Just How Well Are We?

A glance at trends in avoidable mortality from cancer and circulatory disease in England & Wales

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Executive Summary

There has been much discussion recently of the UK's inferior performance in terms of health outcomes, particularly compared with other countries of comparable development. Much of the blame for this sub-standard performance tends to be placed at the door of the NHS. But is this fair?

This report attempts to shed some light on this issue with respect to the biggest 'killers' in England & Wales, circulatory disease and cancer, by using the concept of avoidable mortality.

Avoidable mortality is based on the concept that deaths from certain conditions should not occur in the presence of timely and effective health care. Generally speaking, causes of death are included in this measure if they are either amenable to treatment and medical care and/or amenable to secondary prevention through early detection. For all, with the best health care, it is reasonable *to expect death to be averted even after the condition has developed.*

Separating amenable conditions from others – where death might *not* be averted even with the best medical care – helps to isolate the effectiveness of a health system from other factors out of its control, such as diet and lifestyle, which may lead to the natural end of someone's life.

This study finds:

- Avoidable mortality from cancer and circulatory disease has fallen by 15.0% *(Table 2)* and 34.0% *(Table 3)* respectively, between 1999 and 2005 in England & Wales.

- The most significant reduction has been in the mortality rate from the biggest killer, ischaemic heart disease (IHD), of 26.9 deaths per 100,000 population, or 35.4%. The mortality rate from strokes (cerebrovascular disease) has also fallen by 31.4%.

- Generally speaking, *avoidable mortality from cancer and circulatory disease has fallen at an increasing rate* over time. The average five-yearly fall in avoidable mortality from both cancer and circulatory disease was just over 10 percentage points higher between 1994 and 2004, than between 1979 and 1994 (chart 1).

- It is worrying, then, that the rate at which avoidable mortality from cancer has dropped has *decreased year-on-year from 3.6% in 1999 to 1.7% in 2005 (Table 2)*. Indicative of this, *the period 1999-2004 is the only five-year period since 1979 where the rate of decrease in avoidable cancer mortality fell on the previous period (Table 9).* **This may well call into question the effectiveness of the NHS Cancer Plan.**

- Yet despite this concerning trend, the decrease in avoidable mortality in England & Wales between 1999-2004 was in fact higher than the eleven-country European average of Austria, Czech Republic, Finland, France, Germany, Hungary, the Netherlands, Norway, Spain, Sweden and England & Wales. *Avoidable mortality from cancer decreased by 13.5% in England & Wales,*

compared with an average decrease of 9.9% (Table 10); and avoidable mortality from circulatory disease decreased by 29.4%, compared with an average decrease of 26.2% (Table 11).

- Nonetheless, the experience of Austria – that started from a similar position as England & Wales in terms of avoidable mortality rates – shows **a better performance is inherently possible**. *Avoidable mortality from cancer fell by 14.1% and from circulatory disease by a massive 38.4% in Austria between 1999 and 2004 (Table 11).*

- Of utmost concern is that, despite the improvements, **avoidable mortality rates, particularly from circulatory disease, still remain very high in England & Wales** compared with the other eleven other countries studied.

- *In 2004, avoidable mortality from circulatory disease stood at 72.6 deaths per 100,000 of the population in England & Wales, compared with just 31.7 in France, 44.5 in Spain and 47.4 in the Netherlands (the three best performers).*

- In 2004, around 18,400 more people died in England & Wales from circulatory disease, where death is considered avoidable, than in France, despite the population being some 10 million less. *Even if France failed to register any improvement in avoidable mortality from circulatory disease from now on, and the NHS continued to register the rate of improvement it showed between 1999 and 2004,* **it would still take until about 2019 for England & Wales to catch up** *(chart 4).*

Care had to be taken throughout this study both in using data, but particularly in drawing inferences from it; not least because there is considerable debate over just how much any improvement in avoidable mortality may be attributed to a health system such as the NHS.

The concept of avoidable mortality *helps* to isolate the effects of a health system by focusing on deaths that can be attributed to it – we are ruling out those conditions where even the best health care may not save lives – but it is still the case that avoidable mortality rates, as much as non-avoidable, may be falling due to other factors such as improved living standards and a lower incidence of that disease.

This study also attempted to address this. The fact that avoidable mortality is decreasing in England & Wales at the same time that the incidence of cancer and circulatory disease seems to be on the increase, and that avoidable mortality rates have fallen at a faster rate than non-avoidable mortality rates, *strongly suggests that better health care has had a very real impact on the fall in avoidable mortality.* **In other words health care does save lives.**

This is important. For all its limitations, we are dealing with *avoidable* mortality and this has one major advantage: the conditions considered here – with the possible exception of ischaemic heart disease – are considered amenable to health care; it is reasonable to expect death to be averted even after the onset of disease. **The NHS has a massive challenge to cut avoidable mortality, but it shouldn't be insurmountable.**

Part I: Health outcomes and avoidable mortality

The context

There has been much discussion recently of the UK's inferior performance in terms of health outcomes, particularly compared with other countries of comparable development and not least following the results of the EUROCARE-4 study into cancer survival.[i]

Nonetheless, studies using sufficiently disaggregated and *current* data on health outcomes remain somewhat difficult to come by. Even on the domestic front Sir Derek Wanless, in a recent report for the King's Fund, went so far as to conclude 'in the absence of any routine data on changes in health status as a result of NHS interventions, we have to rely on less direct measures of population health'.[ii]

This is true to an extent, but we can do better than the statistics he relies on. Using the latest mortality data from the European Detailed Mortality Database (EDMD),[iii] maintained by the World Health Organisation (WHO), and from the Office of National Statistics, this study will attempt to provide an up-to-date perspective on how well the NHS has performed in terms of certain health outcomes since the large injection of funds in 2000. Focusing on the biggest 'killers', circulatory disease and cancer, it will analyse:

i. Whether health outcomes have improved;

ii. The extent to which any improvement can be attributed to the NHS;

iii. Whether improvement is unique – is there any divergence from long-term trends and how has the NHS fared compared with other countries?

To this end, the study will use the concept of avoidable mortality, in a direct attempt to isolate the effects of a health system on health outcomes; to try to assess the effectiveness of a health system rather than the healthiness of the population.

Measuring health outcomes

To achieve an improvement in health outcomes – to improve people's quality and length of life – must be the raison d'être of any healthcare system; it is both the final stage in the productivity matrix and, when it comes down to it, what really matters to patients.

Despite this, measurement of health outcomes remains in its infancy. To a large extent this is because it is so difficult to isolate the effect of a health service on someone's health. There are a multitude of other factors at play, such as diet, nutrition, lifestyle, socio-economic status et cetera, that lie beyond the immediate reach of any health service. Are mortality rates in the UK comparatively higher because the health service is bad or because a higher proportion of the population are obese or binge drink? It's very difficult to tell.

Added to this is the difficulty – to put it bluntly – of measuring anything but death as a proxy for how good a health system is, be it through mortality rates, hospital-standardised mortality rates (HSMR), premature mortality rates or survival rates. Yes, such data is incredibly important, but it does represent

a comparatively narrow focus on the worst case scenario; most operations patients undergo aren't life-threatening. As Heather Walker recently wrote in the *HSJ*: 'Death is only one outcome. As far as the NHS is concerned, very little is known about the other outcomes of those discharged from hospital. Do patients actually feel any better for the health care intervention they have just undergone?'[iv] Moreover, no account is taken of services that are focused primarily on relieving pain and improving quality of life.[v] The ultimate goal must be to incorporate the views of patients both on their experiences of health care and on the health outcomes of that care, perhaps along the lines of the SF-36 pre- and post-operative questionnaires already used by BUPA.[vi]

In the meantime, for so long as reliable data on morbidity remains scarce, 'mortality continues to be one of the most effective ways of comparing clinical performance, safety and quality' in health care.[vii]

'Avoidable' mortality

There is one particular measure of mortality, that of 'avoidable' mortality, which can serve as a very useful proxy for the performance of a health system as a whole. Avoidable mortality is 'based on the concept that deaths from certain conditions should not occur in the presence of timely and effective health care'.[viii] Generally speaking, causes of death are included in this measure if they are either amenable to treatment and medical care and/or amenable to secondary prevention through early detection.[ix] For all, with the best health care, it is reasonable *to expect death to be averted even after the condition has developed.* This contrasts with conditions, such as Alzheimer's disease, that ultimately remain incurable in even the best health system (though it may be able to extend life), and from those, such as HIV, that remain incurable but may be preventable through primary prevention (risk factor reduction in apparently healthy people, which is reliant on a number of factors outside the health care system).

