Original research article

How many deaths would be avoidable if socioeconomic inequalities in cancer survival in England were eliminated? A national population-based study, 1996-2006

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Accepted version

Abstract

Aim

Inequalities in survival between rich and poor have been reported for most adult cancers in England. This study aims to quantify the public health impact of these inequalities by estimating the number of cancer-related deaths that would be avoidable if all patients were to have the same survival as the most affluent patients.

Methods

National Cancer Registry data for all adults diagnosed with one of 21 common cancers in England were used to estimate relative survival. We estimated the number of excess (cancer-related) deaths that would be avoidable within three years after diagnosis if relative survival for patients in all deprivation groups were as high as the most affluent group.

Results

For patients diagnosed during 2004-2006, 7122 of the 64,940 excess deaths a year (11%) would have been avoidable if three-year survival for all patients had been as high as in the most affluent group. The annual number of avoidable deaths fell from 8435 (13%) a year for patients diagnosed during 1996-2000. Over 60% of the total number of avoidable deaths occurred within six months after diagnosis and approximately 70% occurred in the two most deprived groups.

Conclusion

The downward trend in the annual number of avoidable deaths reflects more an improvement in survival in England overall, rather than a narrowing of the deficit in cancer survival between rich and poor. The lack of any substantial change in the percentage of avoidable excess deaths highlights the persistent nature of the deficit in survival between affluent and deprived groups.

248 words

Key words: cancer survival, socioeconomic inequalities, avoidable deaths

Introduction

Inequalities in survival between rich and poor have been reported for most adult cancers in England and Wales.[1,2] The origins of these disparities in survival are still not fully understood, but factors such as stage at diagnosis and access to optimal treatment have been implicated.[3] Such observations suggest that deprived patients do not benefit equally from health-care services in the UK, despite a universal health-care system that is free to all at the point of use. Quantifying the public health impact of these inequalities in cancer survival is important to inform health policy. One such approach is to consider the number of deaths that would be avoidable if all patients were to have the same survival as that observed for the most affluent patients.

The NHS Cancer Plan for England, published in late 2000, was designed to improve prevention, early diagnosis and screening, and to provide optimal treatment for all patients. One of the main aims of the Cancer Plan was to tackle inequalities in cancer survival for people from deprived or less affluent backgrounds.[4] Recent observations suggest there has been a modest acceleration of the previous upward trend in survival in England since implementation of the NHS Cancer Plan.[5] However, there is little evidence that the Cancer Plan has been effective in reducing socioeconomic inequalities in short-term survival in the period up to 2006.[2] Inequalities in short-term survival between rich and poor were still large for many cancers among patients diagnosed in 2006.

We set out to update the public health evaluation of socioeconomic inequalities in survival by estimating how many cancer deaths would have been avoidable within three years of diagnosis if relative survival for all patients had been as high as for the most affluent patients. We examined National Cancer Registry data for England in three calendar periods, defined in relation to the NHS Cancer Plan: 1996–2000 (five years; before the Cancer Plan), 2001–2003 (three years; initialisation) and 2004–2006 (three years; implementation). Trends in the annual number of avoidable deaths can be used as a public health measure of progress towards the goals set out in the NHS Cancer Plan.

Materials and Methods

Relative survival, excess mortality and avoidable deaths

The overall mortality in a group of cancer patients can be divided into two components: the background mortality (or expected mortality, derived from all-cause death rates in the general population), and the excess mortality, attributable to the cancer. Excess (cancer-related) mortality is estimated using the relative survival approach.[6,7] Avoidable deaths are the component of excess mortality that would not occur if relative survival in all deprivation categories were as high as in affluent patients, i.e. if the socioeconomic inequalities in excess mortality did not exist (Figure 1).

Relative survival is an estimate of net survival, and is the standard approach to estimating population-based cancer survival.[6,7] Relative survival is interpretable as survival from the cancer after adjustment for other causes of death ('background mortality'), which varies widely by age, sex, socioeconomic group and over time. Background mortality is derived from annual life tables and corresponds to the age- and sex-specific mortality of the comparable general population. To account for the socioeconomic differences in mortality, complete (single-year-of-age) deprivation-specific life tables were used.[8]

To estimate the number of avoidable deaths, we first produced estimates of relative survival: the method is described in detail elsewhere.[2] Briefly, we used National Cancer Registry data on all adults (15-99 years) diagnosed with one of 21 common primary malignant neoplasms in England during the 11 years 1996–2006 and followed up to the end of 2009. These 21 common cancers represent 90.7% of all cancers. Cancer patients were assigned to one of five deprivation categories, based on quintiles of the national distribution of IMD (income domain) scores at the Lower Super Output Area (LSOA) level.[9] Relative survival up to three years was estimated for each of five categories of socioeconomic deprivation, and for each cancer, sex and calendar period of diagnosis. All patients were followed up for at least three years, so the cohort approach was applied throughout.

Calculation of avoidable deaths

The number of avoidable deaths compared with the most affluent category (reference category) was calculated for each of the deprivation categories 2, 3, 4 and 5 (most deprived), for each calendar period, sex, cancer and follow-up interval. To achieve this, the following formula was applied (for a given calendar period, sex, cancer, interval and deprivation category x):

$$Avoidable\ deaths\ in\ deprivation\ category\ x = N_x \times ES_x \times \left(RS_{affluent} - RS_x\right)$$

where *N* is the number of cancer cases in the deprivation category of interest (2,...,5), *ES* the expected survival in the deprivation category of interest, derived from the deprivation-specific life table, and *RS* the relative survival in the deprivation category of reference (most affluent) or in the deprivation category of interest (x). The total number of avoidable deaths for a given calendar period, sex, cancer, and interval is the sum across deprivation categories.

The annual number of avoidable deaths and the percentage they represent of all excess deaths were estimated up to three years after diagnosis. This was done for each calendar period and cancer. The cumulative number of avoidable deaths with time since diagnosis, and the relative contribution of each deprivation category to the total number of avoidable deaths are also shown.

Results

For patients diagnosed with one of 21 common cancers in England during 2004-2006, a total of 7122 of the 64,940 excess (cancer-related) deaths a year would have been avoidable within three years since diagnosis if survival for all patients had been as high as the most affluent group. This represents a fall in the number of avoidable deaths within three years since diagnosis from 8435 per year among patients diagnosed during 1996-2000. The percentage of excess deaths that were avoidable fell from 12.8% for patients diagnosed during 1996-2000 to 11.4% for those diagnosed during 2001-2003 and 11.0% for those diagnosed during 2004-2006 (Table 1 and Figure 2). Excluding prostate cancer from the total numbers did not change the overall trend (Table 1). Although some of the cancer-specific figures differed by sex, the overall patterns were very similar (*see web appendix 1*).

The single largest contributor to the total number of avoidable deaths was lung cancer. Among patients diagnosed with lung cancer during 2004-2006, 1350 deaths a year would have been avoidable within three years of diagnosis if survival for all patients had been as high as in the most affluent group. The annual number of avoidable deaths fell from 1621 for patients diagnosed during 1996-2000 to 1350 for those diagnosed during 2004-2006. The percentage of avoidable excess deaths was low (6-7%) due to the very high number of excess deaths, as expected for such a lethal cancer, and fell by just over 1% between 1996-2000 and 2004-2006. When examined by sex, a slightly higher number of avoidable deaths is seen among men in all three calendar periods (719 of the 1350 avoidable deaths in 2004-2006), but the percentage of excess deaths that are considered avoidable is consistently higher in women (*see web appendix 1*).

