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Contacts

This publication

For information about this publication, contact the editors:
Myer Glickman
Carol Summerfield
tel: 01633 455868, email: hsq@ons.gsi.gov.uk

Other customer enquiries

ONS Customer Contact Centre
Tel: 0845 601 3034
International: +44 (0)845 601 3034
Minicom: 01633 815044
Email: info@statistics.gsi.gov.uk
Fax: 01633 652747

Post: Room 1015, Government Buildings,
Cardiff Road, Newport, South Wales NP10 8XG
www.statistics.gov.uk

Media enquiries

Tel: 0845 604 1858
Email: press.office@ons.gsi.gov.uk

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Population Trends	by 23 Oct	by 2 Feb	by 4 May	by 26 July

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Room 1.127
Government Buildings
Cardiff Road
Newport South Wales NP10 8XG

in brief

Health Statistics Quarterly's digital future

Spring 2010 will herald a new phase for *Health Statistics Quarterly* (HSQ) as one of the first Office for National Statistics (ONS) journals to become primarily an online publication. HSQ 45 will be available on the ONS website at www.statistics.gov.uk/hsq from 24 February. ONS's current publisher, Palgrave Macmillan, will continue to provide printed copies to subscribers who prefer that medium, as well as a value-added online subscription service to the content. The move will bring us many new opportunities to develop and enhance our journals while retaining their quality and values.

HSQ will continue to contain high quality, peer reviewed scientific articles analysing patterns and trends in the nation's health using ONS data and describing key methodological developments. Submissions from authors outside ONS will be welcome. Routinely published health data reports will be published separately as Statistical Bulletins, but will be easily accessible through the HSQ web pages.

In future we will have the opportunity to present data in more readily usable formats, provide links to other material, and reach greater numbers of readers online. Readers will not be required to subscribe, and there will be no charge, although institutional users may prefer to take advantage of the value-added subscription service that Palgrave Macmillan will offer.

This is an ongoing project aimed at presenting the journal's data and analysis in the most accessible and practical formats for our readers. Feedback on any aspect of the new online publication would be greatly welcomed and should be sent to hsq@ons.gov.uk.

We are particularly seeking comment on the reference tables which appear in each issue. Feedback should be sent to vsob@ons.gov.uk

…and *Population Trends* moves online too

Hot on the heels of *Health Statistics Quarterly*, *Population Trends* will publish primarily online from Issue 139. The journal will be available on the ONS website at www.statistics.gov.uk/populationtrends from March 2010.

If you have any questions or comments regarding these plans, or would like to be consulted regarding future developments, please contact population.trends@ons.gov.uk

United Kingdom Health Statistics: 2009

On 26 October ONS released *UK Health Statistics,* 2009 online update as an interactive PDF enhanced with Excel files. This publication brings together data from England, Wales, Scotland and Northern Ireland to provide a unique UK-level overview of key health and healthcare statistics, including pregnancy and childbirth, general health and specific health conditions, mortality and life expectancy and preventive healthcare. It provides an update of key tables relating to UK and constituent country level health data first published in *UK Health Statistics,* No.3 in April 2008.

Key findings from the report:

- Infant mortality rates in the UK are at their lowest ever recorded levels, at 4.7 per 1,000 live births in 2008
- In the UK in 2008, deaths among HIV-infected individuals were around four times lower than at their peak in 1996
- Immunisation rates of children prior to their second birthday have increased continually over the last seven years. In 2008, 98 per cent of these children in the UK were immunised against diphtheria, tetanus, polio and whooping cough
- In 2008, mortality rates for all causes of death in Scotland were higher than anywhere else in the UK for both sexes
- In 2007, males in the UK had lower death rates and a higher life expectancy than the EU average

The PDF is available on the ONS website at: www.statistics.gov.uk/statbase/Product.asp?vlnk=6637

Cancer registration in England, 2007

The number and rate of newly diagnosed cases of cancer registered in England in 2007 were published by ONS on 4 November 2009. The data release presents detailed figures for the numbers of cases and rates for selected cancers by sex and age-group, and directly age-standardised rates using the European standard population. These cancers account for approximately 90 per cent of all cancers. They have been produced in collaboration between the National Cancer Intelligence Centre and Vital Statistics Outputs Branch at ONS and the regional cancer registries in England.

There were around 245,300 new cases of cancer registered in England in 2007 (excluding non-melanoma skin cancer). Compared with 2006, the number of registrations increased by around 1,570 cases in males, with a similar increase in females. For males, the overall cancer incidence rates (after adjustment for age) fell slightly to 402 per 100,000 population in 2007, and for females rose slightly to 352 per 100,000; but within the expected range of year on year variation. The three most common cancer in males are prostrate, lung and colorectal and in females are breast, colorectal and lung. Together these account for just over half of all cancers.

The latest data release and previous versions are available on the ONS website at: www.statistics.gov.uk/StatBase/Product.asp?vlnk=7720

A summary is available on the ONS website at: www.statistics.gov.uk/CCI/nugget.asp?ID=915

Occupational mortality

ONS released an analysis of occupational mortality on the 29 October 2009. This is a joint publication between the ONS and the Health and Safety Executive investigating the statistical links between occupations and causes of death in England and Wales covering the period 1991–2000. The report is part of a series published for 10-year periods in the form of Registrar General's Decennial Supplements.

The research was carried out by a team led by Professor David Coggon of the University of Southampton MRC Epidemiology Resource Centre and focuses on those combinations of occupation and cause of death that might be associated with known and postulated potential occupational hazards.

The measure used in the analysis was the proportional mortality ratio (PMR). This measures the proportion of deaths occurring from a given cause for a particular occupation relative to the proportion of deaths from that cause in the whole population.

The report is available on the ONS website at: www.statistics.gov.uk/StatBase/Product.asp?vlnk=1624

Public Sector Productivity: Healthcare

ONS is preparing the fourth 'Public Sector Productivity: Healthcare Output, Input and Productivity' article to be released in March 2010. As an improvement, the article will extend the coverage of the UK healthcare productivity measure to Wales, updating the outputs and inputs measure accordingly.

Population estimates: mid-2008

England and Wales/United Kingdom
On 27 August 2009 ONS published the mid-2008 population estimates. These give estimates of the population for the United Kingdom; constituent countries; Government Office regions; local authorities in England and Wales; council areas within Scotland; district council areas in Northern Ireland and health authorities/boards. Full information on these mid-year population estimates can be found on the ONS website: www.statistics.gov.uk/popest

Scotland
Mid-2008 population estimates for Scotland were released by the General Register Office for Scotland on 28 April 2009. Information on these estimates can be found at www.gro-scotland.gov.uk/statistics/population/index.html

Northern Ireland
Mid-2008 population estimates for Northern Ireland were released by the Northern Ireland Statistics and Research Agency on 30 July 2009. Information on these estimates can be found at www.nisra.gov.uk/demography/default.asp.htm

Thank you

As well as being the last official print edition of HSQ, this is also the last edition to be prepared by Carol Summerfield as managing editor and Nigel Physick as production manager. We would like to thank them for their painstaking work to ensure the quality and efficient production of HSQ over many past editions, and wish them both well for the future.

Recent and forthcoming ONS releases

Recent releases

24 September
Population Trends No. 137 Autumn 2009
www.statistics.gov.uk/statbase/product.asp?vlnk=6303
Print copies available from Palgrave Macmillan 01256 357893

24 September
Focus on Older People: health and social care update
www.statistics.gov.uk/cci/nugget.asp?id=1268

30 September
Older Peoples' Day Statistical Bulletin and Ageing Times
www.statistics.gov.uk/statbase/product.asp?vlnk=15306

15 October
Conception Statistics 2007
www.statistics.gov.uk/statbase/product.asp?vlnk=15055

20 October
Contraception and sexual health, 2008/09
www.statistics.gov.uk/statbase/product.asp?vlnk=6988

21 October
Life expectancy at birth and at 65 by local areas in the United Kingdom, 2006–08
www.statistics.gov.uk/statbase/product.asp?vlnk=8841

21 October
National interim life tables, 2006–08
www.statistics.gov.uk/statbase/product.asp?vlnk=14459

27 October
United Kingdom Health Statistics 2009
www.statistics.gov.uk/statbase/product.asp?vlnk=6637

29 October
Mortality statistics: deaths registered in 2008 (DR)
www.statistics.gov.uk/statbase/product.asp?vlnk=15096

29 October
Occupational Mortality in England and Wales, 1991–2000
www.statistics.gov.uk/statbase/product.asp?vlnk=1624

4 November
Cancer registration statistics 2007
www.statistics.gov.uk/statbase/product.asp?vlnk=7720

11 November
Adoptions 2008
www.statistics.gov.uk/StatBase/Product.asp?vlnk=15049

24 November
Quarterly conceptions to women under 18 – quarter 3 2008
www.statistics.gov.uk/statbase/ssdataset.asp?vlnk=4877

Forthcoming releases

8 December
Birth statistics 2008 (FM1)
www.statistics.gov.uk/statbase/product.asp?vlnk=5768

8 December
Population Trends No. 138 Winter 2009
www.statistics.gov.uk/statbase/product.asp?vlnk=6303
Print copies available from Palgrave Macmillan 01256 357893

