estimate lung cancer survival up to the diagnosis period 2012-2016. The caveats that apply to interpreting this approach are included in section (b) of indicators 1.4.i, ii. The cohort of patients diagnosed in 2012-2016 will be the last to include patients that are currently in contact with the system. A flat projection is used for subsequent cohorts of patients, reflecting the limitations of current practice alone, in continuing to improve survival rates.

- Only the most recent data points that have been consistently defined are used for the projections.
- The line of best fit through the last three diagnosis periods is used to estimate the trend in the data.
- The trend is extrapolated for future years, up to 2016. For later diagnosis periods, the projections are flat.

3.268 Insufficient data has been available to derive age-standardised five-year relative survival rates for females since the diagnosis period 2003-2007. So, five-year lung cancer survival rate projections for females are unstandardised.

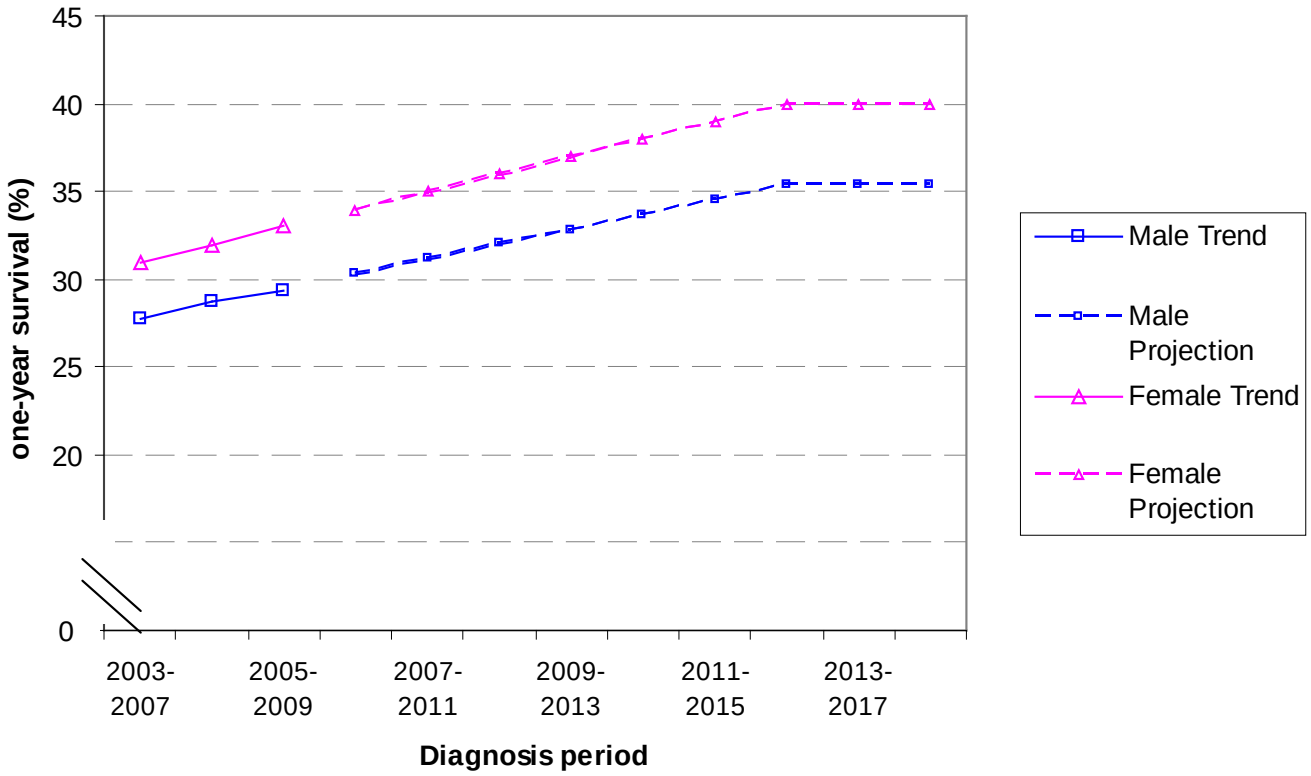
Results

Table 1.4.v.k Current practice projections for one-year survival rates from lung cancer (%)

Year	Male			Female		
	Trend	Projection	Projection + P.I.	Trend	Projection	Projection + P.I.
2003-2007	27.7			31.0		
2004-2008	28.7			31.9		
2005-2009	29.4			33.0		
2006-2010		30.3	30.2		34.0	33.9
2007-2011		31.2	31.1		35.0	34.9
2008-2012		32.0	31.9		36.0	35.9
2009-2013		32.9	32.8		37.0	36.9
2010-2014		33.7	33.6		38.0	37.9
2011-2015		34.6	34.5		39.0	38.9
2012-2016		35.4	35.3		40.0	39.9
2013-2017		35.4	35.3		40.0	39.9
2014-2018		35.4	35.3		40.0	39.9

Source: Office for National Statistics, NHS Information Centre, DH

Figure 1.4.v.j – Current practice projections for one-year survival rates from lung cancer (%)



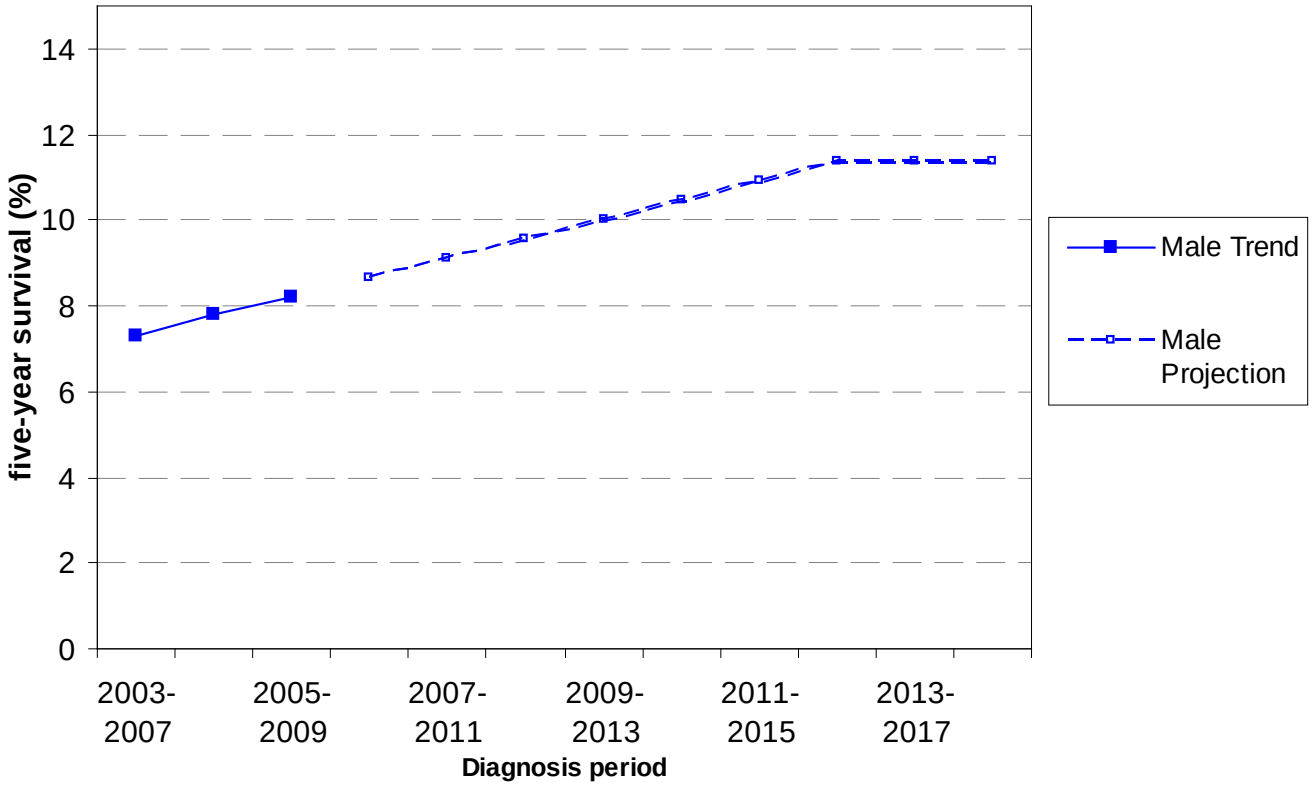
Source: Office for National Statistics, NHS Information Centre, DH

Table 1.4.v.l Current practice projections for five-year survival rates from lung cancer (%), males

Year	Male		
	Trend	Projection	Projection + P.I.
2003-2007	7.3		
2004-2008	7.8		
2005-2009	8.2		
2006-2010		8.7	8.6
2007-2011		9.1	9.1
2008-2012		9.6	9.5
2009-2013		10.0	10.0
2010-2014		10.5	10.4
2011-2015		10.9	10.9
2012-2016		11.4	11.3
2013-2017		11.4	11.3
2014-2018		11.4	11.3

Source: Office for National Statistics, NHS Information Centre, DH

Figure 1.4.v.k Current practice projections for five-year survival rates from lung cancer (%), males



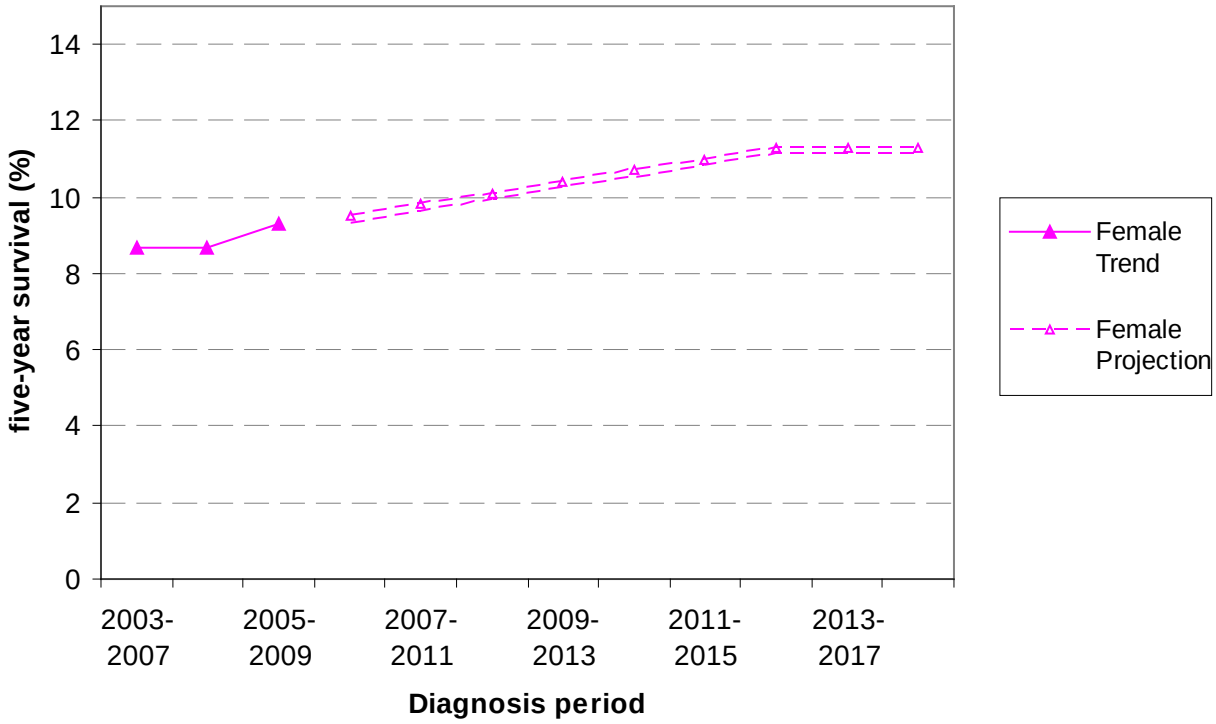
Source: Office for National Statistics, NHS Information Centre, DH

Table 1.4.v.m Current practice projections for five-year survival rates from lung cancer (%), females

Year	Female		
	Trend	Projection	Projection + P.I.
2003-2007	8.7		
2004-2008	8.7		
2005-2009	9.3		
2006-2010		9.5	9.3
2007-2011		9.8	9.6
2008-2012		10.1	9.9
2009-2013		10.4	10.2
2010-2014		10.7	10.5
2011-2015		11.0	10.8
2012-2016		11.3	11.1
2013-2017		11.3	11.1
2014-2018		11.3	11.1

Source: Office for National Statistics, NHS Information Centre
Note: Data is not age-standardised

Figure 1.4.l Current practice projections for five-year survival rates from lung cancer (%), females



Source: Office for National Statistics, NHS Information Centre
Note: Data is not age-standardised

(c) Indicator 1.4.v,vi: Scope for Improvement

3.269 Improvements in survival rates for lung cancer are reflected in progress in the under 75 cancer mortality rate. See Section C of indicator 1.4.vii for further information about improvements in cancer survival rates.

References

1. C. Foot and T. Harrison, How to Improve Cancer Survival: Explaining England's relatively poor rates. The King's Fund. 09/06/2011. http://www.kingsfund.org.uk/publications/cancer_survival.html (accessed 28/05/2011)

2. D M Parkin, The fraction of cancer attributable to lifestyle and environmental factors in the UK in 2010. British Journal of Cancer (2011), 105, S2 – S76

1.4.vii – Under 75 mortality rate from cancer

Outcome sought	Reduced premature mortality from cancer.
Indicator definition	Mortality rate from cancer, ages under 75, per 100,000 population.

(a) Indicator 1.4.vii: Recent Trends and Explanations

3.270 The mortality rate from cancer for under 75s fell by approximately 1.7% between 2009 and 2010, from 110.0 to 108.1 deaths per 100,000 population.

3.271 There has been a continual decline in cancer mortality since around 1990, with rates fairly constant prior to this. Since 2001, mortality rates have declined by 14.3%, with an average annual decline of 1.7%.

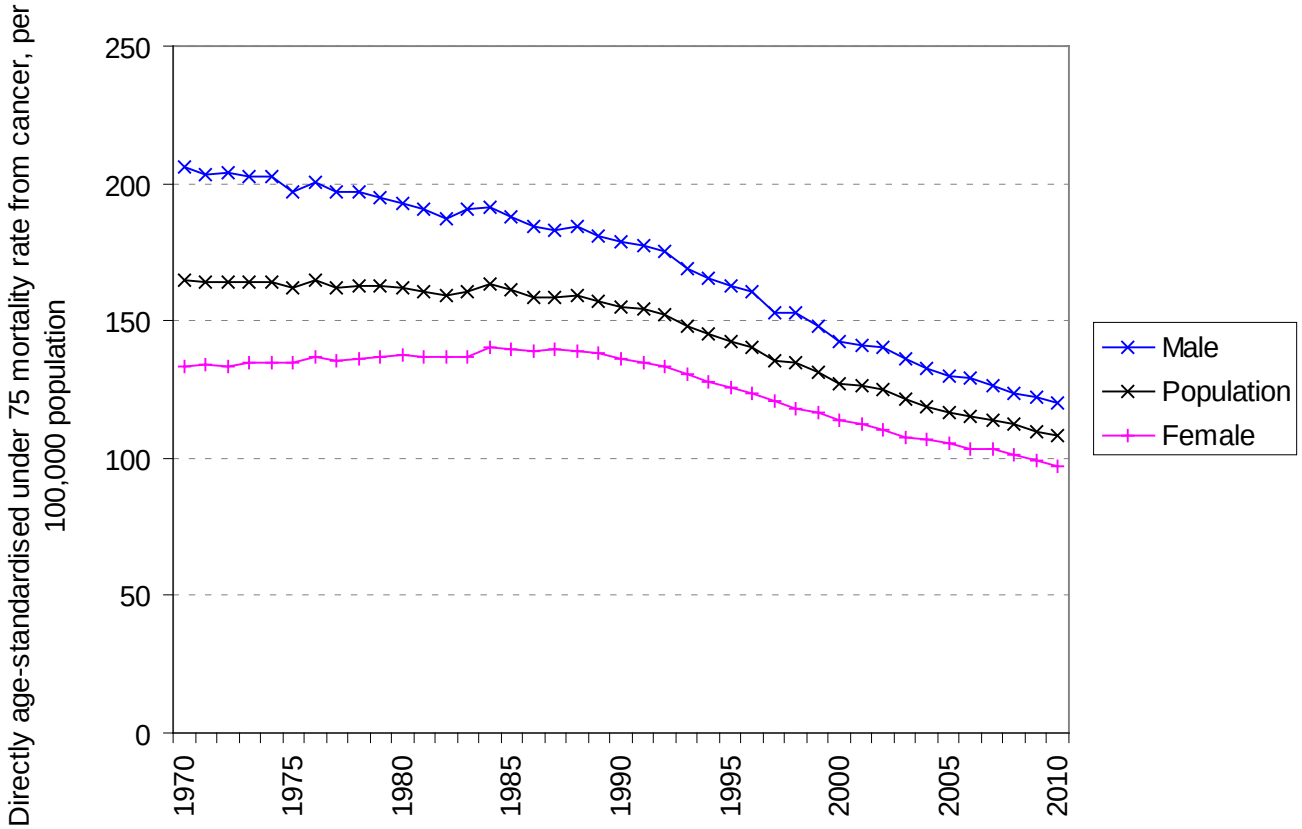
3.272 Despite the gap between male and female rates decreasing since 1990, the mortality rate of males is still approximately 23% higher than that for females. Male cancer mortality fell by 15.1% from 2001 to 2010, compared to 13.6% for females.

Table 1.4.vii.a – Directly age-standardised under 75 mortality rate from cancer, males, females and persons per 100,000 population

	Male	Female	Population
1969	207.0	134.0	165.2
1970	206.3	133.2	164.6
1971	203.5	134.0	163.9
1972	204.2	133.5	164.0
1973	202.7	134.5	164.1
1974	202.6	134.8	164.3
1975	197.2	135.0	162.1
1976	200.6	137.2	165.0
1977	196.9	135.2	162.2
1978	197.1	136.1	162.9
1979	194.9	137.1	162.5
1980	193.1	137.4	161.8
1981	190.3	136.8	160.3
1982	187.5	137.1	159.2
1983	190.3	136.9	160.4
1984	191.4	140.7	163.1
1985	187.7	140.0	161.0
1986	184.2	138.8	158.8
1987	182.7	139.3	158.5
1988	184.6	139.2	159.3
1989	181.0	138.6	157.3
1990	178.7	136.2	155.3
1991	177.5	134.7	154.0
1992	175.0	133.1	152.1
1993	169.0	130.3	147.9
1994	165.7	127.7	145.0
1995	162.5	125.9	142.6
1996	160.4	123.6	140.6
1997	153.2	120.7	135.7
1998	153.0	118.3	134.5
1999	148.4	116.8	131.5
2000	142.6	113.8	127.2
2001	141.3	112.6	126.1
2002	140.6	110.6	124.8
2003	136.5	107.8	121.3
2004	132.5	106.6	118.8
2005	129.8	105.2	116.8
2006	128.8	103.4	115.5
2007	126.1	103.1	114.0
2008	123.9	101.6	112.2
2009	122.0	98.9	110.0
2010	119.9	97.3	108.1
Average annual decline 2001-2010	1.8%	1.6%	1.7%

Source: NHS Information Centre

Figure 1.4.vii.a – Directly age-standardised under 75 mortality rate from cancer, males, females and persons per 100,000 population



Source: NHS Information Centre

Breakdown by condition

3.273 Of the five cancers responsible for the greatest numbers of deaths, three have shown significant declines since 2001. The largest contribution to overall declines has come from reductions in breast and lung cancer mortality, with breast cancer mortality falling by 6.5% from 2009 to 2010, and lung cancer mortality falling by 0.9%.

3.274 Breast cancer mortality rates have shown strong declines due to a combination of widespread screening, increased specialisation of care and the use of tamoxifen in treatment. Mortality rates for pancreatic and oesophageal cancer have, however, remained relatively stable, with limited efficacy of treatment making incidence rates the most important determinant. Sustained declines in colorectal mortality have been achieved through earlier diagnosis and better treatment.

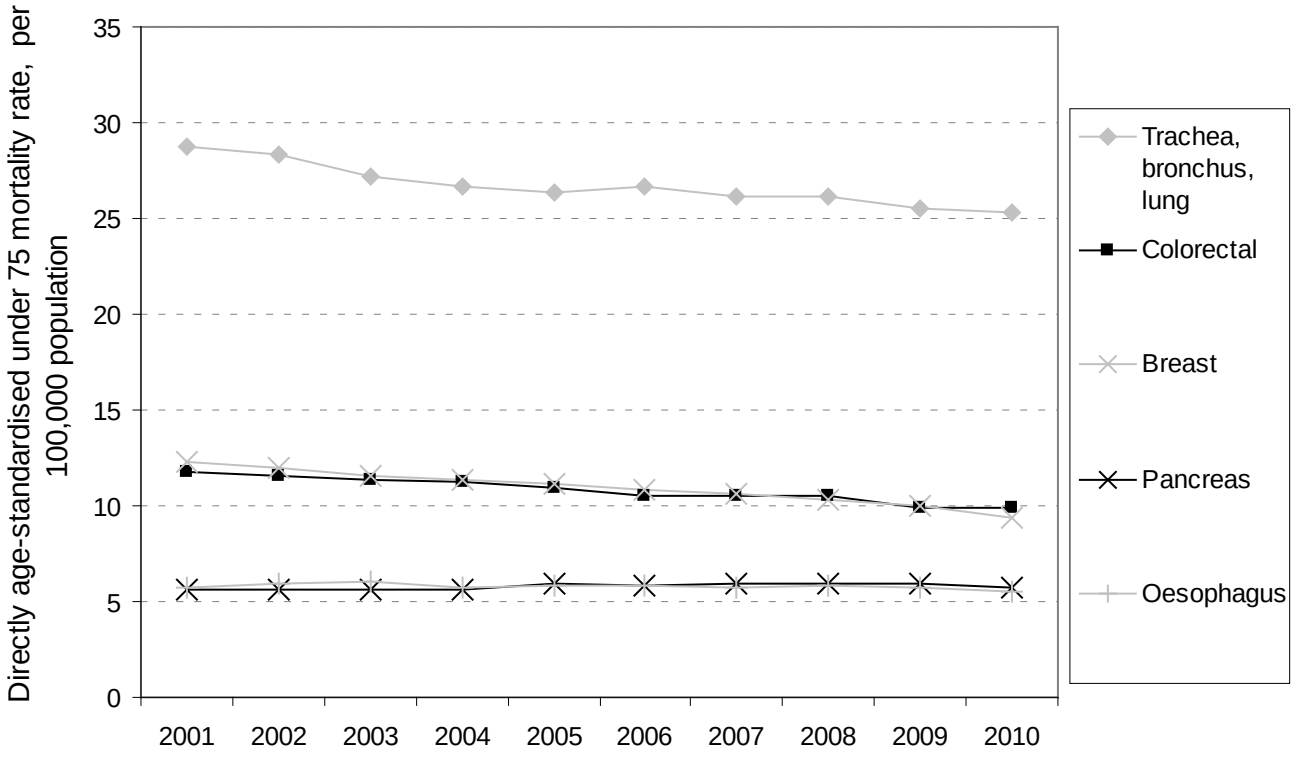
3.275 Lung cancer continues to kill significantly more people under 75 than any other cancer. The well established relationship between smoking and lung cancer means that very strong cohort effects are visible in the data. Declines in smoking prevalence have played an important role in reducing lung cancer mortality over the past decade.

Table 1.4.vii.b – Directly age-standardised under 75 mortality rates, persons per 100,000 population, by specific cancer (5 highest mortality rates)

	Trachea, bronchus, lung	Breast	Colorectal	Pancreatic	Oesophagus
2001	28.7	12.3	11.8	5.9	5.7
2002	28.4	12.0	11.6	6.0	5.9
2003	27.2	11.6	11.3	6.0	6.0
2004	26.7	11.3	11.2	6.0	5.7
2005	26.3	11.1	10.9	6.3	5.8
2006	26.7	10.9	10.5	6.3	5.8
2007	26.2	10.6	10.5	6.4	5.7
2008	26.1	10.3	10.5	6.3	5.8
2009	25.5	10.0	9.9	6.4	5.7
2010	25.3	9.4	9.9	6.2	5.5
Average annual decline	1.4%	3.0%	-1.9%	-0.5%	0.3%

Source: NHS Information Centre

Figure 1.4.vii.b – Directly age-standardised under 75 mortality rate, persons per 100,000 population, by specific cancer (5 highest mortality rates)



Source: NHS Information Centre

3.276 Of the remaining cancers, six have declined over the last decade, with the greatest improvement in stomach cancer mortality (a fall of 36%). This has been driven primarily by falling incidence rates. In general, falling incidence rates, earlier detection and increased efficacy of treatment have led to lower mortality rates for malignant cancers. However, liver and uterine cancer mortality rates have increased steadily over the period, in line with incidence data.

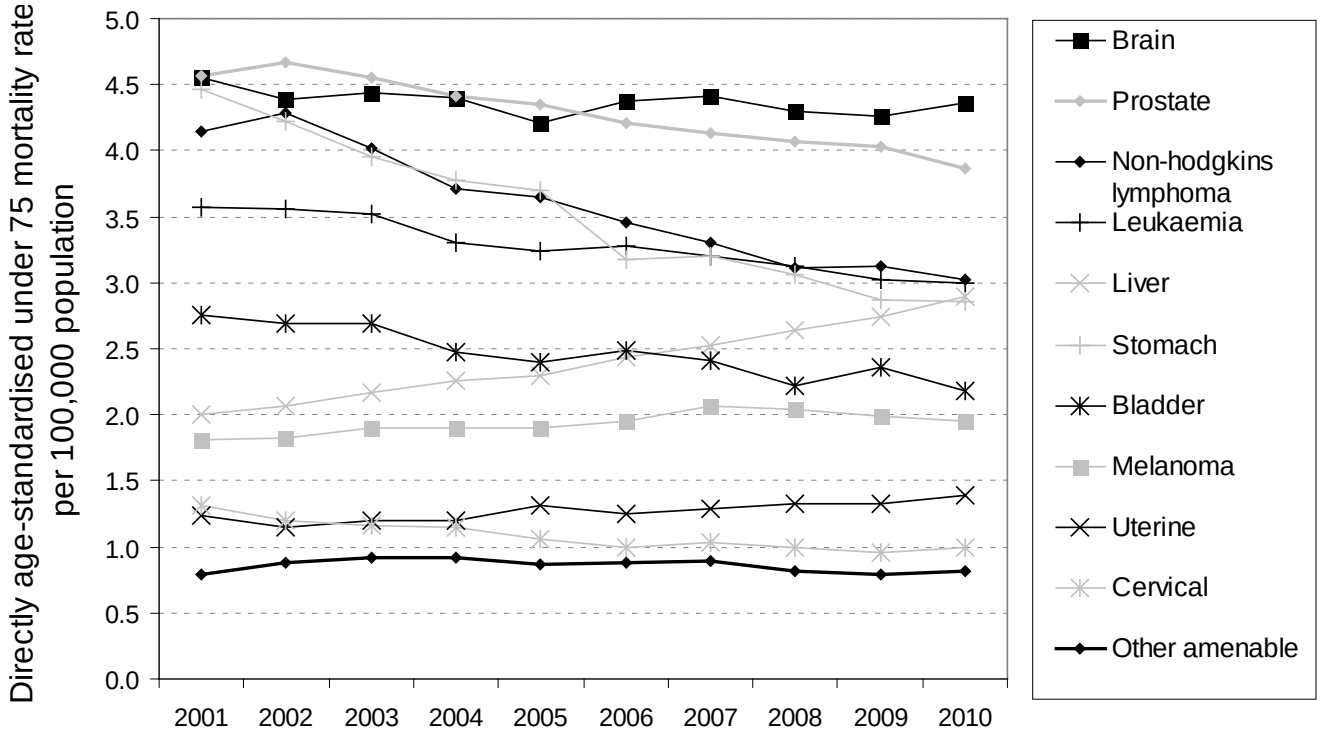
3.277 Mortality rates for melanoma have remained stable over the last decade, as rising incidence rates have been partially negated by improved treatment and earlier detection.

Table 1.4.vii.c – Directly age-standardised under 75 mortality rates, persons per 100,000 population, by specific cancer

	Brain	Prostate	Non-Hodgkin's lymphoma	Leukaemia	Liver	Stomach	Bladder	Melanoma	Uterine	Cervical	Othe amer
2001	4.55	4.57	4.15	3.57	2.01	4.46	2.75	1.81	1.23	1.31	
2002	4.39	4.66	4.28	3.55	2.07	4.22	2.69	1.82	1.14	1.20	
2003	4.44	4.55	4.02	3.51	2.16	3.95	2.69	1.90	1.20	1.16	
2004	4.40	4.41	3.71	3.30	2.26	3.78	2.48	1.90	1.20	1.15	
2005	4.21	4.35	3.64	3.24	2.30	3.70	2.40	1.90	1.31	1.06	
2006	4.37	4.21	3.46	3.27	2.43	3.17	2.48	1.96	1.26	1.00	
2007	4.41	4.13	3.30	3.20	2.53	3.20	2.41	2.06	1.28	1.03	
2008	4.30	4.07	3.11	3.13	2.64	3.07	2.22	2.04	1.33	1.00	
2009	4.25	4.04	3.12	3.03	2.74	2.87	2.36	1.99	1.32	0.96	
2010	4.36	3.86	3.02	3.00	2.89	2.85	2.18	1.95	1.39	0.99	
Average annual decline	0.47%	1.85%	3.47%	1.90%	-4.13%	4.84%	2.57%	-0.82%	-1.32%	3.07%	-0

Source: NHS Information Centre

Figure 1.4.vii.c – Directly age-standardised under 75 mortality rate, persons per 100,000 population, by specific cancer



Source: NHS Information Centre

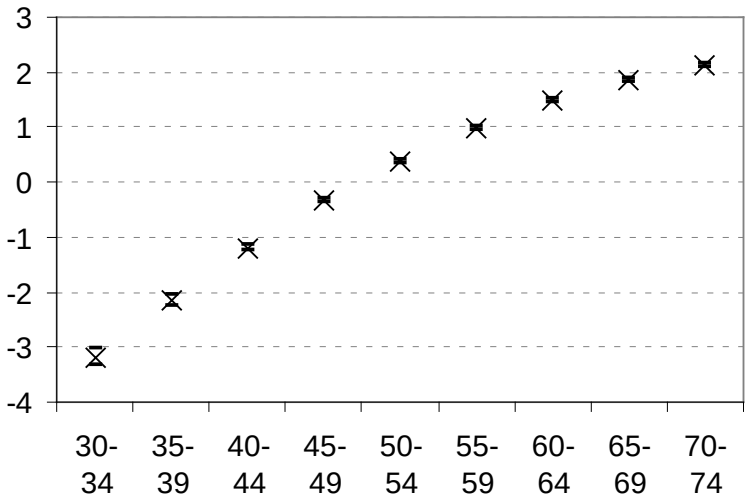
Cohort Analysis

3.278 Age-Period-Cohort (APC) analysis has been applied to lung, colorectal, breast, oesophageal, prostate and stomach cancers. APC Modelling attempts to attribute changes in mortality to the three characteristics listed in the name. Cohort effects capture those characteristics common to people born at roughly the same time that affect their susceptibility to illness and robustness in recovery.

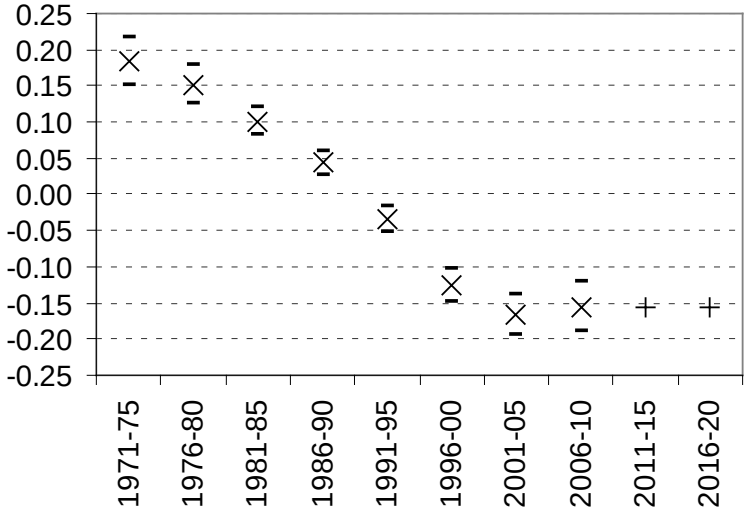
3.279 Such characteristics are distinguished by the fact that the factors determining them affect only those people of a particular age group. They are more likely therefore to be determined during peoples' formative years (including in utero). Age effects capture the morbidity consequences of how old an individual is, whilst the period effect encapsulates all contemporaneous factors affecting the entire population at risk, such as the quality of healthcare provision. In the case of mortality from cancer, it is smoking behaviour that has most definitively been established as a cause of strong cohort effects, but other long term behaviours are also implicated (alcohol, eating habits etc).

3.280 These charts show the estimated coefficients respectively for each age group, time period and birth cohort– which can be interpreted as showing their relative contribution to mortality rates. The coefficients for each of the three characteristics are designed to sum to 0, meaning that any coefficient above zero indicates that a specific value for that characteristic has contributed to above average (for the entire period / population studied) mortality rates. 95% confidence intervals are presented to demonstrate the differing levels of uncertainty around each coefficient estimate. These charts also include the projected coefficients used in calculating the current practice projection – discussed below.