A focus on avoidable mortality therefore helps to isolate the effectiveness of a health system from the multitude of factors aside from medical failure mentioned earlier, such as diet and lifestyle, that may lead to the natural end of someone's life. Even if someone is fat, smokes and does little exercise, they shouldn't really die from amenable conditions if health care is top-notch. The same logic doesn't apply when focusing just on survival rates or mortality rates in general – a fact that has been recognised recently by the DH, which has called for the use of avoidable mortality rates to be used instead of survival rates 'in adjusting for quality when measuring NHS output'.[x]

Methods

The focus of this study will be on circulatory disease and cancer, both because they are the biggest 'killers' in the UK by some distance, and because they have been specifically targeted for concerted action and better performance.[xi] Still, there is an interesting control, which is cerebrovascular disease (strokes), where centrally directed action has not been evident until very recently – it will be interesting to test the hypothesis put by many that improvements in targeted areas have come at the cost of relative neglect in others.[xii]

Because we are focused on avoidable mortality, analysis must be disaggregated. Not all circulatory diseases and not all cancers are yet considered amenable to health care and those that aren't must be excluded. Of course, this makes the implicit assumption that the distinction between what is and what

isn't amenable to health care is clear cut, which it often isn't. Ischaemic heart disease (IHD) is the ultimate case in point. Debate rages over its amenability; 'accumulating evidence suggests [the impact of health care] to be considerable', but as yet perhaps only '50 per cent of premature mortality may be amenable'.[xiii] This is important to bear in mind – IHD will be included, but analysis must always be qualified by this observation. Fortunately, for the majority of other conditions more consensus reigns and life is a bit easier.

Not that we are completely out of the woods. Even if we agree a condition is amenable to health care, there is controversy over the age-range to which this applies. Younger and fitter people are more likely to survive illness than the elderly or frail, but any age-limit is essentially arbitrary; without over-complicating things, the best we can do is to set an age-limit of 75 years for anything that is considered avoidable, because 'the value is consistent with life expectancy at birth in many industrialised countries'.[xiv] The exceptions to this are 'malignant neoplasm of cervix uteri and body of the uterus' and 'leukaemia', where an age-limit of 44 years has been set because 'the preventability of deaths at older ages remains controversial'.[xv]

The resulting selection of cancer and circulatory disease where mortality is considered avoidable are derived from the comprehensive analysis by Ellen Nolte and Martin McKee in their insightful report in 2004 (Table 1).[xvi] Mortality data for these conditions were extracted from the ONS Mortality Statistics Series DH2 (Cause) spreadsheets *for England and Wales*.[xvii] Age-standardised mortality rates were then calculated for each condition, each year, by applying the direct European Standard Population as follows:

Age-standardised mortality rate = $\{\Sigma P_k\, m_k\} / \Sigma P_k$

Where: P_k = standard population in age-group k;

m_k = observed mortality rate in age-group k;

k = age-group 0, 1-4, 5-9..... [xviii]

On top of this, comparability ratios had to be applied for years prior to 2001, as recommended and calculated by the Office of National Statistics. In this year the UK changed from ICD-9 to ICD-10 coding, which 'had a great impact on the interpretation of statistical data'; the comparability ratios help to nullify this effect and make data equivalent. [xix]

The same process was followed for the other European countries selected for comparison, with data extracted from the European Detailed Mortality Database (EDMD).[xx]

Unfortunately, this comparison had to be restricted to just ten countries – Austria, the Czech Republic, Finland, France, Germany, Hungary, the Netherlands, Norway, Spain and Sweden – for a variety of reasons. While all countries now collect mortality data according to the ICD-10 classification of disease, Greece, Poland and Portugal were excluded because data quality in these countries is described by the WHO as 'low'; and Belgium, Italy, Denmark and Switzerland were added to this list because data only runs up to 2001 or before. Estonia, Iceland, Latvia, Lithuania, Luxembourg, Malta, Moldova, Slovenia,

Slovakia, Croatia and Macedonia were also excluded because their population is less than 5 million; along with Azerbaijan, Belarus, Bulgaria, Georgia, Romania and Ukraine because GDP per capita is less than $10,000 at purchasing power parity.[xxi]

Table 1. Cancer and circulatory disease where mortality is considered avoidable[xxii]

Condition	Age	ICD-9	ICD-10
Malignant neoplasm of colon and rectum	0-74	153-154	C18-C21
Malignant neoplasm of skin	0-74	173	C44
Malignant neoplasm of breast	0-74	174	C50
Malignant neoplasm of cervix uteri	0-74	180	C53
Malignant neoplasm of cervix uteri and body uterus	0-44	179, 182	C54, C55
Malignant neoplasm of testis	0-74	186	C62
Hodgkin's disease	0-74	201	C81
Leukaemia	0-44	204-208	C91-C95
Chronic rheumatic heart disease	0-74	393-398	I05-I09
Hypertensive disease	0-74	401-405	I10-I13, I15
Ischaemic heart disease (IHD)	0-74	410-414	I20-I25
Cerebrovascular disease	0-74	430-438	I60-I69

** Listed according to codes under the ICD system of disease classification.*

Part II: Have health outcomes improved?

Statistics show that the NHS in England & Wales has presided over impressive improvements in avoidable mortality from cancer and circulatory disease since 1999, which has fallen by 15.0% *(Table 2)* and 34.0% *(Table 3)* respectively:

Table 2. CANCER: Age-standardised mortality rates in England & Wales (per 100,000 population, 0-74 years, unless stated)[xxiii]

ICD-9	ICD-10	Condition (0-74 yrs unless specified)	1999*	2000*	2001	2002	2003	2004	2005	% change 1999-2005
153-154	C18-C21	Malignant neoplasm of colon and rectum	12.92	12.36	11.91	11.63	11.43	11.27	11.09	**-14.21**
173	C44	Malignant neoplasm of skin	0.21	0.23	0.19	0.19	0.20	0.21	0.18	**-14.24**
174	C50	Malignant neoplasm of breast	13.00	12.67	12.40	12.08	11.63	11.34	11.24	**-13.55**
180	C53	Malignant neoplasm of cervix uteri	1.40	1.45	1.34	1.23	1.17	1.17	1.11	**-20.94**
179, 182	C54, C55	Malignant neoplasm of cervix uteri and body of the uterus (0-44 yrs)	0.04	0.05	0.04	0.05	0.03	0.05	0.05	**28.28**
186	C62	Malignant neoplasm of testis	0.13	0.12	0.10	0.11	0.12	0.13	0.11	**-15.06**
201	C81	Hodgkin's disease	0.36	0.38	0.33	0.35	0.38	0.34	0.32	**-10.13**
204-208	C91-C95	Leukaemia (0-44yrs)	1.39	1.14	1.22	1.08	1.02	0.95	0.95	**-31.49**
		Total avoidable mortality	***29.45***	***28.40***	***27.52***	***26.73***	***25.98***	***25.47***	***25.04***	***-14.96***
		% change year-on-year		***-3.55***	***-3.09***	***-2.90***	***-2.79***	***-1.95***	***-1.69***	

Table 3. CIRCULATORY DISEASE: Age-standardised mortality rates in England & Wales (per 100,000 population, 0-74 years, unless stated)[xxiv]

ICD-9	ICD-10	Condition (0-74 yrs unless specified)	1999*	2000*	2001	2002	2003	2004	2005	% change 1999-2005
393-398	I05-I09	Chronic rheumatic heart diseases	1.10	1.01	0.92	0.78	0.75	0.72	0.69	**-37.22**
401-405	I10-I13	Hypertensive diseases, excluding secondary hypertension	2.11	1.96	1.93	1.88	1.89	1.77	1.88	**-10.99**
410-414	I20-I25	Ischaemic heart diseases	76.06	70.07	66.24	61.92	57.98	52.74	49.14	**-35.39**
430-438	I60-I69	Cerebrovascular diseases	23.54	21.34	20.66	20.15	19.19	17.35	16.15	**-31.43**
		Total avoidable mortality	***102.82***	***94.38***	***89.75***	***84.73***	***79.80***	***72.58***	***67.86***	***-34.00***
		% change year-on-year		***-8.21***	***-4.91***	***-5.60***	***-5.81***	***-9.06***	***-6.50***	

**ICD-9 coding.*

The single largest numerical reduction across the field has been in deaths from the biggest killer, ischaemic heart disease (IHD), of 26.9 deaths per 100,000 population, or 35.4% of the total, but even removing this from analysis – given the debate over exactly how amenable it is to medical care – avoidable mortality from circulatory disease has still fallen by 30.1% overall. This is in no small part due to a significant reduction of 31.4% in the mortality rate from strokes (cerebrovascular disease), which apparently contradicts the oft-cited thesis that stroke care has suffered at the hands of areas of care that have been more heavily targeted, such as cancer and coronary heart disease.[xxv] The only condition to have seen an increase in mortality has been deaths from cancer of the cervix uteri and body of the uterus, of 28.8%, but this figure is somewhat distorted by the very few people who die from this illness.

Still, there is a short-term trend in cancer care that is of concern and should be watched carefully, which is the apparent flat-lining in improvements in avoidable mortality. Avoidable mortality from cancer fell by a respectable 3.6% between 1999 and 2000, but has since decreased year-on-year to just 1.7% between 2004 and 2005. This is somewhat surprising given the high priority cancer has been given by the government in the NHS Cancer Plan, which is supposed to have provided for great improvements in cancer care.[xxvi] Instead, its impact appears to have been negligible.

However, no such trends are evident for avoidable mortality from circulatory disease, where rates of improvement have fluctuated both as a whole and for specific illnesses across the entire time period. All circulatory conditions amenable to health care registered the greatest improvements between 1999/2000 and between 2003/04, totalling 8.2% and 9.1% respectively. The average improvement was 6.7% per annum. The overall picture is undeniably positive, and seems to question many of the

doomsday scenarios painted for the NHS recently. But an obvious question remains: can all this really be attributed to the NHS?