13 January 2010
Cancer registrations 2007 (MB1)
www.statistics.gov.uk/statbase/product.asp?vlnk=8843

4 February
Congenital anomalies 2008 (MB3)
www.statistics.gov.uk/statbase/product.asp?vlnk=5799

For further information, contact the ONS Customer Contact Centre 0845 601 3034, email info@statistics.gsi.gov.uk

Health indicators

England and Wales

Figure A Population change (mid-year to mid-year)

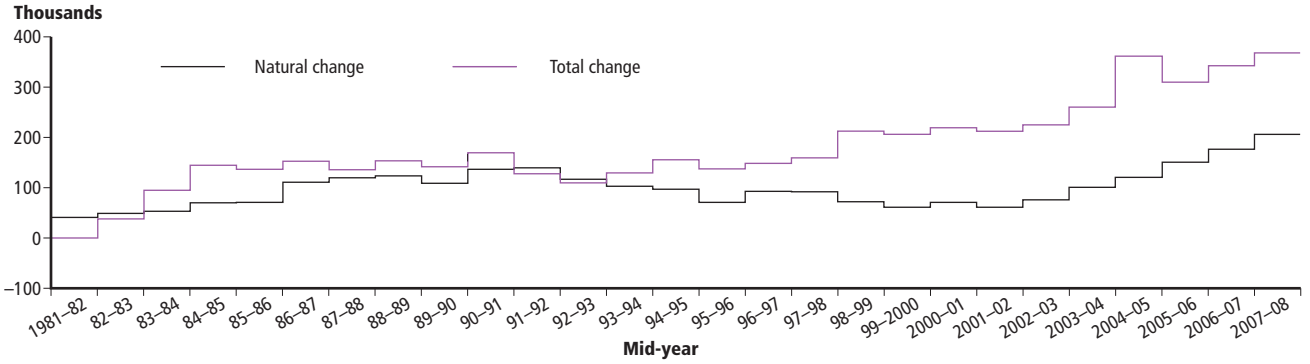


Figure B Age-standardised mortality rate[1]

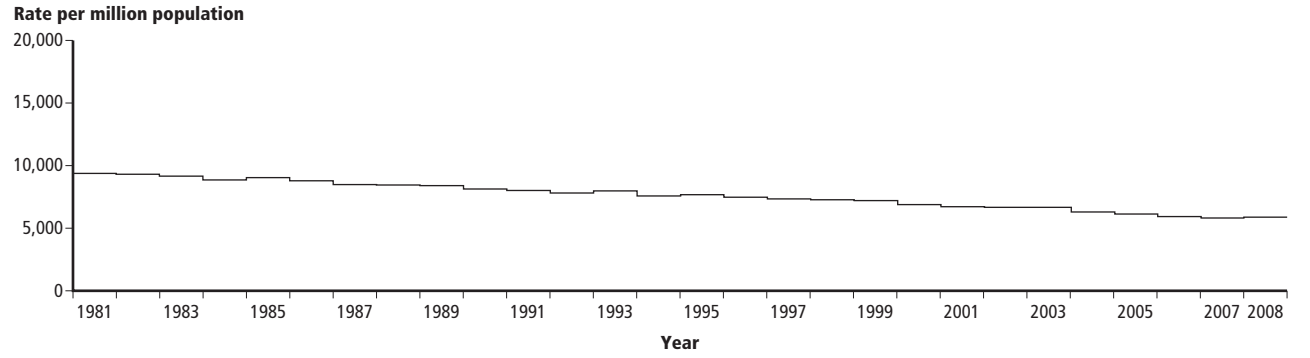


Figure C Infant mortality (under 1 year)

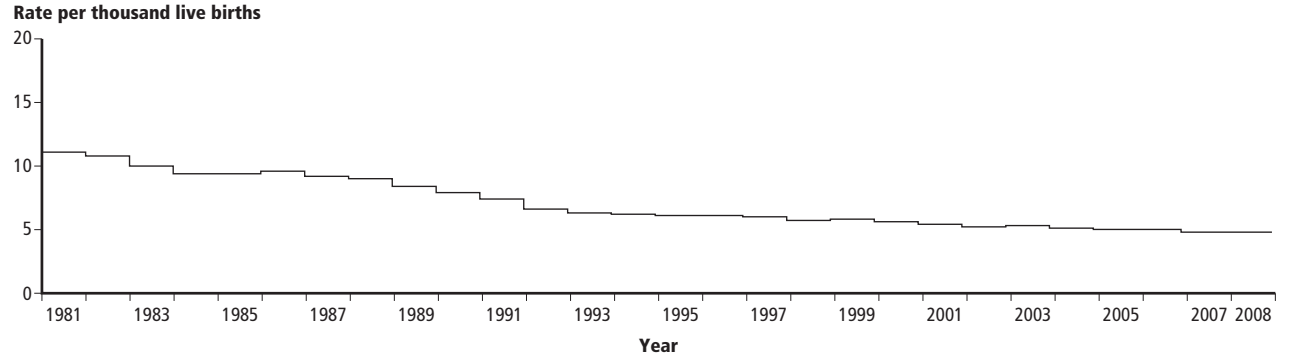
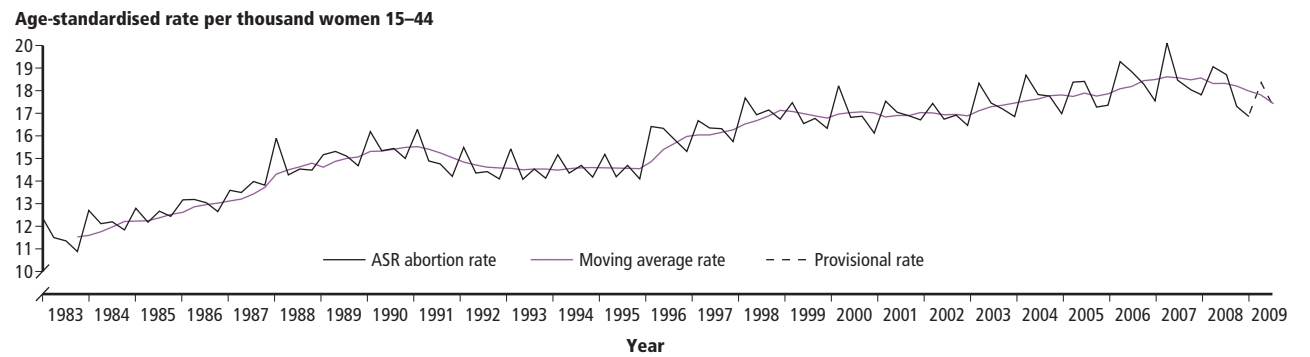


Figure D Age-standardised quarterly abortion rates – residents[2]



1 The age-standardised mortality rate for 2007 and 2008 is based on mid-2007 population estimates published on 21 August 2007.

2 Rates for 2008 and 2009 are based on projected projections.

Social inequalities in female mortality by region and by selected causes of death, England and Wales, 2001–03

Ann Langford, Brian Johnson and Alaa Al-Hamad
Office for National Statistics

This article reports on social inequalities in female mortality by region and cause of death for women aged 25–59 years in England and Wales in the period 2001–03. It is the first official compilation of detailed mortality statistics for women based on the National Statistics Socio-economic Classification (NS-SEC). It is part of a series of articles measuring inequalities in adult mortality.

The results demonstrate a strong socio-economic effect on the mortality of women in all regions. This pattern remained consistent between regions.

There were marked differences in the socio-economic gradient by cause. Mortality rates for women in the least and most advantaged NS-SEC classes were similar for breast cancer. In contrast, compared to women in the most advantaged class, mortality rates were three times as high for the least advantaged women for lung cancer and cerebrovascular disease, around five times as high for ischaemic heart disease and all digestive diseases, and six times as high for respiratory diseases.

Introduction

This article describes social inequalities in adult female mortality rates for selected causes of death and across the Government Office Regions of England, and Wales. It is the fifth in a series of articles reporting mortality using the final version of the National Statistics Socio-economic Classification (NS-SEC). The first three articles covered social inequalities by NS-SEC for men,[1] by cause of death,[2] and by Government Office Region.[3] The fourth article examined inequalities for women in all-cause mortality,[4] and presented results for two classifications, one based on a woman's own occupation, and another on a 'combined' classification based on the most advantaged NS-SEC class of the woman or her husband.

This study focuses on women aged 25–59 in the period 2001–03, and uses the 'combined' NS-SEC classification to analyse mortality rates by region and selected causes of death.

Background

There is a long history of the study of health inequalities by socio-economic classification in England and Wales. The influential Black report[5] showed that there had been a striking lack of improvement in the health experience of the less advantaged social classes up to the 1970s. The Acheson Report[6] in 1998 highlighted widening differences between the expectation of life of the most advantaged and most disadvantaged groups in society. The Government strategy *Tackling Health Inequalities: A programme for action*[7] aspired to 'address the inequalities that are found across different geographical areas, between genders... and between different social and economic groups'. Four years later, however, the *2007 Status Report on the Programme for Action*[8] reported that 'the gap has not narrowed for life expectancy in disadvantaged areas; indeed, the gap has widened, particularly for women.'

The interest in health inequalities has led to a large volume of literature on the analysis of mortality by socio-economic classification[9,10,11] but relatively little on mortality in women. This is due, in part, to a number of well-known difficulties inherent in any analysis of female mortality by a classification based on occupation.[12] There are conceptual difficulties because many women have weaker ties to the labour market than men, which reduces the potential relevance of occupation-based indicators of social class. There are also practical difficulties, since the occupation of a substantial minority of women is inadequately described at death registration and, in many cases, is not recorded at all.