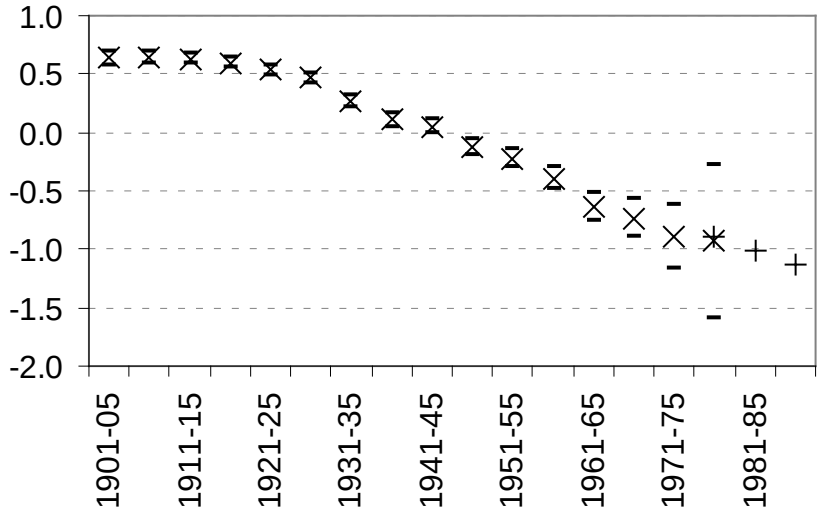
Lung cancer – Males – Age effect coefficients



Lung cancer – Males – Period effect coefficients



Lung cancer – Males – Cohort effect coefficients

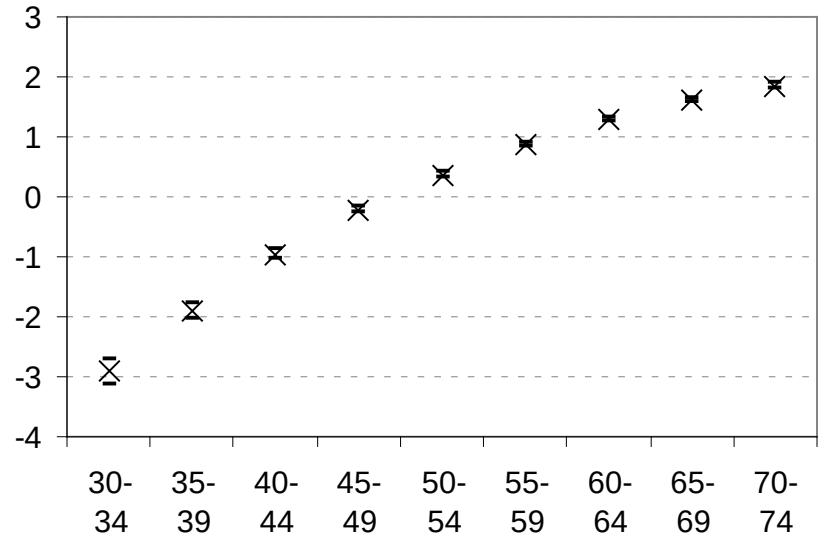


Summary

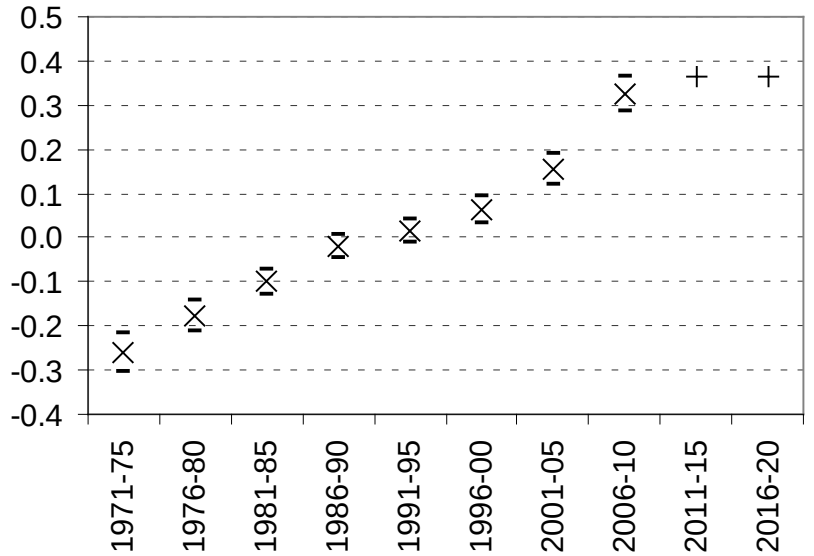
The period effect for male lung cancer mortality declined from 1971 to 2005, since when it appears to have stabilised.

The cohort effect has declined consistently since its peak in 1901-05 (associated with the high rates of young adult smoking in and around WWI). The magnitude of the cohort effect is significantly larger than the period effect.

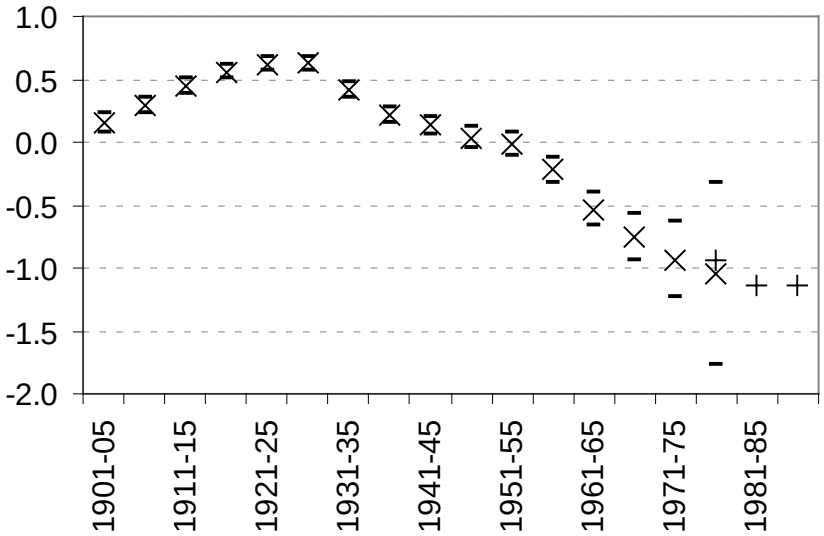
Lung cancer – Females – Age effect coefficients



Lung cancer – Females – Period effect coefficients



Lung cancer – Females – Cohort effect coefficients

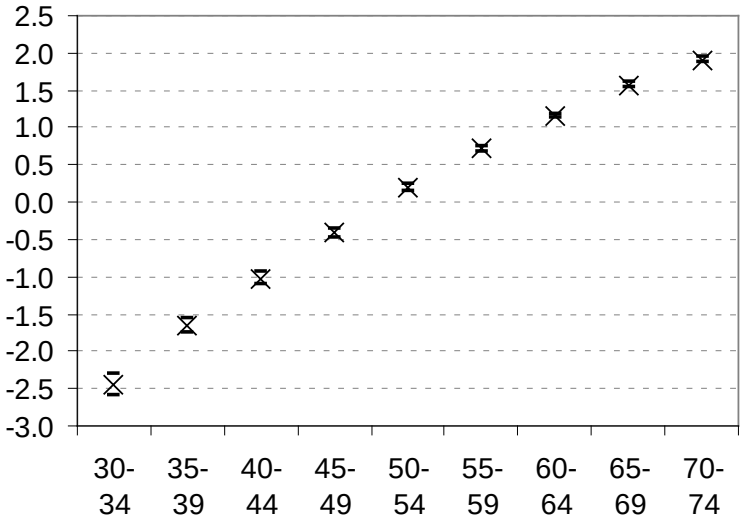


Summary

The period effect for female lung cancer mortality has increased steadily since 1971. Although the magnitude of the period effect is smaller than the cohort effect, it is still significant, and it is not clear what has driven the change. A possible contemporaneous link to smoking behaviour via cessation rates has been proposed, but this is yet to be examined.

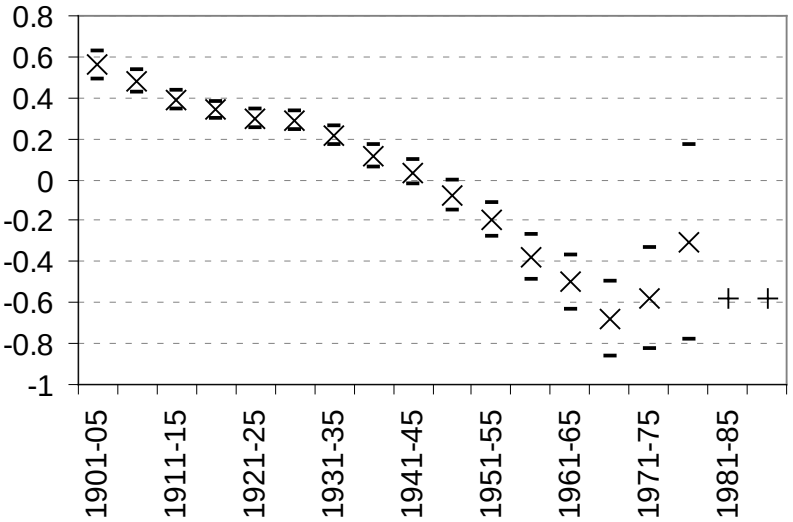
The increasing cohort effect from 1901 to 1930 corresponds to the uptake in smoking amongst women that peaked during WWII. Steady reductions in smoking rates since then are responsible for the following decline in cohort coefficients.

Colorectal cancer – Males – Age effect coefficients



Colorectal cancer – Males – Period effect coefficients

Colorectal cancer – Males – Cohort effect coefficients

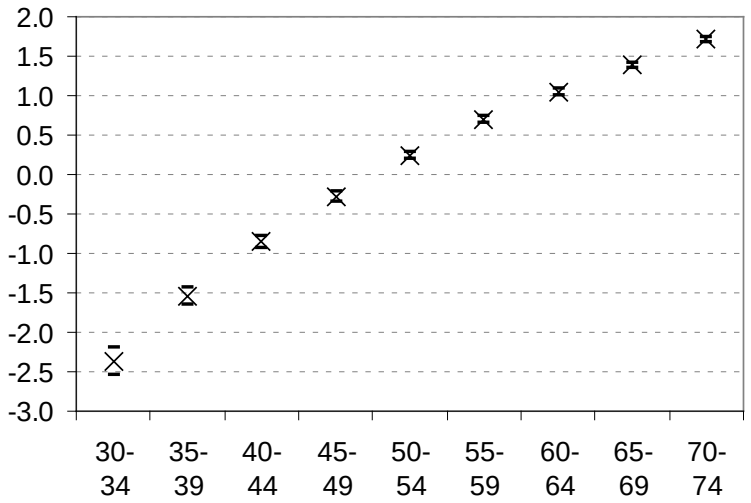


Summary

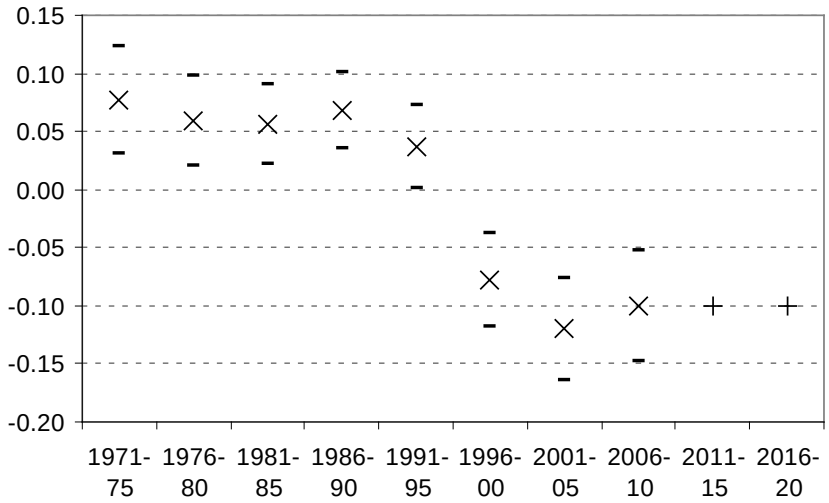
After increasing steadily from 1971 to 1995, the period effect for male colorectal cancer has since fallen. However, the magnitude of this effect is considerably smaller than the cohort effect.

Successive cohorts have faced lower mortality rates since the beginning of the period, although this trend appears to have halted by 1970. It is currently unclear if these levels are remaining flat or starting to increase.

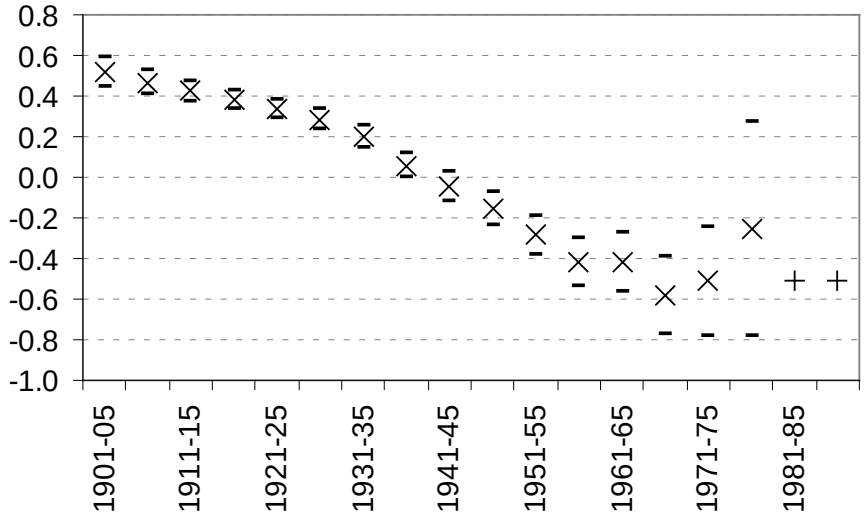
Colorectal cancer – Females – Age effect coefficients



Colorectal cancer – Females – Period effect coefficients



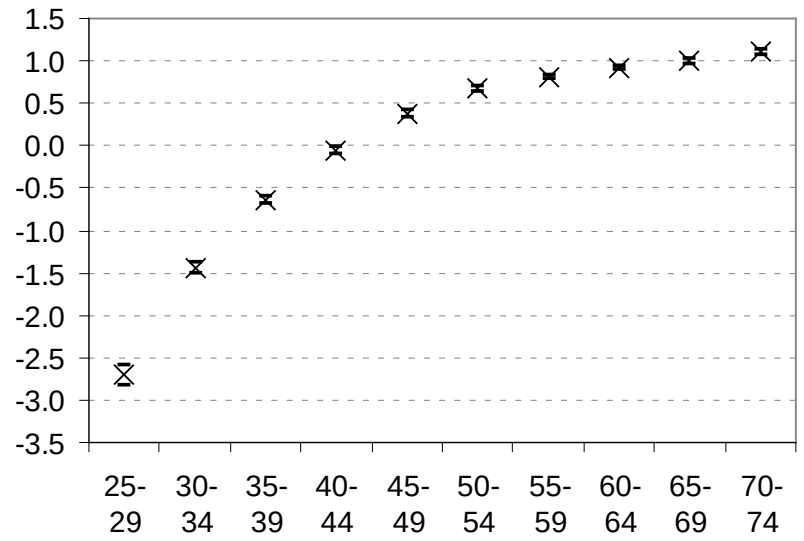
Colorectal cancer – Females – Cohort effect coefficients



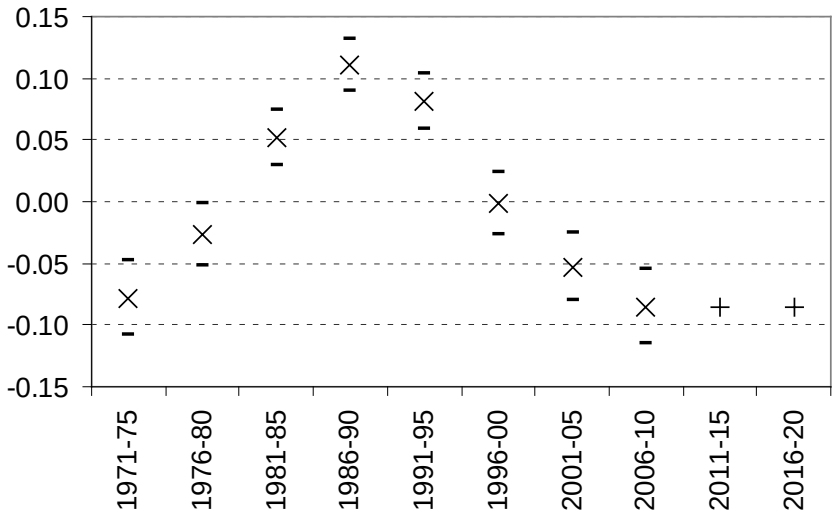
Summary

The parameter estimates for female colorectal cancer closely resemble those for males. However, the pre-1991 increase in period effects is not observed here.

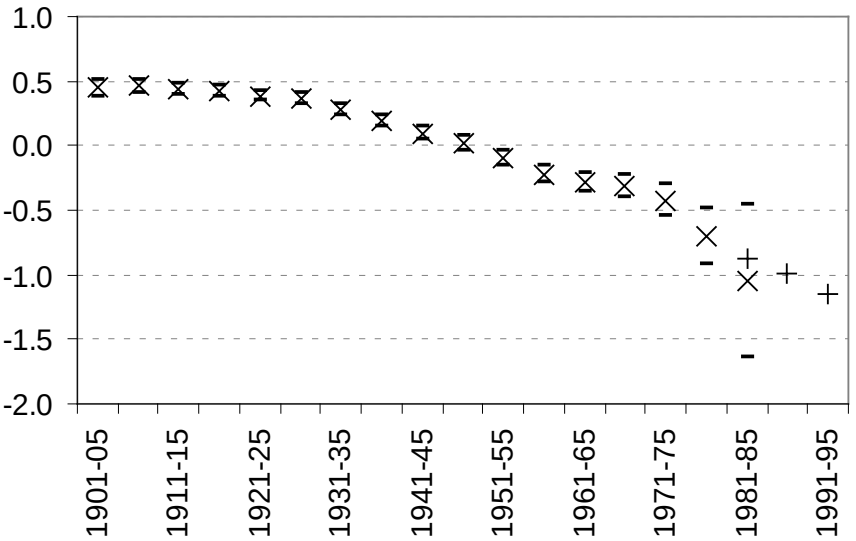
Breast cancer – Females – Age effect coefficients



Breast cancer – Females – Period effect coefficients



Breast cancer – Females – Cohort effect coefficients

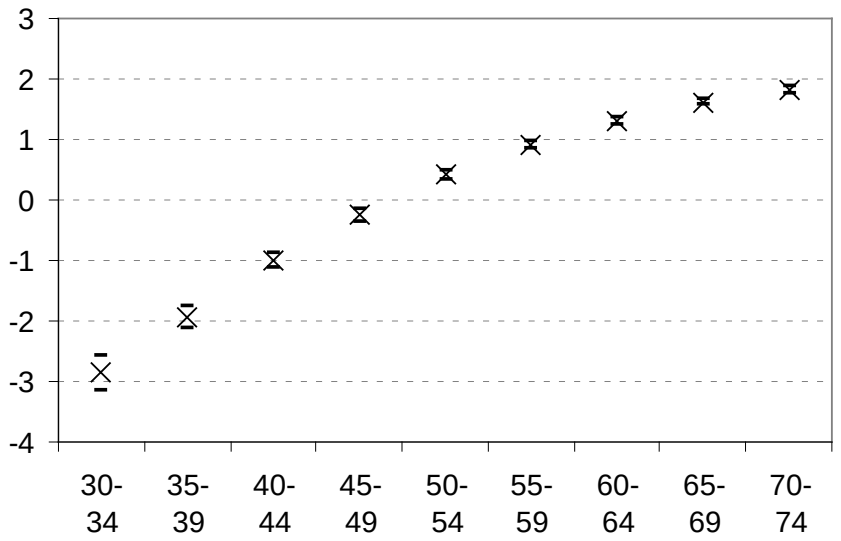


Summary

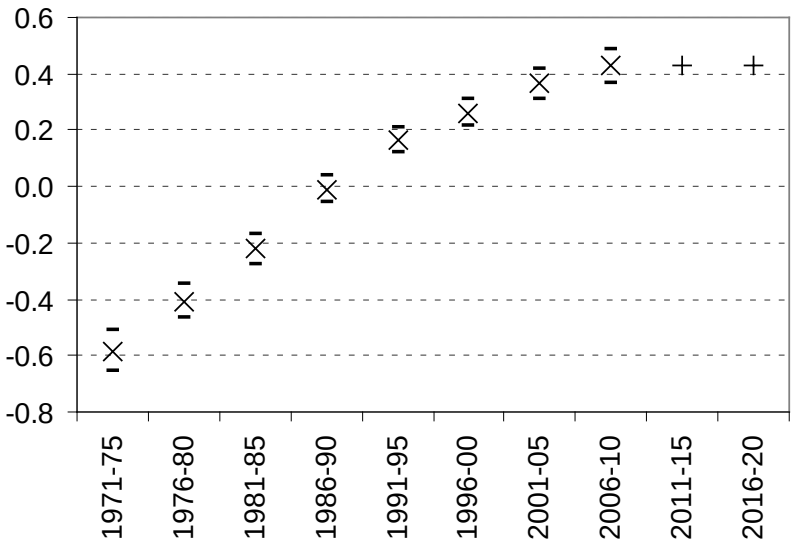
The decline in period effect since 1986-90 appears to be due to the introduction of breast cancer screening in 1988. It is unclear what is responsible for the increases prior to this point.

There have been considerable declines in cohort effect since around 1930, covering all people under 75. The magnitude of this effect is significantly larger than the period effect.

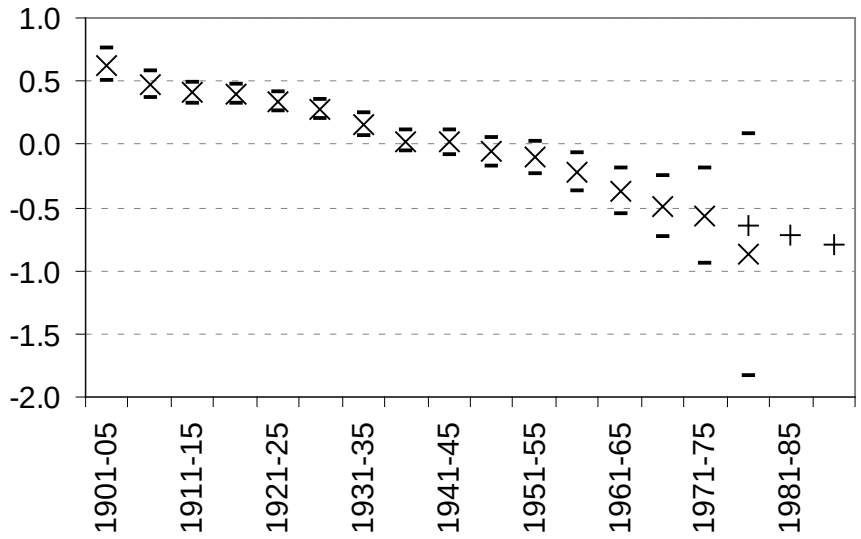
Oesophageal cancer – Males – Age effect coefficients



Oesophageal cancer – Males – Period effect coefficients



Oesophageal cancer – Males – Cohort effect coefficients

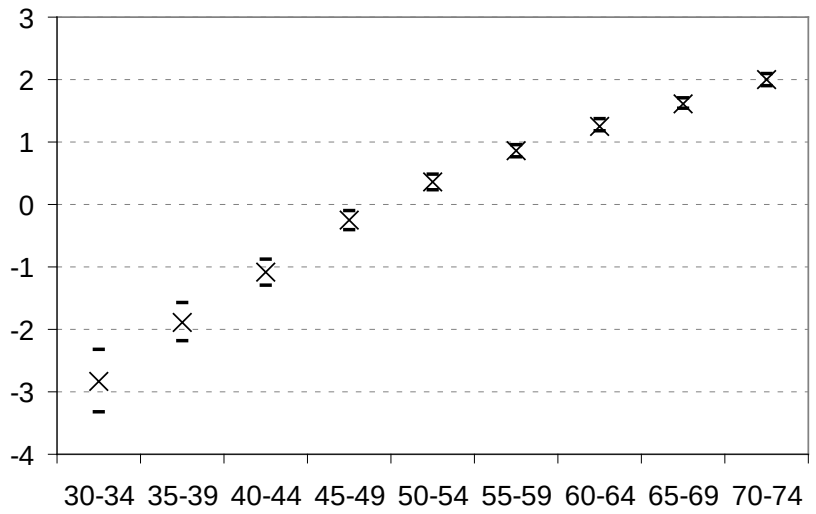


Summary

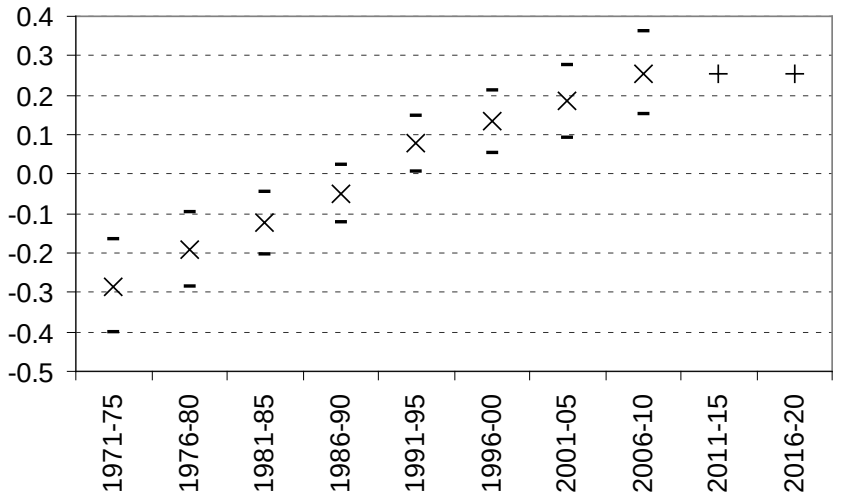
The period effect for male oesophageal cancer has increased steadily over the period, in line with incidence rates. The magnitude of the period effect is comparable to the cohort effect.

There have been considerable declines in cohort effect throughout the entire period.

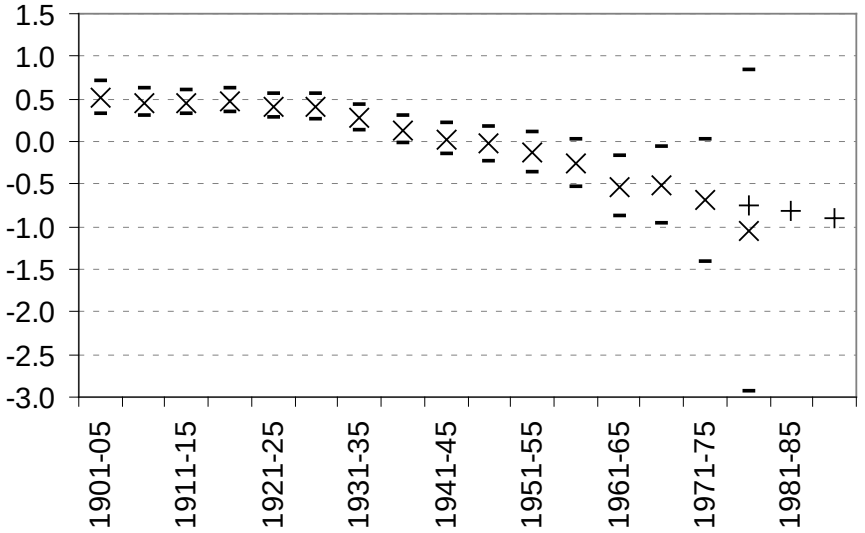
Oesophageal cancer – Females – Age effect coefficients



Oesophageal cancer – Females – Period effect coefficients



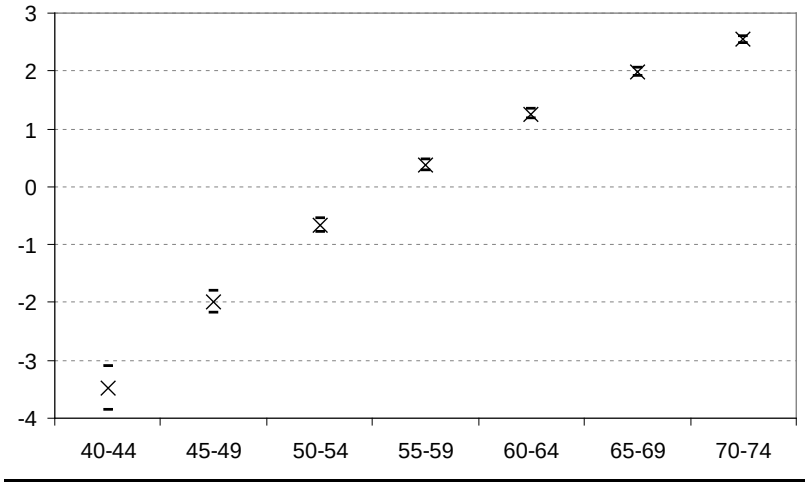
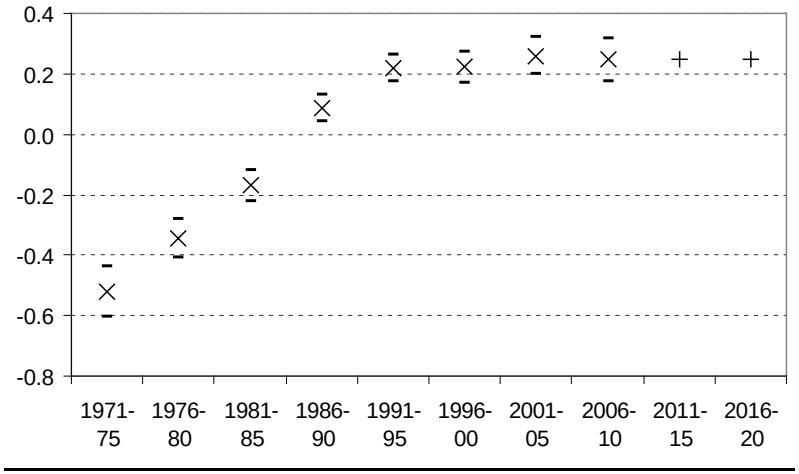
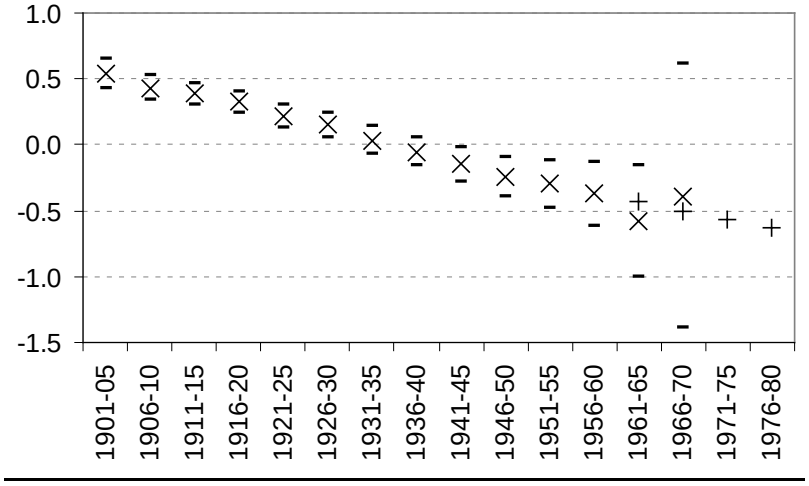
Oesophageal cancer – Females – Cohort effect coefficients



Summary

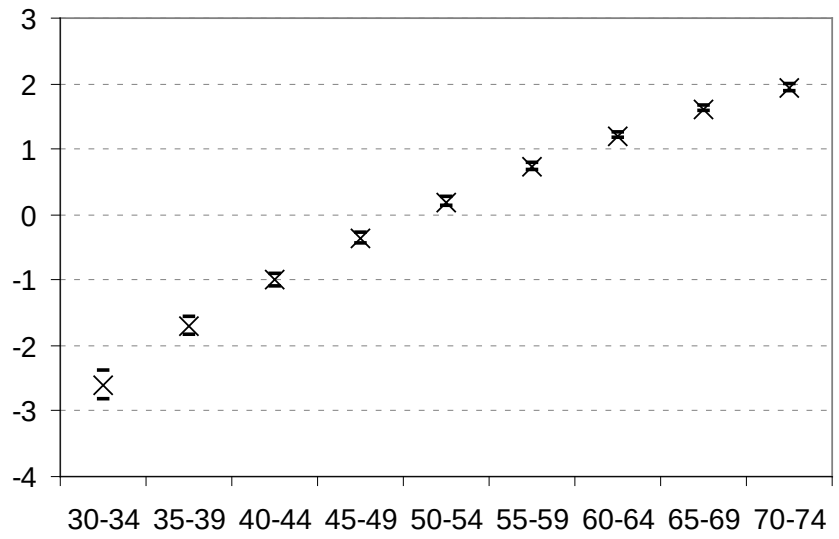
The period effect for female oesophageal cancer has increased steadily over the last 40 years. Given only modest increases in incidence rates until the 1990s, it is not clear what has been driving the change in period effect, but it does mirror the patterns seen for males.

There have been considerable declines in cohort effect since around 1930, covering all people under 75.

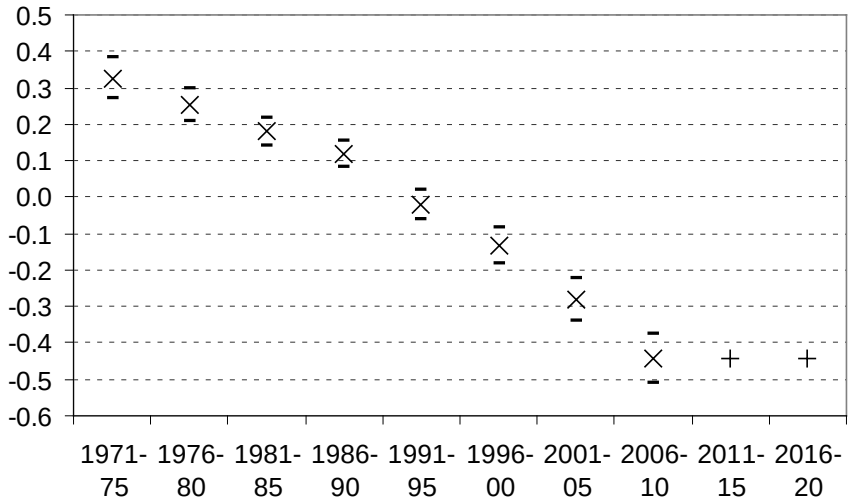
Prostate cancer – Age effect coefficients	Prostate cancer – Period effect coefficients
	
Prostate cancer – Cohort effect coefficients	**Summary**
	After increasing from 1971 to 1995, the period effect for prostate cancer has since stabilised. The rise appears to be related to factors other than treatment quality, as five-year relative survival rates increased from 31% to 54% during this time[20]. Given the lack of modifiable risk behaviour for prostate cancer, it is not clear what has driven the continual decline in cohort effects.