The second largest contributor to the total number of avoidable deaths was colon cancer. Among patients diagnosed during 2004-2006, 916 (15.5%) of the 5917 excess deaths a year were considered to be avoidable. In contrast to lung cancer, the annual number and percentage of avoidable excess deaths has increased slightly since 1996-2000, although estimates fluctuate across the three calendar periods (Table 1 and Figure 2).

For women diagnosed with breast or cervical cancer, a high percentage of excess deaths were considered to be avoidable (over 25% on average), even though the absolute numbers of avoidable deaths were comparatively small (646 per year among breast cancer patients and 152 per year among cervical cancer patients in 2004-2006). This is because both cancers have high survival (so, few excess deaths) but inequalities in survival are fairly wide (therefore the percentage of those excess deaths that are potentially avoidable is high). The number of avoidable deaths fell for both cancers between 1996-2000 and 2004-2006, most dramatically so for breast cancer (from 904 deaths per year among patients diagnosed during 1996-2000 to 646 among patients diagnosed during 2004-2006) (Table 1 and Figure 2).

Cumulative avoidable mortality increases rapidly in the first year after diagnosis in all calendar periods examined (Figure 3a). Over 60% of avoidable deaths in a given calendar year occurred within 6 months of diagnosis, and 80% within the first year since diagnosis; this pattern did not change over the period 1996-2006 (Figure 3b). The patterns vary by cancer, but a rapid accumulation of avoidable deaths within the first 6 months is a common feature among the 21 common cancers examined. Notable exceptions are prostate cancer in men, breast cancer in women and melanoma of the skin, where the cumulative number of avoidable deaths increases more steadily with time since diagnosis (*see figures on web appendix 2 for individual cancers*). This reflects the flatter survival curves seen in these cancers. The total number of avoidable deaths depends on the cut-off point in follow-up time. There is however some evidence to suggest that the total number of avoidable deaths has started to plateau at three years since diagnosis (Figure 3a).

For all cancers combined, the total annual number of avoidable deaths within three years since diagnosis fell, but the proportionate contribution of each deprivation category to the total changed very little between 1996 and 2006 (Figure 4). Deprivation categories 4 and 5 make the highest contribution, with approximately 70% of all avoidable deaths occurring in these two deprived groups. For patients diagnosed during 2004-2006, a similar proportion of avoidable deaths occurred in each group (35% in category 5 and 33% in category 4). Deprivation category 3 contributes approximately 20% of all avoidable deaths, with the remaining 10% in category 2. The most affluent group (1) is the reference group, so by definition, the number of avoidable deaths is zero.

Discussion

The absolute number of avoidable deaths for a particular cancer depends on the deficit in relative survival between affluent and deprived groups (the ‘deprivation gap’), but also on the number of patients diagnosed with that cancer and on the relative survival for that cancer. Our findings show that for adult cancer patients diagnosed in England during 2004-2006, 7122 (11%) of the 64,940 cancer-related deaths that occurred each year within three years since diagnosis would have been avoidable if relative survival for all patients had been as high as for the most affluent patients. Despite an increase in the number of patients diagnosed with cancer, the trend in the number of avoidable deaths declined over the period 1996-2006. This reflects an encouraging improvement in cancer survival in England overall and hence a reduction in the number of excess (cancer-related) deaths. It does not, however, reflect a substantial narrowing of the deprivation gap in cancer survival overall. The percentage of those excess deaths in cancer patients that may be attributable to socio-economic inequalities in cancer survival fell by just under 2% over this period, highlighting the persistent nature of the deficit in survival between affluent and deprived groups.

The National Cancer Registry contains no information about the income or socioeconomic status of individual cancer patients. Instead, an ecological measure of deprivation was used (the income domain score of the Index of Multiple Deprivation 2004[9] or IMD), on the basis of characteristics of the small area in which each patient was resident at the time of diagnosis. We used the smallest geographic area for which the IMD could be derived in England (Lower Super Output Area, socially homogeneous population approximately 1500) to minimise any misclassification. The effect of deprivation on all-cause[8] and cancer[10] mortality remains strong at an ecological level. The IMD 2004 is based on administrative and census data from 2001-2002, which roughly equates to the mid-point of the study. The IMD 2004 was therefore used to estimate deprivation for all patients included in the study to ensure consistency.

The calculation of avoidable deaths to quantify the public health impact of inequalities in cancer survival has been performed for a number of different comparators. A similar study of avoidable deaths among patients diagnosed in Finland during 1996-2005 reported that approximately 10% of deaths would have been avoidable if all cancer patients had the same survival as those with the highest educational background. The authors conclude that even in an equitable society with high health care standards, inequalities in cancer survival persist, and that early diagnosis may play a key role.[11] The percentage of avoidable deaths among Finnish cancer patients if inequalities in survival did not exist is similar to our findings for England. In a series of studies examining the effect of socioeconomic status on cancer survival in Canada and the United States, two countries with higher survival than England, a significant advantage was found for deprived patients in Canada compared to deprived patients in the US,[12] even after adjusting for differences in stage at diagnosis.[13] These findings implicate systematic differences in access to health care between the two countries, in particular in health insurance coverage for the most deprived populations. It is also worthy of note that differences in cancer survival between black and white populations in the US[14] are wider than any difference in survival between socioeconomic[1,2] or ethnic[15] groups in England.

We have previously estimated that approximately 7000 cancer-related deaths a year would have been avoidable among adults diagnosed in Britain during 1995-1999 if five-year cancer survival had been equivalent to the mean European level.[16] Narrowing the gap in survival between rich and poor in England could contribute significantly to reducing the gap in survival between England and the rest of Europe, a key aim of the NHS Cancer Plan.[4]

Socioeconomic inequalities in survival persist for most adult cancers in England, and the NHS Cancer Plan has, so far, had little effect on reducing the deficit in survival between rich and poor.[2] The number of deaths among cancer patients within three years of diagnosis that would have been avoidable if inequalities in survival did not exist helps to quantify its public health importance. It provides insight into how much the excess cancer mortality could be reduced if the levels of survival attained by the most affluent patients could be achieved in all patients, after adjusting for the differences in background mortality between socioeconomic groups. The absolute number of avoidable deaths is one measure of the cancer burden, and it can be used to help prioritise heath provision and expenditure. By contrast, the percentage of avoidable excess deaths can be used to evaluate the efficacy of health care measures in reducing inequalities in cancer survival.

This study suggests there are still vast improvements to be made. The proportion of cancer-related deaths in England that would be avoidable if socioeconomic inequalities in survival were eliminated is still over 10%. More than 80% of the avoidable deaths in the first three years occurred during the first year after diagnosis, highlighting the importance of timely diagnosis and treatment, which is a key aim of the Department of Health's National Awareness and Early Diagnosis Initiative (NAEDI).[17] More than two-thirds of the total avoidable deaths are contributed by the two most deprived groups, in almost equal proportions, and there is an urgent need to target these patients and improve their access to the healthcare system. The government report "Improving Outcomes: A strategy for Cancer",[18] published in 2011, aims "to save an extra 5000 lives a year"; a goal that could almost certainly be achieved by eliminating inequalities in survival in England. This is dependent on the success of Government initiatives such as NAEDI.