An implicit assumption made thus far, that any reduction in avoidable mortality from cancer and circulatory disease is due to better health care, need not be the case. The concept of avoidable mortality *helps* to isolate the effects of a health system by focusing on deaths that can be attributed to it – we are ruling out those conditions where even the best health care may not save lives – but it may still be the case that avoidable mortality rates, as much as non-avoidable, are falling due to other factors such as improved living standards and a lower incidence of that disease.

The paucity of relevant data and the intrinsic difficulties of establishing causal links makes it very difficult to establish exactly what is causing avoidable mortality to fall. The best we can do is to look at a couple of variables that may be indicative of the whole. One is the incidence of disease and the other is the difference (or similarity) between the decrease in avoidable mortality and 'non-avoidable' mortality.[xxvii] To have a degree of confidence in the hypothesis that the decline in avoidable mortality from cancer and circulatory disease is due to better health care, the incidence of disease shouldn't be falling at any great rate and avoidable mortality should be falling faster than 'non-avoidable' mortality. If the former doesn't hold, avoidable mortality could be simply falling because the incidence of disease is. If the latter doesn't hold, avoidable mortality is likely to be falling due to factors outside health care that are having a universal impact on both avoidable and 'non-avoidable' mortality.[xxviii]

Incidence of cancer and circulatory disease

The incidence of cancer and circulatory disease isn't falling; on the contrary, both seem to be on the rise. Statistics on the incidence of cancer collected by the ONS, from eight regional cancer registries in England, show that the overall age-standardised prevalence of those cancers we have considered amenable to health care (0-74 years), increased by 7.3% between 1999 and 2004 (Table 4):

Table 4. Incidence of cancer in England (age-standardised registration rates per 100,000 population, 0-74 years)[xxix]

ICD-10	Condition	1999	2000	2001	2002	2003	2004	% change 1999-2004
C18-C21, C44, C50, C53-55, C62, C81, C91-95	All cancer considered amenable to health care	143.61	143.47	144.57	145.61	149.41	154.05	7.27

While such registries do not exist for circulatory disease, we can get an indication of the incidence of these conditions through looking at primary diagnosis statistics. A similar picture is evident. Finished episodes of care regarding the two biggest amenable killers, IHD and strokes, have increased by 17.6% and 23.6% respectively between 1999/00 and 2005/06 in NHS hospitals in England (Table 5):

Table 5. Finished episodes as per primary diagnosis (NHS hospitals in England)[xxx]

ICD-10	Condition	1999-2000	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	% change 1999-2005
I20-I25	Ischaemic heart diseases	364,168	378,532	387,494	409,412	415,452	421,397	428,262	**17.6**
I60-I69	Cerebrovascular diseases	144,221	144,661	151,571	164,667	165,787	172,190	178,321	**23.6**

This is not watertight. For one, no account is taken of age – the increase may have been due to more medical care for those outside the 0-74 year age bracket. But more importantly, 'finished episodes' can only ever be a weak proxy for incidence. Improved diagnostic practice, such as the greater availability of radiological imaging and better detection of minor cases of stroke/IHD may very well lead to more hospitals episodes, without the incidence having actually increased.[xxxi] The long-term trend is for individuals to consume more medical care.

Still, it seems unlikely that the incidence has fallen, particularly with the rapid rise in obesity.[xxxii] Certainly, the incidence of cancer amenable to health care appears to have increased. This makes the performance on avoidable mortality look more impressive; without improvements in treatment the natural trend would presumably be for mortality rates to rise with the incidence of disease.

Avoidable and 'non-avoidable' mortality

In the case of both cancer and circulatory disease, avoidable and non-avoidable mortality haven't shown the same trend decrease. We already know mortality from cancer considered amenable to health care decreased by 15.0% between 1999 and 2005; looking again at the ONS database shows the rate for other cancers was just 10.1% (Table 6). The same pattern is evident for circulatory disease; amenable conditions decreased by 32.9% compared with 28.1% for the rest (Table 7). In both cases this is *a difference of nearly 5 percentage points:*

Table 6. CANCER: Age-standardised mortality rates 0-74 years (per 100,000 population)[xxxiii]

ICD-10	Condition	1999	2000	2001	2002	2003	2004	2005	% change 1999-2005
C18-C21, C44, C50, C53-55, C62, C81, C91-95	Cancer amenable to health care	29.45	28.40	27.52	26.73	25.98	25.47	25.04	**-14.96**
	All other cancer	103.24	101.09	99.28	98.71	95.97	93.99	92.78	**-10.14**

Table 7. CIRCULATORY DISEASE: Age-standardised mortality rates 0-74 years (per 100,000 population)[xxxiv]

ICD-10	Condition	1999	2000	2001	2002	2003	2004	2005	% change 1999-2005
I05-I09, I10-I13, I20-I25, I60-I69	Circulatory disease amenable to health care	127.15	118.05	109.53	104.14	99.09	90.60	85.35	**-32.87**
	All other circulatory disease	24.33	23.67	19.78	19.42	19.29	18.02	17.49	**-28.10**

The implication of this is both that the NHS has made a real and significant contribution to the decline in mortality from cancer and circulatory disease, but also that it is probably not responsible for all or even most of it. The fact the difference in the rate of improvement between amenable and non-amenable conditions is just 5 percentage points seems to imply external factors – that impact on both avoidable and non-avoidable mortality –have had a significant impact. This is consistent with a number of studies in Europe, the US and New Zealand, which have 'consistently suggested that 50-70% of the fall in cardiac deaths can be attributed to population-wide improvements in major risk factors, particularly smoking, cholesterol and blood pressure'.[xxxv] One could add an increase in 'health-seeking' behaviour to this, which means people are much more likely to get diagnosed earlier, increasing survival chances. By contrast, the NHS' direct 'remit' – modern cardiological treatments such as thrombolysis and the use of statins – generally explains 25-50% of the fall. [xxxvi]

Of course the alternative explanation could be that health care has, in fact, had a more significant impact across the board – that mortality rates from 'non-amenable' disease have fallen at least partly due to better health care. This is inherently possible given that the line between what is and what isn't classed as amenable to health care is always going to be a bit fuzzy. Lung cancer, not considered here as amenable to health care, has been cured in numerous patients by primary prevention, early detection and treatment – indeed some authors have used the concept of 'partly amenable' conditions.[xxxvii] An insightful study by the QQUIP looking at programme budgeting expenditure by Primary Care Trusts (PCTs) in England also revealed 'a strong positive link between expenditure and standardised mortality rates' in cancer and circulatory disease[xxxviii]; suggesting that more health care equates to better health outcomes even across the board.

Given this uncertainty, it would be improper to put a definitive point on any conclusion. What we can say is this:

i. Avoidable mortality from both cancer and circulatory disease has decreased significantly since 1999, though there is some cause for concern in the case of cancer.

ii. Avoidable mortality has decreased at a faster rate than non-avoidable mortality for both cancer and circulatory disease.
iii. This has occurred despite an apparent increase in the incidence of both cancer and circulatory disease.

This suggests that the decrease in avoidable mortality has come at least in part due to better health care. The NHS has played its part.

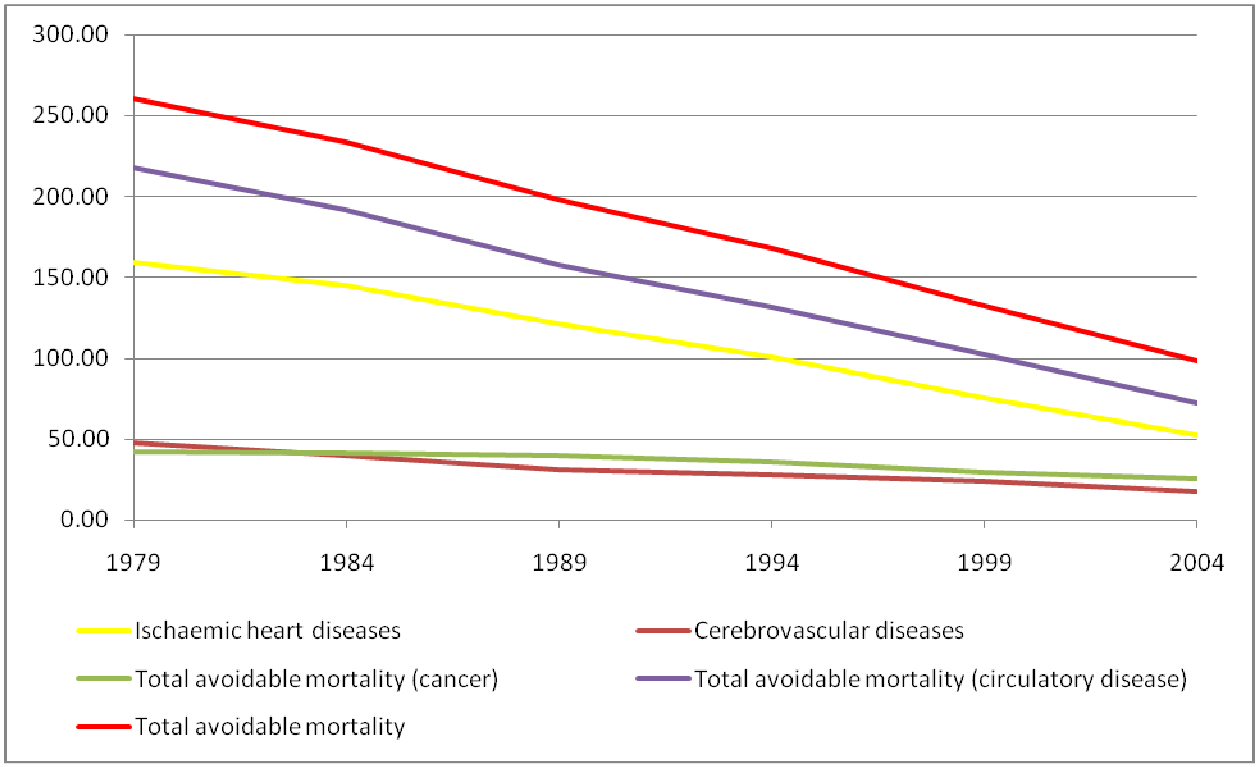
Is it unique?