[20] http://info.cancerresearchuk.org/cancerstats/types/prostate/survival/

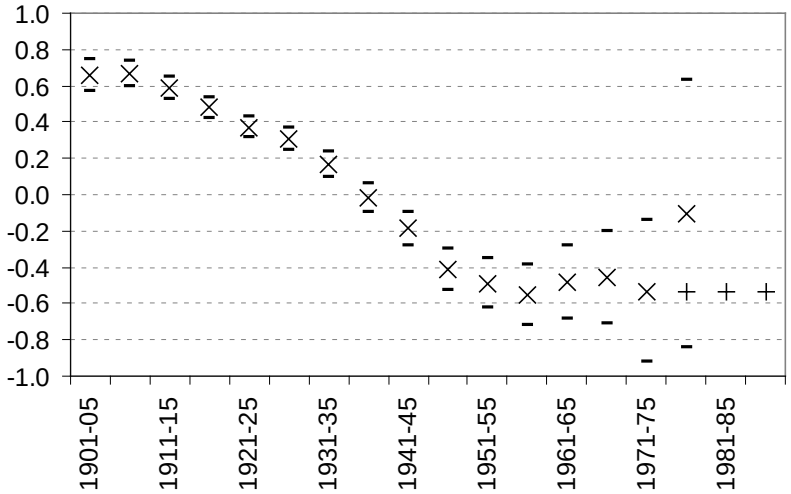
Stomach cancer – Males – Age effect coefficients



Stomach cancer – Males – Period effect coefficients



Stomach cancer – Males – Cohort effect coefficients

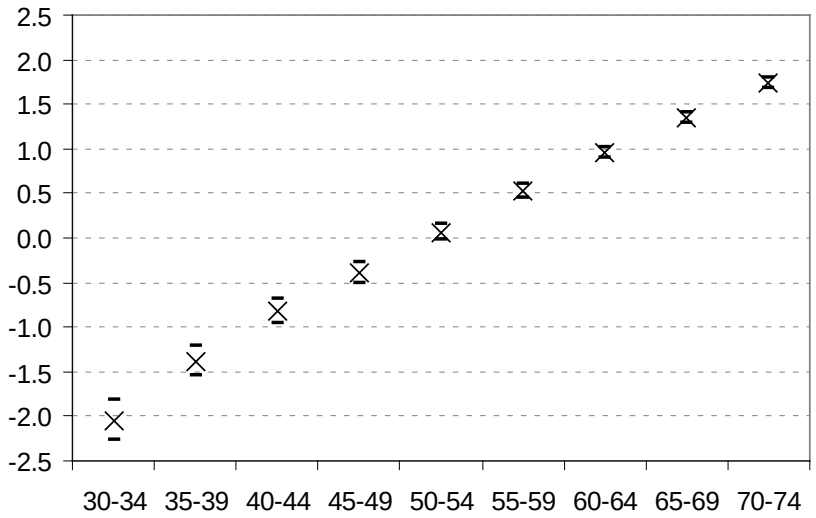


Summary

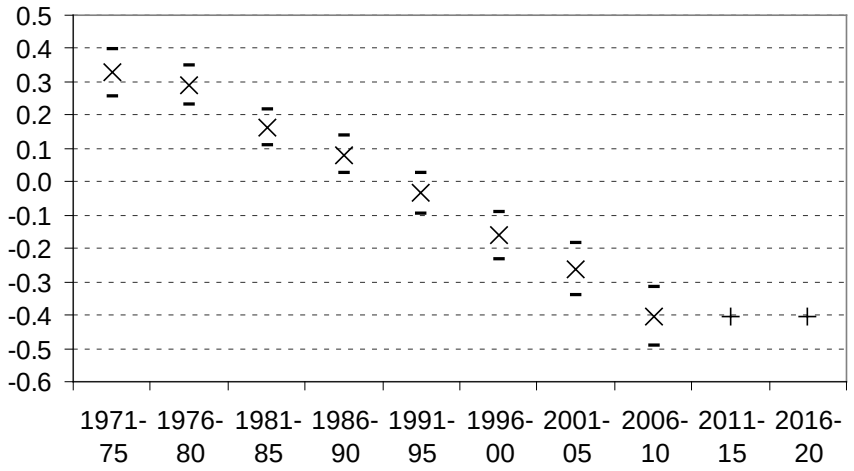
The period effect for male stomach cancer has declined continually over the period. This corresponds to both improved relative survival and decreased incidence rates.

Successive cohorts were at lower risk of mortality from 1901 to around 1960, since when this appears to have stabilised.

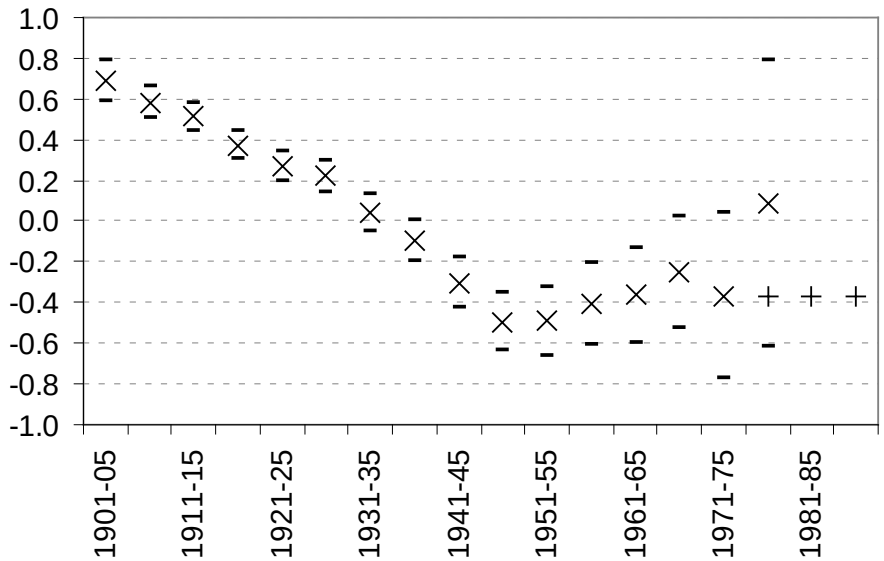
Stomach cancer – Females – Age effect coefficients



Stomach cancer – Females – Period effect coefficients



Stomach cancer – Females – Cohort effect coefficients



Summary

The parameter estimates for female stomach cancer closely resemble those for males. However, recent cohorts show more conclusive evidence of an increase.

Breakdown by age

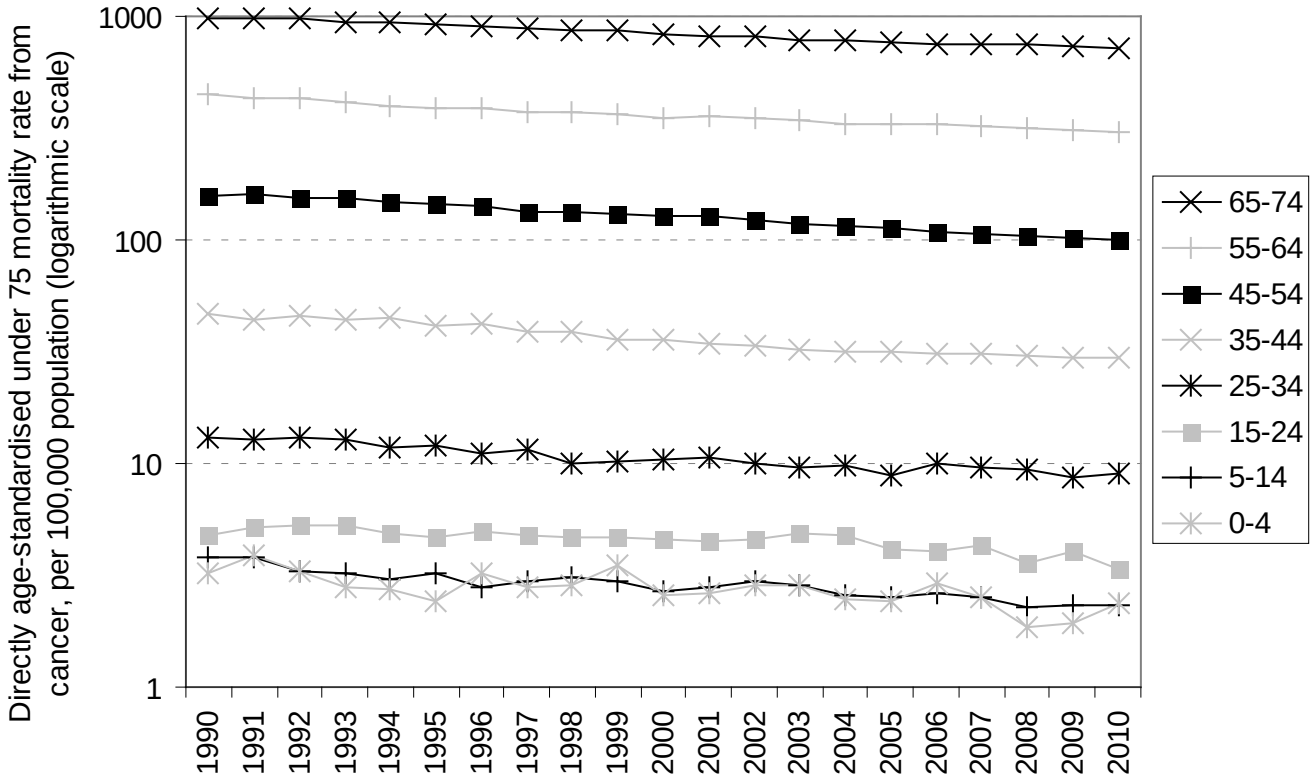
3.281 Cancer mortality has fallen for all age groups over the past decade, with the largest fall (of 25%) for 15-24 year olds. Mortality rates for 0-4 year olds have improved the least, mainly driven by a slight increase since 2008.

Table 1.4.vii.d – Directly age-standardised under 75 mortality rate from cancer, persons per 100,000 population, by age group

	0-4	5-9	15-24	25-34	35-44	45-54	55-64	65-74
1990	3.2	3.8	4.8	13.0	46.6	156.1	446.9	974.9
1991	3.9	3.8	5.2	12.8	43.9	159.3	433.3	977.0
1992	3.3	3.3	5.3	13.2	45.9	153.4	426.2	969.9
1993	2.8	3.3	5.3	12.7	44.2	152.9	412.6	940.0
1994	2.8	3.0	4.9	11.8	44.5	147.1	399.9	934.2
1995	2.4	3.2	4.6	12.0	41.0	145.2	390.9	926.5
1996	3.2	2.8	5.0	11.0	42.1	142.1	387.0	910.5
1997	2.8	3.0	4.7	11.6	39.1	134.7	371.5	888.1
1998	2.8	3.1	4.7	10.0	38.7	134.0	372.2	874.9
1999	3.5	3.0	4.7	10.2	35.9	130.7	364.9	857.5
2000	2.6	2.7	4.6	10.4	35.7	127.7	353.3	824.5
2001	2.7	2.8	4.5	10.7	34.1	127.0	354.2	811.3
2002	2.8	3.0	4.6	10.0	33.5	122.6	351.7	808.0
2003	2.8	2.9	4.8	9.7	32.3	118.9	340.8	788.1
2004	2.5	2.6	4.7	9.8	31.8	115.6	331.0	777.4
2005	2.4	2.5	4.1	8.9	31.3	112.6	327.8	765.5
2006	2.9	2.6	4.1	10.0	31.0	109.7	327.1	752.6
2007	2.5	2.5	4.3	9.5	31.2	107.4	321.0	746.6
2008	1.8	2.3	3.6	9.4	30.1	104.9	313.6	743.6
2009	1.9	2.3	4.1	8.6	29.6	101.5	308.0	729.7
2010	2.4	2.3	3.4	9.0	29.7	100.5	302.6	713.8
Average annual decline 2011-2010	1.3%	2.0%	3.2%	1.9%	1.5%	2.6%	1.7%	1.4%

Source: NHS Information Centre

Figure 1.4.vii.d – Directly age-standardised under 75 mortality rate from cancer, persons per 100,000 population, by age group (logarithmic scale)



Source: NHS Information Centre

Breakdown by region

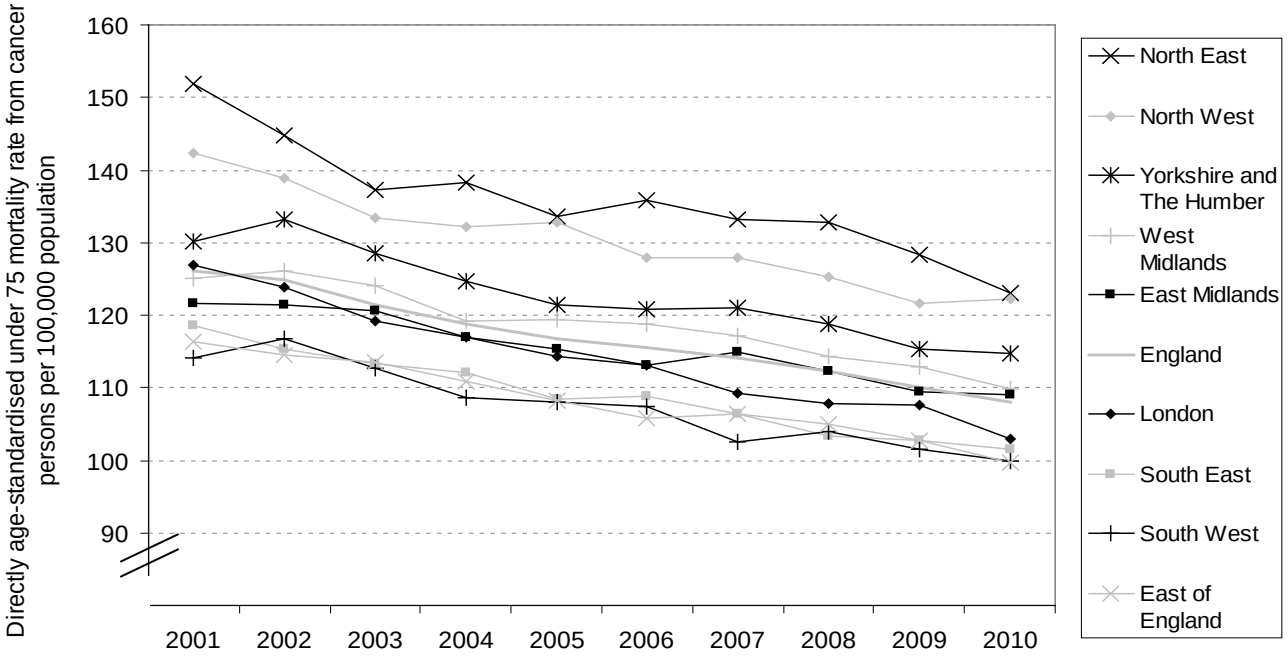
3.282 There is considerable variation by region for under 75 cancer mortality. Although there have been declines in all areas, mortality rates in the North East and North West were still 23.5% and 22.7% higher respectively than the region with the lowest rates, the East of England, in 2010. However, the overall variability has fallen, with the North East experiencing the largest fall in rates over the decade.

Table 1.4.vii.e – Directly age-standardised under 75 mortality rate from cancer, persons per 100,000 population, by region

Year	East Midlands	East of England	London	North East	North West	South East	South West	West Midlands	Yorkshire and The Humber
2001	121.5	116.3	126.9	151.8	118.6	114.0	125.2	130.1	121.5
2002	121.5	114.4	123.9	144.7	115.2	116.8	126.1	133.3	121.5
2003	120.7	113.5	119.1	137.2	113.3	112.6	124.0	128.5	120.7
2004	116.9	110.9	116.9	138.3	112.1	108.6	119.3	124.7	116.9
2005	115.2	108.1	114.2	133.6	108.5	108.0	119.4	121.3	115.2
2006	113.0	105.8	113.1	135.9	108.9	107.4	118.9	120.8	113.0
2007	114.8	106.4	109.2	133.3	106.4	102.5	117.2	120.9	114.8
2008	112.3	105.0	107.8	132.8	103.3	104.0	114.3	118.9	112.3
2009	109.4	102.7	107.6	128.3	102.7	101.5	112.8	115.3	109.4
2010	109.0	99.6	102.9	123.0	101.5	100.0	109.9	114.8	109.0
Average annual decline	-1.2%	-1.7%	-2.3%	-2.3%	-1.7%	-1.4%	-1.4%	-1.4%	-1.2%

Source: NHS Information Centre

Figure 1.4.vii.e – Directly age-standardised under 75 mortality rate from cancer, persons per 100,000 population, by region

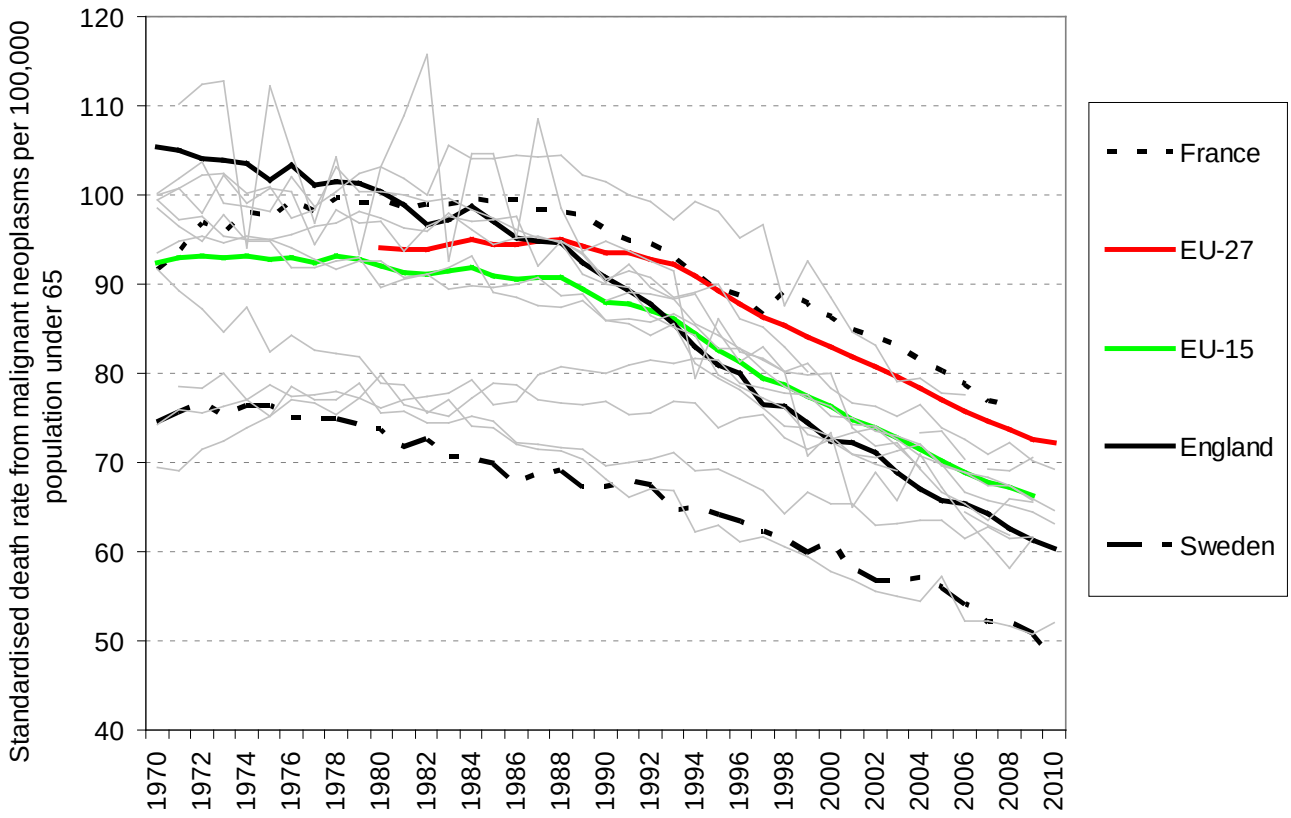


Source: NHS Information Centre

International Comparisons

3.283 As a complete data source for international comparisons of this indicator is not available, a World Health Organisation (WHO) dataset on under 65-mortality from malignant neoplasms is used as a proxy. Despite initially having higher rates than the EU-15 during the 1980s, average annual declines since 1980 of 1.7% have left England with an under 65-mortality rate 8.9% lower than the EU-15 average. Sweden continues to perform significantly better than England, but the difference has fallen over time.

Figure 1.4.vii.f Standardised death rate from malignant neoplasms, under 65, per 100,000 population



Source: NHS Information Centre

Notes:

- What accounts for the diverse patterns of period effects for different cancers and genders?

Drivers of this indicator

3.284 Table 1.4.vii.f outlines estimated figures for the percentage of cancers caused by different risk factors. These factors have been found to cause over 50% of oesophageal, stomach, colorectal, lung, melanoma and cervix uteri cancers.

3.285 WHO estimate that about 30% of worldwide cancer deaths are due to five key behavioural and dietary drivers. These are high body mass index, low fruit and vegetable intake, lack of physical activity, tobacco use and alcohol use. For recent trends in these drivers, see Chapter 8.

Table 1.4.vii.f Percentage of cancers attributable to risk factor exposure

	Oesophagus	Stomach	Colon-rectum	Liver	Pancreas	Lung	Melanoma	Breast	Cervix uteri	Corpus uteri	Bladder	Kidney	Leukaemia	All
Tobacco	65.5	22.2	8.1	23	28.7	85.6	—	—	7.2	—	36.7	24.1	6.2	19.4
Alcohol	20.6	—	11.6	9.1	—	—	—	6.4	—	—	—	—	—	4
Fruit and vegetables	46.1	35.8	—	—	—	8.8	—	—	—	—	—	—	—	4.7
Meat	—	—	21.1	—	—	—	—	—	—	—	—	—	—	2.7
Fibre	—	—	12.2	—	—	—	—	—	—	—	—	—	—	1.5
Salt	—	24	—	—	—	—	—	—	—	—	—	—	—	0.5
Overweight and obesity	21.7	—	13	—	12.2	—	—	8.7	—	33.7	—	24	—	5.5
Physical exercise	—	—	3.3	—	—	—	—	3.4	—	3.8	—	—	—	1
Post-menopausal hormones	—	—	—	—	—	—	—	3.2	0	1.2	—	—	—	0.5
Infections	—	31.7	2.2	15.9	—	—	—	0	100	—	—	—	—	3.1
Radiation- ionising	2.7	1.2	1.6	0.8	—	4.7	—	0.9	—	—	2.5	—	8.9	1.8
Radiation - UV	—	—	—	—	—	—	85.9	—	—	—	—	—	—	3.5
Occupation	2.6	2	—	0.2	—	13.2	—	4.6	0.7	—	5.7	—	0.7	3.7
Reproduction (breastfeeding)	—	—	—	—	—	—	—	3.1	—	—	—	—	—	0.9
All of the above	89	74.9	54.4	41.6	37.3	89.2	85.9	26.8	100	36.9	41.8	42.3	15.2	42.7

Healthcare contribution

3.286 The NHS's contribution to improving cancer mortality outcomes involves:

- Earlier and more accurate diagnosis.
- Making optimal use of referral pathways and available interventions.
- Providing patients with appropriate radiotherapy, chemotherapy and surgical treatments.
- Providing support after primary treatment for lifestyle changes, including changes in diet, smoking and physical exercise.

Public health and social care contribution

3.287 Public health and social care's contribution to improving cancer mortality outcomes involves:

- Encouragement of early presentation through raising awareness.
- Screening programmes.
- Managing tobacco use, illicit drug use and alcohol consumption.
- Early identification and management of medical risk factors, including cholesterol, diabetes, chronic kidney disease, and hepatitis B & C.
- Managing obesity, promoting better diet (including "5 a day"), physical activity and breastfeeding.
- Quality of social care in hospital.
- Quality of care received whilst living at home or in residential care (e.g. recognition of symptoms).
- Medication compliance.
- Mitigation of social isolation.
- Appropriate use of non-steroidal anti-inflammatory drugs, statins, hormone replacement therapy and oral contraceptives.

(b) Indicator 1.4.vii: Current Practice Projections Methodology

3.288 The projections displayed in Table 1.4.vii.g and Figure 1.4.vii.g were arrived at by the following methodology:

3.289 Where sufficient data was available, Age-Period-Cohort (APC) models have been used to forecast cancer mortality. This applies to lung, breast, stomach, prostate, oesophageal and colorectal cancers, and is discussed in more detail below. In 2010, these cancers accounted for 52% of all cancer mortality. The remaining conditions were either projected flat at their exponentially smoothed mean, or as a continuation of the existing linear trend. Observed incidence rates and predicted changes in survival rates given current NHS quality of service were used to inform the decision on which method to apply to each specific cancer.

3.290 To avoid biased estimation given near zero mortality rates for younger groups [21], the APC model was generally only applied to people aged 30 and over (with some variation across cancers). Male and female rates were modelled separately due to the different historical trends in their risk factor behaviour (prostate cancer was modelled at population level for obvious reasons). Mortality rates for those ages not covered by the model were simply projected flat at the average value of the previous 3 years

3.291 For the use of APC techniques in projections, and the assumptions used, see discussion in the Overview to Domain 1 at the beginning of this Chapter. The aggregated results are displayed in table 1.4.vii.g and figure 1.4.vii.g.

3.292 It is recognised that using a flat projection for every cancer's period effect may result in some site-specific projections being over or underestimates. However, this approach is expected to be unbiased at indicator level. Disaggregated projections are displayed to ensure transparency, but do not represent firm commitments to the actual figures.

3.293 During the consultation period, the projections for mortality will be integrated with the survival projections presented in sections 1.4.i-vi.

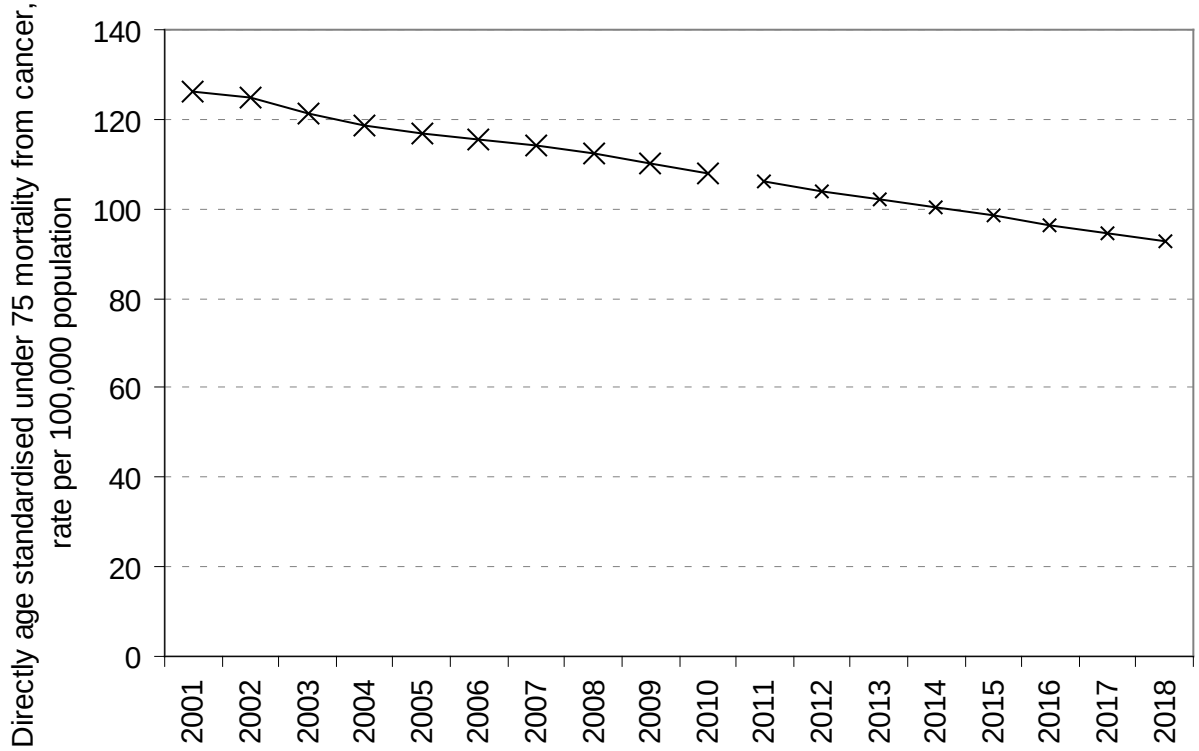
[21] This follows "Forecasting Mortality, different approaches for different cause of deaths? The cases on lung cancer; influenza, pneumonia and bronchitis; and motor vehicle accidents" M. Di Cesare and M. Murphy, B.A.J. 15, Supplement, 185-211 (2009

Table 1.4.vii.g – Current Practice Projection for under 75 cancer mortality rate, persons per 100,000 population

	Actual	Predicted
2001	126.07	
2002	124.78	
2003	121.35	
2004	118.82	
2005	116.83	
2006	115.53	
2007	114.04	
2008	112.22	
2009	109.97	
2010	108.05	
2011		105.92
2012		104.01
2013		102.10
2014		100.22
2015		98.34
2016		96.46
2017		94.58
2018		92.70

Source: NHS Information Centre, DH

Figure 1.4.vii.g – Current Practice Projection for under 75 cancer mortality rate, persons per 100,000 population



Source: NHS Information Centre, DH

3.294 Tables 1.4.vii.h, 1.4.vii.i, 1.4.vii.j and Figures 1.4.vii.h, 1.4.vii.i and 1.4.vii.j show projected mortality from cancers estimated using APC models.

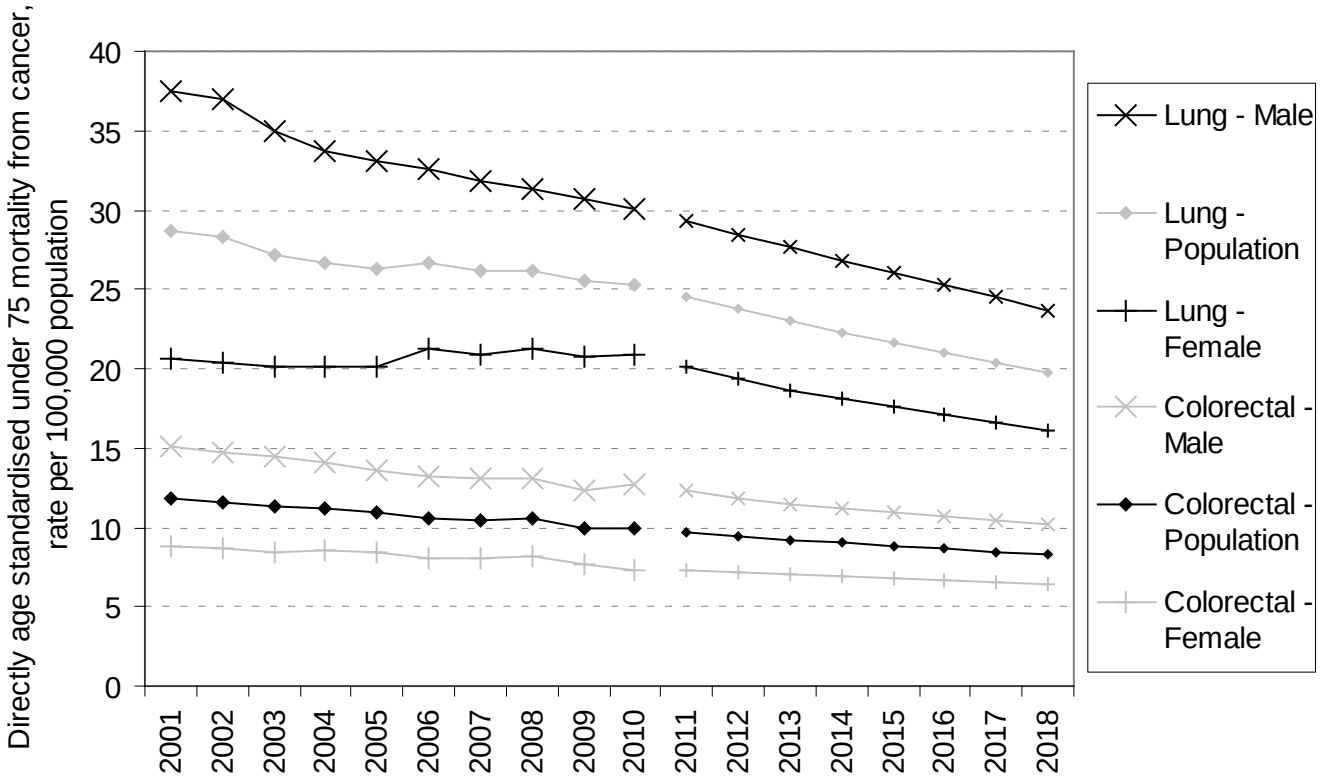
3.295 The precise methodology behind projecting cohort effect coefficients varied across the different cancers. Observed trends could not be simply extended due to the increasing uncertainty around the most recent estimates. The final cohort coefficient, based on only one data point, was deemed too uncertain to use in projections and was replaced by an estimated value. In general, linear extensions of trends were used in cases where long run, sustained patterns existed, with flat projections used for anything else. For lung cancer, the cohort effect has been projected based on changes in smoking rates for 16-24 year olds. For example, the decrease for females from 1976-80 to 1981-85 corresponds with the drop in 20-24 year old smoking prevalence from 35% in 2000 to 30% in 2005 .