Lung cancer contributed a large number of avoidable deaths, although the deficit in survival between affluent and deprived patients is small (approximately 2%). The public health impact in terms of avoidable deaths is substantial because lung cancer is so common: even small improvements in survival for deprived patients could prevent large numbers of deaths. Despite differential trends in lung cancer incidence in men and women,[19] examination of avoidable deaths by sex revealed only small differences because relative survival and the 'deprivation gap' in survival are similar for both sexes and have been for several decades.[2,20]

One of the most rapid falls in the annual number of avoidable deaths was among men diagnosed with prostate cancer, and this was despite a substantial increase in the number of patients diagnosed over the period 1996-2006. An explanation for these phenomena may be an equalisation in the uptake of PSA testing among affluent and deprived men. Men in the most deprived groups, who had lower uptake of PSA testing during the 1990s,[21] have started to 'catch up' with affluent men. This is supported by an increase in the number of prostate cancer cases among deprived men included in these analyses after around 2000. Furthermore, by applying the annual prostate cancer incidence rate in deprived men in 1996-2000 to the population of deprived men in 2004-2006, we estimated that approximately 20% of cases among deprived men diagnosed during 2004-2006 could be due to increased uptake of PSA testing.

For cancers included in national screening programmes during the study period, the number (breast) and percentage (cervix) of avoidable deaths were high, and there is no doubt that improving the low uptake of screening among the more deprived populations would dramatically reduce these avoidable deaths.

The overall downward trend in avoidable deaths is replicated in the vast majority of cancers, with a few notable exceptions. Among patients diagnosed with cancers of the colon, rectum, kidney and uterus, the annual number of avoidable deaths increased over time, despite substantial improvements in survival.[5] This is due to an increase in incidence combined with either a static or widening deficit in survival between affluent and deprived. In 2004-2006, colon cancer was the second largest contributor to the total number of avoidable deaths.

Differences in the uptake of screening,[22] stage at diagnosis,[3] level of comorbidity[23,24] and access to optimal treatment[25] are all potential explanations for the difference in cancer survival between rich and poor patients. Whilst differences in stage at diagnosis and comorbidity have explained only a small proportion of the socioeconomic disparities in survival from colorectal cancer,[26] differential access to healthcare has been shown to strongly influence these inequalities in survival.[27,28] This is likely to hold true for other common cancers. Future research will focus on selected cancers and examine the number of deaths that would be avoidable in particular if stage at diagnosis and treatment were the same for all deprivation groups.

Word count: 3091

Conflict of interest statement
The authors declare no conflicts of interest.

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Acknowledgments
We thank the cancer registry staff in England: their sustained data collection and quality control have enabled the survival of patients to be analysed and compared in this study. We also thank the Cancer Team at ONS for extensive work in preparing the data in the National Cancer Registry.

Role of funding source
This work was supported by the Office for National Statistics (ONS) [NT-04/2355A]; and Cancer Research UK [C1336/A5735]. ONS collated the data from the regional registries and arranged their linkage to data on deaths at the National Health Service Central Register. Neither Cancer Research UK nor ONS had any role in study design, analysis, interpretation of the data, writing of the report, or in the decision to submit the paper for publication. The findings and conclusions in this report are those of the authors and do not necessarily represent the views of ONS or Cancer Research UK. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

Author contributions
BR and MPC led the study design. LE, BR and MPC carried out the data preparation and quality control. LE did the analyses. LE, BR and MPC contributed to interpretation of the findings and drafted the report.

Conflict of interests
The authors declare no conflicts of interest.

Tables and Figures

Table 1. Annual number of patients, and the number (and percentage) of excess deaths that would be avoidable in England within three years of diagnosis if relative survival were as high as in the most affluent category: selected cancers, adults diagnosed during 1996-2000, 2001-2003 and 2004-2006

Footnotes to Table 1
[1] The annual number of patients, excess and avoidable deaths have been averaged over the three or five years in each calendar period
[2] The percentage of avoidable deaths is the number of avoidable deaths as a proportion of all excess deaths
[3] The number of avoidable deaths partly depends on the deficit in relative survival between affluent and deprived groups. If survival for a particular cancer is higher in deprivation categories 2-5 than the most affluent category (1), the number and proportion of avoidable deaths can be negative.

Figure 1. Partition of the annual number of deaths in cancer patients within three years of diagnosis into the number expected from background mortality and the number of excess deaths (attributable to cancer). This hypothetical example shows the proportion of all excess deaths that would be avoidable (27%) if relative survival in all deprivation categories were as high as in the most affluent patients.

Figure 2a. Annual number of avoidable cancer deaths[1] in England within three years of diagnosis: selected cancers, adults diagnosed during 1996-2000, 2001-2003 and 2004-2006

Figure 2b. Avoidable cancer deaths as a percentage of all excess (cancer-related) deaths[1] in England within three years of diagnosis: selected cancers, adults diagnosed during 1996-2000, 2001-2003 and 2004-2006

Footnote to Figures 2a and 2b
[1] The number of avoidable deaths partly depends on the deficit in relative survival between affluent and deprived groups. If survival for a particular cancer is higher in deprivation categories 2-5 than the most affluent category (1), the number and proportion of avoidable deaths can be negative.

Figure 3a. Cumulative annual number of avoidable deaths up to three years after diagnosis: 21 cancers combined, England

Figure 3b. Cumulative proportion of avoidable deaths[1] up to three years after diagnosis: 21 cancers combined, England

Footnote to Figures 3b
[1] The percentage of avoidable deaths is the cumulative number of avoidable deaths as a proportion of the total number of avoidable deaths

Figure 4. Contribution of each deprivation category to the annual number of avoidable deaths in England within three years since diagnosis: 21 cancers combined, by calendar period

Web appendix 1. Annual number of patients, and the number (and percentage) of excess deaths that would be avoidable in England within three years of diagnosis if relative survival were as high as in the most affluent category: selected cancers by sex, adults diagnosed during 1996-2000, 2001-2003 and 2004-2006

Footnotes to Web appendix 1

[1] The annual number of patients, excess and avoidable deaths have been averaged over the three or five years in each calendar period

[2] The percentage of avoidable deaths is the number of avoidable deaths as a proportion of the excess deaths

[3] The number of avoidable deaths partly depends on the deficit in relative survival between affluent and deprived groups. If survival for a particular cancer is higher in deprivation categories 2-5 than the most affluent category (1), the number and proportion of avoidable deaths can be negative.

Web appendix 2. Cumulative number of avoidable deaths up to three years after diagnosis: 21 common cancers, England

Footnotes to Web appendix 2

The number of avoidable deaths for a particular cancer partly depends on the deficit in relative survival between affluent and deprived groups. If survival is higher in deprivation categories 2-5 compared to the most affluent category (1), the resultant number of avoidable deaths can be negative. It is therefore possible for the cumulative number of avoidable deaths to decrease with time since diagnosis.