That said, the million-dollar question remains: yes, the improvements look good on paper, but just how good are they? Are they unprecedented; or just a continuation of long-term trends? Are they unique; or have other countries done better? These are pertinent issues. The NHS has been pumped full of cash in recent years – one would like avoidable mortality to register commeasurable decreases.

Over time

Since 1979, avoidable mortality from cancer and circulatory disease has decreased almost year-on-year in England and Wales and, generally speaking, at an increasingly fast rate (chart.1). In both cases, the rate of decrease in mortality has been considerably higher in the last ten years than the fifteen years prior to that. In fact the average five-yearly fall in avoidable mortality was just over 10 percentage points greater between 1994 and 2004 than between 1979 and 1994:[xxxix]

Chart.1. Trends in age-standardised mortality rates in England & Wales 1979-2004 (per 100,000 population, 0-74 years, unless stated)[xl]



Nonetheless, the picture of improvement again looks more positive in the case of circulatory disease than cancer. While it's true the incidence of circulatory disease has always been significantly higher, so has the rate of decrease. Crucially – although not necessarily representing any clear break with the long-term trend of an 'increasing rate of decrease' – the five-year fall of 29.4% in avoidable mortality between 1999 and 2004, was easily the highest in the period analysed since 1979 (Table 8). Even if IHD is removed from the equation the impression remains roughly the same; while any long-term trend is more difficult to discern, the decrease in mortality between 1999 and 2004 is still the highest out of any five-year period, at 25.9%:

Table 8. CIRCULATORY DISEASE: Age-standardised mortality rates in England & Wales (per 100,000 population, 0-74 years, unless stated)[xli]

ICD-9	ICD-10	Condition (0-74 yrs unless specified)	1979	1984	1989	1994	1999	2004
393-398	I05-I09	Chronic rheumatic heart diseases	4.71	3.45	2.26	1.38	1.10	0.72
401-405	I10-I13	Hypertensive diseases	5.64	3.81	2.74	1.95	2.11	1.77
410-414	I20-I25	Ischaemic heart diseases	159.49	144.97	121.70	100.74	76.06	52.74
430-438	I60-I69	Cerebrovascular diseases	47.98	39.57	31.18	27.69	23.54	17.35
		Total avoidable mortality	***217.82***	***191.81***	***157.89***	***131.77***	***102.82***	***72.58***
		% change year-on-year		***-11.94***	***-17.69***	***-16.54***	***-21.97***	***-29.42***

Unfortunately the same cannot be said of cancer; at 13.5%, the decrease in avoidable mortality between 1999 and 2004 was both *less than* the 17.9% decrease achieved between 1994 and 1999, and the *only* five-year period since 1979 in which the *rate of decrease slowed* (Table 9):

Table 9. CANCER: Age-standardised mortality rates in England & Wales (per 100,000 population, 0-74 years, unless stated)[xlii]

ICD-9	ICD-10	Condition (0-74 yrs unless specified)	1979	1984	1989	1994*	1999*	2004
153-154	C18-C21	Malignant neoplasm of colon and rectum	17.70	17.33	16.24	15.14	12.92	11.27
173	C44	Malignant neoplasm of skin	0.31	0.35	0.36	0.37	0.21	0.21
174	C50	Malignant neoplasm of breast	17.46	18.00	17.70	16.17	13.00	11.34
180	C53	Malignant neoplasm of cervix uteri	3.42	3.12	2.85	2.00	1.40	1.17
179, 182	C54, C55	Malignant neoplasm of cervix uteri and body of the uterus (0-44 yrs)	0.05	0.08	0.10	0.05	0.04	0.05
186	C62	Malignant neoplasm of testis	0.39	0.30	0.22	0.15	0.13	0.13
201	C81	Hodgkin's disease	1.05	0.84	0.68	0.48	0.36	0.34
204-208	C91-C95	Leukaemia (0-44yrs)	2.14	1.98	1.77	1.51	1.39	0.95
		Total avoidable mortality	***42.52***	***42.00***	***39.93***	***35.88***	***29.45***	***25.47***
		% change year-on-year		***-1.22***	***-4.93***	***-10.15***	***-17.92***	***-13.49***

While it is important to emphasise that this still represents an important improvement in avoidable mortality rates, the slowing rate is somewhat disappointing; representing a negative break with the long-term trend, at a time when the NHS has received record increases in funding and at a time when cancer care has been specifically targeted by the government.

Of course, it is possible to make the case that as avoidable mortality rates get closer to zero – and avoidable mortality from cancer is certainly much lower than from circulatory disease – then incremental improvement becomes more difficult. This may be so, but it is equally possible to turn this on its head. For one, avoidable mortality from cancer is still some way from approaching zero. But more importantly, many conditions included here as 'amenable' to health care probably weren't back in 1979 – indeed as recently as 1988 the European Community, in producing its atlas of 'avoidable' death, didn't list breast, skin or testicular cancer, nor IHD.[xliii] It is only because of fairly recent medical advances, such as the introduction of thrombolytic therapy with regard to IHD and more effective and less invasive combinations of surgery and radiotherapy in the case of many cancers, that death from such conditions is now generally considered avoidable.[xliv] Given that diffusion of such technology is typically slow at first and then tends to expand more rapidly,[xlv] a long-term trend of faster decreases in mortality might well be expected.

Across countries

Compared with the ten other European countries deemed suitable for cross-country comparison, England & Wales has performed quite favourably over the period 1999-2004, registering the third best improvement in avoidable mortality from cancer – despite concerns highlighted in the domestic context – and the fourth best improvement in avoidable mortality from circulatory disease. The decrease in avoidable cancer mortality of 13.5% between 1999 and 2004 in England & Wales was 3.6 percentage points higher than the average decrease of 9.9% and only 1.5 percentage points less than the best performer, Finland (Table 10):

Table 10. CANCER AMENABLE TO HEALTHCARE: Age-standardised mortality rates 0-74 years (per 100,000 population)[xlvi]

ICD-10		Austria	Czech Republic	Finland	France	Germany	Hungary	Netherlands	Norway	Spain	Sweden	England & Wales	AVERAGE
C18-21, C44, C50, C53-55, C62, C81, C91-95	**1999**	28.62	42.14	22.21	26.52	30.25	48.45	31.62	27.94	24.97	23.01	**29.45**	**30.47**
	2004	24.59	38.52	18.88	24.53	26.45	45.28	27.78	25.53	23.42	22.02	**25.47**	**27.50**
Absolute change		-4.02	-3.62	-3.33	-1.99	-3.81	-3.18	-3.84	-2.42	-1.56	-0.99	**-3.98**	**-2.98**
% change		**-14.06**	**-8.59**	**-14.99**	**-7.49**	**-12.58**	**-6.55**	**-12.15**	**-8.65**	**-6.24**	**-4.32**	**-13.51**	**-9.92**

This compares with circulatory disease, where England & Wales, with a decrease in avoidable mortality of 29.4% between 1999 and 2004, was 3.2 percentage points above the average, though 8.9 percentage points behind the best performer, Austria (Table 11):

Table 11. CIRCULATORY DISEASE AMENABLE TO HEALTHCARE: Age-standardised mortality rates 0-74 years (per 100,000 population)[xlvii]

ICD-10		Austria	Czech Republic	Finland	France	Germany	Hungary	Netherlands	Norway	Spain	Sweden	England & Wales	AVERAGE
I05-I09, I10-I13, I20-I25, I60-I69	**1999**	90.08	149.41	105.45	41.31	83.03	216.20	68.13	76.97	57.17	75.98	**102.82**	**95.37**
	2004	55.55	111.18	82.79	31.69	63.81	180.46	47.41	51.45	44.50	57.14	**72.58**	**71.24**
Absolute change		-34.52	-38.23	-22.66	-9.62	-19.21	-35.74	-20.72	-25.52	-12.67	-18.83	**-30.24**	**-24.13**
% change		**-38.33**	**-25.58**	**-21.49**	**-23.28**	**-23.14**	**-16.53**	**-30.42**	**-33.16**	**-22.16**	**-24.79**	**-29.41**	**-26.30**

Of course, one might say this above-average performance is unsurprising given the fairly abysmal comparative position of avoidable mortality in England & Wales in 1999, but this is not really borne out in the statistics – there is little correlation between 'starting' avoidable mortality rates in 1999 and subsequent improvement up to 2004. The Netherlands, for example, saw the second highest fall in avoidable circulatory disease (30.4%), despite already being the second-best performer in 1999; whereas Hungary, the worst performer in 1999, also showed the worst percentage improvement. Neither is consistent with England & Wales' good performance from a low starting point.