Table 1.4.vii.h – APC projections for under 75 cancer mortality, by site, persons per 100,000 population

	Lung Cancer			Colorectal Cancer		
	Males	Females	Population	Males	Females	Population
2001	37.52	20.64	28.71	15.09	8.77	11.8
2002	37.03	20.39	28.35	14.73	8.64	11.57
2003	34.96	20.07	27.19	14.49	8.47	11.35
2004	33.73	20.18	26.66	14.11	8.51	11.2
2005	33.04	20.12	26.33	13.58	8.48	10.93
2006	32.53	21.23	26.66	13.16	8.11	10.54
2007	31.86	20.92	26.18	13.07	8.1	10.5
2008	31.36	21.26	26.11	13.07	8.17	10.53
2009	30.74	20.73	25.55	12.37	7.68	9.94
2010	30.07	20.89	25.31	12.7	7.35	9.93
2011	29.25	20.14	24.53	12.29	7.26	9.69
2012	28.43	19.39	23.74	11.88	7.18	9.45
2013	27.61	18.64	22.96	11.48	7.09	9.21
2014	26.83	18.13	22.32	11.22	6.96	9.02
2015	26.05	17.62	21.69	10.96	6.84	8.83
2016	25.26	17.11	21.05	10.7	6.72	8.64
2017	24.48	16.6	20.41	10.44	6.59	8.45
2018	23.7	16.1	19.77	10.18	6.47	8.26

Source: NHS Information Centre, DH

Figure 1.4.vii.h – APC projections for under 75 cancer mortality, by site, persons per 100,000 population



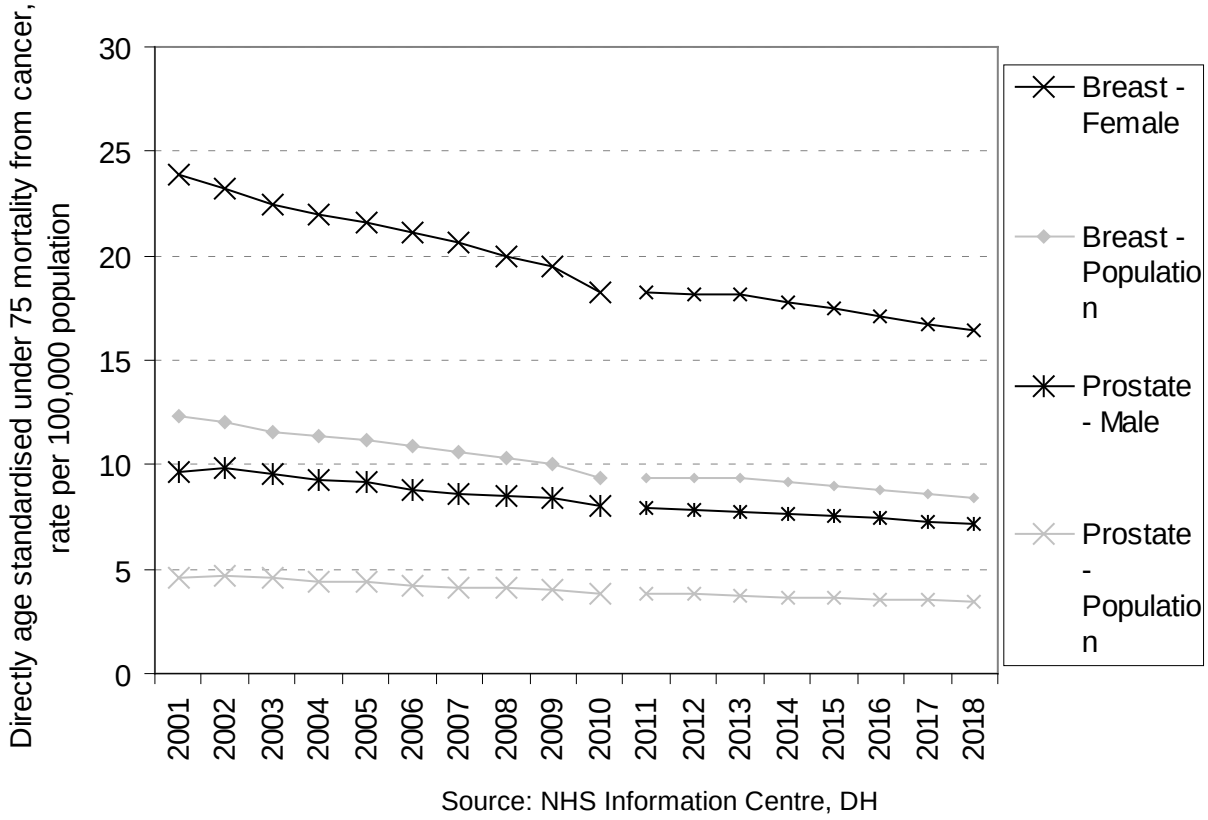
Source: NHS Information Centre, DH

Table 1.4.vii.i – APC projections for under 75 cancer mortality, by site, persons per 100,000 population

	Breast Cancer			Prostate Cancer		
	Males*	Females	Population	Males	Females	Population
2001	0.15	23.86	12.31	9.66	N/A	4.57
2002	0.16	23.26	12.01	9.83	N/A	4.66
2003	0.12	22.47	11.58	9.58	N/A	4.55
2004	0.09	22.01	11.34	9.28	N/A	4.41
2005	0.15	21.62	11.15	9.13	N/A	4.35
2006	0.11	21.10	10.86	8.82	N/A	4.21
2007	0.13	20.66	10.65	8.63	N/A	4.13
2008	0.09	20.00	10.29	8.49	N/A	4.07
2009	0.12	19.50	10.04	8.42	N/A	4.04
2010	0.09	18.26	9.39	8.04	N/A	3.86
2011	0.10	18.22	9.37	7.95	N/A	3.82
2012	0.10	18.18	9.35	7.86	N/A	3.77
2013	0.10	18.14	9.32	7.76	N/A	3.73
2014	0.10	17.79	9.15	7.64	N/A	3.68
2015	0.10	17.45	8.97	7.53	N/A	3.62
2016	0.10	17.11	8.79	7.41	N/A	3.57
2017	0.10	16.77	8.62	7.29	N/A	3.51
2018	0.10	16.42	8.44	7.18	N/A	3.46

Source: NHS Information Centre, DH

Figure 1.4.vii.i – APC projections for under 75 cancer mortality, by site, persons per 100,000 population



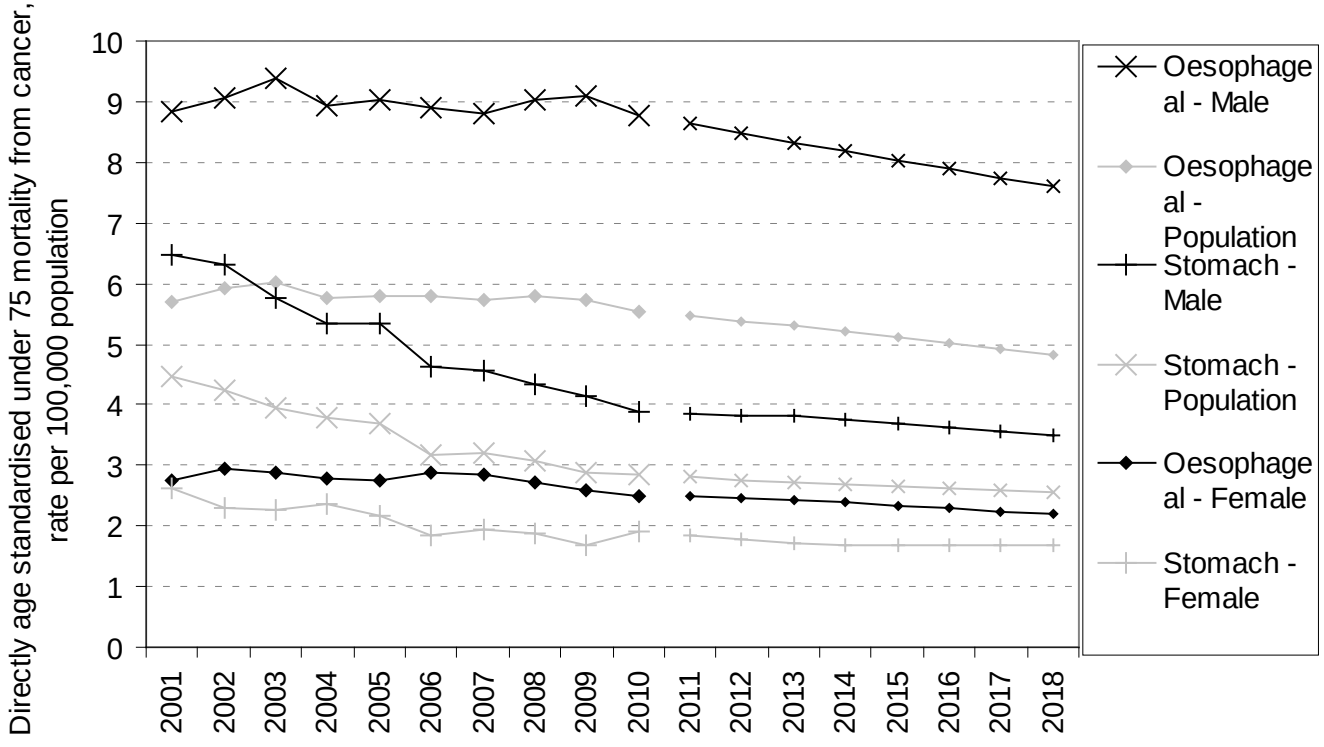
Source: NHS Information Centre, DH

Table 1.4.vii.j – APC projections for under 75 cancer mortality, by site, persons per 100,000 population

	Oesophageal Cancer			Stomach Cancer		
	Males	Females	Population	Males	Females	Population
2001	8.84	2.74	5.68	6.47	2.63	4.46
2002	9.07	2.96	5.91	6.31	2.31	4.22
2003	9.38	2.87	6.02	5.77	2.27	3.95
2004	8.92	2.78	5.75	5.33	2.36	3.78
2005	9.04	2.74	5.79	5.35	2.18	3.70
2006	8.91	2.87	5.80	4.61	1.84	3.17
2007	8.81	2.84	5.73	4.55	1.94	3.20
2008	9.04	2.73	5.79	4.34	1.88	3.07
2009	9.08	2.60	5.74	4.13	1.68	2.87
2010	8.78	2.50	5.55	3.88	1.89	2.85
2011	8.63	2.48	5.47	3.86	1.83	2.81
2012	8.48	2.46	5.38	3.83	1.77	2.77
2013	8.33	2.44	5.30	3.81	1.70	2.72
2014	8.18	2.39	5.20	3.75	1.70	2.69
2015	8.04	2.34	5.11	3.69	1.69	2.66
2016	7.89	2.29	5.01	3.63	1.68	2.63
2017	7.75	2.24	4.92	3.57	1.68	2.59
2018	7.60	2.19	4.82	3.51	1.67	2.56

Source: NHS Information Centre, DH

Figure 1.4.vii.j – APC projections for under 75 cancer mortality, by site, persons per 100,000 population



Source: NHS Information Centre, DH

3.296 Tables 1.4.vii.k, 1.4.vii.l, and Figures 1.4.vii.k and 1.4.vii.l show projected mortality from cancers not covered by the APC methodology.

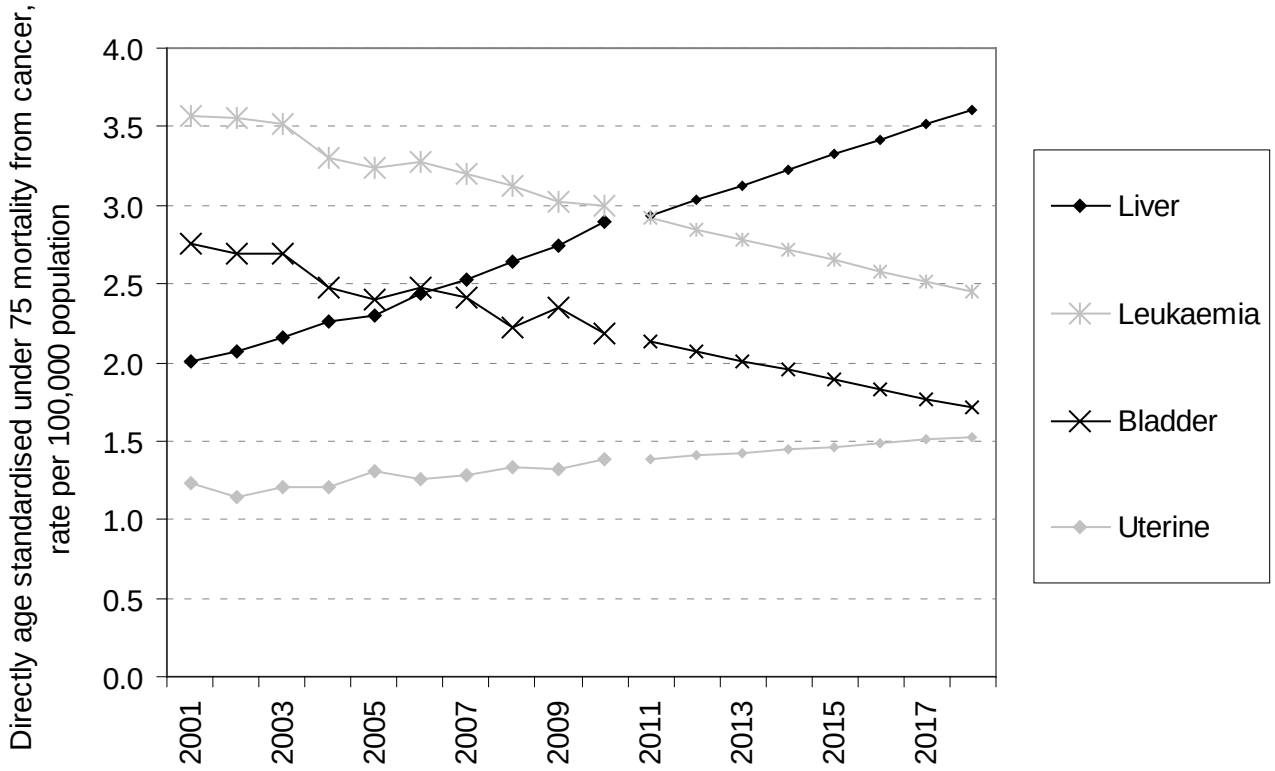
3.297 Mortality from both liver and uterine cancer is expected to continue increasing in line with projected incidence rates . Likewise, the projected declines in incidence for leukaemia and bladder cancer justify continuing their improving mortality trends.

Table 1.4.vii.k – Linear projections for under 75 cancer mortality, by site, persons per 100,000 population

	All Other Cancers	Liver	Leukaemia	Bladder	Uterine
2001	30.75	2.01	3.57	2.75	1.23
2002	30.41	2.07	3.55	2.69	1.14
2003	29.06	2.16	3.51	2.69	1.20
2004	28.78	2.26	3.30	2.48	1.20
2005	27.75	2.30	3.24	2.40	1.31
2006	27.30	2.43	3.27	2.48	1.26
2007	26.54	2.53	3.20	2.41	1.28
2008	25.84	2.64	3.13	2.22	1.33
2009	25.29	2.74	3.03	2.36	1.32
2010	24.80	2.89	3.00	2.18	1.39
2011	23.90	2.94	2.91	2.13	1.38
2012	23.21	3.03	2.85	2.07	1.40
2013	22.53	3.13	2.78	2.01	1.42
2014	21.85	3.22	2.72	1.95	1.45
2015	21.16	3.32	2.65	1.89	1.47
2016	20.48	3.42	2.58	1.83	1.49
2017	19.80	3.51	2.52	1.77	1.51
2018	19.11	3.61	2.45	1.71	1.53

Source: NHS Information Centre, DH

Figure 1.4.vii.k – Linear projections for under 75 cancer mortality, by site, persons per 100,000 population



Source: NHS Information Centre, DH

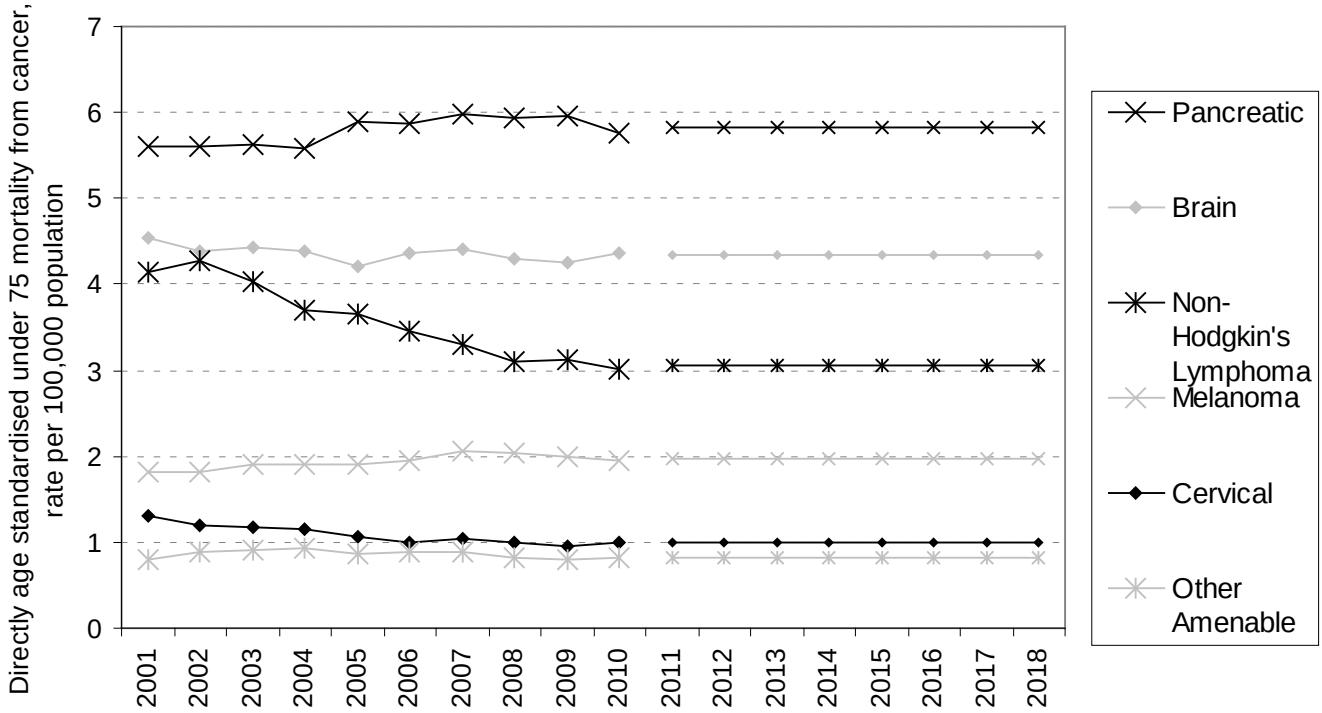
3.298 For the remaining cancers, the default position of a flat projection could not be rejected. This is because either projected incidence rates show little change from their current level, or changes in treatment efficacy are expected to offset any trends in incidence. The exponentially smoothed projections displayed below were calculated using a smoothing factor of 0.3.

Table 1.4.vii.l – Exponentially smoothed projections for under 75 cancer mortality, by site, persons per 100,000 population

	Pancreatic	Brain	Non-Hodgkin's Lymphoma	Melanoma	Cervical	Other Amenable
2001	5.61	4.55	4.15	1.81	1.31	0.79
2002	5.60	4.39	4.28	1.82	1.20	0.88
2003	5.63	4.44	4.02	1.90	1.16	0.92
2004	5.59	4.40	3.71	1.90	1.15	0.92
2005	5.90	4.21	3.64	1.90	1.06	0.87
2006	5.87	4.37	3.46	1.96	1.00	0.88
2007	5.99	4.41	3.30	2.06	1.03	0.89
2008	5.93	4.30	3.11	2.04	1.00	0.82
2009	5.96	4.25	3.12	1.99	0.96	0.79
2010	5.76	4.36	3.02	1.95	0.99	0.82
2011	5.82	4.34	3.06	1.97	0.99	0.82
2012	5.82	4.34	3.06	1.97	0.99	0.82
2013	5.82	4.34	3.06	1.97	0.99	0.82
2014	5.82	4.34	3.06	1.97	0.99	0.82
2015	5.82	4.34	3.06	1.97	0.99	0.82
2016	5.82	4.34	3.06	1.97	0.99	0.82
2017	5.82	4.34	3.06	1.97	0.99	0.82
2018	5.82	4.34	3.06	1.97	0.99	0.82

Source: NHS Information Centre, DH

Figure 1.4.vii.l – Exponentially smoothed projections for under 75 cancer mortality, by site, persons per 100,000 population



Source: NHS Information Centre, DH

(c) Indicator 1.4.vii: Scope for Improvement

3.299 The Cancer Outcomes Strategy outlines three areas through which cancer survival will be improved: new and extended screening programmes, earlier diagnosis of symptomatic cancers, and improved access to treatment, particularly radiotherapy. In addition, it shows how other aspects of mortality can be reduced (i.e. through prevention). It will be important that the NHS Commissioning Board works with Public Health England to deliver these improvements.

3.300 By increasing the number of linear accelerators by 12, and increasing the throughput on radiotherapy machines throughout the country, an estimated 1296 extra cancer sufferers will survive for at least five years each year by 2014/15. Tackling variation in intervention rates, such as lung cancer operations, may also allow further improvements in survival rates.

3.301 Actions are also being taken to increase the proportion of cancers diagnosed by screening programmes. Screening for colorectal cancer will be rolled out under a new flexible sigmoidoscopy programme, which alongside the extension of breast screening to 47-49 and 71-73 year olds is expected to deliver five-year survival for an additional 915 people per year by 2014/15.

3.302 The creation of the National Awareness and Early Diagnosis Initiative is expected to deliver an additional 2814 five-year survivors per year by 2014/15. This will be achieved by improving access to tests in primary care, notably chest x-rays, non-obstetric ultrasounds, flexible sigmoidoscopies, colonoscopies and brain MRIs. The detailed collection of procedural information will also allow GPs to benchmark their performance, and to identify if they are providing too few tests. Public awareness campaigns should help people to identify symptoms and seek treatments at earlier stages of their illnesses.

3.303 It is important to note that the figures for additional five-year survivors refer to the entire population, so the under-75 group will only benefit from a certain proportion of this.

3.304 Wider policy initiatives aimed at tackling obesity, unhealthy diets, smoking and alcohol abuse may also help to bring down incidence rates.

1.5 – Excess under 75 mortality rate in adults with serious mental illness

Outcome sought	Reduced premature mortality in adults with serious mental illness.
Indicator definition	Excess mortality rate in adults with serious mental illness, aged under 75, per 100,000 population. Premature mortality in adults with serious mental illness (SMI)[22] will be compared to premature mortality in adults in the general population[23].

(a) Indicator 1.5: Recent Trends and Explanations

3.305 This indicator has been developed recently and its recent trends and explanations will be analysed in the post consultation document version of the Technical Annex.

(b) Indicator 1.5: Current Practice Projections

3.306 This indicator has been developed recently and its current practice projections will be set out in the mandate document.

(c) Indicator 1.5: Scope for Improvement

3.307 Several future planned policy initiatives may lead to improvements in this outcome within current resources. These policies are still currently being developed and it is difficult to quantify the impact they will have on the indicator. Quantifying this impact will also require a finalised definition of the indicator.

3.308 In February 2011, the Government published "No Health Without Mental Health", a cross-government mental health outcomes strategy for people of all ages.

3.309 Additionally, the Suicide Prevention Strategy, due to be published shortly, in line with the objective in the Mental Health Outcomes Strategy, aims to lower the suicide rate for those with mental illness. Those with mental illness are a high risk group for suicide.

3.310 This new Suicide Strategy is expected to continue the work of the previous suicide prevention strategy introduced in 2002. Between 2003 and 2008 there were around 365 fewer suicides than would have been expected if the number of suicides had followed its pre-2003 trend. This implies, on average, around 60 less suicides per year. However, most of this reduction occurred in later years when the recommendations of the 2002 strategy were more fully implemented. By 2008, there were at least 140 suicides less than predicted by the pre-2003 trend.

[22] *Adults with serious mental illness' are defined as those aged 18 and over listed in the Mental Health Minimum Dataset (MHMDS) for the current and previous two years. The MHMDS covers those adults receiving secondary health care for a mental illness.*

[23] *It is proposed to exclude those aged 75 and over to align with the other premature mortality indicators in Domain 1, and those aged under 18. Children under 18 are not covered by the main data source (MHMDS). There is no evidence that children with SMI are at particularly high risk of death by disease. The exact method of calculating the indicator is still to be finalised by DH in consultation with ONS and Information Centre for Health and Social Care (NHS IC).*

3.311 The definition of contact with mental health services differs between these figures and indicator 1.5; in these figures contact with mental health services is defined as contact in the last 12 months prior to death.

3.312 In the indicator, adults with serious mental illness are defined as those aged 18 and over listed in the Mental Health Minimum Dataset (MHMDS) for the current and previous two years. The MHMDS covers those adults receiving secondary health care for a mental illness.

3.313 Similarly, there may have been external factors affecting the number of suicides and this will need further investigation. It should, however, be noted that a recent study published in the Lancet [24] on the impact of the mental health recommendations between 1998 and 2006 suggests that uptake of mental health service recommendations is strongly correlated with a lower suicide rate. The mental health recommendations have already been widely implemented. It is important that local areas continue implementing them to maintain what has been achieved since 2003. On a limited number of recommendations, there is still some room for improvement, which could lead to further reductions in suicides for this group of people. Similarly, further reductions could be achieved through quality improvements building on what has already been implemented, e.g. in the way 24hrs teams are operating.

3.314 These figures may also need to be reviewed to refine the assumptions used to forecast the number of suicides.

3.315 The Royal College of GPs are currently reviewing training on mental health for GPs. People with serious mental illness are particularly exposed to risk factors related to lifestyle (diet, smoking & substance misuse) as well as to healthcare (clinical attention) and to access to services.

3.316 The mental health provider workforce does not always have the skills or capacity to help manage physical health problems. Conversely, Physical Health specialists see many people with mental health problems, but they do not always have the skills, incentives or access to mental health support to identify or respond to mental health problems. Many people with mental health problems are not registered with a GP and therefore miss health checks. Some GPs have limited mental health training.

3.317 This proposal aims to remedy this lack of training and to enable GPs to detect physical health problems of mental health patients earlier. Tackling mental health problems earlier can prevent them from escalating. The extent to which this can reduce premature mortality from Serious Mental Illness will be quantified by assessing available evidence and liaising with the Royal College of GPs during the consultation period.

[24] Implementation of mental health service recommendations in England and Wales and suicide rates, 1997-2006: a cross-sectional and before-and-after observational study". While, David; Bickley, Harriet; Roscoe, Alison; Windfuhr, Kirsten; Rahman, Shaiyan; Shaw, Jenny; Appleby, Louis; Kapur, Navneet Lancet. 2012; https://www.escholar.manchester.ac.uk/uk-ac-man-scw:157404

3.318 Aside from these initiatives, closer working with the other public health priority areas (e.g. smoking, physical activity, obesity) could focus existing programmes more acutely on people with mental health problems, who are disproportionately represented in the high use/high risk groups for these factors.

1.6.i – Infant mortality and 1.6.ii – Neonatal mortality and stillbirths

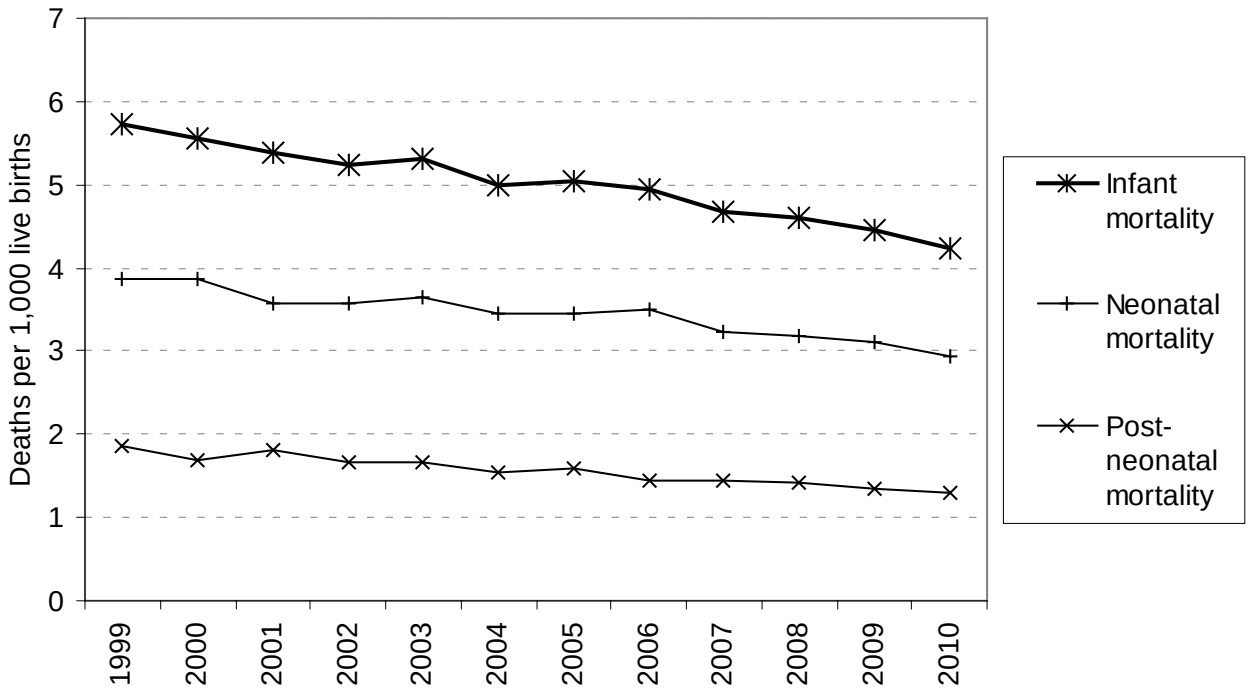
Outcomes sought	Reduced neonatal and infant mortality and stillbirths
Indicator definition	1.6.i Infant mortality rate per 1,000 live births. 1.6.ii Neonatal mortality and stillbirth rate per 1,000 live births and stillbirths. Infant mortality refers to deaths under 1 year of age. Neonatal mortality refers to deaths 0-27 days after live birth and post-neonatal mortality refers to deaths between 28 days and 1 year. Stillbirths are defined as deaths in babies born after 24 or more weeks completed gestation and which did not, at any time, breathe or show signs of life.

(a) Indicator 1.6: Recent Trends and Explanations - 1.6.i Infant mortality

3.319 In 2010, the England infant mortality rate was 4.2 deaths per 1000 live births, down from 4.5 in 2009, a drop of 6.7%. From 2001 to 2010, the infant mortality rate decreased from 5.4 to 4.2 deaths per 1,000 live births, giving an average annual decline of 2.7%. Neonatal deaths accounted for 69% of infant deaths in 2010, a proportion which has hardly changed since 2001.

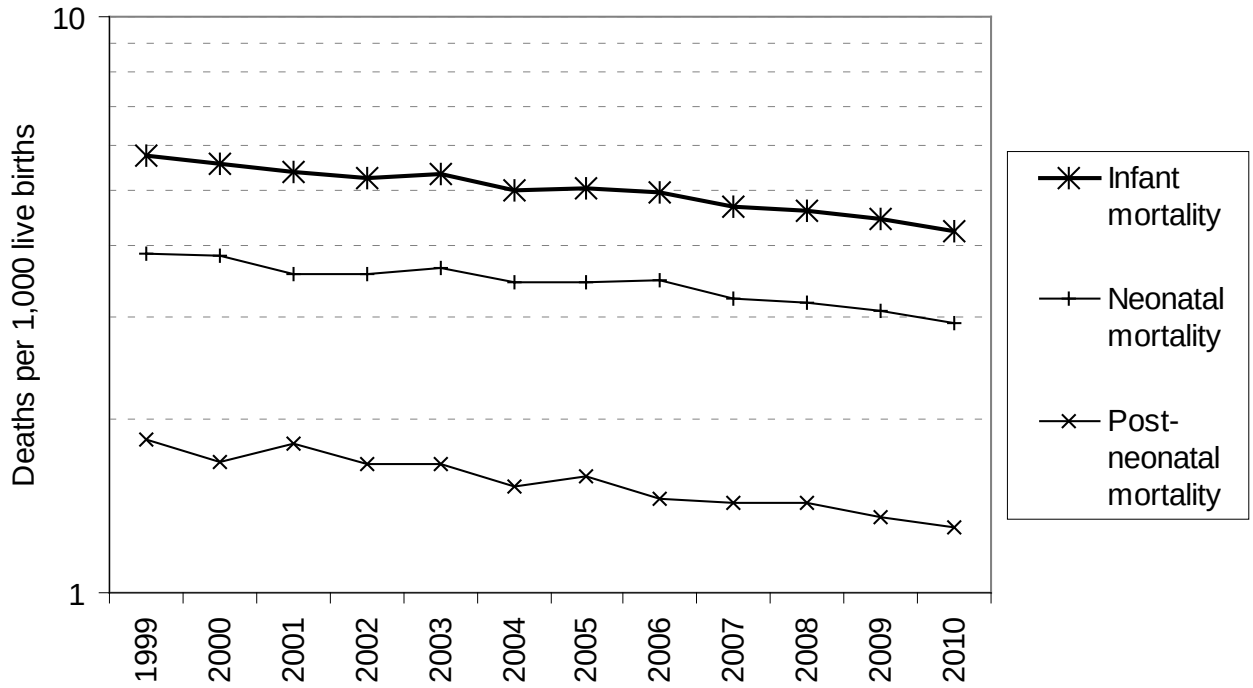
3.320 From 2001 to 2010, the neonatal mortality rate fell from 3.6 to 2.9 deaths per 1,000 live births and the post-neonatal mortality rate fell from 1.8 to 1.3 deaths per 1,000 live births, giving average annual declines of 2.2% and 3.6%, respectively.

Figure 1.6.a Infant mortality rate in England (per 1,000 live births)



Source: NHS Information Centre, Office for National Statistics, DH

Figure 1.6.b Infant mortality rate in England (per 1,000 live births) (logarithmic scale)



Source: NHS Information Centre, Office for National Statistics, DH

Table 1.6.a Infant mortality rate in England (per 1,000 live births)

	Neonatal mortality	Post-neonatal mortality	Infant mortality
1999	3.9	1.8	5.7
2000	3.9	1.7	5.6
2001	3.6	1.8	5.4
2002	3.6	1.7	5.2
2003	3.7	1.7	5.3
2004	3.4	1.5	5.0
2005	3.5	1.6	5.0
2006	3.5	1.5	4.9
2007	3.2	1.4	4.7
2008	3.2	1.4	4.6
2009	3.1	1.4	4.5
2010	2.9	1.3	4.2

Source: NHS Information Centre, Office for National Statistics, DH

Breakdown by region

3.321 Table 1.6.b shows the average annual declines for neonatal, post-neonatal and infant mortality between 2001 and 2010 for the nine regions in England.

3.322 There are variations between regions, with the greatest average annual decline for infant mortality between 2001 and 2010 in the South West (5.0%) and the least average annual reduction in Yorkshire and the Humber (0.7%).