Cancer	1996-2000[1] No. of patients	Excess deaths	Avoidable deaths	%[2]	2001-2003[1] No. of patients	Excess deaths	Avoidable deaths	%[2]	2004-2006[1] No. of patients	Excess deaths	Avoidable deaths	%[2]
Bladder	9,774	2,695	**502**	**18.6**	8,334	2,734	**332**	**12.1**	8,164	2,686	**471**	**17.5**
Brain	2,991	1,917	**165**	**8.6**	3,126	2,014	**66**	**3.3**	3,220	2,025	**133**	**6.6**
Breast	31,025	3,355	**904**	**26.9**	33,661	2,997	**754**	**25.1**	35,648	2,643	**646**	**24.4**
Cervix	2,511	627	**179**	**28.6**	2,329	572	**230**	**40.1**	2,261	488	**152**	**31.1**
Colon	16,163	5,991	**841**	**14.0**	16,473	5,889	**701**	**11.9**	17,596	5,917	**916**	**15.5**
Hodgkin's disease[3]	1,096	124	**52**	**42.2**	1,131	129	**26**	**20.0**	1,250	149	**-18**	**-12.3**
Kidney	4,404	1,706	**196**	**11.5**	5,033	1,905	**264**	**13.9**	5,778	2,032	**214**	**10.5**
Larynx	1,444	363	**104**	**28.8**	1,393	351	**110**	**31.4**	1,405	323	**61**	**18.9**
Leukaemia	4,878	1,967	**235**	**11.9**	5,335	2,072	**193**	**9.3**	5,479	2,127	**161**	**7.6**
Lung	27,409	21,320	**1,621**	**7.6**	27,726	21,147	**1,228**	**5.8**	28,704	21,588	**1,350**	**6.3**
Melanoma	5,047	419	**100**	**23.8**	6,468	451	**63**	**14.0**	7,950	515	**76**	**14.8**
Myeloma	2,763	1,274	**168**	**13.2**	2,969	1,265	**134**	**10.6**	3,196	1,263	**130**	**10.3**
Non-Hodgkin Lymphoma	6,942	2,277	**384**	**16.9**	7,715	2,363	**404**	**17.1**	8,310	2,205	**352**	**16.0**
Oesophagus	5,292	3,830	**389**	**10.2**	5,922	4,110	**472**	**11.5**	6,113	4,096	**327**	**8.0**
Ovary	5,132	2,188	**209**	**9.6**	5,480	2,299	**277**	**12.1**	5,316	2,090	**108**	**5.2**
Pancreas	4,684	3,631	**409**	**11.3**	5,234	4,019	**394**	**9.8**	5,710	4,280	**306**	**7.1**
Prostate	19,949	3,198	**752**	**23.5**	27,066	2,805	**759**	**27.0**	29,753	2,317	**497**	**21.4**
Rectum	9,961	3,362	**603**	**17.9**	10,182	3,263	**631**	**19.3**	10,831	3,298	**677**	**20.5**
Stomach	7,401	5,111	**522**	**10.2**	6,774	4,544	**419**	**9.2**	6,153	4,035	**436**	**10.8**
Testis	1,526	41	**4**	**10.8**	1,557	38	**5**	**12.8**	1,664	43	**13**	**31.5**
Uterus	4,361	744	**94**	**12.6**	5,023	764	**63**	**8.3**	5,612	820	**114**	**13.9**
Total	174,753	66,142	**8,435**	**12.8**	188,930	65,729	**7,524**	**11.4**	200,112	64,940	**7,122**	**11.0**
Total excluding prostate	154,804	62,945	**7,683**	**12.2**	161,864	62,924	**6,765**	**10.8**	170,359	62,622	**6,625**	**10.6**

Table 1. Annual number of patients, and the number (and percentage) of excess deaths that would be avoidable in England within three years of diagnosis if relative survival were as high as in the most affluent category: selected cancers, adults diagnosed during 1996-2000, 2001-2003 and 2004-2006.

Cancer		1996-2000[1] No. of	Excess deaths	Avoidable deaths	%[2]	2001-2003[1] No. of	Excess deaths	Avoidable deaths	%[2]	2004-2006[1] No. of	Excess deaths	Avoidable deaths	%[2]
Bladder	Men	7,032	1,740	**332**	**19.1**	5,984	1,753	**188**	**10.7**	5,876	1,746	**254**	**14.5**
	Women	2,742	955	**170**	**17.8**	2,349	981	**144**	**14.7**	2,288	940	**217**	**23.1**
Brain	Men	1,733	1,099	**35**	**3.1**	1,840	1,173	**6**	**0.5**	1,908	1,199	**98**	**8.2**
	Women	1,258	818	**131**	**16.0**	1,286	841	**60**	**7.1**	1,312	826	**35**	**4.3**
Breast	Women	31,025	3,355	**904**	**26.9**	33,661	2,997	**754**	**25.1**	35,648	2,643	**646**	**24.4**
Cervix	Women	2,511	627	**179**	**28.6**	2,329	572	**230**	**40.1**	2,261	488	**152**	**31.1**
Colon	Men	8,088	2,942	**410**	**13.9**	8,394	2,945	**314**	**10.7**	9,080	2,966	**403**	**13.6**
	Women	8,075	3,050	**431**	**14.1**	8,079	2,944	**387**	**13.1**	8,515	2,951	**514**	**17.4**
Hodgkin's disease[3]	Men	626	71	**29**	**41.3**	657	79	**8**	**10.0**	694	78	**-23**	**-29.1**
	Women	470	53	**23**	**43.5**	475	50	**18**	**35.6**	556	71	**4**	**6.1**
Kidney	Men	2,756	1,039	**132**	**12.7**	3,154	1,178	**154**	**13.1**	3,638	1,275	**218**	**17.1**
	Women	1,648	667	**65**	**9.7**	1,879	727	**110**	**15.1**	2,140	757	**-4**	**-0.5**
Larynx	Men	1,444	363	**104**	**28.8**	1,393	351	**110**	**31.4**	1,405	323	**61**	**18.9**
Leukaemia	Men	2,755	1,062	**81**	**7.7**	3,058	1,143	**119**	**10.4**	3,183	1,215	**130**	**10.7**
	Women	2,123	906	**154**	**17.0**	2,276	929	**75**	**8.0**	2,296	912	**31**	**3.4**
Lung	Men	17,183	13,335	**902**	**6.8**	16,602	12,666	**665**	**5.3**	16,761	12,622	**719**	**5.7**
	Women	10,226	7,986	**719**	**9.0**	11,124	8,481	**562**	**6.6**	11,943	8,966	**631**	**7.0**
Melanoma	Men	2,171	256	**62**	**24.3**	2,854	280	**36**	**12.8**	3,639	340	**62**	**18.3**
	Women	2,876	163	**37**	**23.0**	3,614	172	**28**	**16.1**	4,311	175	**14**	**7.9**
Myeloma	Men	1,446	641	**77**	**12.0**	1,604	662	**70**	**10.6**	1,738	665	**84**	**12.6**
	Women	1,317	633	**92**	**14.5**	1,365	603	**64**	**10.6**	1,458	598	**46**	**7.7**
Non-Hodgkin Lymphoma	Men	3,673	1,204	**152**	**12.6**	4,079	1,269	**175**	**13.8**	4,455	1,189	**170**	**14.3**
	Women	3,269	1,073	**232**	**21.7**	3,635	1,094	**229**	**20.9**	3,855	1,016	**182**	**17.9**
Oesophagus	Men	3,239	2,332	**244**	**10.5**	3,759	2,591	**292**	**11.3**	3,964	2,639	**234**	**8.9**
	Women	2,053	1,498	**146**	**9.7**	2,163	1,519	**180**	**11.8**	2,148	1,457	**93**	**6.4**
Ovary	Women	5,132	2,188	**209**	**9.6**	5,480	2,299	**277**	**12.1**	5,316	2,090	**108**	**5.2**
Pancreas	Men	2,310	1,781	**246**	**13.8**	2,566	1,944	**191**	**9.8**	2,786	2,058	**166**	**8.1**
	Women	2,375	1,850	**164**	**8.9**	2,668	2,075	**203**	**9.8**	2,924	2,222	**140**	**6.3**
Prostate	Men	19,949	3,198	**752**	**23.5**	27,066	2,805	**759**	**27.0**	29,753	2,317	**497**	**21.4**