Austria is another very interesting case in point, blazing the way in both areas of care with a 14.1% fall in avoidable cancer mortality and a 38.3% fall in avoidable circulatory mortality. This must be significant as far as the NHS is concerned; Austria started from a comparable position to England & Wales in 1999, in terms of avoidable mortality from cancer and circulatory disease, but has outstripped our improvement quite significantly. How they have managed this must be cause for further investigation, but one thing is clear: it's not directly linked to short-term increases in health expenditure. While per capita health expenditure in England & Wales rocketed by nearly 50% (at US$ PPP) between 1999 and 2004, Austria's only increased by 26.5%.[xlviii] The NHS has done ok, but the experience of other countries – not least Austria – shows it could still have done much better.

And doing better is important. Of the utmost concern must be the fact that despite the comparatively good performance between 1999 and 2004, avoidable mortality rates remain very high in England & Wales compared with other countries. This may apply less to cancer – avoidable mortality stood at 25.5 deaths per 100,000 in England & Wales, compared with 18.9 in Finland, 22.0 in Sweden and 23.4 in Spain (the three best performers) – but it certainly applies to circulatory disease. In 2004, avoidable mortality from circulatory disease was 72.6 deaths per 100,000 of the population in England & Wales, compared with just 31.7 in France, 44.5 in Spain and 47.4 in the Netherlands (the three best performers). This is a huge difference; *around 18,400 more people died from avoidable circulatory disease (including IHD) in England & Wales in 2004 than in France, despite the population being some 10 million less.*[xlix]

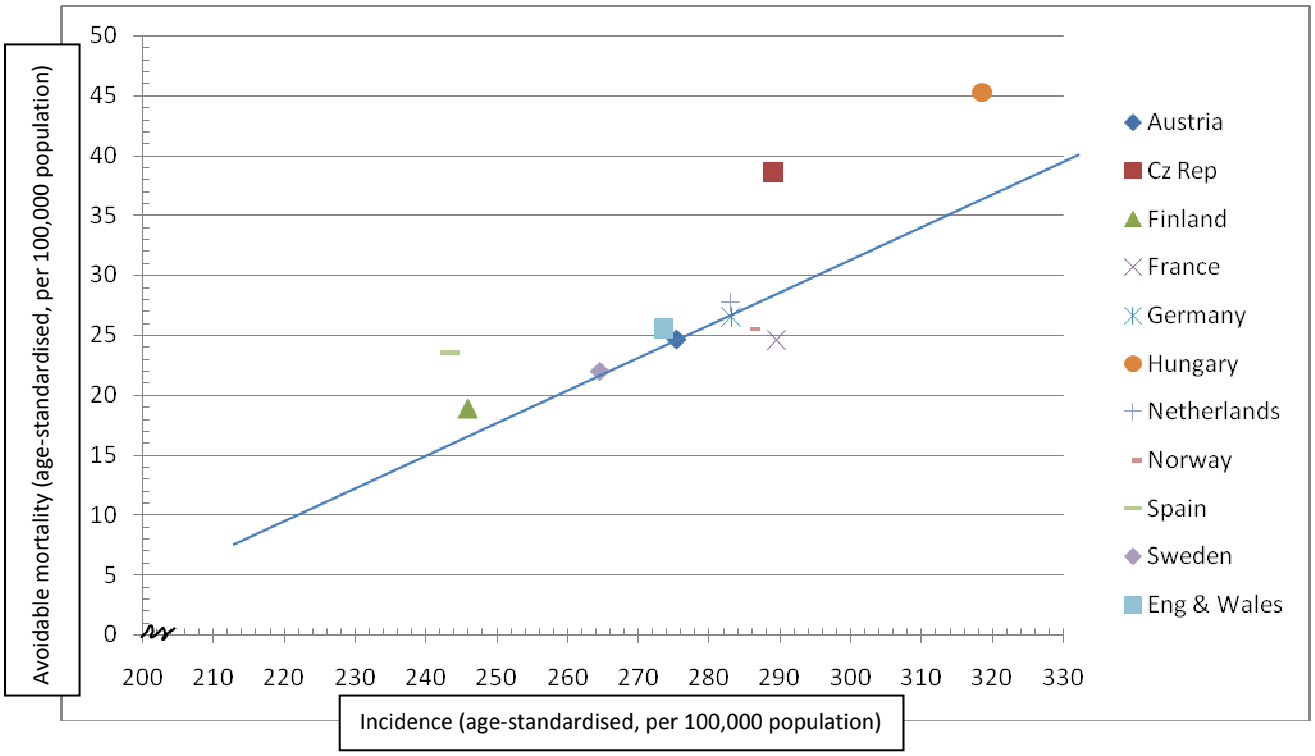
But this is probably being slightly unfair to the NHS. Much academic literature has been devoted to the discussion of the so-called 'French paradox'; why mortality rates from circulatory disease are significantly less in France, than Britain, despite many of the major risk factors apparently being no less favourable.[l] We could also coin the 'Finnish' or 'Swedish' paradox with regard to cancer mortality. Is it just because health care is better? This is no doubt true in part, but it won't account for everything. It is likely that mortality rates are a reflection not just of the standard of medical care, but also of the incidence of disease in each country and, in turn, any number of different factors. Indeed, some authors have estimated that unclassified disease in France may account for as much as 12% of the difference in mortality from heart disease between France and Britain.[li] But the most important findings are that of the WHO MONICA Project (Table 12). Firstly, the study provided conclusive evidence that there are not only large differences in mortality rates from circulatory disease between countries (and indeed between different regions within a country) but that the incidence varies tremendously:

Table 12. Mean (SE) annual event rates (per 100,000 population, age-standardised, 35-64 years)[lii]

Population	Sex	Official CHD	Mean (SE)
Czech Republic	M	266	515
	F	57	101
Finland – Kuopio Province	M	313	718
	F	46	124
Finland – North Karelia	M	389	835
	F	59	145
Finland – Turku/Loimaa	M	255	549
	F	44	94
France – Lille	M	89	298
	F	16	64
France – Strasbourg	M	80	292
	F	17	64
France – Toulouse	M	53	233
	F	9	36
Germany – Ausberg	M	130	286
	F	32	63
Germany – Bremen	M	137	361
	F	26	81
Germany – East Germany	M	149	370
	F	36	78
Spain – Catalonia	M	63	210
	F	11	35
Sweden – Gothenburg	M	151	363
	F	34	84
Sweden – Northern Sweden	M	178	509
	F	35	119
UK – Belfast	M	280	695
	F	79	188
UK – Glasgow	M	332	777
	F	144	265

Unfortunately no study was done on a region or city in England & Wales, but the likely extent of variation is clear; the incidence of circulatory disease in Belfast, for example, is near 150% higher than in Strasbourg. This has led some commentators to call for the 'paradox' to be rephrased as seeking to explain why the incidence of circulatory disease itself, rather than mortality rates, is less prevalent in southern than northern Europe,[liii] somewhat discounting any effect of a health system. The same can be said of cancer; a snap-shot look at the age-standardised incidence of cancer reported in the GLOBOCAN database in 2002 shows both significant variation in incidence and a clear correlation between this and avoidable mortality (chart.3):

Chart.3. Relationship between incidence of cancer and amenable mortality (per 100,000 population, age-standardised)[liv]



Clearly there is variation – Finland, for example, has a significantly better avoidable mortality rate from cancer than Spain despite having a similar incidence – so standards of health care matter to outcomes, but so does the incidence of disease.