Table 1.6.b Average annual decline by region between 2001 and 2010 (%)

	Neonatal mortality	Post-neonatal mortality	Infant mortality	Infant mortality rate per 1,000 live births, 2010
England	2.2	3.6	2.7	4.2
North East	2.8	4.5	3.3	4.0
North West	2.3	3.5	2.7	4.6
Yorkshire and the Humber	-1.3	4.2	0.7	5.2
East Midlands	2.2	4.9	3.0	3.7
West Midlands	2.1	2.2	2.2	5.3
East of England	1.8	3.9	2.5	3.6
London	2.7	4.3	3.2	4.6
South East	2.2	1.8	2.1	3.5
South West	5.4	4.3	5.0	3.4

Source: NHS Information Centre, Office for National Statistics, DH

3.323 Infant mortality rates by region are displayed in Table 1.6.d. A socio-economic gradient exists in infant mortality, with the most deprived areas experiencing the highest levels of infant mortality. To give a guide as to the level of deprivation within each region, the percentage of the regional population living in the 20% most deprived lower layer super output areas [25] (LSOAs) in England is displayed in Table 1.6.c.

3.324 Almost one in three people in the North East and North West live in one of the 20% most deprived areas in England, while in the East of England, South East and South West fewer than one in ten people live in such an area.

Table 1.6.c Proportion of regional population living in the 20% most deprived LSOAs in 2010 (percentage)

North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
32.0	31.8	27.5	16.6	28.0	7.5	26.0	7.0	9.0	19.8

Source: The English Indices of Deprivation 2010

3.325 In 2010, the South West had the lowest infant mortality rate (3.4 deaths per 1,000 live births), while the West Midlands had the highest rate (5.3 deaths per 1,000 live births). The West Midlands has had the highest infant mortality rate among the regions since 2001.

3.326 Between 2001 and 2010, the absolute difference between the regions with the highest and lowest infant mortality rates decreased slightly, from 2.1 to 1.9 deaths per 1,000 live births. The region with the lowest rate in 2001 was the South East, with 4.2 deaths per 1,000 live births, while the rate in the West Midlands was 6.4 deaths per 1,000 live births

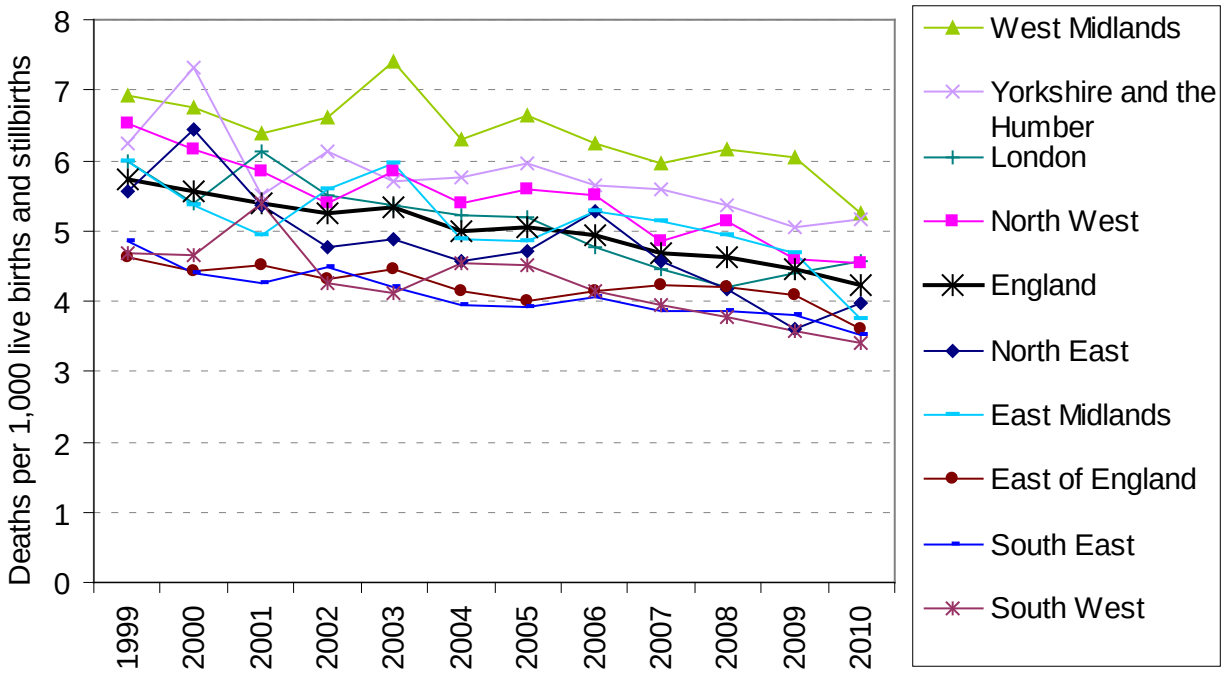
3.327 The relative gap between the regions with the highest and lowest infant mortality rates has, however, widened over this period. In 2001, the highest rate was 52.4% higher than the lowest rate, while in 2010 this gap was 55.9%.

25

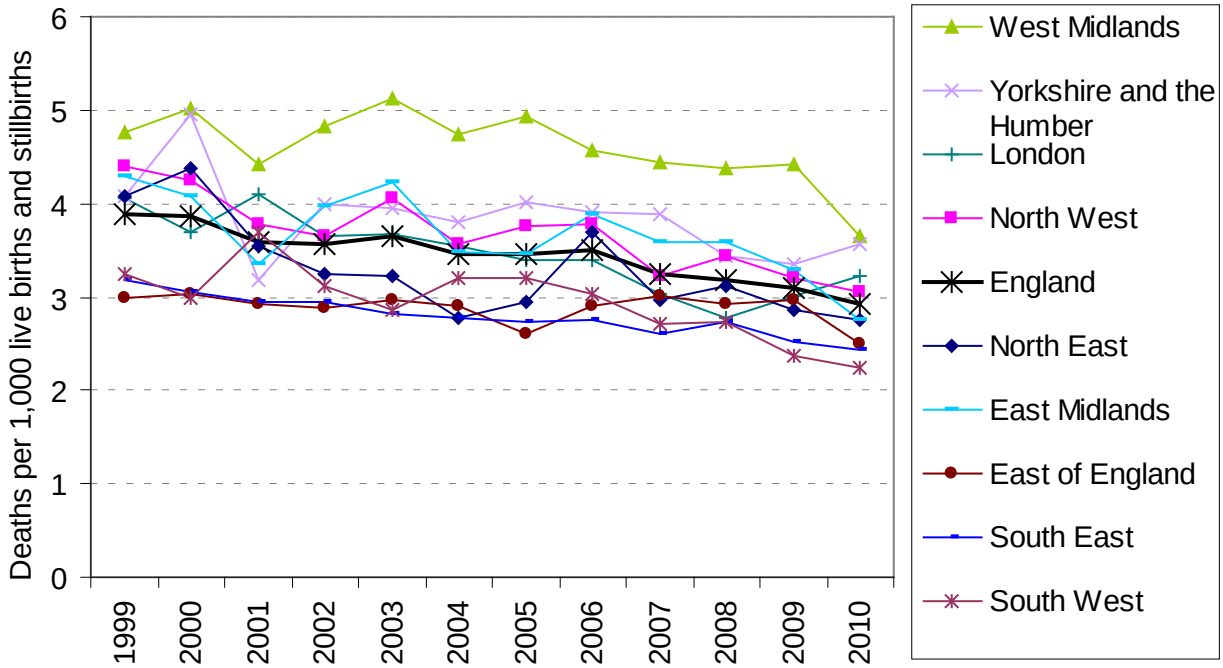
http://www.neighbourhood.statistics.gov.uk/dissemination/Info.do?page=userguide/moreaboutareas/furtherareas/further-areas.htm

3.328 For neonatal mortality, the relative gap increased from 51.7% in 2001 to 63.6% in 2010. However, for post-neonatal mortality, the relative gap decreased from 75.9% in 2001 to 60.0% in 2010.

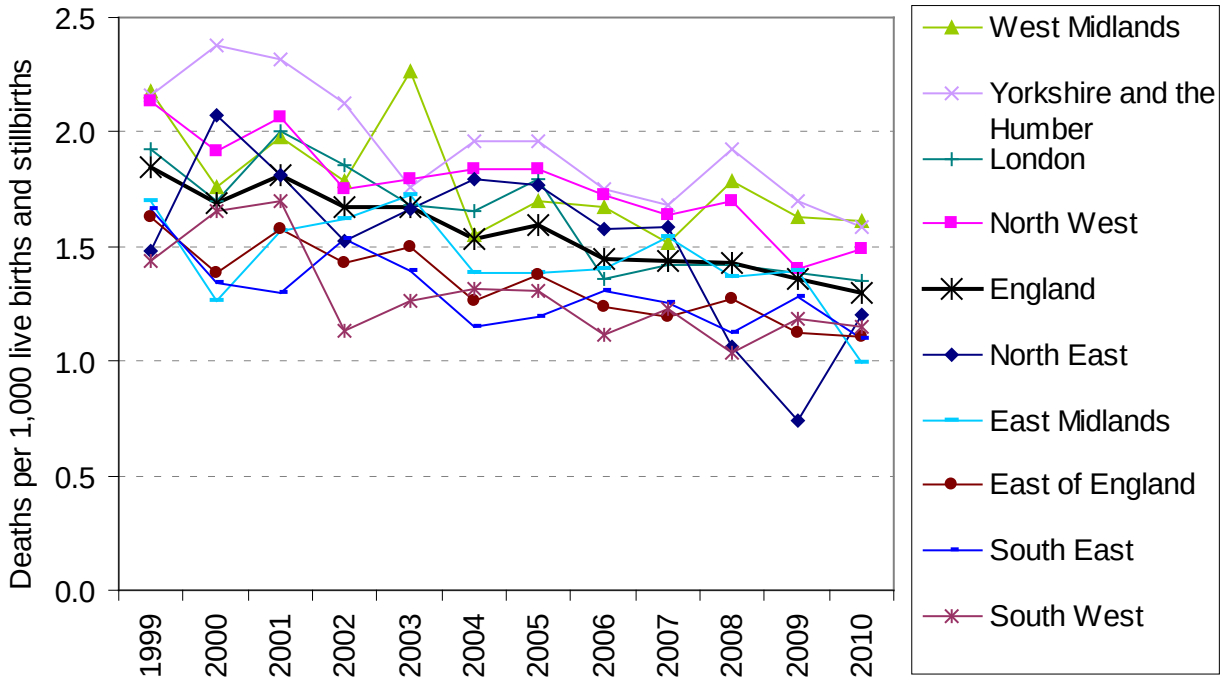
Figure 1.6.c Infant mortality rate by region (per 1,000 live births)



Neonatal mortality (per 1,000 live births)



Post-neonatal mortality (per 1,000 live births)



Source: NHS Information Centre, Office for National Statistics, DH

Table 1.6.d Infant mortality rate by region (per 1000 live births)

										Infant mortality
	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
1999	5.6	6.5	6.3	6.0	6.9	4.6	6.0	4.8	4.7	5.7
2000	6.5	6.2	7.3	5.4	6.8	4.4	5.4	4.4	4.7	5.6
2001	5.4	5.8	5.5	4.9	6.4	4.5	6.1	4.2	5.4	5.4
2002	4.8	5.4	6.1	5.6	6.6	4.3	5.5	4.5	4.3	5.2
2003	4.9	5.9	5.7	5.9	7.4	4.5	5.4	4.2	4.1	5.3
2004	4.6	5.4	5.8	4.9	6.3	4.2	5.2	3.9	4.5	5.0
2005	4.7	5.6	6.0	4.8	6.6	4.0	5.2	3.9	4.5	5.0
2006	5.3	5.5	5.7	5.3	6.2	4.1	4.8	4.1	4.1	4.9
2007	4.6	4.9	5.6	5.1	6.0	4.2	4.4	3.9	3.9	4.7
2008	4.2	5.1	5.4	4.9	6.2	4.2	4.2	3.9	3.8	4.6
2009	3.6	4.6	5.1	4.7	6.1	4.1	4.4	3.8	3.6	4.5
2010	4.0	4.6	5.2	3.7	5.3	3.6	4.6	3.5	3.4	4.2

										n**eonatal mortality**
	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
1999	4.1	4.4	4.1	4.3	4.8	3.0	4.1	3.2	3.2	3.9
2000	4.4	4.3	4.9	4.1	5.0	3.0	3.7	3.1	3.0	3.9
2001	3.5	3.8	3.2	3.4	4.4	2.9	4.1	2.9	3.7	3.6
2002	3.2	3.6	4.0	4.0	4.8	2.9	3.6	2.9	3.1	3.6
2003	3.2	4.1	4.0	4.2	5.1	3.0	3.7	2.8	2.9	3.7
2004	2.8	3.6	3.8	3.5	4.7	2.9	3.6	2.8	3.2	3.4
2005	2.9	3.8	4.0	3.5	4.9	2.6	3.4	2.7	3.2	3.5
2006	3.7	3.8	3.9	3.9	4.6	2.9	3.4	2.7	3.0	3.5
2007	3.0	3.2	3.9	3.6	4.5	3.0	3.0	2.6	2.7	3.2
2008	3.1	3.4	3.4	3.6	4.4	2.9	2.8	2.7	2.7	3.2
2009	2.9	3.2	3.4	3.3	4.4	3.0	3.0	2.5	2.4	3.1
2010	2.8	3.1	3.6	2.8	3.6	2.5	3.2	2.4	2.2	2.9
										Post-neonatal mortality
	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
1999	1.5	2.1	2.2	1.7	2.2	1.6	1.9	1.7	1.4	1.8
2000	2.1	1.9	2.4	1.3	1.8	1.4	1.7	1.3	1.7	1.7
2001	1.8	2.1	2.3	1.6	2.0	1.6	2.0	1.3	1.7	1.8
2002	1.5	1.8	2.1	1.6	1.8	1.4	1.9	1.5	1.1	1.7
2003	1.7	1.8	1.8	1.7	2.3	1.5	1.7	1.4	1.3	1.7
2004	1.8	1.8	2.0	1.4	1.5	1.3	1.7	1.2	1.3	1.5
2005	1.8	1.8	2.0	1.4	1.7	1.4	1.8	1.2	1.3	1.6
2006	1.6	1.7	1.7	1.4	1.7	1.2	1.4	1.3	1.1	1.5
2007	1.6	1.6	1.7	1.5	1.5	1.2	1.4	1.3	1.2	1.4
2008	1.1	1.7	1.9	1.4	1.8	1.3	1.4	1.1	1.0	1.4
2009	0.7	1.4	1.7	1.4	1.6	1.1	1.4	1.3	1.2	1.4
2010	1.2	1.5	1.6	1.0	1.6	1.1	1.4	1.1	1.1	1.3

Source: NHS Information Centre, Office for National Statistics, DH

Breakdown by sex

3.329 By sex, the average annual declines for infant mortality between 2001 and 2010 were greater for males than for females, for both neonatal and post-neonatal mortality, and so for infant mortality as a whole.

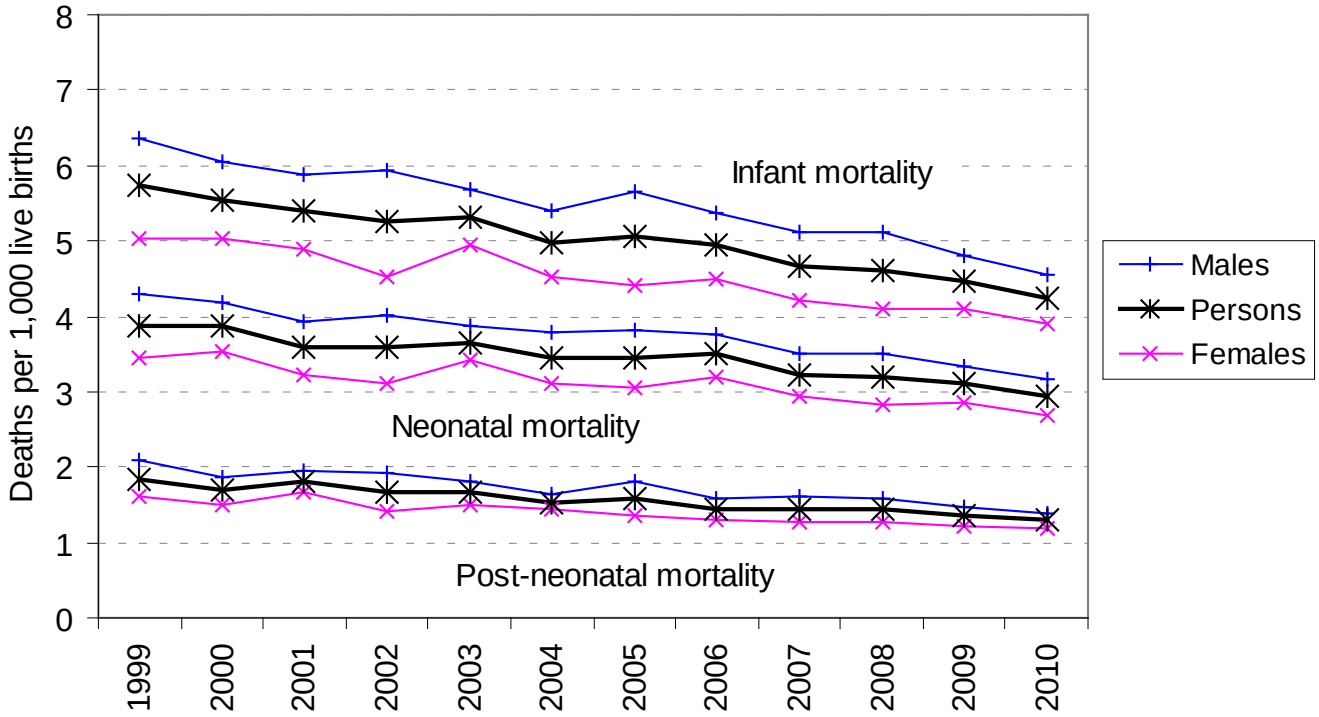
3.330 Infant mortality rates have consistently been higher among males than among females.

Table 1.6.e Average annual decline by sex between 2001 and 2010 (%)

	Neonatal mortality	Post-neonatal mortality	Infant mortality	Infant mortality rate per 1,000 live births and stillbirths, 2010
Males	2.4	3.7	2.8	4.6
Females	2.0	3.6	2.5	3.9
Persons	2.2	3.6	2.7	4.2

Source: NHS Information Centre, Office for National Statistics, DH

Figure 1.6.d Infant mortality rate by sex (per 1,000 live births)



Source: NHS Information Centre, Office for National Statistics, DH

Table 1.6.f Infant mortality rate by sex (per 1,000 live births)

Neonatal mortality			Post-neonatal mortality			Infant mortality		
Males	Females	Persons	Males	Females	Persons	Males	Females	Persons
4.3	3.4	3.9	2.1	1.6	1.8	6.4	5.0	5.7
4.2	3.5	3.9	1.9	1.5	1.7	6.0	5.0	5.6
3.9	3.2	3.6	2.0	1.7	1.8	5.9	4.9	5.4
4.0	3.1	3.6	1.9	1.4	1.7	5.9	4.5	5.2
3.9	3.4	3.7	1.8	1.5	1.7	5.7	4.9	5.3
3.8	3.1	3.4	1.6	1.4	1.5	5.4	4.5	5.0
3.8	3.1	3.5	1.8	1.4	1.6	5.6	4.4	5.0
3.8	3.2	3.5	1.6	1.3	1.5	5.4	4.5	4.9
3.5	3.0	3.2	1.6	1.3	1.4	5.1	4.2	4.7
3.5	2.8	3.2	1.6	1.3	1.4	5.1	4.1	4.6
3.3	2.9	3.1	1.5	1.2	1.4	4.8	4.1	4.5
3.2	2.7	2.9	1.4	1.2	1.3	4.6	3.9	4.2

Source: NHS Information Centre, Office for National Statistics, DH

Breakdown by age of mother (England and Wales)

3.331 Data for England only is currently unavailable, however data for England and Wales together shows that infant mortality rates do vary by age of mother, with the highest rates amongst babies of mothers aged less than 20, followed by those of mothers aged 40 and over.

Table 1.6.g Infant mortality rates by age of mother for England and Wales (per 1,000 live births)

	All ages	Under 20	20–24	25–29	30–34	35–39	40 and over
1999	5.7	8.7	6.5	5.2	5.0	5.4	6.3
2000	5.5	8.4	6.9	4.9	4.6	5.1	6.8
2001	5.3	8.3	6.0	4.8	4.6	5.1	7.3
2002	5.2	8.0	5.8	4.8	4.3	5.0	7.2
2003	5.2	7.9	6.1	5.0	4.3	4.9	6.2
2004	4.9	7.7	5.3	4.7	4.2	4.8	5.9
2005	5.0	7.2	5.6	4.9	4.2	4.8	5.1
2006	4.9	6.5	5.7	4.8	4.1	4.3	5.9
2007	4.6	7.2	5.3	4.3	4.0	4.4	4.9
2008	4.5	6.5	5.2	4.5	3.8	4.1	5.3
2009	4.4	5.9	5.1	4.3	3.9	4.0	5.8
2010	4.2	5.6	4.5	4.0	3.8	3.9	5.8
Number of live births in 2010	723,079	40,595	137,296	199,193	202,442	115,826	27,727

Source: Office for National Statistics (Release: Infant and perinatal mortality in England and Wales by social and biological factors)

Breakdown by country of birth of mother (England and Wales)

3.332 There are variations in infant mortality rates by mother's country of birth, with the highest rates amongst babies of mothers born in Africa and the Middle East and Asia.

Table 1.6.h Infant mortality rates for England and Wales by mother's country of birth, 2010

Country of birth	Rates per 1,000 live births			Proportion of live births
	Neonatal mortality	Post-neonatal mortality	Infant	
Total	2.9	1.3	4.2	100.0%
UK	2.8	1.3	4.0	74.9%
Total outside UK	3.2	1.3	4.6	25.1%
EU	2.7	0.8	3.5	7.3%
New EU	2.8	0.8	3.6	4.7%
Rest of Europe (non EU)	2.1	0.7	2.8	1.0%
Middle East and Asia	3.4	1.8	5.2	9.2%
Africa	4.2	1.5	5.6	5.5%
Rest of World	2.6	0.8	3.4	2.1%
				Total live births 723,079

Source: Office for National Statistics (Release: Infant and perinatal mortality in England and Wales by social and biological factors)

Note: UK includes Isle of Man and Channel Islands. Rest of World includes The Americas and the Caribbean and Antarctica and Oceania. The 'New EU' constitutes the twelve countries which have joined the European Union since 2004 (see Metadata). The 12 countries which have joined the European Union since 2004 are included in both the New EU and the EU row.

3.333 The highest infant mortality rates in 2008, 2009 and 2010 have been amongst babies of mothers born in Pakistan and the Caribbean, with rates roughly double those of babies of mothers born in the UK. In 2010, babies of mothers born in Central and Western Africa also had high infant mortality rates in relation to the UK rate.

Table 1.6.i Infant mortality rates among babies born in England and Wales to mothers born in Pakistan, Western Africa, the Caribbean, Central Africa and the UK (per 1,000 live births)

	Pakistan	Western Africa	Caribbean	Central Africa	UK
2008	8.7	-	9.5	-	4.4
2009	7.9	-	8.4	-	4.2
2010	8.5	7.3	6.3	8.8	4.0
Average proportion of live births 2008-2010	2.6%	1.8%	0.5%	0.4%	75.4%
					Total live births 723,165

Source: Office for National Statistics (Release: Child Mortality Statistics: Childhood, infant and perinatal)

Note: There was a change in classification from political entities to geographic entities in 2010.

Breakdown by registration type (England and Wales)

3.334 In 2010, the registration types with the highest mortality rates were sole registered births (5.4 per 1,000 live births) and births outside marriage jointly registered by both parents giving different addresses (5.5 per 1,000 live births). This is in line with previous years.

Table 1.6.j Infant mortality rates by marital status/type of registration (per 1,000 live births)

	All	Inside marriage	Joint registration/ same address	Joint registration/ different address	Sole registration
2008	4.5	4.1	4.3	6.2	6.8
2009	4.4	4.1	4.4	5.6	5.5
2010	4.2	3.9	4.0	5.5	5.4
					Total live births 723,165

Source: Office for National Statistics (Release: Child mortality statistics: Childhood, infant and perinatal)
Note: The figures used in the sections “breakdown by age of mother” and “breakdown by country of birth” relate to live births, stillbirths and infant deaths that occurred in England and Wales in that year and comprise the infant deaths which had been linked to their corresponding birth records (around 98% of infant deaths in 2008, 2009 and 2010).

International position

3.335 International comparisons of infant mortality should be treated with caution due to variations among countries in registration practices of premature infants. Some countries have gestational age and/or weight limits for registration, which may result in lower infant mortality rates for these countries, as the figures exclude very small and/or very premature babies, who are more vulnerable.

3.336 The UK infant mortality rate has fallen substantially since 1970, when it was 18.5 deaths per 1,000 live births. However, the EU-15 average rate has fallen more quickly than the UK rate. In 1970, the UK rate was below the EU-15 average of 21.9 deaths per 1,000 live births, but since 1994 the UK rate has been higher. More recently, the EU-27 average has dropped below the UK infant mortality rate. In 2009, the EU-15 and EU-27 averages were 4.3 and 3.7 deaths per 1,000 live births, respectively, while the UK infant mortality rate was 4.5 deaths per 1,000 live births.

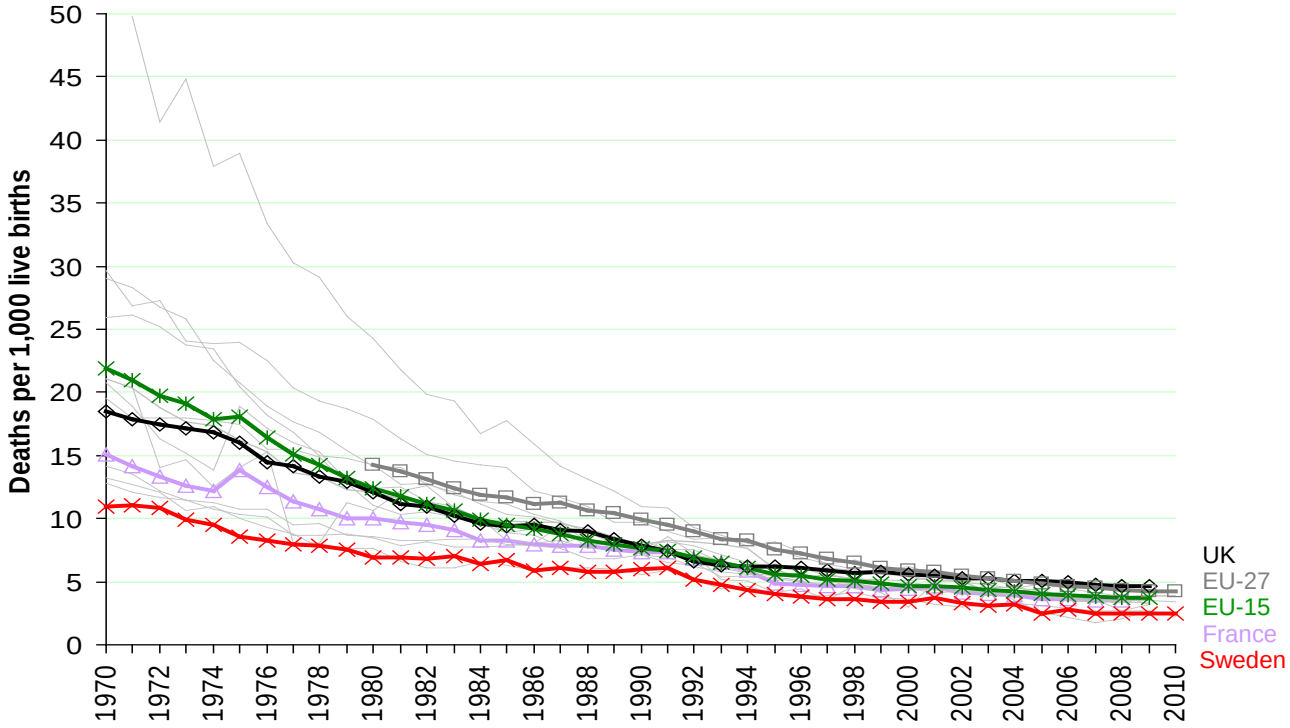
3.337 However, the difference in infant mortality rates between countries could be due to a number of factors, including:

- population based socio-demographic and socio-economic differences
- differences in access and provision of maternity services

3.338 Although, it is not clear how much of the difference is explained by these factors. Together, these factors and others could lead to a systematic bias in comparisons of infant mortality rates.

Figure 1.6.e - Infant mortality

Aged under 1 year, England, EU-15 countries and selected averages



Source: WHO European Health For All database (HFA-DB)

Cautionary note: It is difficult to make valid international comparisons in this area due to different definitions and data registration systems. The differences in registration of live births mean there are variations between countries in the reporting of both live births and infant deaths.

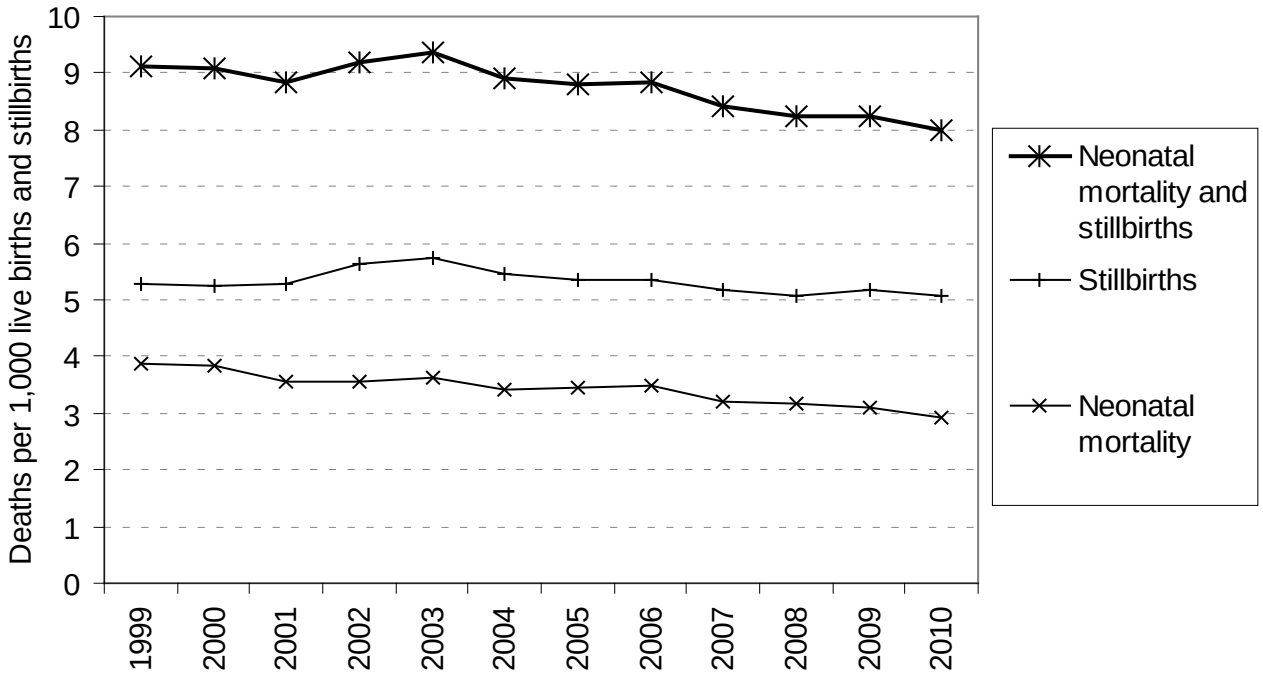
1.6.ii Neonatal mortality and stillbirths

3.339 In 2010, the neonatal mortality and stillbirth rate was 8.0, down from 8.3 in 2009, deaths per 1,000 live births and stillbirths, a drop of 3%. Between 2001 and 2010, this rate decreased from 8.8 to 8.0 deaths per 1,000 live births and stillbirths, giving an average annual decline of 1.1%. Stillbirths accounted for 63.5% of neonatal mortality and stillbirths in 2010, this proportion has increased gradually from 59.7% in 1999.

3.340 In the decade to 2010, the neonatal mortality rate fell from 3.6 to 2.9 deaths per 1,000 live births and stillbirths and the stillbirths rate fell from 5.3 to 5.1 deaths per 1,000 live births, giving average annual declines of 2.2% and 0.4%, respectively.

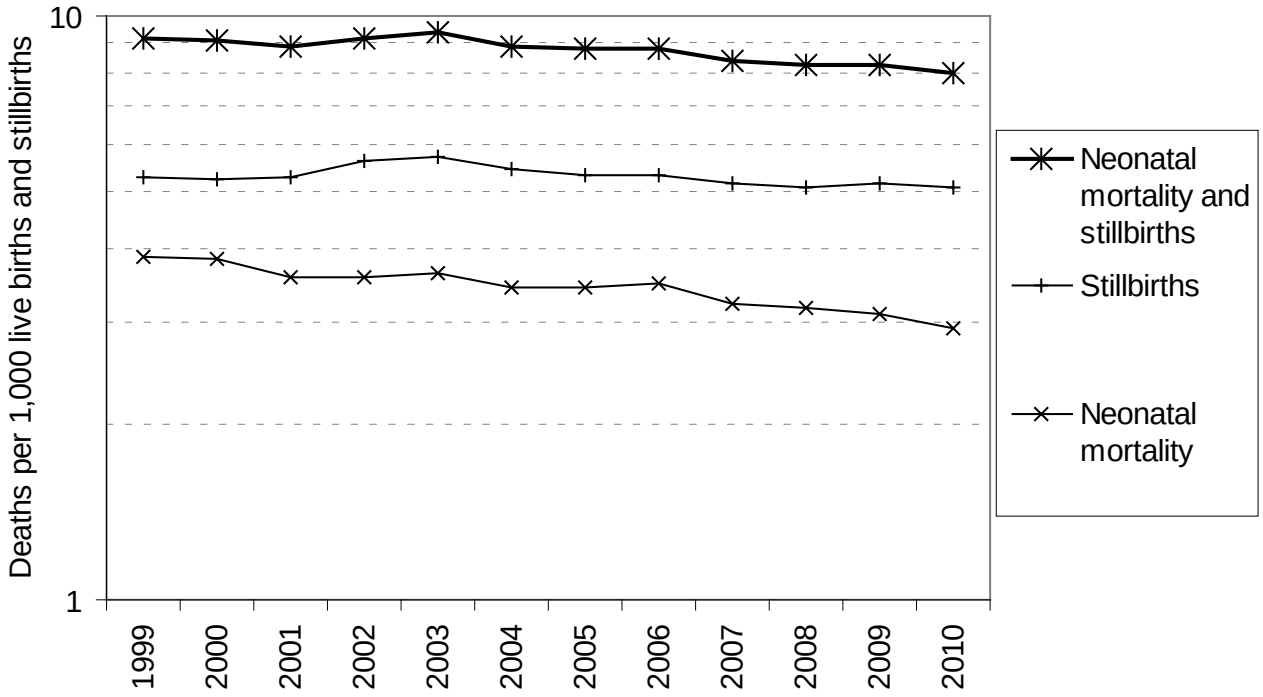
3.341 Figure 1.6.g, with the logarithmic chart, shows the rate of change, rather than the absolute change, over time. This helps to highlight whether disaggregations of the data are changing at different rates. In this case, it shows that the neonatal mortality rate is decreasing more quickly than the stillbirths rate, and thus we can conclude that the reduction in the neonatal mortality and stillbirth rate has been driven by a reduction in the neonatal mortality rate.