Rectum	Men	5,959	2,028	**419**	**20.7**	6,177	1,969	**400**	**20.3**	6,622	2,014	**456**	**22.6**
	Women	4,002	1,334	**184**	**13.8**	4,005	1,293	**231**	**17.9**	4,209	1,285	**222**	**17.2**
Stomach	Men	4,784	3,290	**298**	**9.1**	4,398	2,948	**283**	**9.6**	4,021	2,599	**305**	**11.7**
	Women	2,617	1,821	**224**	**12.3**	2,375	1,595	**137**	**8.6**	2,132	1,436	**131**	**9.1**
Testis	Men	1,526	41	**4**	**10.8**	1,557	38	**5**	**12.8**	1,664	43	**13**	**31.5**
Uterus	Women	4,361	744	**94**	**12.6**	5,023	764	**63**	**8.3**	5,612	820	**114**	**13.9**
Total	Men	86,673	36,422	4,278	**11.7**	95,143	35,794	3,774	**10.5**	101,188	35,288	3,845	**10.9**
	Women	88,079	29,721	4,157	**14.0**	93,787	29,935	3,750	**12.5**	98,924	29,652	3,277	**11.0**
Total excluding prostate	*Men*	*66,725*	*33,224*	*3,527*	***10.6***	*68,077*	*32,989*	*3,015*	***9.1***	*71,435*	*32,971*	*3,349*	***10.2***

[1] The annual number of patients, excess and avoidable deaths have been averaged over the three or five years in each calendar period

[2] The percentage of avoidable deaths is the number of avoidable deaths as a proportion of the excess deaths

[3] The number of avoidable deaths partly depends on the deficit in relative survival between affluent and deprived groups. If survival for a particular cancer is higher in deprivation categories 2-5 compared to the most affluent category (1), the number and proportion of avoidable deaths can be negative.

Web appendix 1. Annual number of patients, and the number (and percentage) of excess deaths that would be avoidable in England within three years of diagnosis if relative survival were as high as in the most affluent category: selected cancers by sex, adults diagnosed during 1996-2000, 2001-2003 and 2004-2006

Figure 1. Partition of the annual number of deaths in cancer patients within 3 years of diagnosis into the number expected from background mortality and the excess deaths (attributable to cancer). This hypothetical example shows the proportion of all excess deaths that would be avoidable (27%) if relative survival in all deprivation categories were as high as in affluent patients.

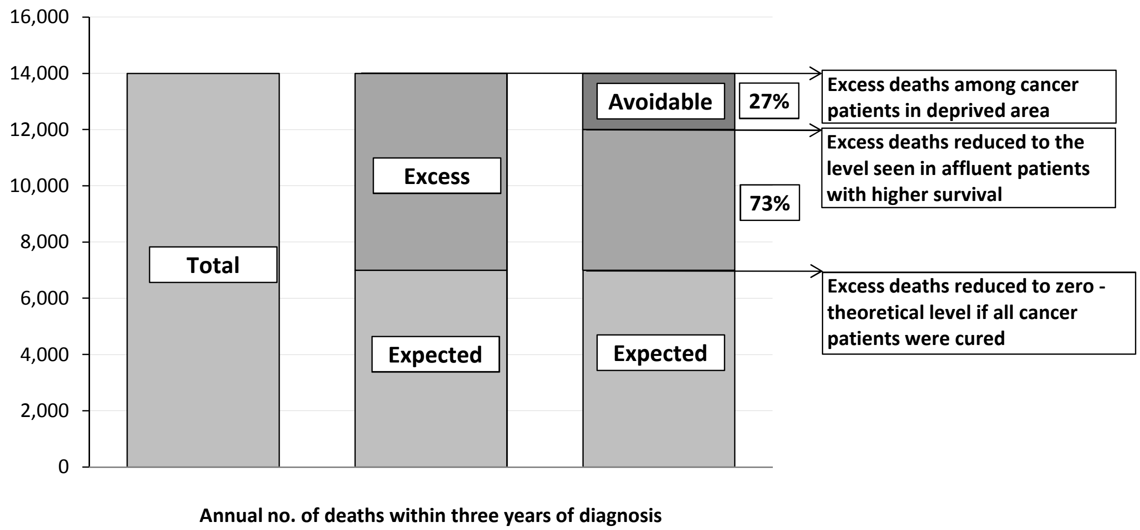


Figure 2a. Annual number of avoidable cancer deaths[1] in England within three years of diagnosis: selected cancers, adults diagnosed during 1996-2000, 2001-2003 and 2004-2006