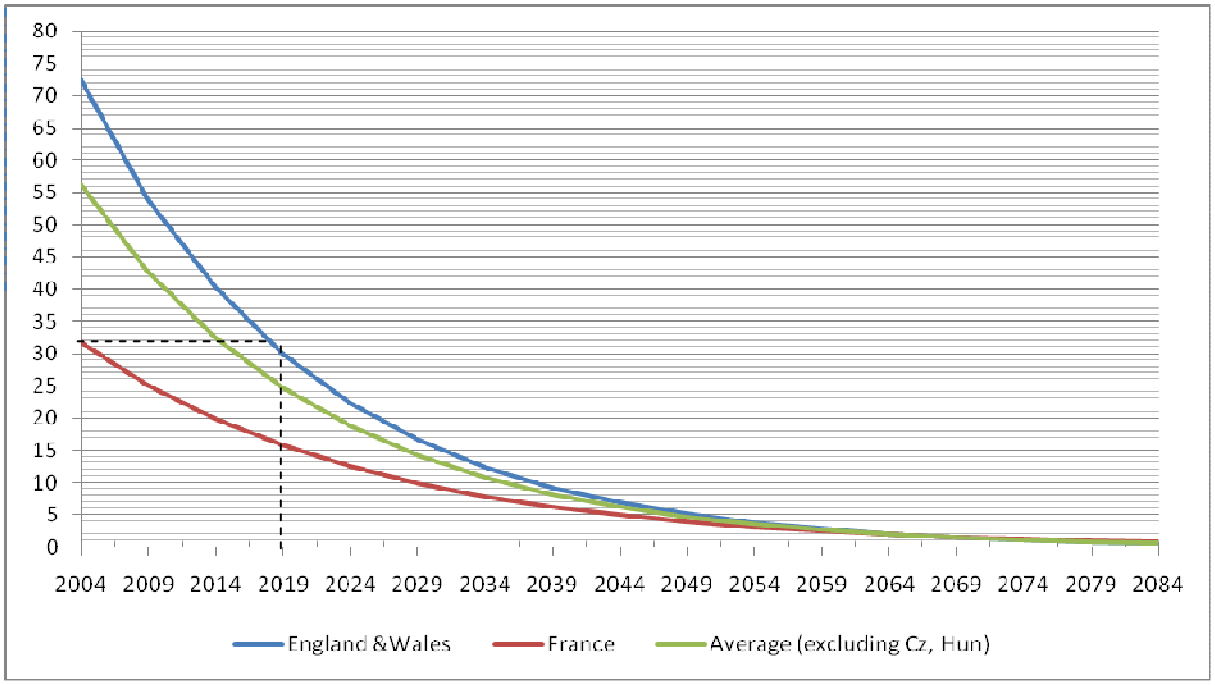
This is also the second important conclusion of the MONICA Project. Specifically, it found that in populations where the incidence of coronary heart disease (CHD) was falling, changes in the number of coronary-events actually accounted for two-thirds of the decrease, with changes in case fatality (a proxy for better medical care) contributing only a third.[lv] Of course, this is a generalised result that the authors' conclude may not hold in the particular – '[the] results are heterogenous. No one population is typical. Some are [in fact] dominated by changes in case fatality'[lvi] – and we should remember that the MONICA study refers to all coronary events, not just those considered amenable to health care, where we would expect case fatality to have a comparatively greater effect. But the waters are certainly muddied and we arrive at the same old problem: to what extent can mortality rates and, in turn, any decrease in avoidable mortality rates really be attributed to a health system?

We cannot provide a firm answer, but what we should remember is this: we are dealing with *avoidable* mortality. Yes, with a higher incidence of circulatory disease (and by implication avoidable circulatory disease) in England & Wales, the NHS inevitably has a much more difficult job in keeping the avoidable mortality rate down, purely because it must treat many, many, more patients (until lifestyle changes, or preventative medicine gets better). But by virtue of the fact the conditions considered here *are*

amenable to health care people still shouldn't really be dying from them, at least between the ages of 0-74 years. IHD is the one possible exception to this, yet if we take the stance of Nolte and McKee that about 50% is 'amenable'[lvii], this is a ratio which applies across all countries – absolute numbers fall, but the comparative difference remains.

If the rates at which avoidable circulatory disease fell between 1999 and 2004 in England & Wales (29.4%) and in France (23.3%) – the country with the lowest avoidable mortality in 2004 – were to remain in the same proportion over the coming years, *it would take 68 years for avoidable mortality from circulatory disease in England & Wales to reach French levels* (chart.4). Excluding Hungary and the Czech Republic who have exceptionally high mortality rates, *it would also take 60 years for avoidable mortality to even reach the average level in the countries studied*:

Chart.4. Predicted decrease in circulatory mortality over time, given rates of change between 1999-2004 (per 100,000 population, age-standardised)[lviii]



This is probably a bit too spurious though. For one it has already been shown that the long-term trend appears to be for avoidable mortality from circulatory disease to decrease at an increasing rate and any path is unlikely to be smooth, instead erratic. But more importantly, when mortality rates do eventually converge, hardly anyone is dying from amenable circulatory disease anymore – a circumstance evident from around 30 years before. The assumptions are being pushed too far. What we can say instead is simply this: *if France for some reason failed to register any improvement in avoidable mortality from circulatory disease from now on, and the NHS continued to register the rate of improvement it showed between 1999 and 2004, it would still take until about 2019 for it to catch up* (chart 4).

While it's true that the NHS should perhaps be given more leeway for having to deal with higher incidence of disease,[lix] it's also true we're still a long way behind. The following is a tough statement,

but with top quality health care for all there's no intrinsic reason why mortality rates shouldn't fall to the levels of the best international performers. After all, England & Wales already performs better than Finland and the Czech Republic in terms of avoidable mortality from circulatory disease, despite apparently having an equivalent or higher incidence. Moreover, to turn to cancer, if the NHS continued to improve at 13.5% as it did between 1999 and 2004, compared with the average improvement of 10.4% across other countries, *avoidable mortality from cancer would be at the average by 2011 and have overtaken all but the most rapidly improving countries, Austria and Finland, by 2014.*[lx]

Part III: Discussion

There is fairly robust evidence that avoidable mortality from the 'biggest killers', circulatory disease and cancer, has improved quite markedly between 1999 and 2005 in England & Wales. This applies across the board; a decline in mortality was observed for all circulatory disease and all cancers considered amenable to health care, with the exception of cancer of the cervix uteri and body uterus.

The most significant decreases were in deaths from ischaemic heart disease (-35.4%) and – perhaps somewhat surprisingly given the long-standing vilification of stroke care in the England & Wales – cerebrovascular disease (-31.4%). Looking at the more aggregated picture, the most impressive performance has been in reducing avoidable mortality from circulatory disease as a whole; the decrease achieved between 1999 and 2004 was *at least in line with, if not above, the trend decrease since 1979.*

The same doesn't appear to be true for cancer.[lxi] In all years, the fall in avoidable mortality from circulatory disease far outstripped that in cancer, often by around 100%, though this is consistent with the international experience. Of more concern is the fact that the most recent five-year period, 1999-2004, was the first since 1979 where the rate of decrease in avoidable cancer mortality fell on the previous period. Even more worryingly, this appears indicative of a something of a long-term trend: *the decline in avoidable mortality from cancer decreased every year between 1999 and 2005 to just 1.7% between 20004/5.* This finding, particularly coupled with those of the EUROCARE-4 study that found cancer survival rates in the UK continuing to lag behind other European countries, must surely call into question the effectiveness of the NHS Cancer Plan.[lxii]

Still, despite this blot, the domestic performance since 1999 still looks fairly impressive in the international context. Improvements in avoidable mortality from both cancer and circulatory disease in England & Wales over the period 1999-2004 are apparently *above average compared with other European countries of comparable development.* This has to be good news.

However, there remains a massive cause for concern, which is that despite the improvements, avoidable mortality rates in England & Wales remain comparatively very high. This is particularly the case in circulatory disease. In fact, avoidable mortality from circulatory disease in 2004 was over 100% higher than the best performing country, France. This is alarming, not least given the tide of public health concerns currently blighting England & Wales – of which the obesity 'epidemic' clearly leads the way. The *Health Profile of England in 2007*, just published by the DH, showed that the rate of obesity in British adults is not only the worst in Europe, but in some areas in now worse than in the US.[lxiii] With a correlation evident between incidence of circulatory disease and avoidable mortality, the task of catching up could get even more difficult.

Still, we should be wary of drawing too many conclusions too fast from this study; the concept of avoidable mortality does have its limitations and these should be taken into account. For one – as is conceded by Nolte and McKee in their report on avoidable mortality – the selection of diagnostic categories in original data collection, the selection of age range and, to some extent, the selection of the conditions where death is considered 'avoidable' is inevitably somewhat arbitrary: 'A major limitation is that, for many conditions, death is the final event in a complex chain of processes that involve issues

related to underlying social and economic factors, lifestyles and preventative and curative health care'.[lxiv]

The rate, and rate of change, of avoidable mortality will be influenced by factors such as the incidence of disease, how the cause of death is partitioned in clinical coding, unspecified lags between changes in resources and changes in mortality, as well as health care funding and the organisation and delivery of health care.[lxv] One thing we should also be particularly wary of, in the context of a study on mortality, is the fact that improvements in health care will apply not just to preventing death once the disease sets in, but also to preventing the disease in the first place and prolonging a decent quality of life through rehabilitation and the like afterwards. This presented huge problems in this study; just how much can we learn from avoidable mortality? Just how much are the improvements in avoidable mortality in England & Wales down to better health care in the NHS?