Figure 1.6.f Neonatal mortality and stillbirths in England (per 1,000 live births and stillbirths)



Source: NHS Information Centre, Office for National Statistics, DH

Figure 1.6.g Neonatal mortality and stillbirths in England (per 1,000 live births and stillbirths) (logarithmic scale)



Source: NHS Information Centre, Office for National Statistics, DH

Table 1.6.k Neonatal mortality and stillbirth rates in England (per 1,000 live births and stillbirths)

	Neonatal mortality	Stillbirths	Neonatal mortality and stillbirths
1999	3.9	5.3	9.1
2000	3.8	5.3	9.1
2001	3.6	5.3	8.8
2002	3.6	5.6	9.2
2003	3.6	5.7	9.4
2004	3.4	5.5	8.9
2005	3.4	5.4	8.8
2006	3.5	5.3	8.8
2007	3.2	5.2	8.4
2008	3.2	5.1	8.2
2009	3.1	5.2	8.3
2010	2.9	5.1	8.0

Source: NHS Information Centre, Office for National Statistics, DH

Breakdown by region

3.342 The average annual declines for neonatal mortality and stillbirths between 2001 and 2010 for the nine regions in England are displayed in Table 1.6.l.

3.343 Variations exist between regions, with the greatest average annual decline in the neonatal mortality and stillbirth rate between 2001 and 2010 in the South West (2.3%), while the rate in Yorkshire and The Humber actually increased over this decade, giving a negative average annual decline of -1.0%.

Table 1.6.l Average annual decline by region between 2001 and 2010 (%)

	Neonatal mortality	Stillbirths	Neonatal mortality and stillbirths	Neonatal mortality and stillbirth rate per 1,000 live births and stillbirths, 2010
England	2.2	0.4	1.1	8.0
North East	2.7	1.3	1.9	7.4
North West	2.3	1.7	1.9	8.2
Yorkshire and the Humber	-1.3	-0.8	-1.0	9.1
East Midlands	2.2	0.2	0.9	8.0
West Midlands	2.1	0.5	1.2	8.9
East of England	1.8	0.3	0.8	7.2
London	2.7	0.7	1.5	8.7
South East	2.2	-0.3	0.6	7.2
South West	5.4	0.2	2.3	6.5

Source: NHS Information Centre, Office for National Statistics, DH

3.344 Neonatal mortality and stillbirth rates are displayed in Table 1.6.m. These rates are susceptible to differences in recording practice, and it has been found that there are regional variations in registering live births according to gestational age category[26] . Thus, there could be systematically higher or lower rates of neonatal mortality or stillbirths in some regions, while the overall neonatal mortality and stillbirth rate in these regions is not markedly different that of other regions.

3.345 Other factors, including population based socio-demographic and socio-economic differences, could account for some of the differences in neonatal mortality and stillbirths between regions.

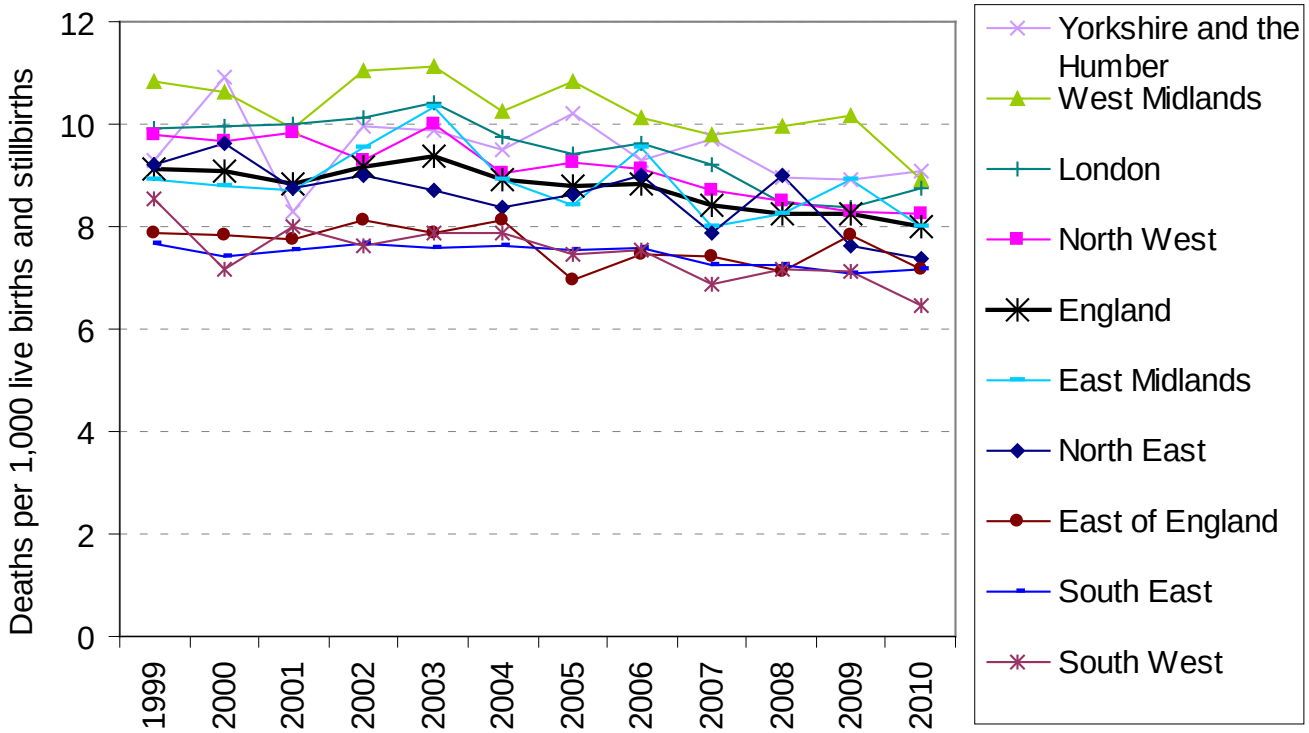
3.346 The relative difference between the regions with the highest and lowest neonatal mortality and stillbirth rates increased between 2001 and 2010.

3.347 The highest rate in 2001 (10.0 deaths per 1,000 live births, in London) was 33.3% higher than the lowest rate (7.5 deaths per 1,000 live births, in the South East). In 2010, the highest rate was 40.0% higher than the lowest rate (highest in Yorkshire and the Humber and lowest in the South West, with 9.1 and 6.5 deaths per 1,000 live births, respectively).

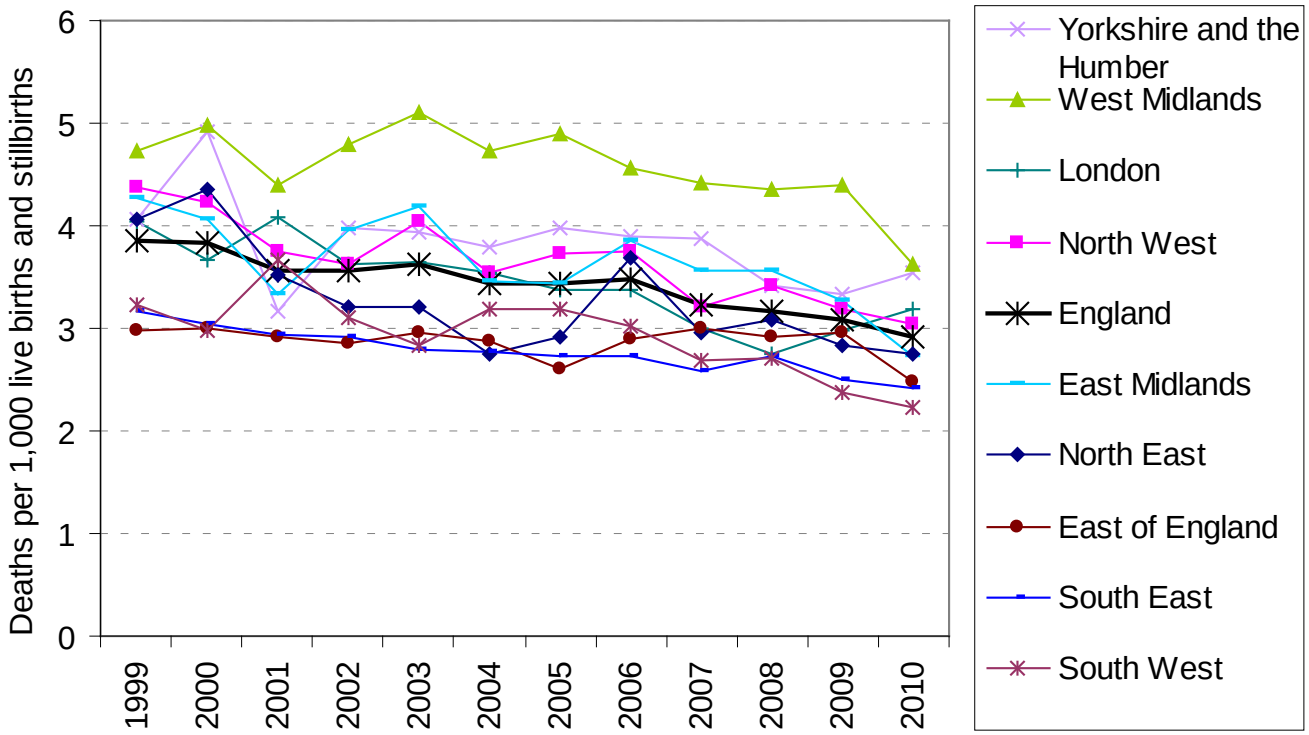
3.348 For neonatal mortality, the relative gap increased from 51.7% in 2001 to 63.6% in 2010. However, for post-neonatal mortality, the relative gap decreased from 41.9% in 2001 to 31.0% in 2010.

[26] http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_065544

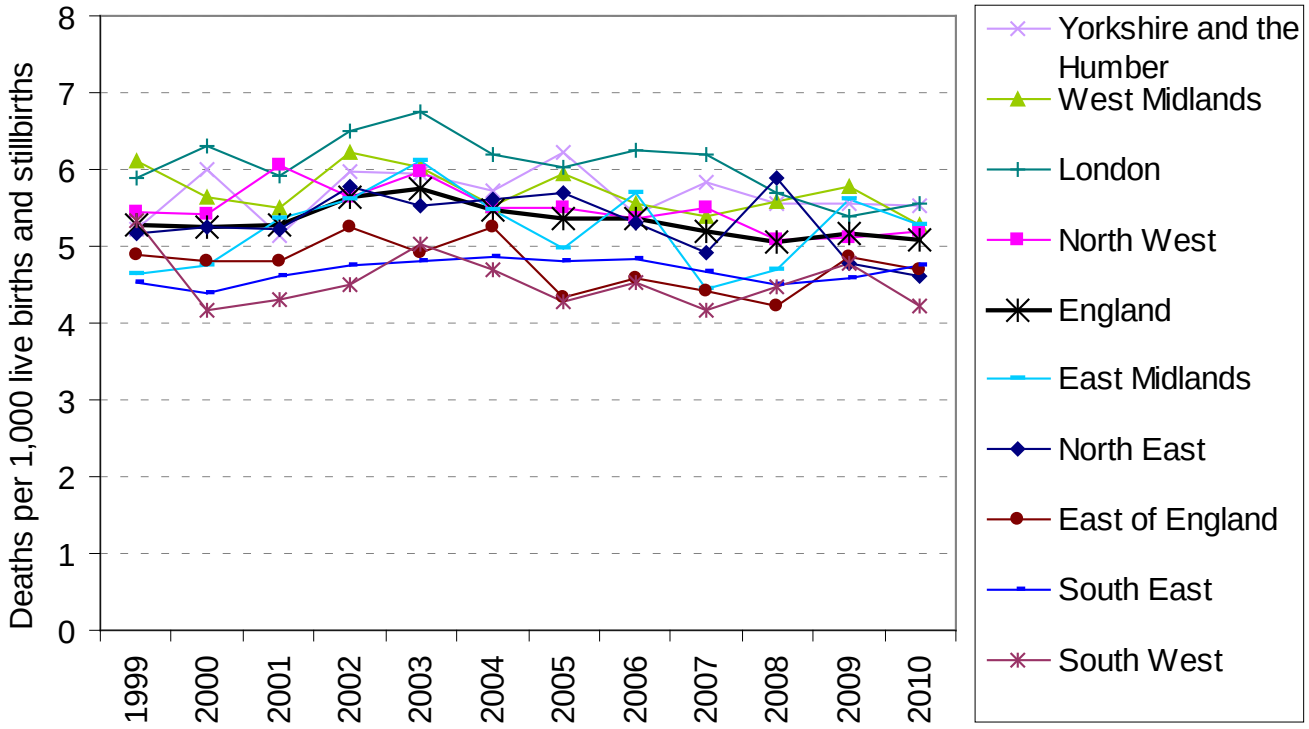
Figure 1.6.h Neonatal mortality and stillbirth rates by region (per 1,000 live births and stillbirths)



Neonatal mortality (per 1,000 live births and stillbirths)



Stillbirths (per 1,000 live births and stillbirths)



Source: NHS Information Centre, Office for National Statistics, DH

Table 1.6.m Neonatal mortality and stillbirth rates by region (per 1,000 live births and stillbirths)

Neonatal mortality and stillbirths										
	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
1999	9.2	9.8	9.3	8.9	10.9	7.9	9.9	7.7	8.6	9.1
2000	9.6	9.7	10.9	8.8	10.6	7.8	10.0	7.4	7.2	9.1
2001	8.7	9.8	8.3	8.7	9.9	7.7	10.0	7.5	8.0	8.8
2002	9.0	9.3	10.0	9.6	11.0	8.1	10.1	7.7	7.6	9.2
2003	8.7	10.0	9.9	10.3	11.1	7.9	10.4	7.6	7.9	9.4
2004	8.4	9.0	9.5	8.9	10.3	8.1	9.7	7.6	7.9	8.9
2005	8.6	9.3	10.2	8.4	10.8	6.9	9.4	7.5	7.5	8.8
2006	9.0	9.1	9.3	9.6	10.1	7.5	9.6	7.6	7.6	8.8
2007	7.9	8.7	9.7	8.0	9.8	7.4	9.2	7.3	6.9	8.4
2008	9.0	8.5	9.0	8.3	9.9	7.1	8.4	7.2	7.2	8.2
2009	7.6	8.3	8.9	8.9	10.2	7.8	8.4	7.1	7.1	8.3
2010	7.4	8.2	9.1	8.0	8.9	7.2	8.7	7.2	6.5	8.0
Neonatal mortality										
	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
1999	4.1	4.4	4.1	4.3	4.7	3.0	4.0	3.2	3.2	3.9
2000	4.4	4.2	4.9	4.1	5.0	3.0	3.7	3.0	3.0	3.8
2001	3.5	3.8	3.2	3.3	4.4	2.9	4.1	2.9	3.7	3.6
2002	3.2	3.6	4.0	4.0	4.8	2.9	3.6	2.9	3.1	3.6
2003	3.2	4.0	3.9	4.2	5.1	3.0	3.7	2.8	2.8	3.6
2004	2.8	3.5	3.8	3.5	4.7	2.9	3.5	2.8	3.2	3.4
2005	2.9	3.7	4.0	3.4	4.9	2.6	3.4	2.7	3.2	3.4
2006	3.7	3.8	3.9	3.9	4.6	2.9	3.4	2.7	3.0	3.5
2007	3.0	3.2	3.9	3.6	4.4	3.0	3.0	2.6	2.7	3.2
2008	3.1	3.4	3.4	3.6	4.4	2.9	2.8	2.7	2.7	3.2
2009	2.8	3.2	3.3	3.3	4.4	3.0	3.0	2.5	2.4	3.1
2010	2.7	3.0	3.5	2.7	3.6	2.5	3.2	2.4	2.2	2.9
Stillbirths										
	North East	North West	Yorkshire and the Humber	East Midlands	West Midlands	East of England	London	South East	South West	England
1999	5.2	5.4	5.2	4.6	6.1	4.9	5.9	4.5	5.3	5.3
2000	5.3	5.4	6.0	4.7	5.6	4.8	6.3	4.4	4.2	5.3
2001	5.2	6.1	5.1	5.4	5.5	4.8	5.9	4.6	4.3	5.3
2002	5.8	5.6	6.0	5.6	6.2	5.3	6.5	4.8	4.5	5.6
2003	5.5	6.0	6.0	6.1	6.0	4.9	6.8	4.8	5.0	5.7
2004	5.6	5.5	5.7	5.5	5.5	5.2	6.2	4.9	4.7	5.5
2005	5.7	5.5	6.2	5.0	5.9	4.3	6.0	4.8	4.3	5.4
2006	5.3	5.4	5.4	5.7	5.6	4.6	6.3	4.8	4.5	5.3
2007	4.9	5.5	5.8	4.4	5.4	4.4	6.2	4.7	4.2	5.2
2008	5.9	5.1	5.6	4.7	5.6	4.2	5.7	4.5	4.5	5.1
2009	4.8	5.1	5.6	5.6	5.8	4.9	5.4	4.6	4.8	5.2
2010	4.6	5.2	5.5	5.3	5.3	4.7	5.5	4.7	4.2	5.1

Source: NHS Information Centre, Office for National Statistics, DH

Breakdown by sex

3.349 By sex, the average annual declines for neonatal mortality and stillbirths between 2001 and 2010 are displayed in Table 1.6.n.

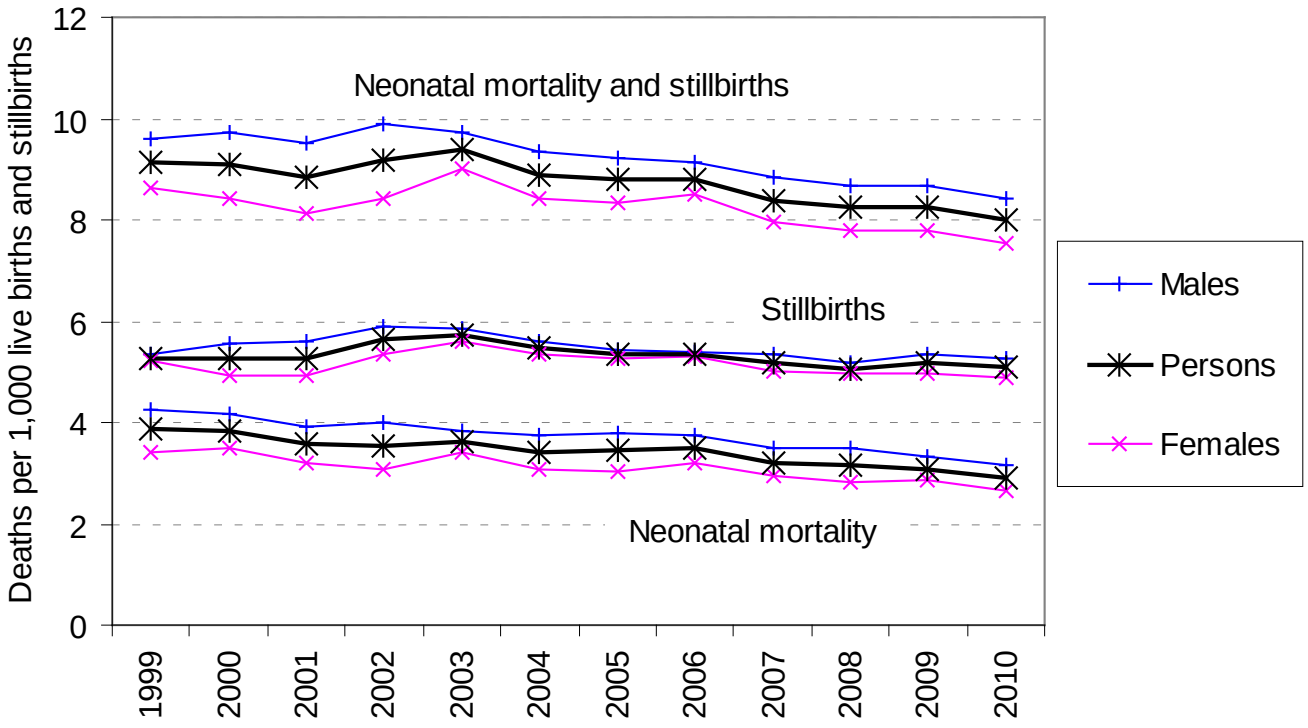
3.350 For both sexes, the average annual declines in neonatal mortality were similar over the decade to 2010, while for stillbirths there was very little change. The neonatal mortality and stillbirth rates have been consistently higher among males than among females.

Table 1.6.n Average annual decline by sex between 2001-2010 (%)

	Neonatal mortality	Stillbirths	Neonatal mortality and stillbirths	Neonatal mortality and stillbirth rate per 1,000 live births and stillbirths, 2009
Males	2.4	0.7	1.3	8.4
Females	2.0	0.1	0.8	7.5
Persons	2.2	0.4	1.1	8.0

Source: NHS Information Centre, Office for National Statistics, DH

Figure 1.6.i Neonatal mortality and stillbirth rates by sex (per 1,000 live births and stillbirths)



Source: NHS Information Centre, Office for National Statistics, DH

Breakdown by age of mother (England and Wales)

3.351 Data for England is currently unavailable, but England and Wales data shows that neonatal mortality and stillbirth rates vary by age of mother, with the highest rates among babies of mothers aged 40 and over, followed by those of mothers aged under 20.

Table 1.6.p Neonatal mortality and stillbirth rates by age of mother for England and Wales (per 1,000 live births and stillbirths)

	All ages	Under 20	20–24	25–29	30–34	35–39	40 and over
1999	9.1	10.3	9.7	8.8	8.2	9.6	14.0
2000	9.1	11.2	9.7	8.3	8.3	9.7	13.2
2001	8.8	10.7	9.3	8.1	8.2	9.0	12.8
2002	9.1	10.8	9.7	8.7	8.1	9.6	13.3
2003	9.3	12.0	9.1	9.1	8.6	9.2	12.6
2004	8.9	12.0	9.1	8.3	7.9	9.2	12.9
2005	8.7	10.9	8.8	8.7	7.8	9.0	11.1
2006	8.8	10.0	8.9	8.7	7.8	8.8	13.0
2007	8.4	10.2	8.8	8.0	7.7	8.3	11.0
2008	8.2	9.5	9.0	7.5	7.5	8.3	10.8
2009	8.3	9.8	8.7	7.7	7.5	8.6	11.5
2010	8.0	9.1	8.4	7.3	7.4	8.5	11.2
Number of live births in 2010	723,079	40,595	137,296	199,193	202,442	115,826	27,727
Number of stillbirths in 2010	3,714	238	759	915	945	648	209

Source: Office for National Statistics, DH (Release: Infant and perinatal mortality in England and Wales by social and biological factors)

Breakdown by country of birth of mother (England and Wales)

3.352 There are variations in infant mortality rates by mother's country of birth, with rates roughly double among the babies of mothers born in Pakistan, the Caribbean, Central and Western Africa than amongst babies of mothers born in the UK.

Table 1.6.q Neonatal mortality and stillbirth rates among babies born in England and Wales to mothers born in Pakistan, Western Africa, the Caribbean, Central Africa and the UK (per 1,000 live births and stillbirths)

	Pakistan	Western Africa	Caribbean	Central Africa	UK
2008	13	-	15.7	-	7.7
2009	13.6	-	15.2	-	7.9
2010	14.4	15.4	11	14.2	7.5
Average proportion of live births 2008-2010	2.60%	1.80%	0.50%	0.40%	75.40%
Average proportion of stillbirths 2008-2010	4.40%	3.70%	0.70%	0.60%	70.30%
					Total live births 723,165
					Total stillbirths 3,714

Source: Office for National Statistics, DH (Child Mortality Statistics: childhood, infant, perinatal)

3.353 The following table shows neonatal mortality and stillbirth rates among babies of mothers born in different countries.

Table 1.6.r Neonatal mortality and stillbirth rates by mother's country of birth, 2010

Country of birth	Rates per 1,000 live births and stillbirths			Proportion of births	
	Neonatal mortality	Stillbirths	Neonatal mortality and stillbirths	Live births	Stillbirths
Total	2.9	5.1	8.0	100.0%	100.0%
UK	2.8	4.7	7.5	74.9%	69.2%
Total outside UK	3.2	6.2	9.5	25.1%	30.7%
EU	2.6	4.9	7.6	7.3%	7.0%
New EU	2.8	4.8	7.6	4.7%	4.4%
Rest of Europe (non EU)	2.1	3.6	5.7	1.0%	0.7%
Middle East and Asia	3.4	7.1	10.5	9.2%	12.8%
Africa	4.2	7.9	12.1	5.5%	8.5%
Rest of World	2.6	4.1	6.7	2.1%	1.7%
					Total live births 723,079
					Total stillbirths 3,714

Source: Office for National Statistics, DH (Release: Infant and perinatal mortality in England and Wales by social and biological factors)

Note: Rest of World includes The Americas and the Caribbean and Antarctica and Oceania. The 'New EU' constitutes the twelve countries which have joined the European Union since 2004 (see Metadata). The twelve countries which have joined the European Union since 2004 are included in both the New EU and the EU column.

Breakdown by registration type (England and Wales)

3.354 In 2010, the registration types with the highest mortality rates were sole registered births (9.6 per 1,000 live births) and births outside marriage jointly registered by both parents giving different addresses (9.2 per 1,000 live births). These types of registration also had the highest neonatal mortality and stillbirth rates in 2008 and 2009.

Table 1.6.s Neonatal mortality and stillbirth rates by marital status/type of registration (per 1,000 live births and stillbirths)

	All	Inside marriage	Joint registration/ same address	Joint registration/ different address	Sole registration
2008	8.2	7.6	8.4	9.2	10.6
2009	8.3	7.9	8.1	9.5	10.4
2010	8.0	7.6	8.0	9.2	9.6
					Total live births 723,165
					Total stillbirths 3,714

Source: Office for National Statistics (Release: Child mortality statistics: Childhood, infant and perinatal)

International position

3.355 International comparisons are available for neonatal mortality and for stillbirths separately (using fetal deaths as a proxy). A fetal death is defined by the World Health Organisation as death prior to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of pregnancy; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles.

3.356 These international comparisons need to be interpreted with caution due to differences in international recording of neonatal deaths and stillbirths. These indicators are not considered reliable measures of international comparisons for the levels of neonatal deaths and stillbirths. They are, however, useful to compare rates of change in the levels of neonatal deaths and stillbirths over time.

3.357 The UK neonatal mortality rate, given per 1,000 live births rather than per 1,000 live births and stillbirths, was lower than the EU-15 average from 1980 to 1991, after which the UK rate has been higher. In 2009, the EU-15 and EU-27 averages were 2.5 and 2.8 neonatal deaths per 1,000 live births, while the UK neonatal mortality rate was 3.18 per 1,000 live births.

3.358 However, there are a number of reasons to which the difference in neonatal mortality rates between countries may be attributed, masking the actual difference, including:

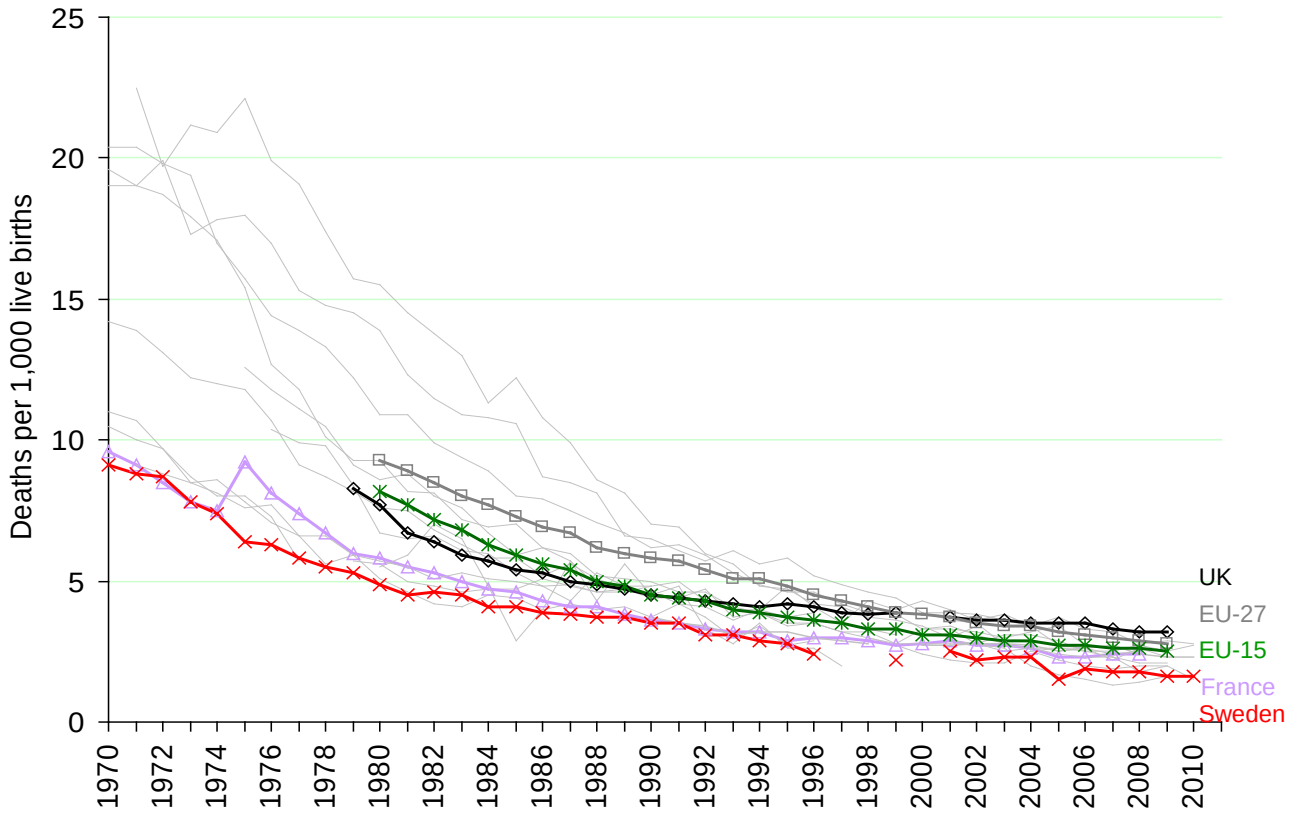
- differing criteria for registering stillbirths - some countries use gestational age and birth weight limits, while others use only one of these, with age limits varying between 22 and 28 weeks gestation and weight limits between 500g and 1000g[27]
- the coverage of the data collections varies - some collection systems exclude births outside of hospital[3]
- differences in the socio-demographic characteristics of childbearing women in England to those of women in Europe.

3.359 However, it is not clear how much these factors explain the difference.Together, these factors and others could lead to a systematic bias in comparisons of neonatal mortality rates.

[27] http://www.europeristat.com/publications/european-perinatal-health-report.shtml

Figure 1.6.j Neonatal mortality

Aged under 28 days, England, EU-15 and selected averages

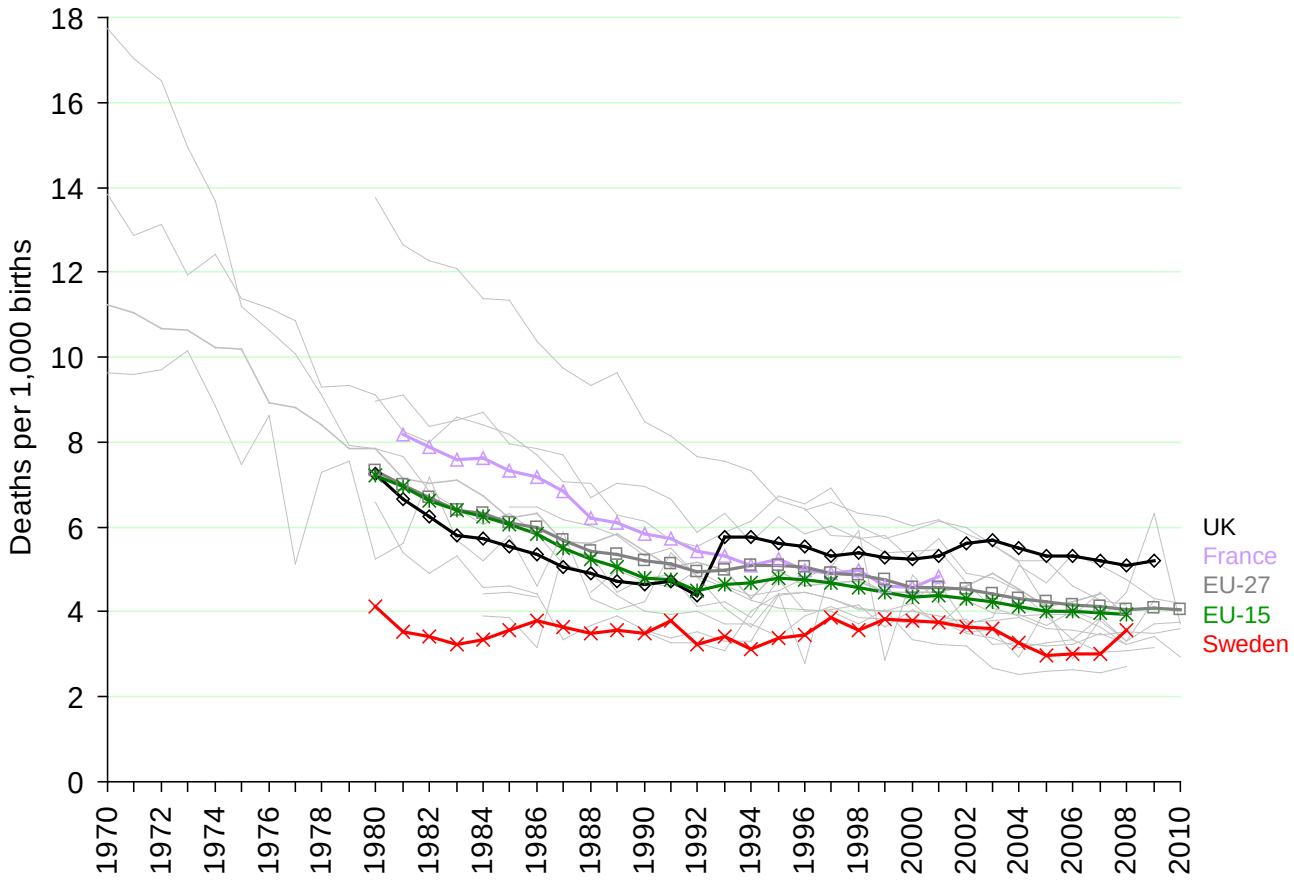


Source: WHO European Health For All database (HFA-DB)

Cautionary note: It is difficult to make valid international comparisons in this area due to different definitions and data registration systems. The differences in registration of live births mean there are variations between countries in the reporting of both live births and infant deaths.