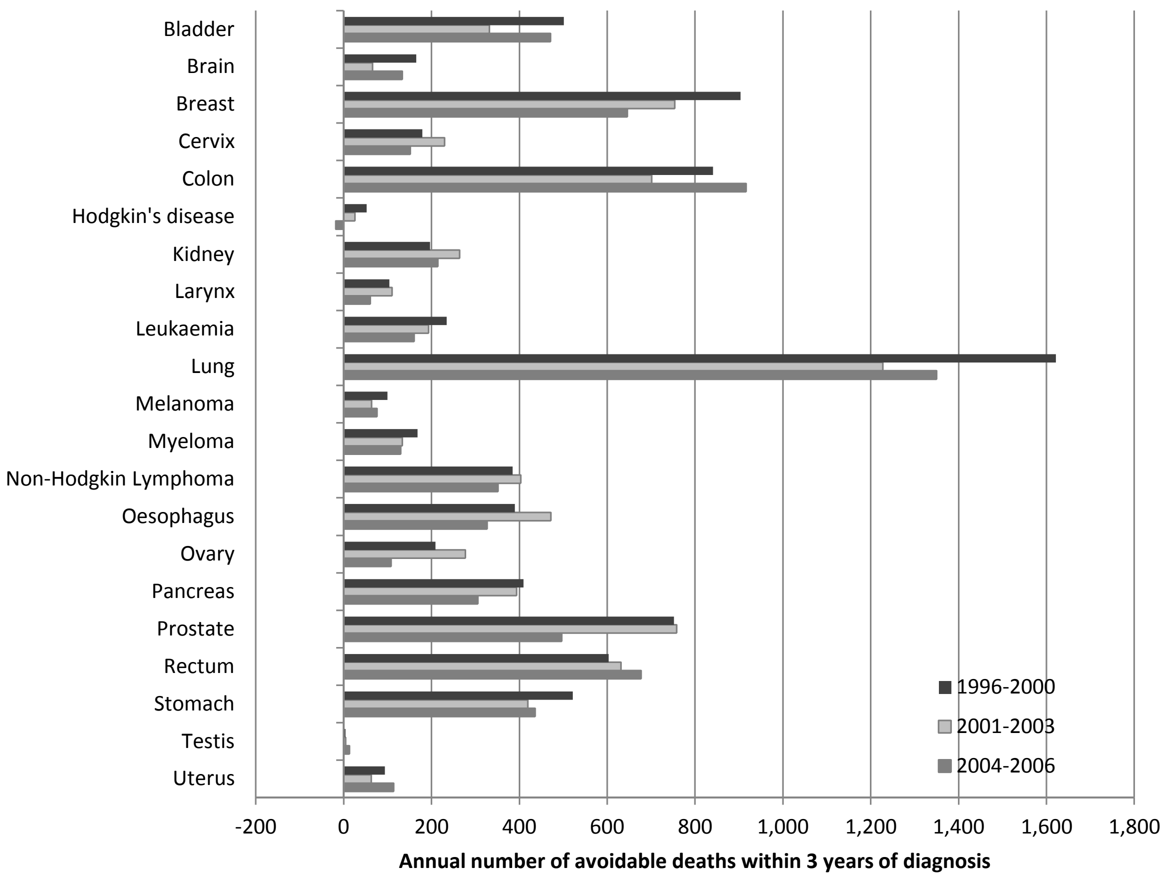
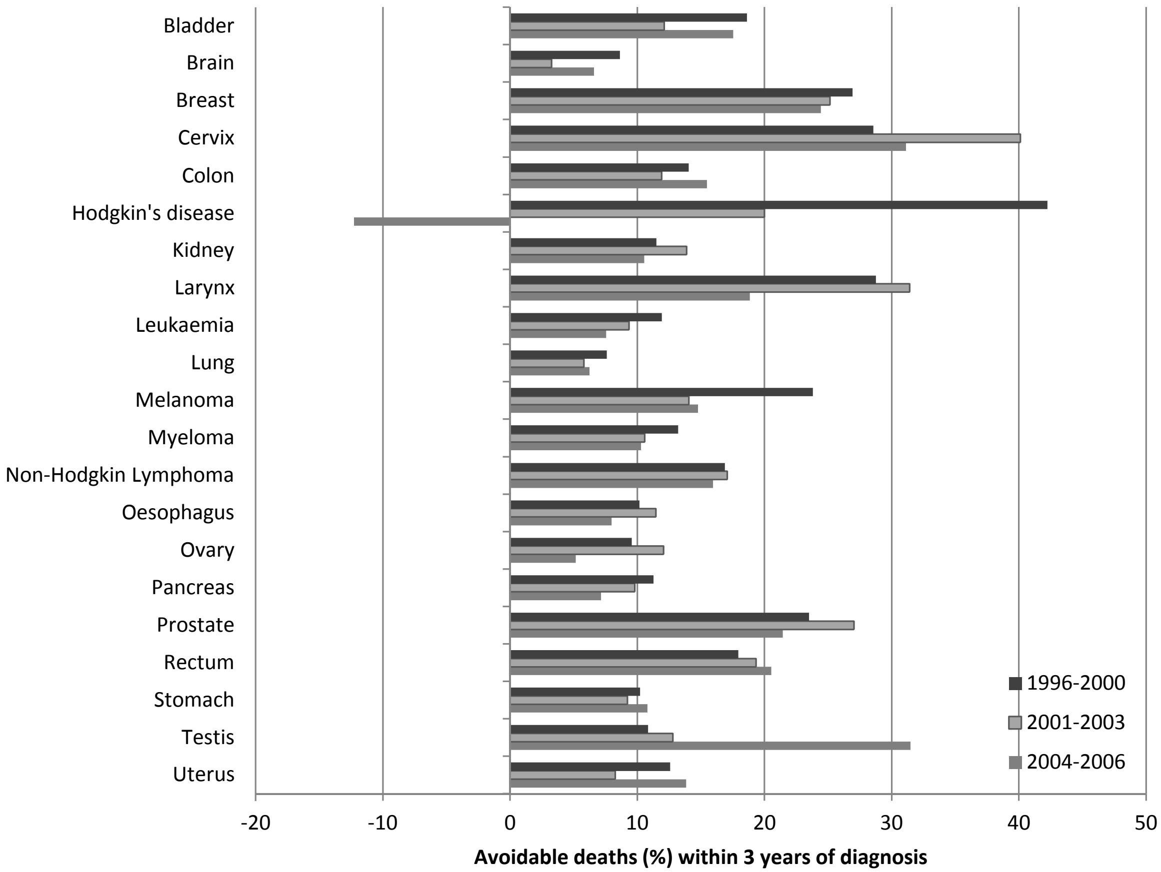


Figure 2b. Avoidable cancer deaths as a percentage of excess (cancer-related) deaths[1] in England within three years of diagnosis: selected cancers, adults diagnosed during 1996-2000, 2001-2003 and 2004-2006



[1] The number of avoidable deaths partly depends on the deficit in relative survival between affluent and deprived groups. If survival for a particular cancer is higher in deprivation categories 2-5 compared to the most affluent category (1), the number and proportion of avoidable deaths can be negative.

Figure 3a. Cumulative annual number of avoidable deaths up to three years after diagnosis: 21 cancers combined, England