The previous article in this series[4] examined two methods of classification for women. One was based on the woman's own occupation, and the other on a 'combined' measure which also took into account the husband's classification, where available and if reflecting more advantage than the woman's own occupational class. The concept behind the latter classification is similar to the 'dominance' approach first suggested by Erikson[13] who maintained that the life-chances of individuals in a family unit are more likely to be aligned with those of the most advantaged individual in that unit. The idea was summarised as follows: 'A secretary who is married to an executive may have life chances closer to those of executives than to those of other secretaries.'[14] The previous article in this series[4] found that the 'combined' measure was a better discriminator of female mortality, with the mortality rate among those assigned to the least advantaged class 2.6 times that of those in the most advantaged class.

Previous authors[11,15] have studied inequalities in the mortality of women by cause using the Registrar General's Social Class (RGSC).[15] Others have studied inequalities in the mortality of women by region and cause in the early 1990s[16] and covering the period of this study[17] but both these studies analysed by deprivation of area of residence rather than individual socio-economic characteristics. All have found evidence of inequalities that vary by cause and region. However this article is the first to present an analysis of the mortality of women by selected causes of death and region using the new measure of social class – the NS-SEC – which replaced the RGSC in 2001.

Methods

In this article the measure of social class used is the National Statistics Socio-economic Classification (NS-SEC), which is described below, along with the definition of the regions and the selected causes analysed. The sources of data, calculation methods and outcomes are also described in this section.

The classification of women by the National Statistics Socio-economic Classification (NS-SEC)

The National Statistics Socio-economic Classification (NS-SEC) was developed in order to replace the Registrar General's Social Class, which had been criticised as lacking a coherent theoretical basis and becoming increasingly irrelevant to the changing patterns of industry and employment in modern economies.[18]

The conceptual basis of the NS-SEC is the structure of employment relations operating in modern developed economies.[19] Occupations are differentiated in terms of reward mechanisms, promotion prospects, autonomy and job security. The most advantaged NS-SEC classes (for example higher managerial and professional occupations), typically exhibit personalised reward structures, have good opportunities for advancement, have relatively high levels of autonomy within the job, and are relatively secure. These attributes tend to be reversed for the most disadvantaged classes (for example routine occupations). Box One shows the NS-SEC analytical class breakdowns used in this analysis, and provides examples of the occupations included in each class.

Further information on the rationale, derivation and application of the NS-SEC is available on the Office for National Statistics (ONS) website.[20]

This analysis uses the 'combined' classification method, whereby a non-married woman is assigned an NS-SEC class on the basis of her own occupation and employment status, and a married woman is assigned the most advantaged NS-SEC class of either herself or her husband.

Regions and selected causes of death

This article focuses on mortality in the Government Office Regions of England and in Wales. Government Office Regions are the largest level statistical sub-divisions in England (Box Two). Wales is not sub-divided in this analysis. For convenience, use of the term 'region' throughout this article includes Wales.

Further information can be found in the guide to UK geography on the ONS website.[21]

Box one

National Statistics Socio-economic Classification – analytic classes

Analytic class		Examples of occupations included
1	Higher managerial and professional occupations	Directors and chief executives of major organisations, civil engineers, medical practitioners, IT strategy and planning professionals, legal professionals, architects, senior officials in national and local government
2	Lower managerial and professional occupations	Teachers in primary and secondary schools, quantity surveyors, public service administrative professionals, social workers, nurses, IT technicians
3	Intermediate occupations	Graphic designers, medical and dental technicians, Civil Service administrative officers and local government clerical officers, counter clerks, school and company secretaries
4	Small employers and own account workers	Hairdressing and beauty salon proprietors, shopkeepers, dispensing opticians in private practice, farmers, self-employed decorators
5	Lower supervisory and technical occupations	Bakers and flour confectioners, catering supervisor, head waitress, postal supervisor, sales assistant supervising others
6	Semi-routine occupations	Retail assistants, catering assistants, clothing cutters, dressmaker, traffic wardens, veterinary nurses and assistants, shelf fillers
7	Routine occupations	Hairdressing employees, floral arrangers, sewing machinists, bar staff, cleaners and domestics
	Other	Full-time students, never worked, long-term unemployed, inadequately described, not classifiable for other reasons

Source: NS-SEC User Manual, Office for National Statistics

Box two

The Government Office Regions of England

North East (NE)
North West (NW)
Yorkshire and The Humber (YH)
East Midlands (EM)
West Midlands (WM)
East of England (E)
London (L)
South East (SE)
South West (SW)

The causes of death examined in this article are listed in Box Three, along with the number and percentage of all deaths represented in the study population. These causes of death account for approximately 80 per cent of all deaths among women aged 25–59. Causes of death were grouped to ensure sufficiently large numbers for robust statistical analysis when broken down by region and NS-SEC class. Thus the mortality rates reported in this article are for all deaths, four major groups of causes and four specific causes of death. Deaths were coded to the tenth revision of the International Classification of Diseases (ICD).[22]

Box three

Causes of death to women 25–59 included in the analysis

Cause of death	ICD–10 codes	Number of deaths	Percentage of deaths
All causes	A00–R99, V00–Y89	65,276	100
All cancers	C00–C97	31,639	48
Trachea, bronchus and lung	*C33–C34*	*4,607*	*7*
Breast cancer	*C50*	*9,313*	*14*
All circulatory diseases	I00–I99	11,505	18
Ischemic heart disease	*I20–I25*	*4,616*	*7*
Cerebrovascular disease	*I60–I69*	*3,559*	*5*
All respiratory diseases	J00–J99	3,794	6
All digestive diseases	K00–K93	5,322	8

Sources of data

Numerators

The routine collection of data at death registration provided the number of deaths in each age-group for each NS-SEC class in each region for the period 2001–03. These data were used as the basis of numerators for the mortality rates.

The numbers of deaths were subject to two adjustments. The first reapportioned some deaths from NS-SEC analytical classes 3 to class 2. In the first study of this series[1] examination of the ONS Longitudinal Study (LS), a one per cent sample of linked census and death records, revealed that a number of men had been allocated at death registration to NS-SEC class 3 on the basis that they had no supervisory duties. Examination of their 2001 linked Census records revealed, however, that they had in fact been supervisors in 2001, and thus were more appropriately assigned to NS-SEC class 2. A similar phenomenon was observed on examination of the records of women in the ONS Longitudinal Study, and appropriate adjustment factors were calculated to correct for this bias.[4]

The second adjustment was to correct for the under-reporting of the occupation of women at death. The previous article[4] reported that for 19 per cent of deaths insufficient occupational details were available to allow classification by 'combined' NS-SEC. In a sample of 158 women who were 'unclassified at death', the NS-SEC classification could be determined by reference to their census records. The distribution of this sample (Table 1) was used to reallocate the unclassified women across NS-SEC classes in this study.

Appendix A contains Tables A1 and A2, showing the numbers of deaths after these adjustments, by five-year age-band and 'combined' NS-SEC, for region and selected causes respectively.

Table 1 **NS-SEC class[1] at Census for those female members of the LS who died 2001–05 and were not classified or inadequately described at death**

England and Wales — Numbers and percentages

	NS-SEC analytic class								
	1	2	3	4	5	6	7	Other and FTS[2]	Total
Numbers	6	12	19	7	14	32	22	46	158
Percentages	*4*	*8*	*12*	*4*	*9*	*20*	*14*	*29*	*100*

1 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification.
2 Other and FTS includes never worked, long-term unemployed, inadequately described, not classifiable for other reasons and full-time students.
Source: ONS Longitudinal Study

Denominators

All denominators were based on the 'optimised population estimates' for mortality analysis presented in the previous article.[4] To obtain regional denominators, for each age group and NS-SEC combination, the percentage distribution across the regions was calculated from 2001 Census data. The resulting percentages were applied to the optimised population estimates in order to obtain an estimate of person-years at risk by five-year age group and NS-SEC for each region.

Appendix A also contains Table A3, showing the resulting population estimates by region.

Outcome measures

Mortality rates per 100,000 person years, age-standardised to the European standard population, were calculated for each NS-SEC class in each Government Office Region, and for each selected cause of death. As in previous articles in this series[1,2,3,4] the ratio between the mortality rates of the least and most advantaged NS-SEC classes is also presented. For convenience, this mortality rate ratio is referred to as the 'socio-economic gradient'.