3.360 As indicated by the fetal deaths chart below, there was a big jump in the fetal death rate in the UK between 1992 and 1993. This was due to a change in the definition of stillbirths on 1st October 1992, when the legal definition of a stillbirth was changed from a baby born dead after 28 or more weeks completed gestation to one born dead after 24 or more weeks completed gestation.

Figure 1.6.k Fetal deaths



Source: WHO European Health For All database (HFA-DB)

Cautionary note: It is difficult to make valid international comparisons in this area due to different definitions and data registration systems. The differences in registration of live births mean there are variations between countries in the reporting of both live births and infant deaths.

Note: In 1993, the UK definition of stillbirths changed from fetal deaths at or over 28 weeks gestation to fetal deaths at or over 24 weeks. Definitions for other countries vary by country, often including a weight restriction as well as gestational age.

3.361 The main causes of infant mortality are congenital anomalies and immaturity related conditions, including maternal complications of pregnancy, preterm births, low birth weight and respiratory conditions. Other causes are asphyxia, anoxia or trauma, sudden infant deaths and infections.

3.362 For neonatal mortality, the main causes of death are immaturity related conditions, congenital anomalies, and asphyxia, anoxia or trauma.

3.363 For stillbirths, the main causes of death, where identified, are congenital anomalies and asphyxia, anoxia or trauma. However, the causes of roughly half of stillbirths are uncertain, and they are included in the “remaining antepartum deaths” cause group.

Notes:

3.364 There are a number of questions that arise from the neonatal and infant mortality and stillbirths data:

- What is driving the decline in the infant mortality rate?
- The jump in fetal deaths between 1992 and 1993 is explained by a definition change, but it seems that the EU countries’ rates have continued to fall, while the UK rate has not. Why?
- What is driving the recent steep decline in the North East infant mortality rate?
- What caused the increase in infant mortality rates in 2003?
- Why has the neonatal and stillbirth rate increased among the babies of mothers born in Pakistan?
- Why is the infant mortality rate higher amongst babies born to mothers who were born in Pakistan or the Caribbean than among those born to mothers born in the UK?
- Why are the mortality rates higher among males than among females?

Drivers of this indicator

External drivers:

KEY DRIVERS	
Immigration	There are various differences in mortality rates in immigrant groups. The differences carry through to sub-continent geographical variations. There are also reports of the age at time of immigration having an effect. However, some conditions causing infant mortality are reduced (e.g. sudden infant death syndrome in the Asian population) and this makes overall effects difficult to determine. The tables above with infant and neonatal mortality and stillbirth rates by mother's country of birth show that the highest mortality rates are among babies of women born in Africa and the Middle East and Asia. In 2010, the proportion of live births to mothers born in these areas was highest in London, at 33.7% of the 133,111 live births, and next highest in the West Midlands, at 15.6% of the 72,090 live births. The complexity of this driver means effects are difficult to quantify but a change would be likely to have an impact in the short to medium term.
Multiple birth rates	There is clear evidence that twin and triplet pregnancies increase the risk of neonatal mortality[13], although once past the neonatal period there is probably little increased risk (there may be a slight increase in risk of death for extreme pre-term infants). The neonatal mortality rate would drop rapidly if multiple birth rates were to fall (within a year or so), with a slightly longer time period for infant mortality to see a recorded effect.
Number of younger mothers (<20)	There are clear associations between younger mothers and infant mortality[15,16]. In England and Wales, the proportion of younger mothers has steadily decreased over the last decade, from 7.8% of births in 1999 to about 5.6% of births in 2010. According to the report of the infant mortality national support team "Tackling health inequalities in infant and maternal health outcomes", infant mortality rates are 60% higher for teenage mothers than for mothers aged 20-39. This higher rate could be because younger mothers are more likely to attend late for antenatal care, to smoke and to have poorer diets during pregnancy, and are less likely to breastfeed. There may be a slight lag to an effect for infant mortality.
Socio-economic status	Socio-economic inequalities in congenital anomalies have been shown to exist in the rates of stillbirth and perinatal, neonatal mortality[10]. There is a strong relationship between socio-economic status and SIDS as demonstrated by a systematic review[11]. It is reported that almost 80% of the deprivation gap in neonatal mortality in England is the result of differences in deaths related to either immaturity or congenital anomalies[12]. According to the Centre for Maternal and Child Enquiries (CMACE) Perinatal Report 2009, mothers from the most deprived areas in England have higher neonatal mortality and stillbirth rates than the least deprived, so it is a risk factor associated with higher levels of stillbirths and neonatal mortality. (http://www.hqip.org.uk/assets/NCAPOP-Library/CMACE-Reports/35.-March-2011-Perinatal-Mortality-2009.pdf) The complexity of this driver means effects are difficult to quantify but this is likely to be a medium to long term effect dependent on the degree of change in status.
Tobacco use	There is clear evidence that tobacco use increases the risk of preterm labour and associated complications, including stillbirths[3]. There is a reported two-fold increased rate of SIDS associated with maternal cigarette consumption[4]. National Institute for Health and Clinical Excellence (NICE) guidelines state that health professionals should refer pregnant women to NHS Stop Smoking Services. The percentage of maternities where the mother smoked at delivery has fallen from 15.1% in 2004/05 to 13.5% in 2010/11 (and 13.1% in quarter 2 of 2011/12).

Percentage of maternities smoking at delivery											
	North East	North West	Yorkshire and The Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West	England

	2004/05	25.6	21.2	21.1						15.1		
	2005/06	24.1	21.0			16.9					16.3	
	2006/07	23.5	19.9			16.1		8.2		13.7	16.6	15.1
	2007/08	22.2	19.2	17.8	15.1	15.4	14.4	7.1	13.5	13.2	15.1	14.4
	2008/09	22.7	18.8	18.2	15.8	15.2	14.5	7.5	13.9	11.2	14.6	14.4
	2009/10	22.2	18.6	17.0	15.2	16.1	14.0	7.3		11.3	14.1	14.1
	2010/11	21.1	17.7	16.9	15.6	15.9	13.3	6.3	12.8	11.0	13.5	13.5
	2011/12 Q2	21.0	16.9	16.3	15.4	15.4	13.0	6.1	11.4	10.7	13.1	13.1
	http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_131825.xls Blank cells indicate that data did not meet validation criteria.											

OTHER DRIVERS

Alcohol consumption

Alcohol has a clear relationship with a number of syndromes, including Fetal Alcohol Syndrome. Exact relationships with neonatal death are difficult to determine. There is evidence that any alcohol use in the post-neonatal period may increase mortality rates. However, the direct effect of parental alcohol consumption has a number of confounders. A relationship with SIDS exists, but this is not as clear as smoking[6].

For term infants, intake of at least 4 drinks of alcohol per week or bingeing on 3 or more occasions during pregnancy is associated with an increased risk of infant mortality, especially during the post-neonatal period[7].

Health Survey for England (HSE) data on alcohol consumption shows a downward trend for alcohol consumption for women 16-44. According to the HSE, over the five years from 2006 to 2010, the proportion of women reported as consuming no units and "up to and including 3" units on the heaviest day's drinking last week has increased, while the proportion drinking "more than 3, up to and including 6" and "more than 6" units on the heaviest day's drinking last week decreased. Thus, it seems that for the majority of women of child-bearing age, more are either not drinking or are drinking less.

Breastfeeding

The percentage of maternities where breastfeeding was initiated has increased in each region. The highest percentages have been recorded in London, and the lowest in the North East. However, the increase in the North East has been greater than that in London.

Percentage of maternities where breastfeeding was initiated (Outturn)

	North East	North West	Yorkshire and The Humber	East Midlands	West Midlands	East of England	London	South East Coast	South Central	South West	England
2004/05	41.2	54.4			55.2				72.6		
2005/06	45.4	56.9	59.4	67.1	58.0		78.9	75.7	73.8	71.8	66.2
2006/07	49.3	58.9	61.7	67.0	59.5	68.5	79.2	75.5	74.8	74.0	68.1
2007/08	52.4	60.1	63.6	67.9	61.9	70.8	83.2	74.3	75.5	74.6	69.9
2008/09	54.4	61.8	66.8	71.1	64.6	71.3	83.8	76.9	77.0	75.8	71.7
2009/10	55.6	63.0	68.0	72.6	65.6	73.1	84.2	76.8	78.0	77.0	72.7
2010/11	57.4	63.4	69.1	72.5	67.1	73.5	86.4	77.1	78.7	76.9	73.7

	Source: DH (Statistical release on breastfeeding Quarter 3, 2011/12) Blank cells indicate that data did not meet validation criteria. The effects of any large change in the population uptake would probably not make it one of the main drivers, and results would lag for at least five years.
Extent to which women chose to have termination	This is a complex driver as termination occurs for a variety of reasons. A significant number of late abortions will be due to life threatening conditions in the fetus.
Illicit drug use	The evidence is not clear, but illicit drug use is likely to be detrimental (although it is difficult to separate the effects of alcohol and drugs). Like alcohol there is evidence of an association but confounding factors do play part. With alcohol there is an association between drug use and mortality. Some studies, however, have reported no association of drug use and SIDS[8,9].
Maternal and infant nutrition	For both maternal and infant nutrition there is obvious biological plausibility of nutrition affecting outcome. Direct evidence in the developed world is related to specific vitamin and other nutritional deficiencies rather than its broader context. This is much clearer in the developing world where evidence exists.
Number of older mothers	Babies of older mothers have an increased chance of congenital abnormalities. In England and Wales, the proportion of older mothers has increased over the last decade, from 2.7% to 3.8% of all live births.
Obesity	There is clear evidence that obesity increases mortality and complications in the neonatal period[2]. It is difficult to get quantitative evidence regarding infant mortality, although there are reported increases in SIDS (but these may be subject to confounders). The proportion of women reported as obese has increased since 1993, while the proportion reported with normal BMI measurements has decreased, although for both categories the rate of change seems to have slowed in the most recent decade (HSE).
Prevalence of co-morbidities	There is evidence of increased preterm birth rate (and resulting increasing infant mortality) with maternal co-morbidities[14]. The evidence is not very strong (minimal studies), but the biological plausibility is high.

References

[2] Nohr EA, Villamor E, Vaeth M, Olsen J, Cnattingius S. Mortality in infants of obese mothers: is risk modified by mode of delivery? Acta Obstet Gynecol Scand 2012;91:

[3]References contained within Lumley J, Chamberlain C, Dowswell T, Oliver S, Oakley L, Watson L. Interventions for promoting smoking cessation during pregnancy. Cochrane Database of Systematic Reviews 2009, Issue 3.

[4] Anderson et al. Sudden Infant Death Syndrome and prenatal maternal smoking: rising attributed risk in the Back to Sleep era BMC Medicine 2005, 3:4

[5] Salihu et al. Levels of Excess Infant Deaths Attributable to Maternal Smoking During Pregnancy in the United States Maternal and Child Health Journal, Vol. 7, No. 4, December 2003

[6] Phillips et al. Alcohol as a risk factor for sudden infant death syndrome (SIDS)add_3199 516..525Addiction, 106, 516–525

[7] Strandberg-Larsen et al. Alcohol Drinking Pattern During Pregnancy and Risk of Infant Mortality Epidemiology 2009;20: 884–891

[8] Wolfe et al. Mortality risk associated with perinatal drug and alcohol use in California. J Perinatol. 2005 Feb;25(2):93-100.

[9] Klonoff-Cohen et al. Maternal and Paternal Recreational Drug Use and Sudden Infant Death Syndrome Arch Pediatr Adolesc Med. 2001;155:765-770

[10] Smith et al. Socioeconomic inequalities in outcome of pregnancy and neonatal mortality associated with congenital anomalies: population based study BMJ 2011;343

[11] Spencer et al. Sudden unexpected death in infancy and socioeconomic status: a systematic review J Epidemiol Community Health 2004;58:366–373

[12] Smith et al. Nature of socioeconomic inequalities in neonatal mortality: population based study BMJ 2010;341

[13] Jennifer J Kurinczuk, Jennifer Hollowell, Peter Brocklehurst, Ron Gray, Inequalities in infant mortality project briefing paper 1. Infant mortality: overview and context. Oxford: National Perinatal Epidemiology Unit, 2009

[14] Auger et al. Association between maternal comorbidity and preterm birth by severity and clinical subtype: retrospective cohort study BMC Pregnancy and Childbirth 2011, 11:67

[15] Office for national statistics. Childhood, infant and perinatal mortality in England and Wales, 2009

[16] Markovitz et al. Socioeconomic factors and adolescent pregnancy outcomes: distinctions between neonatal and post-neonatal deaths? BMC Public Health 2005, 5:79

Healthcare contribution

- access to high standards of care from maternal services throughout the maternity care pathway (antenatal, labour, delivery and postnatal)
- improvements in neonatal care provision and medical technologies enabling babies to survive
- the provision of safe, high quality care for sick and premature babies, and their families, by neonatal care services
- the provision of preconception services to enable pregnant women and their partners to make informed choices
- Health visitors working in partnership with Sure Start Children's Centres that have been locally commissioned to ensure that all families with young children have access to parenting and relationship support when they need it
- the Government is doubling by 2015 coverage of the Family Nurse Partnership, which offers intensive support to first time teenage parents
- the Tobacco Control Plan 2011 for England includes a national ambition to reduce rates of pregnant women smoking at time of delivery to 11% by the end of 2015.

Past initiatives:

3.365 The Infant Mortality National Support Team (IMNST) was established in 2008 with the aim to help disadvantaged local areas to address inequalities in infant mortality and improve infant and maternal outcomes. The funding for this programme ended on 31st March 2011, with the last IMNST visit to Lambeth and Southwark in February 2011.

3.366 The IMNST visited local areas and provided tailored support to each area, with follow up support provided over the course of six months to a year of the visit. According to the report of the support team, the areas that were visited by the IMNST showed an increase in breastfeeding initiation and a decrease in smoking at delivery. These changes were greater than the changes recorded across England as a whole.

3.367 An additional driver is cross-governmental action to tackle wider social factors, such as child poverty and poor and overcrowded housing.

3.368 Following review of the drivers since the publication of the NHS Outcomes Framework 2012/13 - Technical Appendix, incidence of lethal congenital anomalies and mitigation of social isolation was removed as drivers, while alcohol consumption, breastfeeding, illicit drug use and prevalence of co-morbidities were added as drivers.

3.369 Among the drivers of infant and neonatal mortality and stillbirths, there are a number which have been improving, some which have been getting worse and others for which it is not clear whether they have experienced change one way or another.

3.370 Of the drivers which have been improving, the following can be reasonably expected to continue improving, whether due to the legacy of past initiatives such as the IMNST (above) or because of other changes, such as in the profile of new mothers (as older mothers are more likely to breastfeed) the number of younger mothers, smoking in pregnancy, alcohol consumption and breastfeeding.

3.371 Conversely, for the following drivers, there is no clear basis for which to expect that they will improve (not taking into account the impact of any initiatives such as the Family Nurse Partnership): the number of older mothers, obesity, immigration, multiple birth rates, extent to which women chose to have a termination, illicit drug use, maternal and infant nutrition, socio-economic status and prevalence of co-morbidities

3.372 On balance, the improvements in the drivers above are considered sufficient that the improvements over the last decade in the infant and neonatal mortality rates will continue.

(b) Indicator 1.6 infant mortality: Current Practice Projections Methodology

- The projections in Table 1.6.t and Figure 1.6.l were obtained by employing the following methodology:
- The disaggregated data was displayed graphically by region and by sex to explore any trends in neonatal or post-neonatal mortality.
- Although the rates did not decline smoothly over time, the disaggregated data showed that, overall, the rates fell for both sexes and in the regions, in a linear fashion
- As this was the case, it was concluded that infant mortality data at a national level was sufficient for calculating infant mortality projections.
- The default position was that the indicator would not change from the latest year's value.
- Consideration of the drivers led to the view that the non-NHS drivers that have been driving the downward trend would continue to drive better outcomes, assuming that NHS quality is maintained, so the default position was rejected.
- The infant mortality rate was projected forward using a linear regression against time.
- A one sided tolerance interval (T.I.) was calculated as follows:
    - Predicted values for existing observations are calculated using a linear regression against time;
    - The standard deviation of the differences between the observed and expected values was calculated. This number was added to the projected values to obtain the T.I. on the "worse" side.

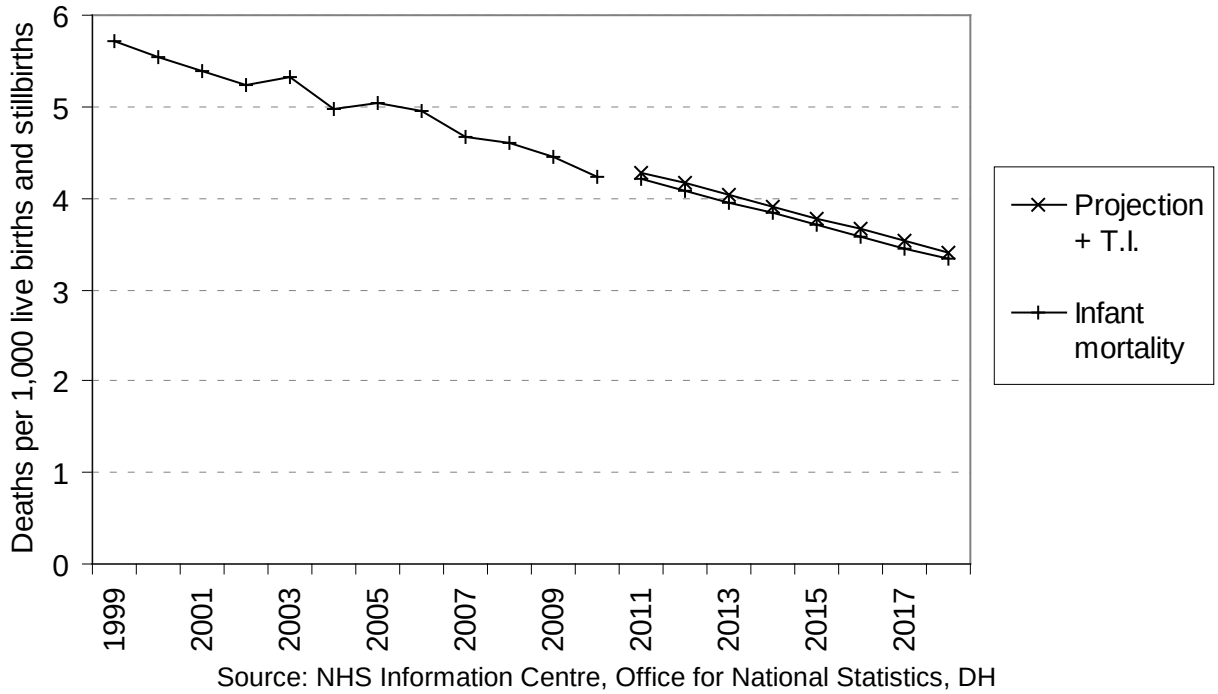
Results

Table 1.6.t Current practice projection for infant mortality rate (per 1,000 live births)

	Infant mortality	Projection	Projection + T.I.
1999	5.7		
2000	5.6		
2001	5.4		
2002	5.2		
2003	5.3		
2004	5.0		
2005	5.0		
2006	4.9		
2007	4.7		
2008	4.6		
2009	4.5		
2010	4.2		
2011		4.2	4.3
2012		4.1	4.2
2013		4.0	4.0
2014		3.8	3.9
2015		3.7	3.8
2016		3.6	3.7
2017		3.5	3.5
2018		3.3	3.4

Source: NHS Information Centre, Office for National Statistics, DH

Figure 1.6.l Current practice projection for infant mortality rate (per 1,000 live births)



Source: NHS Information Centre, Office for National Statistics, DH

1.6.ii Neonatal mortality and stillbirths Methodology

3.373 The projections in Table 1.6.u and Figure 1.6.m were obtained by employing the following methodology:

- The disaggregated data was displayed graphically by region and by sex to explore any trends in neonatal mortality or stillbirth rates.
- While there were no obvious trends in the stillbirth rate for the regions or either gender, for neonatal mortality there appeared to be a decline for most regions and both genders, and so for England overall.
- The default position for projections was that the indicator would not change from the average of the latest years' values.
- For stillbirths, while they are gaining more attention and there is work ongoing that aims to reduce the stillbirth rate, any impact such work will have cannot be quantified and the time when effects may be seen is unknown. This, with the lack of a clear trend in stillbirth rates, meant that the default position could not be refuted, and the stillbirth rate was projected forward at the exponentially smoothed mean of the 1999-2010 stillbirth rates.
- For neonatal mortality, consideration of the drivers, as discussed at the end of the last section, led to the view that the default position should be rejected. This is because the drivers that are expected to continue improving (number of younger mothers, smoking in pregnancy, alcohol consumption and breastfeeding) would have sufficient impact to reduce the neonatal mortality rate further. As the current practice projection focuses on factors external to the NHS, and some of the reduction seen in the neonatal mortality rate can be accounted for by, for example, the impact of the Infant Mortality National Support Team, a past NHS initiative, the neonatal mortality rate was projected downward, but at a slower rate than before.
- The separate stillbirth and neonatal mortality projections were aggregated to form the indicator level projection.

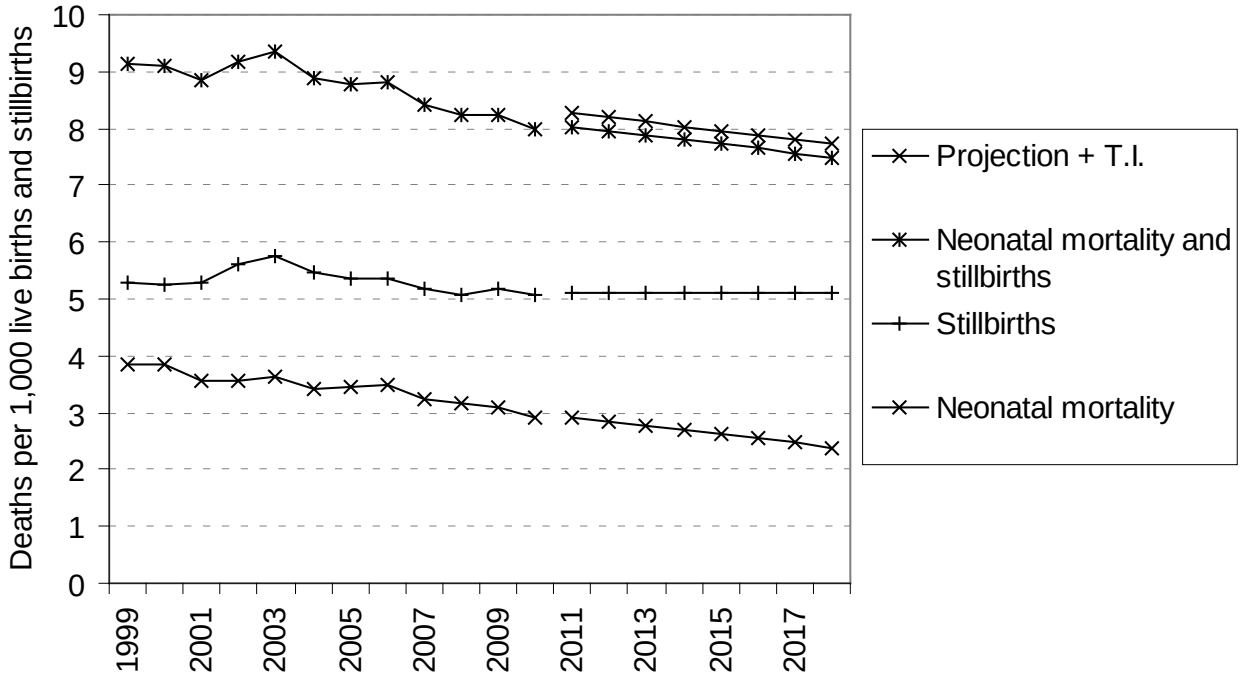
Results

Table 1.6.u Current practice projections for neonatal mortality and stillbirths rate (per 1,000 live births and stillbirths)

	Neonatal mortality		Stillbirths		Neonatal mortality and stillbirths		
	Actual	Projection	Actual	Projection	Actual	Projection	Projection + T.I.
1999	3.9		5.3		9.1		
2000	3.8		5.3		9.1		
2001	3.6		5.3		8.8		
2002	3.6		5.6		9.2		
2003	3.6		5.7		9.4		
2004	3.4		5.5		8.9		
2005	3.4		5.4		8.8		
2006	3.5		5.3		8.8		
2007	3.2		5.2		8.4		
2008	3.2		5.1		8.2		
2009	3.1		5.2		8.3		
2010	2.9		5.1		8.0		
2011		2.9		5.1		8.0	8.3
2012		2.9		5.1		8.0	8.2
2013		2.8		5.1		7.9	8.1
2014		2.7		5.1		7.8	8.0
2015		2.6		5.1		7.7	8.0
2016		2.5		5.1		7.6	7.9
2017		2.5		5.1		7.6	7.8
2018		2.4		5.1		7.5	7.7

Source: NHS Information Centre, Office for National Statistics, DH

Figure 1.6.m Current practice projection for neonatal mortality and stillbirths rate (per 1,000 live births and stillbirths)



Source: NHS Information Centre, Office for National Statistics, DH

(c) Indicator 1.6: Scope for Improvement

3.374 This refers to indicator 1.6.ii - Neonatal mortality and stillbirths only.

3.375 Several current and planned policy initiatives are likely to lead to improvements in this outcome within current resources.

3.376 The NHS Atlas of Variation aims to help commissioners increase value and improve the quality of service commissioned by identifying and tackling regional variation in care. The latest report, for 2011, includes two topics on neonates, “the proportion of full-term babies of all babies admitted to specialist neonatal care” and “emergency admissions of home births and re-admissions to hospital of babies within 14 days of being born”.

3.377 The following policy initiatives are expected to act as levers to drive improvements in neonatal mortality and stillbirth rates:

- neonatal services in England are organised within 23 neonatal managed clinical networks to provide safe and effective services for mothers and babies.
- the Government is doubling the coverage of the Family Nurse Partnership by 2015, to 13,000 at any one time. This programme offers intensive support to first time teenage parents, from early pregnancy up until the child is two
- the Government is acting to strengthen the Healthy Child Programme through its commitment to an extra 4,200 health visitors by 2015. Once the baby is born, the Healthy Child Programme, led and delivered by health visitors, provides every family with screening, immunisations, health and development reviews, and information and guidance to support parenting and healthy choices
- responsibility for commissioning maternity services will sit with clinical commissioning groups (CCGs). It will be the responsibility of CCGs/maternity services to influence women during their first pregnancy (e.g. through smoking cessation, healthy eating, etc.) to improve outcomes in subsequent pregnancies.

3.378 Provided the above policy initiatives work effectively, there should be some reduction in the overall neonatal mortality and stillbirth rate for England, over time.

3.379 Aside from these initiatives there is reason to believe that there is further scope for improving this outcome within the resource envelope. The Department is working with Sands (the Stillbirth and Neonatal Death Society) and other organisations to help reduce the number of stillbirths. This work includes a number of proposals that could help reduce the stillbirth rate, including:

- the development of combined guidance from the Royal College of Obstetricians and Gynaecologists and the Royal College of Midwives to ensure that stillbirth risk, including fetal movement and prolonged pregnancy, is more prominently featured in midwifery and obstetric training curricula
- identifying standards that enable robust perinatal review, dissemination of learning and audit of change
- identifying and developing research proposals which aim to improve antenatal screening for those pregnancies which are still not identified as high risk. The Clinical Study Group (CSG) will look at disseminating its work more widely
- identifying key public health messages that local authorities need to be aware of in order to reduce the risk of stillbirth

3.380 Two evidence based guidance documents - the NICE “Quality Standard for specialist neonatal care” and the NHS “Toolkit for High Quality Neonatal Services” - have been published to help commissioners and providers ensure they are providing safe, high quality care for sick and premature babies and their families. It is estimated that implementing the principles in the Toolkit would lead to reduced neonatal mortality rates.

3.381 One study examining the relationship between nurse staffing and mortality rates in very low birthweight or preterm infants in the UK reported a decrease of 48% in risk adjusted mortality when the ratio of qualified neonatal nurses to intensive care babies is 1:1 throughout the clinical neonatal network. However, this was the only study to identify such a large decrease. Implementation would entail cost implications, estimated in 2009 as £996.7m over 10 years, which would deliver a 10% annual reduction in mortality rates for neonates with very low/low birthweight.

3.382 There is scope for better understanding of key health priority areas, such as:

- better understanding of the causes of stillbirths and neonatal deaths
- better understanding on why regional variations exist
- how midwifery and obstetric training can be improved to identify and act on signs of risk
- how public health initiatives, parental support and wider economic, housing and education initiatives can actively help to reduce the number of stillbirths and neonatal deaths.

3.383 Resources are more constrained now than they have been in the past, so maternity services, like all other services, are looking for ways to improve efficiency to meet rising demands. In some instances this can be achieved by ensuring that maternity services have the right skills mix, good communication, teamworking, and efficient management in place. Improvements in safety standards can be achieved through better staff training.

3.384 The past downward trend of the neonatal mortality rate should be sustained by new initiatives, such as the Family Nurse Partnership.

3.385 Part of the improvement in the neonatal mortality and stillbirths rate could be achieved by reducing the number of deaths of neonates due to lack of oxygen or trauma during labour and birth. Many of these deaths should be avoidable though improvements in clinical practice, such as in fetal monitoring during birth.

3.386 The data available on cause of death gave figures for England and Wales together, and between 2008 and 2010, 9.2% of neonatal deaths in England and Wales were due to asphyxia, anoxia or trauma (intrapartum) (193 of 2091 neonatal deaths in 2010).

3.387 For stillbirths, some of the deaths due to asphyxia, anoxia or trauma could be avoided through early detection and monitoring during the antenatal period or through neonatal resuscitation management being followed during the intrapartum period.

3.388 Improvements in training and the use of resuscitation equipment should help to reduce these types of stillbirths, which accounted for 24.8% of the 3714 stillbirths in 2010 in England and Wales (25.6% in 2009 and 27.6% in 2008).

3.389 Considering the neonatal deaths and stillbirths due to the causes mentioned just in the last three paragraphs, there is scope to reduce the neonatal mortality rate by up to 9.2% and the stillbirth rate by up to 24.8%. For neonatal mortality and stillbirths taken as a whole, there is scope to reduce the mortality rate by up to 19.2%.

3.390 Using the 2010 rates, for England and Wales, the neonatal mortality and stillbirth rates could be reduced as follows:

	2010 rate (per 1,000 live births and stillbirths)	Estimated reduction possible	Reduced rate (per 1,000 live births and stillbirths)
Neonatal mortality	2.9	9.20%	2.7
Stillbirths	5.1	24.80%	3.8
Neonatal mortality and stillbirths	8	19.20%	6.5

Source: ONS, DH (ONS release: Child mortality statistics: Childhood, infant and perinatal, 2010)

3.391 The full extent of these reductions will not be felt immediately, but should start to have an impact within a year. Thus, the scope for improvement for this indicator could be set at a low percentage reduction initially (~1.5%) increasing gradually over time. The inter-relationship between these outcomes and the policies mentioned above warrants further work.

3.392 The socio-demographic risk factors associated with this measure will have to be addressed through commissioning of maternity services by clinical commissioning groups and specialist commissioning of neonatal services by the NHS Commissioning Board, and public health interventions by local authorities. Greater co-ordination between acute providers, primary care and local authorities will be essential during the transition period if reductions in inequalities are to be achieved.