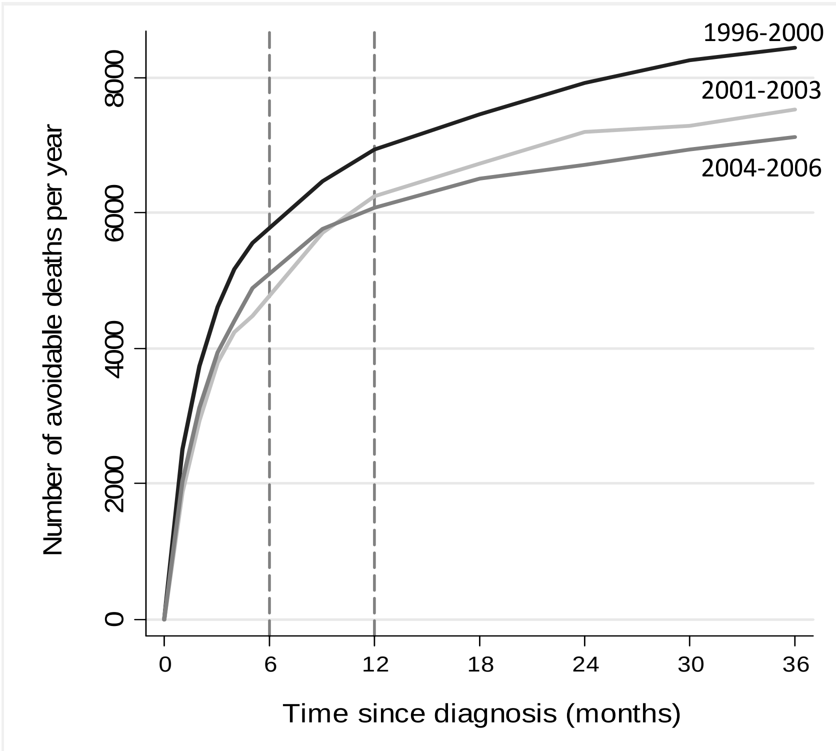
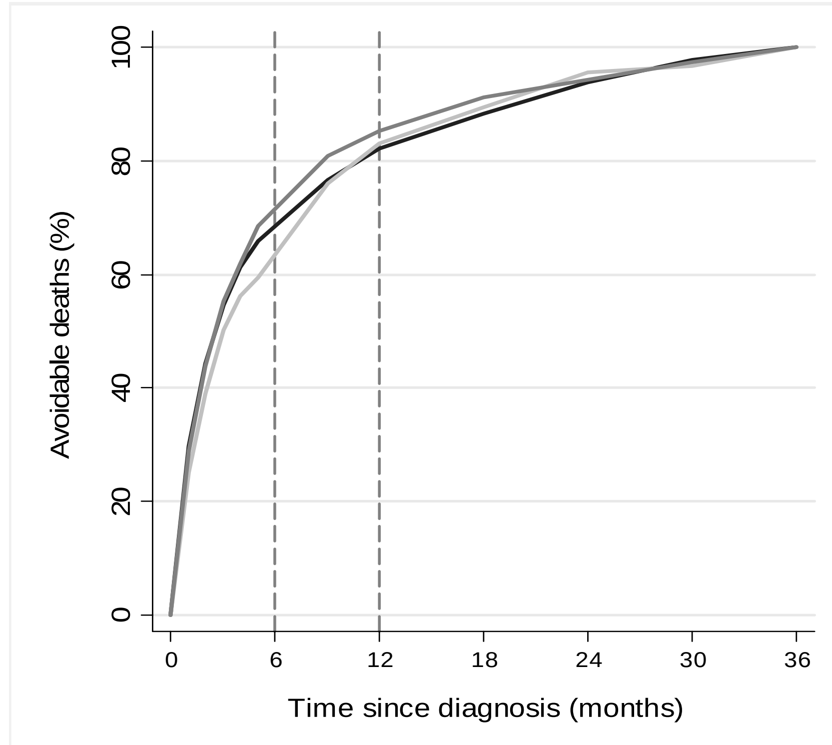
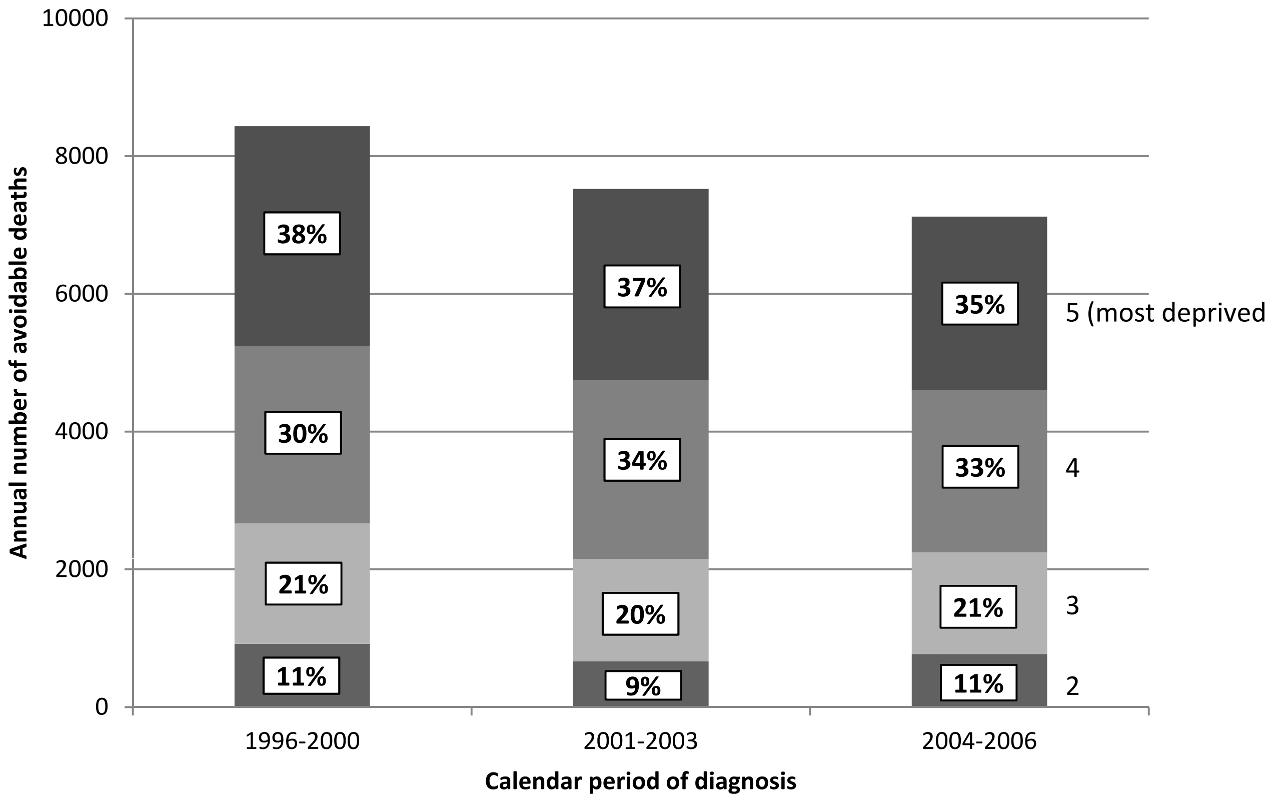


Figure 3b. Cumulative proportion of avoidable deaths[1] up to three years after diagnosis: 21 cancers combined, England