Results

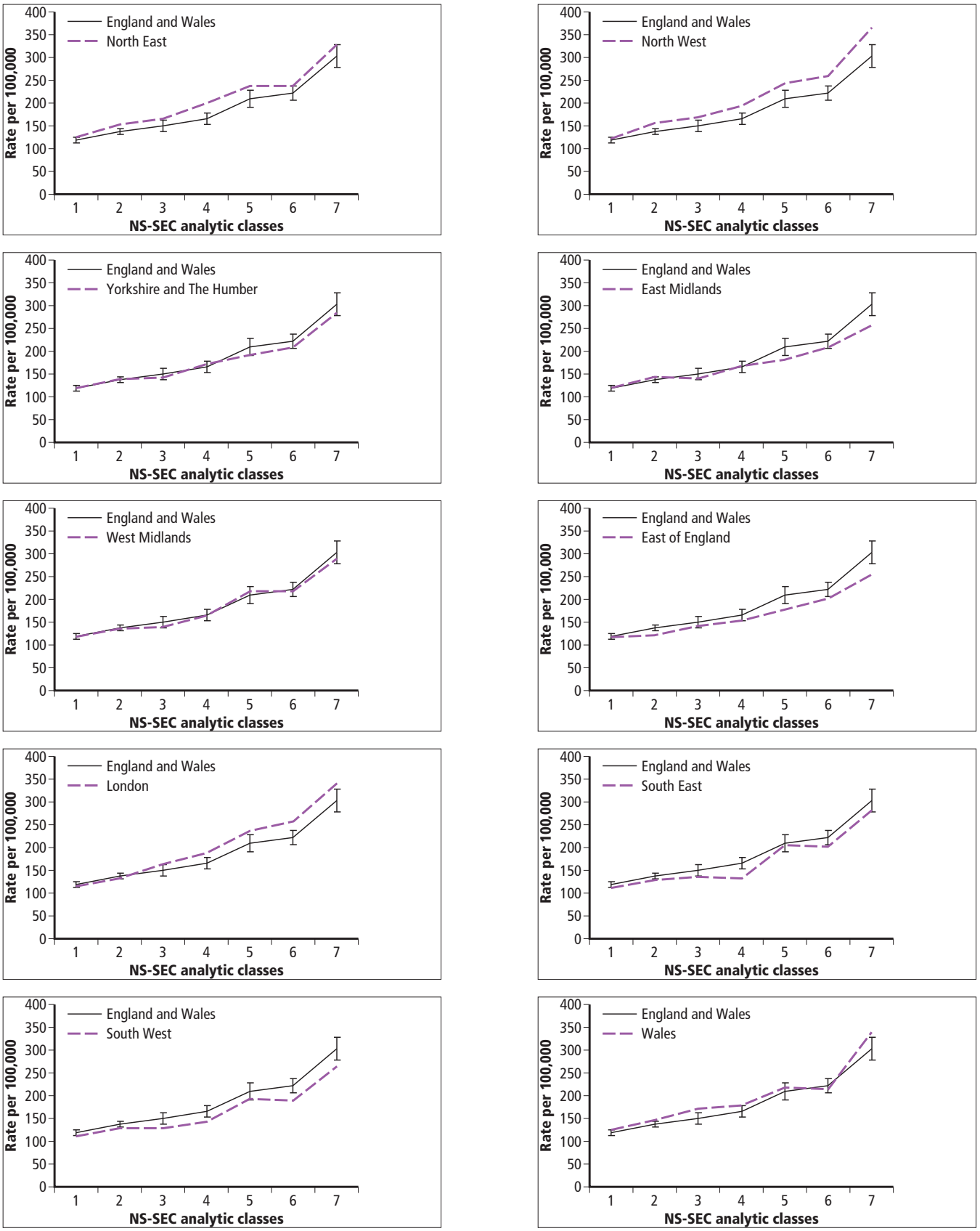
Mortality by region

Age-standardised mortality rates by NS-SEC for Government Office Regions and Wales are presented in Table 2. Shaded areas denote rates that are statistically significantly different from the corresponding rate for England and Wales as a whole. The results are illustrated graphically in Figure 1. Figure 2 displays the socio-economic gradient, that is the ratio of mortality rates of those assigned to routine occupations relative to those assigned to higher managerial and professional occupations, for each region.

The highest gradients are in London and the North West, where women classified to routine occupations have a mortality rate 3.0

Figure 1 Age-standardised mortality rates[1] by NS-SEC,[2] women aged 25–59, 2001–03

Government Office Regions of England, Wales



1 Directly age-standardised rate using the European standard population.

2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods

Table 2 Age-standardised mortality rates[1] by NS-SEC,[2] women aged 25–59, 2001–03

Government Office Regions of England, Wales — Rates per 100,000

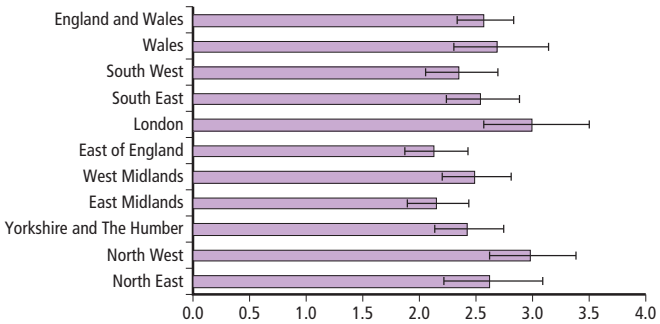
	NS-SEC analytic class							
	1	2	3	4	5	6	7	Socio-economic gradient[3]
North East	126	153 H	167	201 H	237	237	329	2.6
North West	123	156 H	169	195 H	244 H	260 H	367 H	3.0
Yorkshire and The Humber	118	138	141	171	192	208	285	2.4
East Midlands	120	142	141	169	182 L	209	258 L	2.1
West Midlands	116	137	138	164	217	216	290	2.5
East of England	118	123 L	141	152	179 L	202	253 L	2.1
London	114	133	164	187	235	258 H	341	3.0
South East	111	128 L	137	133 L	204	201	282	2.5
South West	112	127 L	130 L	145 L	193	189 L	264	2.4
Wales	127	148	170	179	218	215	340	2.7
England	116	136	147	164	209	221	298	2.6
England and Wales	118	137	149	165	210	221	302	2.6

1 Directly standardised rate using the European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the womans classification. Adjustments for the under-recording of death have been applied as described in Methods.
3 Ratio of mortality rates of NS-SEC class 7 to the mortality rate of NS-SEC class 1.

H Rate is statistically significantly higher than that for England and Wales.
L Rate is statistically significantly lower than that for England and Wales.

Figure 2 Socio-economic gradients,[1] women aged 25–59, 2001–03

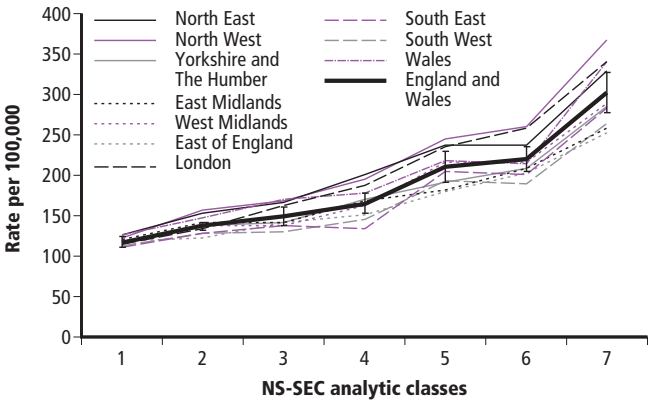
Government Office Regions of England, Wales



1 Ratio of mortality rates of NS-SEC class 7 to the mortality rate of NS-SEC Class 1 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

Figure 3 Age-standardised mortality rates[1] by NS-SEC analytic class,[2] women aged 25–59, 2001–03

Government Office Regions of England, Wales



1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

times that of women classified to higher managerial and professional occupations. This gradient is not however statistically significantly higher than the gradient for England and Wales as a whole (2.6). The lowest gradients are in the East of England and the East Midlands (2.1), and these gradients are statistically significantly lower than those for England and Wales.

Figure 3 demonstrates that there is relatively little difference in mortality rates between regions for the more advantaged classes, but more substantial differences for the more disadvantaged classes.

In detail, the results show that age-adjusted mortality rates in the North West for most NS-SEC classes are statistically significantly higher than the corresponding rates for England and Wales. In both the North West and the North East, mortality rates for each NS-SEC class are consistently higher than the corresponding rate for England and Wales.

Most mortality rates in the South West are statistically significantly lower than the corresponding NS-SEC class rates for England and Wales. In both the South West and the South East, mortality rates for each NS-SEC class are consistently lower than the corresponding rate for England and Wales.

Mortality by selected causes

Cancer

Table 3 presents the age-standardised rates by NS-SEC for all cancers; trachea, bronchus and lung cancer, and breast cancer. The results are displayed in Figure 4.

The mortality rates for all cancers displayed a distinct socio-economic pattern. The socio-economic gradient, that is the ratio of mortality rate of NS-SEC class 7 to NS-SEC class 1, was approximately 1.5. This implies that women in the least advantaged class had a mortality rate approximately one-and-a-half times that of women in the most advantaged class.