No definitive answer has been given here and it would be folly to do so – the necessary data is simply not there. Nonetheless, the fact that avoidable mortality rates have fallen at the same time that the incidence of disease appears to have risen, and that avoidable mortality rates have fallen at a faster rate than non-avoidable mortality rates, *strongly suggests that better health care has had a very real impact on the fall in avoidable mortality.* This is consistent with the findings of the MONICA study, the recent findings of the QQUIP into the link between healthcare spending and outcomes, and the fact that the decrease in avoidable mortality has accelerated apparently in line with the availability of new and better technologies. *Health care save lives.*

So how, then, can this study assist the health care debate? 'Caricatures' of health system performance, such as the reports by World Health Organisation in 2000 and the Commonwealth Fund in 2007, that distort proper analysis by ranking entire health systems on what are, quite frankly, inadequate measures must be avoided.[lxvi] The findings presented in this study *should <u>not</u>* be taken in isolation:

> *'Measures of [avoidable] mortality can rarely, if ever, confirm the presence and nature of a problem. Instead they can act as an indicator of possible concern that should be investigated further...'*[lxvii]

To do just this, it is clear two particular areas for concern and future investigation stand out:

i. *the effectiveness of the NHS Cancer Plan*, given the flat-lining of improvements in avoidable mortality in from cancer since its introduction; and
ii. *a firmer grasp of why, despite improvements, avoidable mortality from circulatory disease remains very high compared with other countries.* Is it because of specific deficiencies, such as those highlighted by Professor Hugh Markus recently in the *BMJ* regarding stroke care,[lxviii] because of deeper issues such as too much central direction,[lxix] because we aren't very good at screening or simply because we are a very unhealthy nation?

The Austrian experience also warrants a very close look. How have they managed to cut avoidable mortality from both cancer and circulatory disease so dramatically since 1999, despite comparatively low increases in health spending? Are there any lessons for the NHS to be learnt here? After all, it

should be imminently possible for England & Wales to 'catch up' with the best performers. For all its limitations, we are dealing with *avoidable* mortality and this has one major advantage: the conditions considered here – with the possible exception of ischaemic heart disease – are considered amenable to health care, it is reasonable to expect death to be averted even after the onset of disease.

The NHS has a massive challenge in cutting avoidable mortality, but it shouldn't be insurmountable. One can always wonder, for a start, what could have been achieved if the increase in expenditure hadn't been front-loaded, and the NHS had been able to use the extra cash anywhere near efficiently. What if unit costs had been controlled to the level expected by Sir Derek Wanless in his 2002 review? He estimates this would have enabled the NHS to treat as much as an extra one million patients. [lxx] Would avoidable mortality then have fallen even further?

James Gubb

[i] Verdecchia, A et al., Recent cancer survival in Europe: a 2000-02 period analysis of EUROCARE-4 data, *The Lancet Oncology*, August 2007

[ii] Wanless, D, et al., Our *Future Health Secured? A Review of NHS Funding and Performance*, London: King's Fund, 2007, p.165

[iii] WHO Regional Office for Europe, *European Detailed Mortality Database*, last updated June 2007. http://data.euro.who.int/dmdb/

[iv] Walker, H, 'Heather Walker on clinical measures', *Health Service Journal*, 19/09/07

[v] Holland, W, and Breeze, E, *The performance of health services*. In: Keynes, M, Coleman, D, and Dimsdale, N, eds., *The political economy of health and welfare*, Houndmills: MacMillan Press, 1988: 149-69

[vi] http://www.bupahospitals.co.uk/asp/hospital_performance/sf36_health_survey.asp

[vii] Tinker, J, *How healthy is your hospital?,* London: Dr Foster Intelligence, 2007, p. 4.
Dr Foster Intelligence have used HSMR to show, for example, that 'if all [NHS] trusts with higher than expected mortality rates were to reduce these in line with the expected rate, 7,400 deaths would have been avoided in 2005/06'. This is no small fish.

[viii] Nolte, E and McKee, M, Measuring the health of nations: Analysis of mortality amenable to healthcare, *BMJ*, 2003;327

[ix] Nolte, E, and McKee, M, *Does health care save lives? Amenable mortality revisited*, Nuffield Trust, 2004, p.65.
Secondary prevention generally includes causes of death for which screening modalities have been established and causes for which death is avoidable through early detection combined with adequate treatment, e.g. thrombolysis, aspirin, statins and coronary artery bypass surgery for sufferers from cardiac conditions.

[x] Derbyshire, K et al., *Further Developments in Measuring Quality Adjusted Healthcare Output,* Department of Health, London: Stationery Office, 2007, ch.6

[xi] See: DH, *The NHS Cancer Plan: a plan for investment, a plan for reform*, London: The Stationery Office, 2000 and DH, *Coronary heart disease: national service framework for CHD – modern standards and service models*, London: The Stationery Office, 2000.
Targets for the reduction of cancer and heart disease were included in the DH's Public Service Agreement (PSA) for the 1998, 2000 and 2002 Spending Reviews; PSA targets for the reduction of strokes were added in the 2004 Review. See: Department of Health*, Departmental Report 2007*, London: The Stationery Office, 2007, Annex 2.

[xii] NAO, *Reducing brain damage: Faster access to better stroke care*, London: National Audit Office, 2005; or Bosanquet, N, de Zoete, H and Haldenby, A, *NHS reform: the empire strikes back*, London: Reform, 2007

[xiii] Nolte, E and McKee, M, Measuring the health of nations: Analysis of mortality amenable to healthcare, *BMJ*, 2003;327

[xiv] Ibid.

[xv] Ibid.

[xvi] Nolte and McKee, *Does health care save lives?* 2004, p.66

[xvii] http://www.statistics.gov.uk/statbase/Product.asp?vlnk=618&More=N, and ONS, 20th Century Mortality (England & Wales 1901-2000) CD-ROM, London: Office of National Statistics, 2000
Given the not insignificant differences between the English and Scottish NHS since devolution, taking UK-wide data as a proxy for the health outcomes performance of both is likely to be inaccurate; it would ignore any differences in health outcomes performance that might now be expected. Because it is the intention of this study to focus on the NHS in England & Wales, data was extracted from ONS databases for England & Wales, rather than for the UK as in the European Detailed Mortality Database.

[xviii] ONS, *Mortality statistics: cause – Review of the Registrar General on deaths by cause, sex and age, in England and Wales, 2005, Series DH2 no. 32*, London: The Stationery Office, 2006, pp.xiv-xv.
It is important to use age-standardised mortality rates rather than crude mortality rates in order to compare data between different years and between countries, where populations will have different age structures. For a useful discussion see: http://www.chooselife.net/nmsruntime/saveasdialog.asp?lID=2509&sID=1586; and for the distortionary effects using crude rates can have see: Tunstall-Pedoe, H, Crude rates, without standardisation for age, are always misleading, *BMJ,* Letters, 1998;317:475 (15 August)

[xix] http://www.who.int/healthinfo/statistics/mortdata/en/index.html, and http://www.statistics.gov.uk/about/classifications/icd10/how_to_apply_comparability_ratios.asp;
Brock et al., *The effect of the introduction of ICD-10 on cancer mortality trends in England and Wales*, Health Statistics Quarterly, London: ONS, Autumn 2004;
Griffiths et al., *The impact of introducing ICD-10 on trends in mortality from circulatory diseases in England and Wales*, Health Statistics Quarterly, London: ONS, Summer 2004.
ICD-10 has around 10,000 conditions for classifying causes of death, compared with around 5,100 in ICD-9, and – perhaps even more importantly – several changes have been made to the rules governing selection of the underlying cause of death. As a result, to interpret trends in mortality between ICD-9 and ICD-10, comparability ratios must be employed – that is the ratio of the number of deaths coded to a cause in ICD-10 to the number coded to the equivalent causes in ICD-9 – to give the "expected" number of deaths which would have been coded to a cause in ICD-9.
Comparability ratios are calculated by using bridge coding, that coding a sample of death certificates independently to both ICD-9 and ICD-10 and comparing the resulting underlying causes of death. Comparability ratios must be employed where they are statistically significant, that is where 95% confidence intervals don't overlap 1.00.
The ONS also recommends that while 'earlier analyses have shown that there is little difference in the age-standardised mortality rates obtained if age-specific comparability ratios are applied to data instead of an all-age ratio….if the data being examined are to be used to examine trends in specific age groups it may be sensible to apply age-specific ratios'. Examining trends within a specific age group (0-74 years) is exactly what this study attempts to do, so age-specific comparability ratios should be used. However, the ONS only provide disaggregated age-specific comparability ratios in the case of malignant neoplasm of the breast, Hodgkin's disease, leukaemia and cerebrovascular disease; 'where there is a significant difference in the comparability ratios by age'. These are employed here; but for other conditions it is presumed there aren't significant differences and the 'all-age' comparability ratios are used.
[xx] http://data.euro.who.int/dmdb/ (accessed August 2007)
France, in 1999, and Austria, in 2001, changed from ICD-9 to ICD-10 within the period of study. Ideally, comparability ratios would also have been used in these countries. However, a bridging exercise carried out in France suggested that the comparability ratios for neoplasms and circulatory disease were 1.01 and 1.00 respectively; i.e. that the change of coding from ICD-9 to ICD-10 actually had little or no effect on age-standardised mortality rates for these conditions. No data was readily available for Austria.
All other countries have used ICD-10 coding since before 1999, so no adjustments were required.
[xxi] It is recognised that the cut-off criteria used here are essentially arbitrary, but a view was taken that the policy context is significantly different for health systems serving very small populations and for those with much fewer resources to spend on health care.
For a discussion of data quality see: Mathers, C , et al., *Counting the dead and what they died from: an assessment of the global status of cause of death data*, Geneva: World Health Organisation, 2004.
[xxii] Ibid.
[xxiii] Office of National Statistics, Mortality Statistics: Cause (Series DH2), see: http://www.statistics.gov.uk/statbase/Product.asp?vlnk=618&More=N. Calculations by author.
[xxiv] Ibid. Calculations by author.
[xxv] NAO, *Reducing brain damage: faster access to better health care*, London: National Audit Office, 2005; Bosanquet et al., *NHS reform: the empire strikes back*, London: Reform, 2007; Gubb, J, *The NHS and the NHS Plan: Is the extra money working?*, London: Civitas, 2006. Of course, it still remains the case that other aspects of care relating to quality of life, rather than mortality, may have suffered in this way.
[xxvi] DH, *NHS Cancer Plan,* 2000
[xxvii] For a discussion relevant to this point see: Nolte and McKee, *Does health care save lives?*, 2004, pp. 44-47.
[xxviii] Derbyshire, K et al., *Further Developments in Measuring Quality Adjusted Healthcare Output,* 2007, p.32
[xxix] Office of National Statistics, Cancer Statistics: Series MB1, London: The Stationery Office, http://www.statistics.gov.uk/StatBase/Product.asp?vlnk=8843. Calculations by the author.
[xxx] The Information Centre, Primary diagnosis: summary, HESOnline: http://www.hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=202