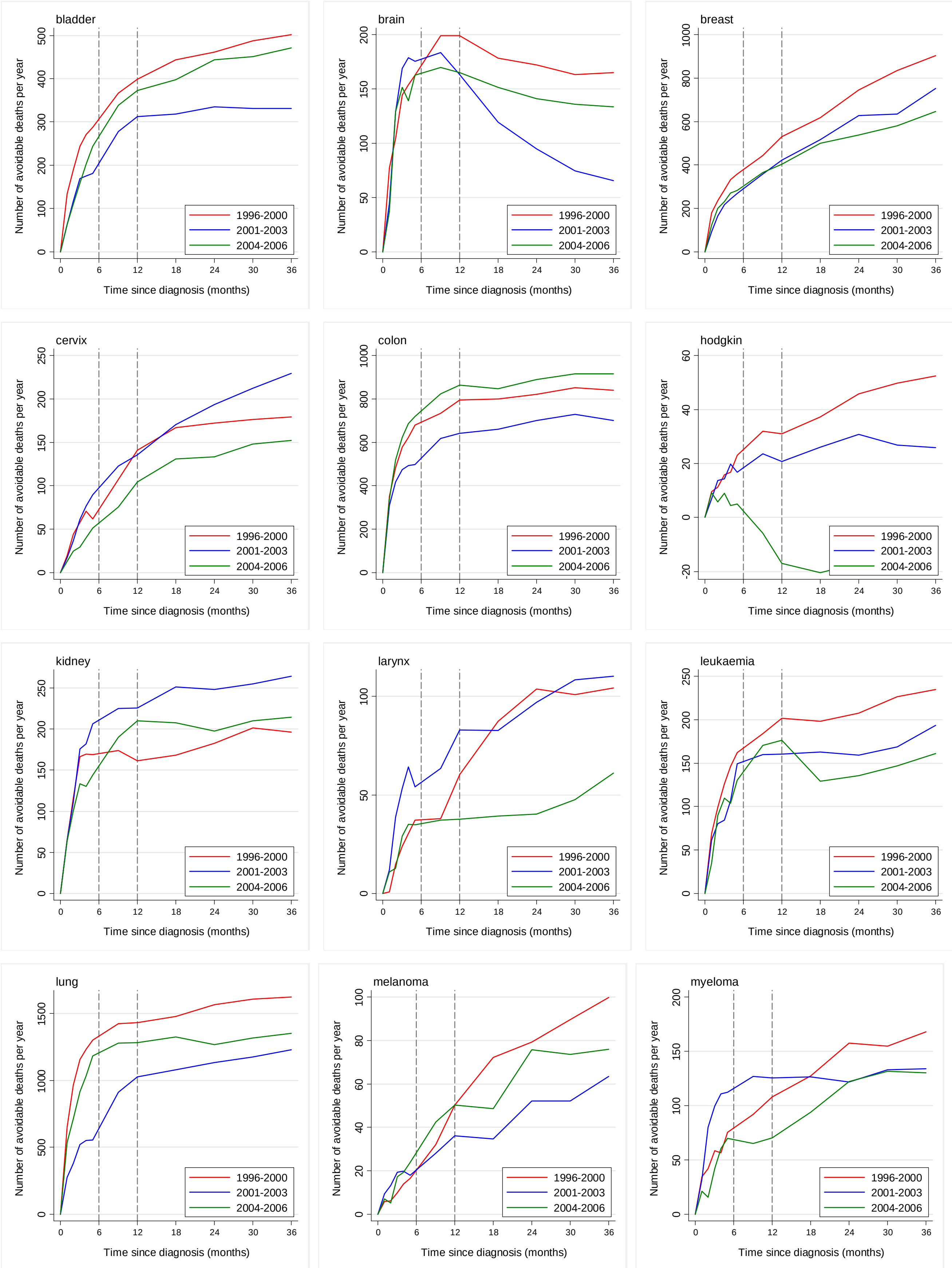


[1] The percentage of avoidable deaths is the cumulative annual number of avoidable deaths as a proportion of the total number of avoidable deaths

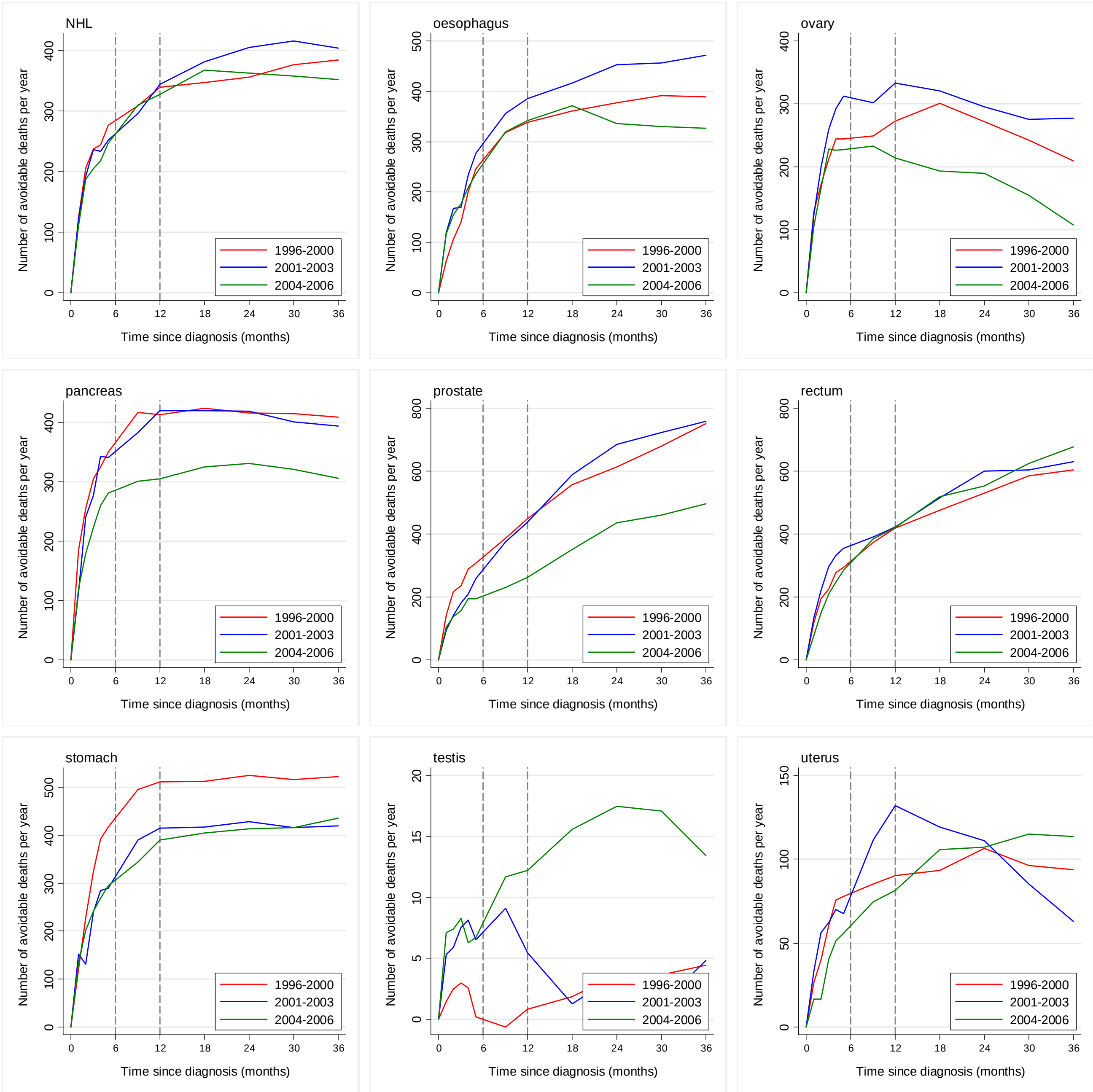
Figure 4. Contribution of each deprivation category to the annual number of avoidable deaths in England within three years of diagnosis: 21 cancers combined, by calendar period



Web appendix 2. Cumulative number of avoidable deaths up to 3 years after diagnosis: 21 common cancers, England



Web appendix 2. Cumulative number of avoidable deaths up to 3 years after diagnosis: 21 common cancers, England



Footnote:

The number of avoidable deaths for a particular cancer partly depends on the deficit in relative survival between affluent and deprived groups. If survival is higher in deprivation categories 2-5 compared to the most affluent category (1), the resultant number of avoidable deaths can be negative. It is therefore possible for the cumulative number of avoidable deaths to decrease with time since diagnosis.