Table 3 Age-standardised mortality rates[1] from selected malignant neoplasms by NS-SEC[2], women aged 25–59, 2001–03

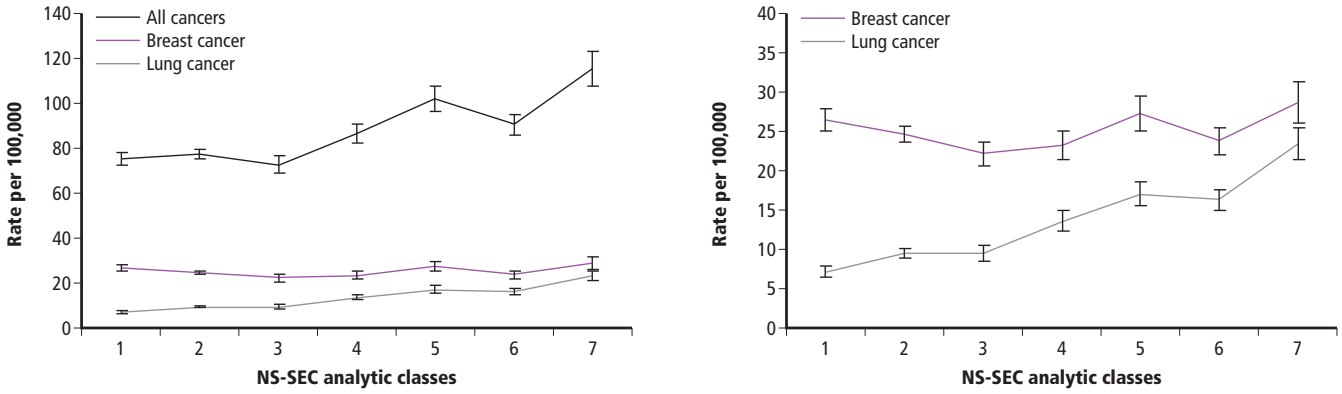
England and Wales — Rate per 100,000

NS-SEC analytic class	All cancers			Trachea, bronchus and lung			Breast cancer		
	Rate	Lower 95% confidence interval	Upper 95% confidence interval	Rate	Lower 95% confidence interval	Upper 95% confidence interval	Rate	Lower 95% confidence interval	Upper 95% confidence interval
1 Higher managerial and professional	75	72	78	7	6	8	26	25	28
2 Lower managerial and professional	77	75	80	9	9	10	25	24	26
3 Intermediate	73	69	77	9	8	10	22	21	24
4 Small employers and own account workers	87	82	91	14	12	15	23	22	25
5 Lower supervisory and technical	102	96	108	17	15	19	27	25	29
6 Semi-routine	90	86	95	16	15	18	24	22	25
7 Routine	116	108	123	23	21	25	29	26	31
Ratio of classes 7:1	1.5	1.4	1.7	3.3	2.9	3.7	1.1	1.0	1.2

1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

Figure 4 Age-standardised mortality rates[1] for all cancers, lung cancer and breast cancer by NS-SEC,[2] women aged 25–59, 2001–03

England and Wales



1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

The mortality rates for breast cancer, however, were fairly consistent over the socio-economic classes, with a gradient of only 1.1. The rate for the most advantaged class was not statistically significantly different from that of the least advantaged class. The pattern for lung cancer was quite different. Most classes had a statistically significantly higher mortality rate than the previous class, and mortality rates for women in the least advantaged class were more than three times that of women in the most advantaged class.

Circulatory diseases

Table 4 presents the age-standardised rates by NS-SEC for all circulatory diseases, and for ischaemic heart disease and cerebrovascular diseases separately. The results are displayed in Figure 5.

The mortality rates for all circulatory diseases displayed a more pronounced socio-economic pattern than those for cancer. Most classes had significantly higher mortality rates than the previous class. The exception was between NS-SEC classes 5 and 6 (lower supervisory and technical, and semi-routine). The mortality rate for NS-SEC class 7 (routine workers) was particularly high. The socio-economic gradient, that is the ratio of mortality rate of NS-SEC class 1 to NS-SEC class 7, was approximately 4.2. This implies that women in the least advantaged class had a mortality rate approximately four times that of women in the most advantaged class.

The socio-economic pattern was very similar for ischaemic heart disease. Women in the least advantaged class had a mortality rate 5.3 times that of women in the most advantaged class.

The socio-economic pattern for cerebrovascular disease was rather different to that of ischaemic heart disease.(Figure 5) The differences in mortality rates between adjacent classes were more consistent and the mortality rate for NS-SEC class 7 was not markedly higher. The socio-economic gradient was still high at 3.4, but was statistically significantly lower than the gradient for all circulatory diseases.

Respiratory and digestive diseases

The results for these two groups of diseases are shown in Table 5 and displayed in Figure 6. The socio-economic pattern of mortality rates was similar to that for ischaemic heart disease. Mortality rates rose gradually between NS-SEC classes 1 and 4. However, the difference in mortality rates between NS-SEC classes 4 and 5, and between classes 6 and 7 were statistically significant. The socio-economic gradients were 6.2 for respiratory diseases and 5.2 for digestive diseases.

Table 4 Age-standardised mortality rates[1] from selected circulatory diseases by NS-SEC,[2] women aged 25–59, 2001–03

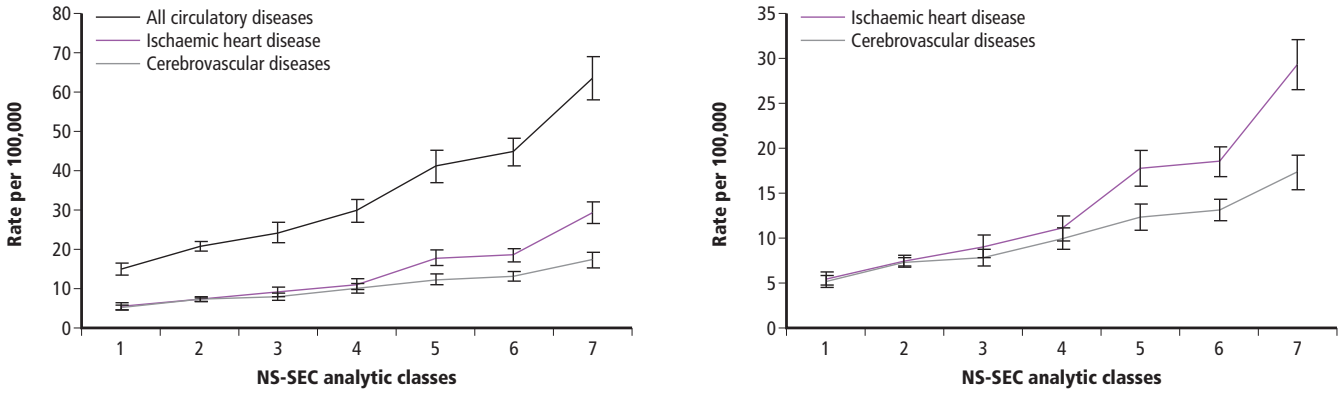
England and Wales — Rate per 100,000

NS-SEC analytic class	All circulatory diseases			Ischaemic heart disease			Cerebrovascular diseases		
	Rate	Lower 95% confidence interval	Upper 95% confidence interval	Rate	Lower 95% confidence interval	Upper 95% confidence interval	Rate	Lower 95% confidence interval	Upper 95% confidence interval
1 Higher managerial and professional	15	13	16	5	5	6	5	5	6
2 Lower managerial and professional	21	20	22	7	7	8	7	7	8
3 Intermediate	24	22	27	9	8	10	8	7	9
4 Small employers and own account workers	30	27	33	11	10	12	10	9	11
5 Lower supervisory and technical	41	37	45	18	16	20	12	11	14
6 Semi-routine	45	41	48	19	17	20	13	12	14
7 Routine	64	58	69	29	27	32	17	15	19
Ratio of classes 7:1	4.2	3.7	4.8	5.4	4.6	6.3	3.4	2.9	3.9

1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

Figure 5 Age-standardised mortality rates[1] for all circulatory diseases, ischaemic heart disease and cerebrovascular diseases by NS-SEC,[2] women aged 25–59, 2001–03

England and Wales



1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

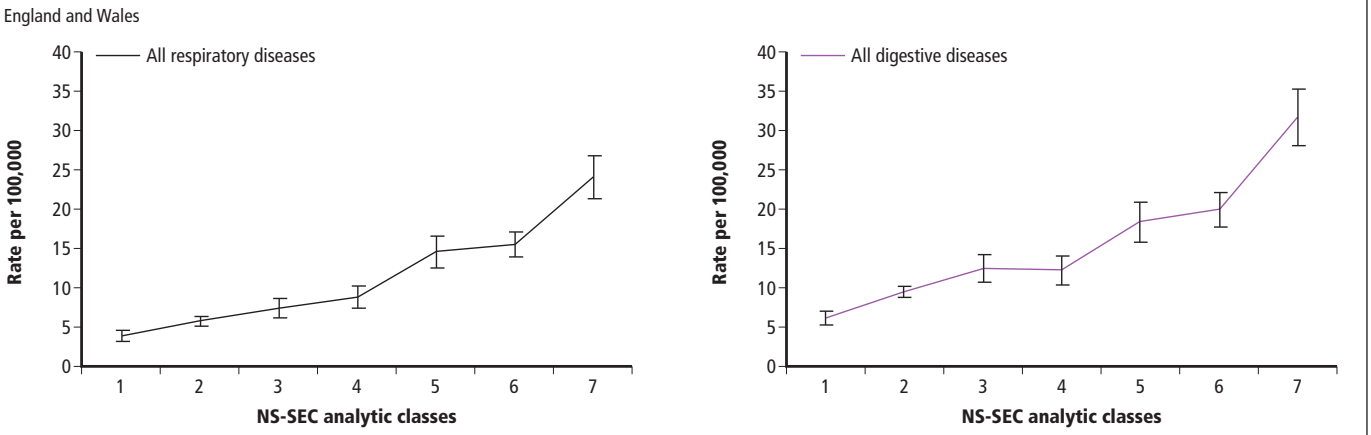
Table 5 Age-standardised mortality rates[1] from all respiratory and all digestive diseases by NS-SEC,[2] women aged 25–59, 2001–03