1.7 – Excess under 75 mortality rate in adults with Learning Disabilities

Outcome sought	Reduced premature mortality in adults with learning disabilities (LD)
Indicator definition	The indicator is under development

(a) Indicator 1.7: Recent Trends and Explanations
Possible indicator construction

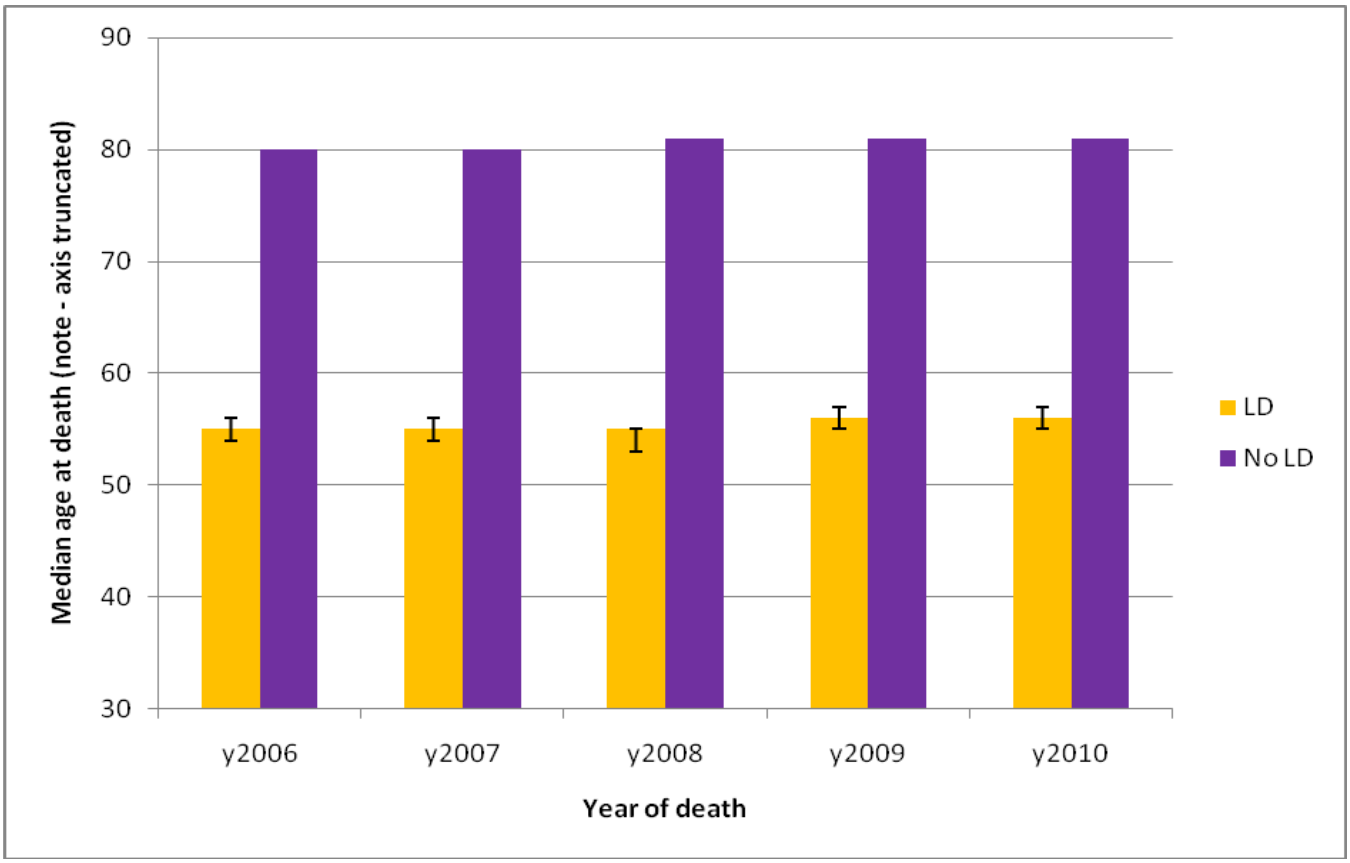
3.393 The preferred construction would compare the mortality rate in the population of adults with learning disabilities (LD) to the mortality rate in the general population, as a ratio or difference. However calculating the mortality rate in adults with LD would require a clearly-defined denominator (the LD population) and numerator (the number of people in this population who died in a particular year). This is not possible at the moment because:

- there is no national register of people with LD and
- the number of people with LD who died in a particular year is not reliably obtainable from mortality data because the presence of LD is estimated to be recorded on death certificates in less than half of cases[2].

3.394 A possible solution to this in the future would be to use a General Practice Extraction Service (GPES) extract of the Quality and Outcomes Framework (QOF) LD marker to define the LD population and to link this LD population to mortality data (possibly using the Primary Care Mortality Database (PCMD)), as has been achieved for indicator 1.5 – Excess Mortality in People with Serious Mental Illness

3.395 In the absence of robust denominator data, an assessment of excess mortality can nonetheless be derived by comparing median age at death for people with LD with that of others. See Figure 1.7.a and Table 1.7.a.

Figure 1.7.a Median age at death for people identified from ONS death registrations as having/ not having learning disabilities, 2006-2010



Source: Office for National Statistics, Gyles Glover and Mohammad Ayub

Table 1.7.a Median age at death for people identified from ONS death registrations as having/ not having learning disabilities, 2006-2010

	Median age at death	
Year	LD	No LD
2006	55	80
2007	55	80
2008	55	81
2009	56	81
2010	56	81

Source: Office for National Statistics, Gyles Glover and Mohammad Ayub

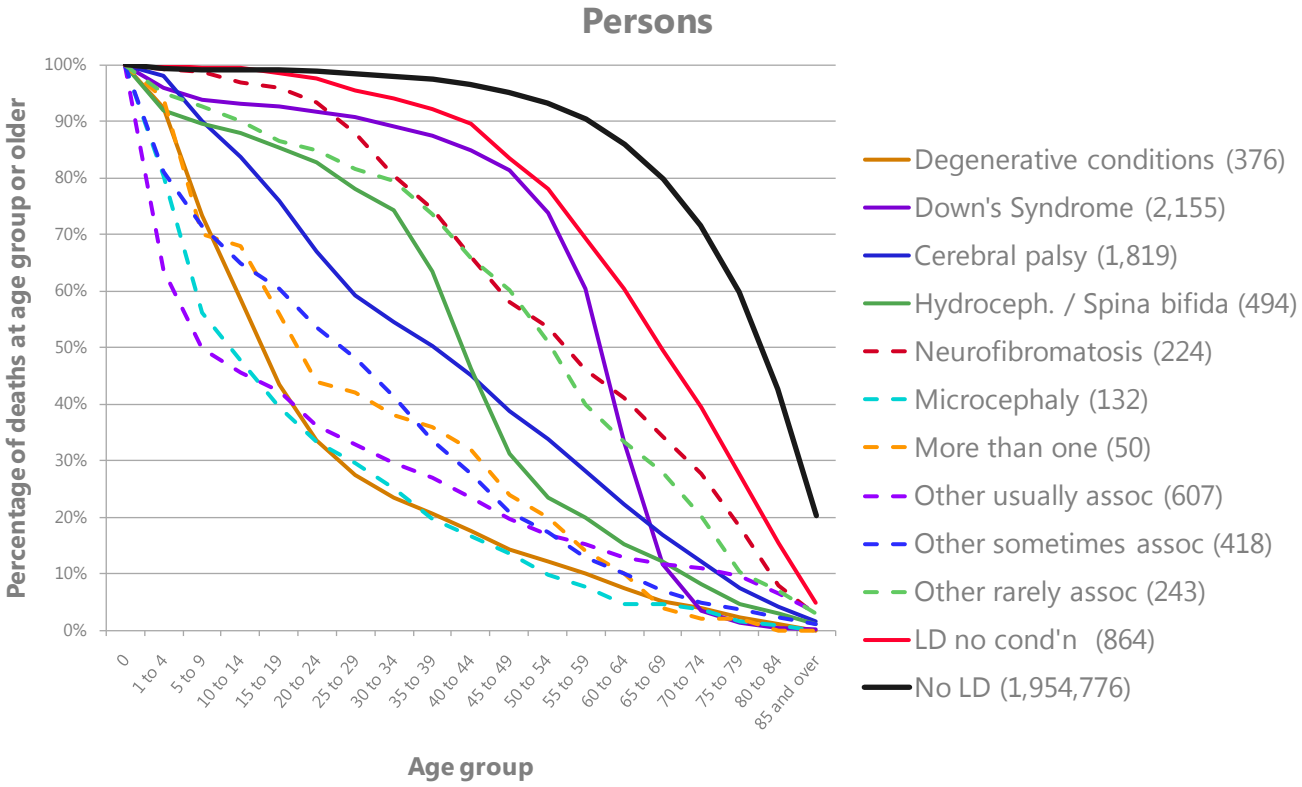
3.396 Median age at death is the age by which half of the deaths in the year have occurred. For people with learning disabilities this is about 25 years (30%) younger than for those without.

3.397 Whilst there is an slight upward trend in median age at death, the difference between age at death for people with LD and that for the rest of the population has remained at 25 years over the 5 year period 2006 to 2010;

Breakdown by condition

3.398 Median age at death varies with different causes of learning disability.

Figure 1.7.b Age at death for people identified from ONS death registrations as having learning disabilities or conditions associated with them (numbers of deaths 2006-2010 in brackets)



Source: Office for National Statistics, Gyles Glover and Mohammad Ayub

3.399 The Glover and Ayub study[1] found that there were two causes of death identified from death certificates in people reported as having LD which stood out as particularly important because they are to some extent preventable and were connected to large numbers of deaths across most groups of people with LD. These were:

- Lung problems caused by solids or liquids going down the wrong way (found in 14% of deaths)
- Epilepsy or convulsions (found in 13% of deaths)

3.400 Just over 5% of people with hydrocephalus/ spina-bifida died with pressure sores; septicaemia had resulted in 75% of these.

Table 1.7.b Diagnoses included and numbers of deaths , 2006-2010

ICD10	ICD10label
D821	Di George's syndrome
E771	Defects in glycoprotein degradation
E778	Other disorders of glycoprotein metabolism
E791	Lesch-Nyhan syndrome
F72	Mental Retardation, severe
F73	Mental Retardation, profound
F79	Mental Retardation, unspecified
F819	Developmental disorder of scholastic skills, unspecified
F83	Mixed specific developmental disorders
F842	Rett's syndrome
F848	Other pervasive developmental disorders
Q000	Anencephaly
Q042	Holoprosencephaly
Q043	Other reduction deformities of brain
Q048	Other specified congenital malformations of brain
Q851	Tuberous sclerosis
Q878	Other specified congenital malformation syndromes, not elsewhere classified
Q909	Down's syndrome, unspecified
Q912	Trisomy 18, translocation
Q913	Trisomy 18, unspecified
Q917	Trisomy 13, unspecified
Q923	Minor partial trisomy
Q933	Deletion of short arm of chromosome 4
Q934	Deletion of short arm of chromosome 5
Q992	Fragile X chromosome
A812	Progressive multifocal leukoencephalopathy
E740	Glycogen storage disease
E750	GM2 gangliosidosis
E751	Other gangliosidosis
E752	Other sphingolipidosis
E754	Neuronal ceroid lipofuscinosis
E755	Other lipid storage disorders
E756	Lipid storage disorder, unspecified
E760	Mucopolysaccharidosis, type I
E761	Mucopolysaccharidosis, type II
E762	Other mucopolysaccharidoses
E763	Mucopolysaccharidosis, unspecified
E770	Defects in post-translational modification of lysosomal enzymes

Notes:

3.401 The following question arises:

- Why is age of death for people with LD so much lower than for the rest of the population even in the absence of a syndromal condition

Drivers of outcome include

- Treatments for specific conditions, for example heart surgery for Down's Syndrome sufferers, which explains the improved longevity of the current generation of those with Down's syndrome.

- Severity mix of people with LD, which in turn depends upon available of lifesaving treatments for those with challenging conditions in infancy; a new larger cohort of those with profound disabilities is currently in childhood.

- Factors reducing presentation of people with LD who have unrelated health problems:
  - poor self care
  - poor health literacy
  - deprivation.

(b) Indicator 1.7: Current Practice Projections

3.402 In the absence of evidence to the contrary, a flat projection is appropriate.

3.403 If data from GP records becomes available, it may be possible to model the impact of the different mix of conditions and the severity mix of people with LD on outcomes over time.

(c) Indicator 1.7: Scope for Improvement

3.404 To explore the question of how much of the mortality of people with LD is amenable to mitigation within the current resource envelope, we explore first the issue of how much is amenable at all.

3.405 Firstly, there is no theoretical reason why on average people with LD should die from causes considered amenable to health care at younger ages than the general population.

3.406 Further, exploration of why people with LD die should highlight avoidable deaths, for example deaths involving pressure sores. Glover's study of how people with LD die identified epilepsy and conditions related to dysphagia, aspiration of food and drink and consequent pneumonitis or pneumonia as key causes for many people, and decubitus ulcers as a key cause for people with hydrocephalus/spina bifida[1].

3.407 The key action would be increasing the uptake and quality of annual health checks.

3.408 The table below sets out the percentage of deaths in people identified as having LD that are from 'amenable' causes, in the terms of the National Centre for Health Outcomes Development (NCHOD) definition[28].

Table 1.7.c – Percentage of deaths in people identified as having LD that are from 'amenable' causes

	2006	2007	2008	2009	2010	Increase 2010 from 2006
No LD associated condition.	11.7%	11.2%	10.9%	10.7%	10.4%	-10.6%
Definite LD	20.7%	21.0%	21.9%	20.6%	18.8%	-9.2%
Possible LD	11.7%	10.6%	12.2%	12.4%	14.3%	22.0%
With conditions rarely causing LD	22.4%	18.0%	18.5%	16.9%	20.7%	-7.7%
Total deaths	11.7%	11.3%	10.9%	10.8%	10.5%	-10.5%

Source: Office for National Statistics, Gyles Glover and Mohammad Ayub

3.409 People are classified in this analysis into 4 categories on the basis of whether there is any reference to LD in any of the diagnoses assigned. (No reference, definite LD (e.g. Q90 or F72x), possible LD (e.g. Cerebral Palsy) or with conditions rarely causing LD (there are too few of this final category for useful analysis)).

3.410 The NCHOD classification of amenable death excludes J69 (pneumonitis due to inhalation of solids or liquids). This appears as the underlying cause in 60 to 80 people with learning disabilities each year and is closely related to poorly managed dysphagia (difficulty swallowing); and T17 (foreign body in the respiratory tract), also commonly associated with dysphagia in people with LD.

3.411 With this proviso, the Glover and Ayub study found that the percentage of deaths in people identified as having definite LD from causes that would be classed as 'amenable' was roughly twice as high as the percentage of deaths in people with no LD associated condition. This goes up to 2.5 times if J69 deaths are included.

3.412 The authors of the study have suggested that it might be possible to narrow this gap by 20% within five years. This could be achieved by good care of epilepsy and dysphagia, though attention to some other conditions, most notably asthma, would also help. The annual GP Health Checks would be an important element in a programme to achieve this.

[28] https://indicators.ic.nhs.uk/download/NCHOD/Specification/Spec_03D_171DR0074_10_V1.pdf

3.413 They suggest that most people with LD who die of epileptic complications, or of the various lung problems associated with inhalation of solids and liquids, will not have this fatal outcome on their first episode. If this is right, for each there will have been a number of avoidable hospitalisations caused by previous similar episodes. Good care should reduce these as well as having a substantially beneficial impact on the health and wellbeing of the individual, and good care for these conditions is not expensive. It simply needs good management under appropriately skilled specialists.

3.414 A more precise assessment of scope for improvement could be generated if an accurately measured indicator of excess 'amenable' mortality in people with LD were developed, using the methodology proposed in section (a).

(3) Domain 1 Levels of Ambition

3.415 This section considers for Domain 1 as a whole:

a) Aggregated Scope for Improvement

b) Levels of Ambition

c) Implications for Inequality

(3)(a) Domain 1 Aggregated Scope for Improvement

3.416 In this section partial analysis of the scope for improvement for different indicators in domain 1 is presented.

Cancer and neo-natal mortality

3.417 The table below is based on potential scope for improvement in neonatal mortality and Cancer outcomes. This is subject to change as further analysis is undertaken. This is only a partial assessment of the domain, because it only includes two indicators. Over the consultation period estimates for other indicators' scope for improvement will be added to form an aggregated scope for improvement – which will inform without determining the setting of the level of ambition (see section 3b and section v of Chapter 1).

3.418 The possible additional areas from which scope for improvement may be assessed are set out below, together with an alternative presentation of numbers for neonatal mortality (indicators 1.6i and 1.6ii).

3.419 The following explains how the Cancer and neonatal mortality were estimated.

Domain 1 - life years saved

Partial Aggregation of Scope for Improvement – Cancer and neonatal mortality only

			Domain 1 - life years saved
	Partial Aggregation of Scope for Improvement – Cancer and neonatal mortality only	To be added : scope for improvement for other indicators	Aggregated scope for improvement
2012/13*	40,000		
2013/14	70,000		
2014/15	100,000		
2015/16	160,000		
2016/17	160,000		
2017/18	190,000		
2018/19	190,000		
2019/20	191,000		
2020/21	191,000		
2021/22	191,000		
2022/23	191,000		
2 year ambition	170,000		
5 year ambition	680,000		
10 year ambition	1,634,000		

*These figures will be updated in the consultation period such that the scope for improvement is calculated from a 2012/2013 base year. As data for 2012/13 will not be available at that time it will be necessary to forecast a 2012/2013 outturn as the basis for such calculation, which will then be subject to review in light of the final figures once available.

3.420 Life years gained are estimated using deaths avoided, age-specific life expectancy and reduced mortality through interventions to improve outcomes. Level of ambition up to 2014/15 is based on reduced mortality for cancer (indicators 1.4 (i) – (vii)).)). Post-2014/15 this includes improvements in neonatal mortality.

3.421 The estimates of lives saved from improved services for cancer are taken from the Impact Assessment (IA) which accompanies the Cancer Outcomes Strategy [29]. They are presented in the table below and are based on projected mortality rates with and without interventions presented in the strategy. This includes improved radiotherapy, screening and early diagnosis.

[29] http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_123505.pdf
Page 11, Cancer Outcomes Strategy Impact Assessment

Estimates

	2011/12	*12/13*	*13/14*	*14/15*	*15/16*	*16/17*	*17/18*	*18/19*	*19/20*	*2020/21*
Radiotherapy - 10 year survivors	278	602	941	1296	1269	1242	1215	1187	1159	1132
Screening - 5 year survivors	0	0	450	915	1570	1621	1663	1700	1725	1734
Earlier Diagnosis - 5 year survivors		1930	2082	2814	3882	4101	5169	4921	5254	5342
Total	278	2,532	3,473	5,024	6,721	6,964	8,047	7,808	8,138	8,208

Source: DH Impact Assessment

3.422 In the cancer outcomes strategy[30] the estimated QALYs gained through increased survivorship are presented and based partly on an assumption that one QALY equals 2 life years. For consistency, that analysis is used here to estimate the number of life years gained through reduced mortality from cancer. The calculations are presented in the following table, these estimates feed into the partial aggregated scope for improvement on the previous page.

[30] ibid

Estimated life year improvements from reduction deaths avoided from cancer

	2011/12	*2012/13*	*2013/14*	*2014/15*	*2015/16*	*2016/17*	*2017/18*	*2018/19*	*2019/20*	*2020/21*	*2021/22*	*2022/23*
Radiotherapy - 10 year survivors - QALY gains	1,390	3,009	4,707	6,480	6,346	6,211	6,074	5,936	5,797	5,658	5,658	5,658
Screening - QALY gains	0	0	9,002	18,293	31,399	32,415	33,268	34,008	34,499	34,686	34,686	34,686
Early - Diagnosis - QALY gains	0	18,162	19,591	26,482	36,538	38,595	48,651	47,769	50,280	50,280	50,280	50,280
Estimated life years, based on a conversion of 0.5 QALYs equals 1 life year												
	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23
Radiotherapy	2,780	6,018	9,414	12,960	12,692	12,422	12,148	11,872	11,594	11,316	11,316	11,316
Screening	0	0	18,004	36,586	62,798	64,830	66,536	68,016	68,998	69,372	69,372	69,372
Early Diagnosis	0	36,324	39,182	52,964	73,076	77,190	97,302	95,538	100,560	100,560	100,560	100,560
Total life years	2,780	42,342	66,600	102,510	148,566	154,442	175,986	175,426	181,152	181,248	181,248	181,248

Illustrative scope for improvement in Life years for neonatal mortality (indicators 1.6i and 1.6ii)

3.423 Whilst further work is needed to assess the likely consequences of successful implementation of the policies mentioned above for reducing neonatal mortality (implementing a NICE Quality Standard for specialist neonatal care, strengthening Family Nurse Partnership by 2015, doubling coverage to 13,000, extra 4,200 health visitors by 2015, strengthening the Healthy Child Programme) the following is a presentation of an ambition based on a reduction in the neonatal mortality rate fall to 2.4 deaths per 1,000 live births on these policies. This is added into the partial aggregated scope for improvement after 2014-15.

3.424 By 2018, on this basis there would be scope for an additional 51,265 life years in excess of those delivered by the current practice projection. This is in addition to the extra 38,551 life years that will be enjoyed as a result of current practice projections being sustained compared to what would have happened had 2012 mortality flatlined. This improvement is then projected to be maintained after 2018.

3.425 The following table sets out these additional life years between 2012 and 2023, inclusive. The life years saved in excess of those delivered by the current practice projections, i.e. the annual estimates of the right hand side of the table, are added to the estimated scope for improvement in cancer care to form the partial aggregated scope for improvement.

Life years saved due to sustained current practice projection over 2012 baseline

Year	Life years saved due to sustained current practice projection over 2012 baseline mortality rate		Life years saved in excess of those delivered by the current practice projection	
	Annual	Cumulative	Annual	Cumulative
2012	-		-	
2013*	1,836	1,836	2,402	2,402
2014	3,672	5,507	4,859	7,261
2015	5,507	11,015	7,316	14,577
2016	7,343	18,358	9,773	24,349
2017	9,179	27,536	12,229	36,579
2018	11,015	38,551	14,686	51,265
2019	11,015	49,566	14,686	65,951
2020	11,015	60,581	14,686	80,637
2021	11,015	71,596	14,686	95,323
2022	11,015	82,611	14,686	110,009
2023	11,015	93,626	14,686	124,695

Note: Numbers may not add up due to rounding.

3.426 *These figures will be updated in the consultation period such that the scope for improvement is calculated from a 2012/2013 base year. As data for 2012/13 will not be available at that time it will be necessary to forecast a 2012/2013 outturn as the basis for such calculation, which will then be subject to review in light of the final figures once available.

Other areas

3.427 Additional scope for improvement has been identified for other outcome and intervention areas listed below. Further work is required to estimate the potential deaths avoided and life years gained from improvements in each area and gauge realistic time frames, to inform assessment of aggregate scope for improvement in Domain 1.

- Hypertension, associated with elevated CVD risk. Research suggests that behavioural change interventions have a strong effect. There is however considerable under-identification of people with hypertension and, for many of those identified, there are considerable numbers whose hypertension is untreated and uncontrolled. (see discussion of Scope for Improvement for indicator 1.1)
- Cholesterol. There is a strong evidence that cholesterol lowering through statins decreases CVD risk, even for those at low risk. There is a serious under-diagnosis of people with familial hypercholesterolaemia, and it is likely that many lives could be saved if the NICE guidelines were fully implemented. (indicator 1.1)
- Diabetes. A recent NAO report suggested scope for improvement and reduction in deaths from diabetes and from CVD amongst diabetics (indicator 1.1)
- Atrial Fibrillation C.12,500 strokes per year directly attributable to atrial fibrillation. Proactive identification could save more lives (contributes to indicator 1.1)
- Cardiac Rehabilitation. Heart patients who do not take part in cardiac rehabilitation are 25% more likely to die in the following 2-5 years, but 60% of patients who need it do not have access to it. (indicator 1.1
- Pulmonary Rehabilitation. There is evidence that the greater take up of pulmonary rehabilitation following COPD exacerbation can improve outcomes for COPD patients whilst reducing readmission rates (indicator 1.2)
- Alcohol related Liver Disease. Initiatives in the recently published Alcohol Strategy (March 2012) offer potential scope for improvement. (indicator 1.3)
- Hepatitus C. Newly improved NICE drugs offer cost-effective treatment. (indicator 1.3)
- Suicide Prevention strategy – there is some evidence that suicide rates are amenable to mental health interventions (indicator 1.5)
- Mental health training for GPs: a Royal College of GPs initiative (indicator 1.5)
- NICE Quality Standard for specialist neonatal care (indicators 1.6i and 1.6ii)

- Family Nurse Partnership by 2015, doubling of coverage to 13,000 (indicators 1.6i and 1.6ii)
- extra 4,200 health visitors by 2015, strengthening the Healthy Child Programme (indicators 1.6i and 1.6ii)
- Excess mortality in those with Learning Disability. There is evidence (cited in relation to indicator 1.7) that those with LD are dying young disproportionately from causes amenable to healthcare. (indicator 1.7)

3.428 Note that this list is itself partial.

3.429 Scope for improvement can also be considered from a top-down perspective by considering outcomes in England compared to other countries for different groups: infants, those older than one year but under 75 (for whom it is possible to distinguish amenable cause of death) and the over-75s.

3.430 For the latter, there has been a marked improvement in life expectancy in the last decade. Analysis is required to identify the NHS contribution to that gain, and the extent to which it might be sustained within the resource envelop.

Illustrative Presentation of Scope for Improvement in Life Years for Indicator (indicators 1.6i and 1.6ii)

3.431 Whilst further work is needed to assess the likely consequences of successful implementation of the policies mentioned above for reducing perinatal mortality (implementing a NICE Quality Standard for specialist neonatal care, strengthening Family Nurse Partnership by 2015, doubling of coverage to 13,000, extra 4,200 health visitors by 2015, strengthening the Healthy Child Programme) the following is a presentation of an ambition based upon a reduction in the neonatal mortality rate fall to 2.4 deaths per 1,000 live births on the basis of these policies.

3.432 By 2018, on this basis there would be scope for an additional 26,915 life years in excess of those delivered by the current practice projection. This is in addition to the extra 20,193 life years that will be enjoyed as a result of current practice being sustained compared to what would have happened had 2012 mortality flatlined.

3.433 The following table sets out these additional life years for each year between 2012 and 2018, inclusive:

Life years saved due to sustained current practice projection over 2012 baseline

Year	Life years saved due to sustained current practice projection over 2012 baseline mortality rate		Life years saved in excess of those delivered by the current practice projection	
	Annual	Cumulative	Annual	Cumulative
2012	-		-	
2013	1,836	1,836	2,402	2,402
2014	3,672	5,507	4,859	7,261
2015	5,507	9,179	7,316	12,175
2016	7,343	12,850	9,773	17,088
2017	9,179	16,522	12,229	22,002
2018	11,015	20,193	14,686	26,915

Note: Numbers may not add up due to rounding

(3)(b) Domain 1: Levels of Ambition

3.434 This section assesses appropriate Levels of Ambition for Domain 1, adding to the scope for improvement of individual indicators the scope for gains in allocative efficiency, conditioned by a realistic assessment of the challenge presented to the NHS to achieve requisite change.

3.435 For Domain 1 the scope for allocative efficiency between different disease areas should be informed by work on marginal cost/life year in different programme budget categories[31].

3.436 Levels of ambition will be published in the final mandate.

[31] See Martin S, **Rice N**, Smith PC. The link between health care spending and health outcomes for the new English Primary Care Trusts. Centre for Health Economics, University of York; *CHE Research Paper 42 (PDF, 746kb)* 2008. This is part of a continuing programme of work.

(3)(c) Domain 1 Implications for Inequality

3.437 This section explores Implications for Inequality in Domain 1, setting out the implications for inequality of realising the scope for improvement in the way envisaged, and considering whether there might be scope for achieving more with or without compromise to overall outcomes.

3.438 Work is under way exploring the appropriate metric for inequality in Domain 1. One candidate mentioned above is the Slope Index of Inequality. This section explains this and sets out recent trends.

3.439 The Slope Index of Inequality (SII) is a measure of the social gradient in an indicator, i.e. how much the indicator varies with socio-economic status or deprivation. The SII summarises social inequalities across the whole population in a single number, which represents the gap in the indicator between the best-off and worst-off within the population, based on a statistical analysis of the relationship between the indicator and deprivation across the whole population.

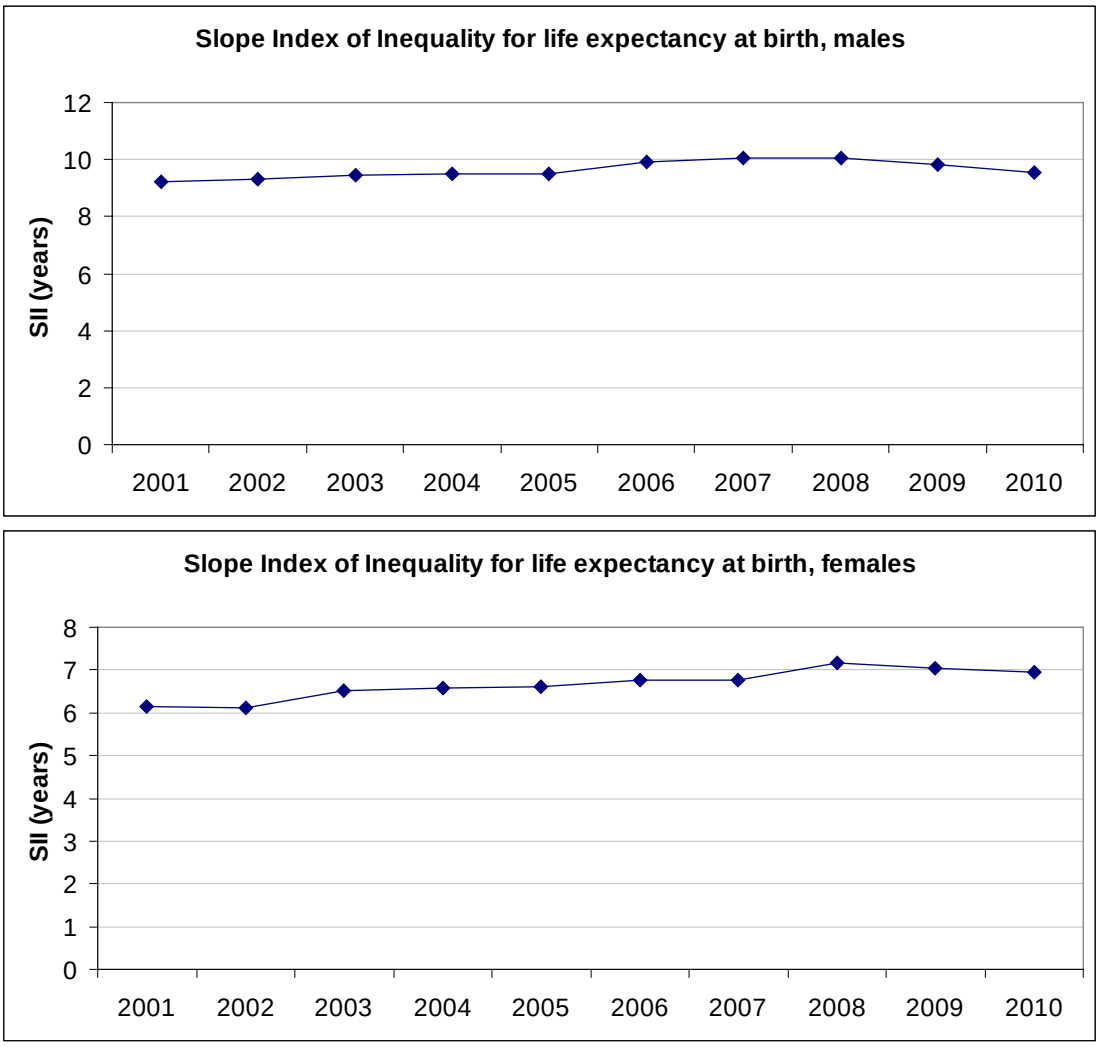
3.440 For example, the SII in life expectancy at birth in England represents the range in life expectancy across England, from most to least deprived, based on a statistical analysis of the relationship between life expectancy and deprivation across the whole population. An SII of 10 years indicates that life expectancy for the best-off is 10 years higher than for the worst-off in England. The higher the value of the SII, the greater the inequality.

3.441 The SII is a better measure of the extent of inequality than simply looking at the gap between the most deprived and least deprived areas, because it also takes account of inequalities that exist between intermediate areas and so reflects the experience of the entire population not just the extremes in terms of deprivation.

3.442 A provisional analysis of the recent trend in SII in life expectancy at birth for England between 2001 and 2010 is shown in the charts and table below. The analysis suggests that inequalities in life expectancy at birth as measured by the SII worsened over the first part of this period, although there has been a levelling off of the trend in recent years.

Slope Index of Inequality (SII) in life expectancy at birth, England, 2001 to 2010

Provisional data (unpublished analysis by DH based on ONS death and population data)



Slope Index of Inequality (SII) in life expectancy at birth, England, 2001 to 2010		
Provisional data (unpublished analysis by DH based on ONS death and population data)		
	SII (years)	SII (years)
Year	Males	Females
2001	9.2	6.2
2002	9.3	6.1
2003	9.4	6.5
2004	9.5	6.6
2005	9.5	6.6
2006	9.9	6.8
2007	10	6.8
2008	10	7.2
2009	9.8	7
2010	9.5	6.9

3.443 The table illustrates the terms of a level of ambition for Domain 1.

3.444 This picture contrasts with that observed for over-75 life expectancies set out with respect to indicator 1b, above. The Slope Index (i.e. the 'modelled gap' between the most and least deprived quintiles) for Life Expectancy at 75 was 2.8 years for males and 2.5 years for females in 2008-10. The Index has increased for both males and females since 2001-03, by 0.7 years (to 2.8 years) and by 0.9 years (to 2.5 years) respectively.

3.445 During the consultation period, work will be conducted to consider whether it would be appropriate to set a level of ambition with respect to the Slope Index overall, or specifically with respect to outcomes for specific age groups or causes of death.

Domain 1: (4) Considerations for Retrospective Assessment

3.446 This section draws attention to the factors that should be taken into account when assessing whether overall domain performance by the NHS has met levels of ambition set

3.447 In retrospect, when data is available for outcomes in 2014/15, and in succeeding years, NHS performance can be judged both bottom up and top down.

3.448 Performance can be assessed from the bottom up by consideration of the observed path of each indicator relative to its projected outcome. This should involve the following steps:

- retrospective adjustment of the projection in light of any unexpected shifts in the external drivers of performance, taking into account lags
- calculation of the residual movement and attribution to NHS performance (noting whether there are any known changes in NHS practice that might explain changes in outcome)
- translation of net divergences into incremental Life Years gained or lost, allowing for the life expectancy of those benefiting or suffering from shifts in disease-specific mortality indicators
- consideration of any specific factors that might have contributed to outcomes outside the scope of the underlying model, including:
    - The effect of any future pandemic on mortality from causes amenable to healthcare, and upon mortality of over-75s and neonates
    - natural disasters, wars and similar non medical determinants of mortality.
- comparison of aggregated net change in Life Years attributed to the NHS with Levels of Ambition.

3.449 Performance can be assessed from the top down by attempting to account for changes in life expectancy overall: what can be explained by cohort and other effects beyond the influence of the NHS: what residual impact is plausibly attributed to the NHS.