[xxxi] Nolte and McKee, *Does health care save lives?,* 2004, pp.45-6

[xxxii] Foresight, *Tackling obesity: future choices*, London: Government Office for Science, 2007.
The report warned that by 2050, 60 per cent of adult men and 50 per cent of adult women could be obese, given current rates of increase. This would result in at least a seven-fold increase in NHS costs.

[xxxiii] Office of National Statistics, Mortality Statistics: Cause (Series DH2). Calculations by author.

[xxxiv] Ibid. Calculations by author.

[xxxv] Unal, B et al., Modelling the decline in coronary heart disease deaths in England and Wales, 1981-2000: comparing contributions from primary prevention and secondary prevention, *BMJ*, 2005;331:614

[xxxvi] Ibid.

[xxxvii] Poikolainen, K and Eskola, J, Health services resources and their relation to mortality from causes amenable to health care interventions: a cross-national study, *International Journal of Epidemiology,* 1988;17:86-89
This would also sit more comfortably with the fact that the incidence of disease, even for under-75s, has increased – one would assume that healthier lifestyles, if an adequate explanation for the fall in mortality, would also lead to a fall in the incidence of disease.

[xxxviii] Martin, S, et al., *The link between healthcare spending and health outcomes – Evidence from English programme budgeting data*, London: The Health Foundation, 2007

[xxxix] Data was extracted only back to 1979 but no further, because this was the year that the UK changed from the ICD-8 to ICD-9 classification of disease. Given that data from 2001 onwards is ICD-10, a view was taken that comparing data across three different classifications risks too many inaccuracies.
In any case, the ONS recommend that comparability ratios between ICD-9 and ICD-10 are only applicable going back to 1994. Thus no comparability ratios were applied to data collected between 1979 and 1993. This is likely to either systematically over or under-estimate mortality rates, but given the comparatively small ratios that apply to data from 1994-2001, the data may still be used to identify broad trends across time.

[xl] Office of National Statistics, Mortality Statistics: Cause (Series DH2). Calculations by author.

[xli] Ibid. Calculations by author.

[xlii] Ibid. Calculations by author.

[xliii] Holland, W.W., ed., *European Community atlas of 'avoidable death'*, Oxford: Oxford University Press, 1988; cited in: Nolte and McKee, *Does health care save lives?*, 2004, pp.23-5
It is possible to argue that a false impression is then given by going back as far as 1979 for all conditions because we move out of the realms of the very thing – amenable mortality – that we are looking to analyse. But this is probably going too far. It is not the purpose of this study to discover the exact point in time that a given condition became amenable to healthcare and not identifying this does not stop us looking at trends over time. Given that the quality and scope of healthcare is such that the condition is *now* considered amenable, permits the purpose of this study, which is to discover whether the NHS has done better or worse between 1999 and 2004 than it has done before.

[xliv] Mackenbach, J, How important have medical advances been? In: Sussex, J (ed.), *Improving population health in industrialized countries (pp.53-59)*, London: Office of Health Economics, 2000

[xlv] McClellan, M, Kessler, A, et al., Technological Change Around the World: Evidence from Heart Attack Care*,* TECH, *Health Affairs*, May/June 2001:25-42

[xlvi] http://data.euro.who.int/dmdb/ (accessed August 2007); and ONS, Mortality Statistics: Cause (Series DH2). Calculations by author.

[xlvii] Ibid.

[xlviii] OECD, *Health Data 2007*, Paris: OECD, 2007. Austria does, however, have a much higher level of health expenditure than the UK; $3,418 per capita (PPP), compared with $2,560.

[xlix] Based on population estimates of 53.4 million in England & Wales and 64.1 million in France.

[l] For a useful literature review see: Law, M and Wald, N, Why heart disease mortality is low in France: the time lag explanation, *BMJ*, 1999;318(7196):1471-1480.
Table 2 in the study shows the similar levels of animal fat consumption, serum total cholesterol and high density lipoprotein cholesterol concentrations, blood pressure, and (in men) smoking in Britain and France.

[li] Law and Wald, Why heart disease mortality is low in France, *BMJ*, 1999

[lii] Tunstall-Pedoe, H et al., Contribution of trends in survival and coronary event rates to changes in coronary heart disease mortality: 10-year results from 37 WHO MONICA Project populations, *The Lancet,* 1999;353:1547-1557, Tables 2 and 3

[liii] Ducimetière, P et al., Rates of coronary events are similar in France and southern Europe, *BMJ*, Letters, 2000;320:249.

[liv] International Agency for Research on Cancer. The GLOBOCAN 2002 software and database, version 2.0, 2004. http://www-dep.iarc.fr/ (accessed 17 October 2007)
http://data.euro.who.int/dmdb/ (accessed August 2007). Calculations by the author.

[lv] Tunstall-Pedoe et al., Contribution of trends in survival and coronary event rates to changes in coronary heart disease mortality, *The Lancet,* 1999

[lvi] Tunstall-Pedoe et al., Contribution of trends in survival and coronary event rates to changes in coronary heart disease mortality, *The Lancet,* 1999

[lvii] Nolte and McKee, Measuring the health of nations, *BMJ*, 2003

[lviii] http://data.euro.who.int/dmdb/ (accessed August 2007)
ONS, Mortality Statistics: Cause (Series DH2).
Calculations by author based on the formula for exponential decay: dM/dT = -RM, where R is the rate of improvement, M is mortality and T is time. The solution for the two 'decays' to converge is therefore:
$T = (100/(R_{Eng} - R_{other}) \ln (M_{Eng} - M_{other})$.

[lix] If the NHS achieved the same amenable mortality rates as, say France, despite having a much higher incidence of the disease, it would clearly be a more impressive achievement.

[lx] http://data.euro.who.int/dmdb/ (accessed August 2007)
ONS, Mortality Statistics: Cause (Series DH2).
Calculations by author based on the formula for exponential decay: dM/dT = -RM, where R is the rate of improvement, M is mortality and T is time. The solution for the two 'decays' to converge is therefore:
$T = (100/(R_{Eng} - R_{other}) \ln (M_{Eng} - M_{other})$.

[lxi] This is despite the decrease in avoidable mortality from cancer between 1999 and 2004 in England & Wales being above the average for the other countries studied.

[lxii] Verdecchia, A et al., Recent cancer survival in Europe: a 2000-02 period analysis of EUROCARE-4 data, The Lancet Oncology, August 2007

[lxiii] DH, *Health Profile of England 2007*, London: The Stationery Office, 2007, section 3

[lxiv] Nolte and McKee, Measuring the health of nations, *BMJ*, 2003

[lxv] Nolte and McKee, *Does health care save lives?*, 2004, pp.43-44

[lxvi] World Health Organisation, *The World Health Report 2000 – Health systems: improving performance,* Geneva: WHO, 2000.
This report used 'disability adjusted life expectancy' as a proxy for health attainment, despite the fact this measure is influenced by any number of factors outside a health care system and has been roundly criticised for using discredited regression methods for countries with inadequate mortality data. See: Law CK, Yip PSF. Healthy life expectancy in Hong Kong special administrative region of China. *Bull WHO* 2003;81: 43-7. Cited in: Nolte and McKee, Measuring the health of nations, *BMJ*, 2003;
Davis, K et al., *Mirror, mirror on the wall: An international update on the comparative performance of American health care*, Commonwealth Fund, 2007. This study ranked six health systems – including the UK – on measures such as efficiency and quality, despite the fact the eclectic range of indicators were primary care biased and could not be said to measure what we generally mean by either efficiency or quality. See: The Economist, 'Top of the class: Is the health service really so good?', *The Economist*, 24/05/07
For a discussion of the problems concerning comparative health system analysis see: Marmor et al., *Comparative perspectives and policy learning in the world of health care,* 2005

[lxvii] Nolte and McKee, *Does health care save lives?*, 2004, p.52

[lxviii] Markus, H, Improving the outcome of stroke: UK needs to reorganise services to follow the example of other countries, *BMJ*, 2007;335:359-360

[lxix] Bosanquet, de Zoete and Haldenby, *NHS reform: the empire strikes back*, 2007

[lxx] Wanless et al., *Our Future Health Secured?*, 2007, p.270