England and Wales — Rate per 100,000

NS-SEC analytic class	All respiratory diseases			All digestive diseases		
	Rate	Lower 95% confidence interval	Upper 95% confidence interval	Rate	Lower 95% confidence interval	Upper 95% confidence interval
1 Higher managerial and professional	4	3	5	6	5	7
2 Lower managerial and professional	6	5	6	9	9	10
3 Intermediate	7	6	9	12	11	14
4 Small employers and own account workers	9	7	10	12	10	14
5 Lower supervisory and technical	15	13	17	18	16	21
6 Semi-routine	16	14	17	20	18	22
7 Routine	24	21	27	32	28	35
Ratio of classes 7:1	6.2	5.0	7.5	5.2	4.3	6.2

1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

Figure 6 Age-standardised mortality rates[1] for all respiratory diseases and all digestive diseases by NS-SEC,[2] women aged 25–59, 2001–03



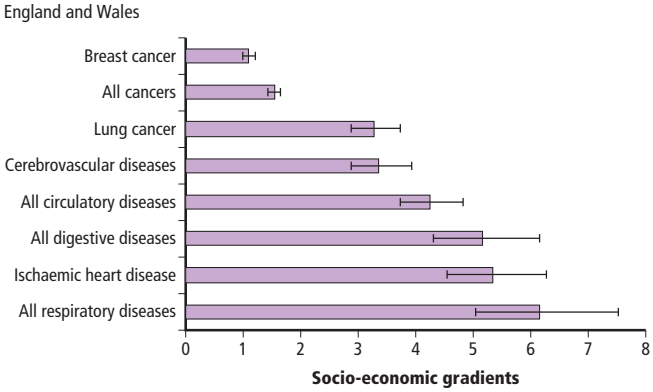
1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

Comparison of gradients by cause

Figure 7 shows the socio-economic gradients for each of the disease categories. The smallest gradients were for all cancers combined and for breast cancer. The highest gradients were for respiratory diseases, digestive diseases and ischaemic heart disease, for which women in the least advantaged classes had mortality rates more than five times that of women in the most advantaged classes.

For all diseases studied, mortality rates for those classed as small employers and own account workers (NS-SEC class 4) were significantly lower than those classed as lower supervisory and technical (NS-SEC class 5). There were no significant differences between the rates for class 5 and the rates for those classed as semi-routine workers (NS-SEC class 6). Rates for those classed as routine workers (NS-SEC class 7) were statistically significantly higher than those classed as semi-routine workers (NS-SEC class 6) for all causes of death studied.

Figure 7 Socio-economic gradients[1] by selected causes, women 25–59, 2001–03



1 Ratio of mortality rates of NS-SEC class 7 to the mortality rate of NS-SEC Class 1. NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

Mortality by selected region and cause

The socio-economic variation of mortality by cause across regions was examined only for the North West and the South West, the regions with the highest and lowest all-cause mortality rates for most NS-SEC classes. Owing to the lack of statistically significant variation between regions for all-cause mortality, only mortality rates for the two major causes of death 'All cancers' (48 per cent of deaths) and 'All circulatory diseases' (18 per cent of deaths) are displayed in Table 6 and illustrated in Figure 8.

The estimated mortality rates for the North West are generally higher than those in the South West and statistically significantly so for NS-SEC classes 2, 3, 4 and 6 for all cancers combined, and for all classes except NS-SEC class 3 for circulatory diseases. By contrast, the socio-economic gradients are not statistically significantly different between the two regions for either major cause of death.

Table 6 Age-standardised mortality rates[1] for selected causes and regions by NS-SEC,[2] women aged 25–59, 2001–03

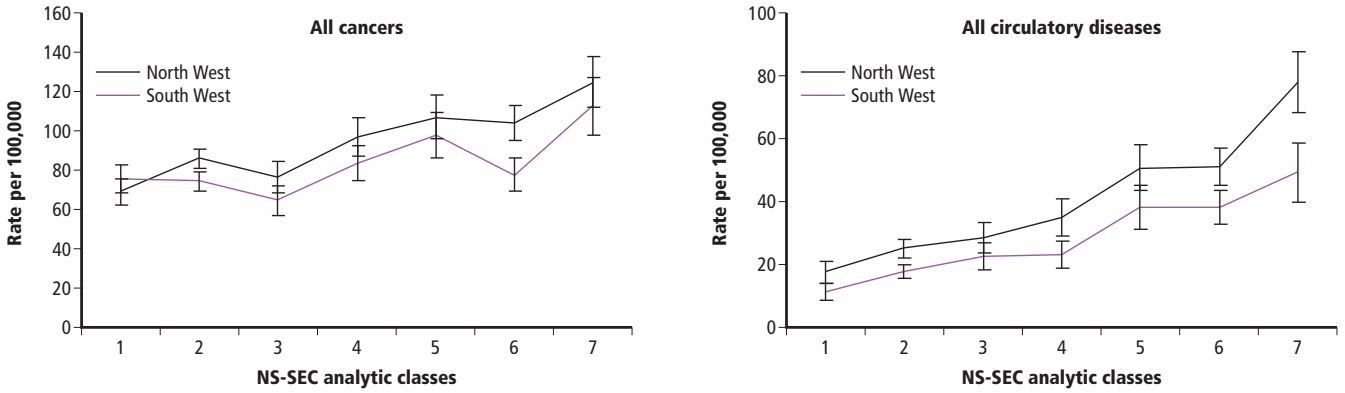
Rates per 100,000

NS-SEC analytic class	All cancers		All circulatory diseases	
	North West	South West	North West	South West
1 Higher managerial and professional	69	76	18	11
2 Lower managerial and professional	86	74	25	18
3 Intermediate	76	65	29	22
4 Small employers and own account workers	97	83	35	23
5 Lower supervisory and technical	107	98	51	38
6 Semi-routine	104	78	51	38
7 Routine	125	112	78	49
Ratio of classes 7:1	1.8	1.5	4.4	4.4

1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

Figure 8 Age-standardised mortality rates[1] for selected causes and regions by NS-SEC,[2] women aged 25–59, 2001–03

England and Wales



1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

Discussion

Regional mortality

The results show variation in mortality rates between regions, with rates in the North West and North East consistently higher for all classes than rates in the South West and South East. A 'north-south' divide was also reported by authors considering female mortality by deprivation of area of residence both in the 1990s[16] and in the period covered in this study.[17] A 'north west-south east divide' in self-reported health[23] was also reported where the authors found that each of the seven NS-SEC classes had 'higher rates of poor health in Wales, the North East and the North West regions of England than elsewhere'.

This analysis also found that regional differences in mortality were smaller for the most advantaged classes and greater for the least advantaged classes. The comparative insensitivity of the most advantaged classes to regional effects has also been found by authors working on local area deprivation.[17] That study found that 'those living in the least deprived areas had similar mortality rates, independent of region'. A similar pattern was reported in the third article in the current series which considered male socio-economic inequalities by region using NS-SEC.[3] On the other hand, for the least advantaged, differences in mortality were more apparent between regions. The North West had mortality rate of 367 all-cause deaths per 100,000 person-years while the East of England had a rate of 253 all-cause deaths per 100,000 person years. A similar effect was found in the analysis of men,[3] however the effect for men appeared to be stronger, since the mortality rate for the least advantaged class varied by approximately 80 per cent across regions, compared with a variation of approximately 45 per cent for women.

The current results do not indicate large regional variation in socio-economic gradients. The highest and lowest gradients were 2.1 and 3.0 respectively, but only two regions had significantly different socio-economic gradients to those for England and Wales as a whole. In the corresponding analysis of men[3] the gradients were similar, but there were significant differences in seven of the ten regions. This may be because relative differences between the sexes were smaller, or because the methodology adopted in the current analysis was not sufficiently sensitive to detect smaller differences.

The crucial aspect of the methodology that could affect the ability of this study to detect smaller differences involves the adjustments that have been made to the data to correct for the under-recording of occupation at death. These adjustments were made to correct for bias, but have necessarily resulted in larger confidence intervals for the estimates. Consequently there were difficulties in the detection of differences in smaller sub-samples, such as the smaller regions and also in smaller causes of death.

However, authors considering mortality by deprivation[16,17] have also found that although mortality rates increase with deprivation for both sexes, the relationship was generally stronger for males. Figures published by authors studying self-reported health[23] have indicated that relative differences between rates of those reporting 'not good' general health between the least and most advantaged NS-SEC classes for England were of the order of 2.7 for men, but only 2.2 for women. Hence there is some evidence in the literature that relative differences in regional socio-economic inequalities were smaller for women.

Many reasons have been suggested as to why there may be inequalities between regions, particularly in the most disadvantaged classes.[3] Theoretical explanations include suggestions that the regional differences in mortality are associated with regional differences in unemployment risk, selective migration, differential concentrations of deprived areas and material disadvantage, or differing geographic patterns in health-related behaviours.

It is well established that there is a higher prevalence of ill-health and excess mortality in men and women who are unemployed.[24,25] In addition, the authors suggested that job insecurity itself may constitute a psychosocial hazard to health. As unemployment and the risk of unemployment is greater in the north,[26] this implies greater psychosocial stress on both men and women, particularly on those in routine or semi-routine occupations. Women may be affected directly, but possibly also through their husbands' employment position, potentially leading to increased stress and consequent mortality for women in the north, and particularly for the more disadvantaged.

Another potential explanation of regional inequalities is that of selective migration.[27] This explanation suggests that those with good long-term health are more likely to move (for example to find work) while those with serious health problems are less likely to move and will have higher mortality rates. This is the so-called 'healthy migrant effect' which would lead to varying mortality rates between advantaged and disadvantaged areas. Some authors[28] however have questioned whether this is a significant effect at the regional level. There are also questions as to how relevant this factor is for female mortality, although others have found that gender made little difference to the likelihood of migrants moving to more advantaged areas.[29]

A further explanation of regional differences may be that regions in the north have a higher concentration of deprived neighbourhoods, whose

effect is not fully captured by the use of an occupational based socio-economic measure such as NS-SEC. A study[30] on cancer survival trends of males and females in England, for instance, found that survival was consistently lower for patients in the deprived Spearhead Primary Care Trust (PCT) Areas than for those resident in the rest of England. Most of these PCT areas are in the North, while there are none in the South West or South East. The disproportionate concentration of local deprivation may therefore be part of the explanation of the regional differences observed in the current study.

A related explanation is that regional differences may be directly related to material deprivation. Materialist explanations of inequalities suggest that individual incomes determine living conditions, including diet and housing quality, which consequently affect health and mortality.[24] Both income inequality and mean income have indeed been found to be associated with mortality[31] and it has been reported that in 2003–04 average incomes in the North East and the North West were among the smallest in England.[32]

Another explanation of the regional differences is that there may be regional differences in health-related behaviour between regions. Lifestyles have been recognised as contributing strongly to inequalities in mortality[33] and differences in the prevalence of smoking, in particular, have been found to account for much of the variation in mortality between areas.[34] More recently it has been shown in a study looking at self-reported health in women that the strongest independent effect on health was from smoking.[35] It is known that levels of smoking vary quite markedly over both regions and social class. The General Household Survey found that in England in 2001, 30 per cent of women living in households classified to the manual group smoked cigarettes, compared with 20 per cent of those in households classified as non-manual. The GHS also reported on variation by region with 29 per cent of women smoking in the North West in 2001, but only 22 per cent in the South West.[36] This would also seem to be a plausible explanation as to why more disadvantaged women in the north have a higher mortality rate than women in a similar position in the south.

Mortality by cause

Malignant neoplasms

The results presented here show a significant, but relatively small, socio-economic gradient for all cancers combined (1.5), a marked gradient for lung cancer (3.3) but no significant gradient for breast cancer.

Many authors have also found strong socio-economic effects in lung cancer mortality.[11,15] In addition, an international study[37] comparing mortality rates for 1981–85 with 1991–95, found that in four western European countries rates of mortality from lung cancer in women had risen over the decade. The authors also found that this rise had been greater for women with lower educational levels in three of the countries studied. It has been estimated[38] that eight in ten lung cancer deaths in women are smoking-attributable, so the socio-economic gradient observed in the current study may well reflect the differential smoking patterns in socio-economic groups.[36] Many authors[39,40] go further, postulating that 'the combination of the greatly increased mortality of smokers with the now much lower prevalence of smoking among the more affluent is the major contributor to the widening health inequalities'[39] and that 'scope for reducing health inequalities related to social position is limited unless many smokers in lower social positions stop smoking'.[39]

In contrast, a flat or inverse socio-economic gradient in breast cancer mortality has been well documented. A study of mortality covering the 1970s and 1980s, which based socio-economic status on tenure and car-ownership, found that breast cancer did not appear to differ significantly between socio-economic groups.[41] Later findings[11] using the Registrar General's Social Class (RGSC) covering the late 1990s found an inverse gradient in breast cancer mortality and concluded that this inverse gradient had increased over the period 1986–2000. An international study[42] also covering the 1990s found that in eight of the 11 European populations studied, women with a higher education level had a greater risk of dying from breast cancer than women of a lower educational level. It has been suggested that this pattern may be related to the rise in incidence of later childbearing, which is more prominent in women in more advantaged classes.[24,43]

The comparatively flat socio-economic pattern in breast cancer mortality found in this study is probably attributable to the fact that while breast cancer incidence is higher among more affluent women, survival is also higher among these groups. Breast cancer incidence has been rising steadily, both in the age range invited for breast screening (50–69 years) and at other ages.[44,45] Survival has also been rising, however.[46,47] Thus although overall five-year survival rose from 68 per cent for women diagnosed in the late 1980s to 80 per cent for women diagnosed in the late 1990s, the gap in survival between the most affluent and the most deprived was stable at around 6 per cent .

The results shown here for all cancers combined can be compared with those from an international study[48] of women aged 20–74 in seven countries that used educational qualifications as a proxy for socio-economic status. That study found an inverse gradient for all neoplasms in two eastern European countries, a small positive gradient in two Scandinavian countries and no significant gradient in the other three countries. The results presented here are more compatible with the Scandinavian results.

Circulatory diseases

This study found higher inequalities for all circulatory diseases and particularly for ischaemic heart disease, the socio-economic gradients were 4.3 and 5.4 respectively. Earlier authors looking at manual/non-manual mortality rate ratios for the 1980s[15] and 1990s[11] also found that ischaemic heart disease had a ratio more than twice that of breast cancer. An international comparison[48] also found stronger socio-economic gradients for cardiovascular disease than for all cancer amongst women.

The explanations that have been put forward for the existence of a socio-economic gradient for circulatory diseases have included differential behavioural factors, material circumstances and exposure to psychosocial hazards at work. Some[48] have suggested that inequalities in ischaemic heart disease could be due to a strong social patterning of behavioural risk factors (dietary factors, lack of physical activity, obesity) among women. Indeed, it has been found that in 2001, 30 per cent of women in routine occupations were obese compared with 16 per cent in higher managerial and professional occupations.[49] The authors[48] suggest that obesity may be a response of women to material disadvantage and/or psychosocial stressors. Support for psychosocial explanations comes from authors who found that high job strain and effort-reward imbalance seemed to increase the risk of cardio-vascular mortality in a study that included both sexes.[50] Others[51] have also claimed that much of the difference in incidence of coronary heart disease can be explained by differences in the psychosocial work environment, with additional contributions from behavioural factors such as smoking and from some life-course factors. The psychosocial explanation is more problematic for this study, as the combined indicator allocates a substantial minority of women to their husband's occupation, rather than their own.

Respiratory and digestive diseases

This study found that mortality rates from these diseases exhibited a similar pattern to that of mortality rates from IHD. It has been estimated[38] that over 80 per cent of deaths from chronic obstructive lung disease can be attributed to smoking. As this disease accounts for over 70 per cent of respiratory disease deaths, it seems that the prevalence of smoking among differing social classes would again be an important factor in explaining socio-economic gradients observed.

Approximately three-quarters of deaths from all digestive diseases are associated with liver disease. The relationship between alcohol consumption and liver disease is well founded[52,53] but the relationship between alcohol consumption and socio-economic position is complex. Surveys on alcohol consumption have reported that women in managerial and professional households are more likely than other women to have drunk alcohol in the last week,[36,54] and more likely to have drunk more in the week than other women[36]. However, it has also been found[54] that among women, those living in semi-routine and routine households were the most likely to indulge in binge drinking, that is drinking that exceeds twice the recommended daily limits. This later study also indicated that this drinking behaviour was far more common at younger ages. As other authors[55] have found that, for younger women, those in the manual classes were more likely to die from alcohol-related causes, binge drinking may be an important factor in explaining the socio-economic mortality gradient found in this study.

Another possible explanation may be related to the individual occupations included in the more disadvantaged classes. A recent study of alcohol-related mortality by occupation[56] found that, for women aged 20–64, the seven occupations with the highest alcohol-related mortality included bar staff, waitresses, hairdressers and elementary office occupations. Most of these occupations would primarily be classified as semi-routine or routine, and may therefore also partly explain the socio-economic gradient found in this study.

Mortality by selected region and cause

Only the two regions with highest and lowest all-cause mortality rates were compared for all cancers and all circulatory diseases. There was evidence of differences in mortality rates between the two regions in all classes but the socio-economic gradients, as measured by the ratio of the mortality rates between the least and most advantaged classes, were not statistically significant. This may be partly due to methodological difficulties in detecting small differences noted earlier. However, other authors[17] have also found relatively small differences between inequalities for these two diseases and regions. For instance, they found that the ratio of mortality rates between the first and fifth deprivation quintile for all cancers was 1.5 for the North West and 1.4 for the South West. For all circulatory diseases the ratio was 2.4 for both the North West and the South East.

Comparison with male mortality

The second article in this series described the socio-economic inequalities by cause of death for men aged 25–64.[2] However, mortality rates for the different diseases between the two articles are not directly comparable for three main reasons. The first is that since women in 2001 retired at 60, the working-age range was chosen to be 25–59, and so the age range is not comparable. The second reason is that it is well known that the effect of disease varies considerably between sexes. The final reason is that the male analysis was conducted using the man's 'own' NS-SEC, but the female analysis was done on a 'combined' quasi-household measure.

Given these provisos, although the mortality rates themselves are not comparable, the inequalities, that is the socio-economic gradients, may be compared. Table 7 presents the socio-economic gradients from the study of men alongside those presented above.

There are similarities in the patterns – inequalities in the diseases studied for both sexes are smallest for all cancers, but higher for lung cancer. In this study the gradients for lung cancer appear similar, other studies have also found that the ratio between most and least deprived were similar for males and females.[17] However, others[15,57] have found that women have an apparently greater relative risk than men of lung cancer.

The socio-economic gradient for ischaemic heart disease for women is markedly higher than that observed for men. A very similar pattern was observed in a study by area deprivation.[16,17] The inequalities for women seem also to be higher for respiratory and digestive diseases, but given the provisos mentioned earlier and the breadth of the confidence intervals it is difficult to draw any firm conclusion.

Table 7 Socio-economic gradients for males and females by selected causes

	Men[1]	Women[2]
All Cancer	1.8	1.5 *(1.4, 1.7)*
Cancer of Trachea, bronchus and lung	3.7	3.3 *(2.9, 3.7)*
All circulatory diseases	2.8	4.2 *(3.7, 4.8)*
Ischemic heart disease	2.9	5.4 *(4.6, 6.3)*
Cerebrovascular disease	2.9	3.4 *(2.9, 3.9)*
All respiratory diseases	4.9	6.2 *(5.0, 7.5)*
All digestive diseases	3.5	5.2 *(4.3, 6.2)*

1. From previous article in series[1]
2. 95% confidence interval in brackets

Limitations of the analysis

Owing to the very sparse recording of women's occupations at death after normal retirement age, it was necessary to restrict the analysis to women aged 25–59. Since only 8 per cent of adult women died age 59 or lower in the years 2001–03, this analysis is focused only on a minority of 'premature' deaths.

There are conceptual problems with the use of a 'combined' NS-SEC. NS-SEC is theoretically based on the employment relations of the individual, using the 'most advantaged' NS-SEC of a married couple implies that one can use the most advantaged NS-SEC of marriage partners as a proxy for the life-chances of each partner. This difficulty is fully discussed in the article on female all cause mortality.[4]

The results are sensitive to the adjustment to the deaths not classified to an occupied NS-SEC class. This adjustment was, of necessity, based on a relatively small sample (only 158 deaths) and resulted in much larger confidence intervals for the estimates presented than for the unadjusted figures. The unadjusted estimates are available for comparison in Appendix B, Table B1–B5. The size of the confidence intervals makes it much more difficult to detect differences in smaller sub-samples, and may partly explain why no significant differences between regional socio-economic gradients within causes were detected.

The outcome measure used throughout this series of articles, referred to above as the socio-economic gradient, has a number of limitations. As it is an age-standardised mortality ratio, it does not take account of the size of each class, nor what happens in the intervening classes. More complex outcome measures, such as the slope index of inequality or the GINI coefficient,[58] could potentially be used in future studies.

The death registers during the period of this study did not recognise civil partnerships, and thus women in such partnerships have been treated as 'single'. The identical definition was used to obtain the census populations so the results presented above are consistent. However there is an argument for treating women in partnerships in the same way as married women.

Conclusions

This analysis has estimated standardised mortality rates by 'combined' NS-SEC for women aged 25–59 in the period 2001–03 by region and cause of death.

A clear social gradient is evident for each region. Regional differences in absolute mortality rates were smaller for the most advantaged class, no region had a mortality rate statistically significantly different from

Key findings

- There were socio-economic differences in mortality for women across Wales and all the English regions for the period 2001–03, with higher mortality rates in the more disadvantaged classes
- Regional differences in mortality were small for the most advantaged classes and greatest for the least advantaged
- The socio-economic gradient did not vary considerably from region to region for all-cause mortality – only two regions had gradients that were significantly different from that of England and Wales as a whole
- Among the causes of death analysed there were marked socio-economic differences in all respiratory diseases, all digestive diseases including liver diseases, ischaemic heart disease, all circulatory diseases, cerebrovascular disease and lung cancer
- There was no significant difference between mortality rates for the most and least advantaged for breast cancer

the England and Wales rate. Differences between regions were more pronounced for the least advantaged, but only three regions had rates that were statistically significantly different from the England and Wales rate.

Mortality rates were significantly higher for the North West region than for England and Wales as a whole for most NS-SEC classes, while mortality rates were lower in the South West region for most NS-SEC classes. None of the regional socio-economic gradients (that is the ratio between mortality rates for the least and most advantaged) were statistically significantly higher than that for England and Wales, as a whole.

A social gradient was also evident for all causes of death studied except for breast cancer. For breast cancer the mortality rates for the least and most advantaged were not statistically significantly different. For the other diseases studied there were marked socio-economic differences. The most disadvantaged women had approximately three times the mortality rate of more advantaged women for lung cancer and cerebrovascular disease, around five times as high for ischaemic heart disease and digestive diseases, and six times as high for respiratory diseases.

Mortality rates for the regions with generally the lowest and highest mortality rates were compared for the two largest causes studied, 'all cancers' and 'all circulatory diseases'. There were statistically significant differences between the mortality rates of the two regions in most NS-SEC classes, but no statistically significant differences in the socio-economic gradient between the two regions.

In comparison to men, there were similarities in the pattern of inequalities between diseases. Inequalities were smallest for all cancer and largest for respiratory and digestive diseases. Inequalities for ischaemic heart disease were particularly high for women.

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Appendix A

Table A1 Number of deaths by NS-SEC[1] and age, women aged 25–59, 2001–03

Government Office Regions of England, Wales — Numbers

	Higher managerial and professional	Lower managerial and professional	Intermediate	Small employers and own account workers	Lower supervisory and technical	Semi-routine	Routine	Others[2]	Total
North West									
25–29	13	42	48	12	17	51	32	42	258
30–34	39	65	65	21	35	97	63	55	440
35–39	60	120	90	41	59	127	85	64	647
40–44	85	199	130	72	89	187	148	76	986
45–49	128	347	177	121	153	287	227	114	1,554
50–54	197	562	280	218	263	442	351	121	2,434
55–59	296	722	358	336	420	600	532	151	3,414
Total	818	2,058	1,148	820	1,035	1,793	1,438	623	9,733
Percentage	*8.4*	*21.1*	*11.8*	*8.4*	*10.6*	*18.4*	*14.8*	*6.4*	
North East									
25–29	3	13	15	4	5	21	11	13	86
30–34	9	20	21	7	14	33	21	19	143
35–39	14	42	20	16	22	50	28	22	213
40–44	18	80	46	27	40	66	50	31	358
45–49	53	123	69	41	59	92	94	40	570
50–54	67	221	104	72	122	160	161	53	960
55–59	93	228	130	78	186	249	239	65	1,269
Total	258	727	405	245	447	671	604	243	3,599
Percentage	*7.2*	*20.2*	*11.2*	*6.8*	*12.4*	*18.6*	*16.8*	*6.8*	
Yorkshire and The Humber									
25–29	11	29	25	7	8	48	28	26	182
30–34	23	62	40	19	21	48	32	27	273
35–39	42	101	42	36	36	86	67	37	448
40–44	53	140	70	50	58	142	101	40	654
45–49	105	216	112	80	104	168	136	56	977
50–54	134	343	155	146	151	253	208	58	1,446
55–59	184	428	229	214	280	397	353	85	2,170
Total	552	1,319	673	551	657	1,142	924	330	6,150
Percentage	*9.0*	*21.5*	*11.0*	*9.0*	*10.7*	*18.6*	*15.0*	*5.4*	
East Midlands									
25–29	9	24	17	8	6	22	22	18	125
30–34	24	44	29	17	22	53	30	26	245
35–39	36	85	45	28	30	67	38	29	359
40–44	59	124	54	41	44	103	72	33	531
45–49	90	165	91	67	84	144	98	41	780
50–54	148	320	144	116	128	219	185	56	1,318
55–59	184	431	191	212	235	332	313	78	1,976
Total	550	1,194	572	488	550	942	757	281	5,334
Percentage	*10.3*	*22.4*	*10.7*	*9.2*	*10.3*	*17.7*	*14.2*	*5.3*	
West Midlands									
25–29	14	19	26	8	13	32	23	24	158
30–34	18	52	33	16	22	63	41	30	275
35–39	34	86	52	29	43	66	54	33	397
40–44	88	150	75	44	66	118	97	38	676
45–49	91	198	93	83	102	207	136	52	962
50–54	161	381	187	147	206	323	244	77	1,726
55–59	239	501	230	229	323	452	342	87	2,404
Total	646	1,386	695	555	776	1,262	937	341	6,598
Percentage	*9.8*	*21.0*	*10.5*	*8.4*	*11.8*	*19.1*	*14.2*	*5.2*	
East of England									
25–29	15	46	27	5	9	31	14	18	166
30–34	32	62	47	20	20	46	30	30	287
35–39	53	103	62	33	29	91	47	35	453
40–44	81	126	80	56	48	101	61	33	586
45–49	136	221	126	88	90	161	95	49	965
50–54	199	396	209	161	146	253	149	60	1,574
55–59	308	543	284	246	217	354	198	80	2,231
Total	824	1,498	835	609	559	1,037	594	305	6,262
Percentage	*13.2*	*23.9*	*13.3*	*9.7*	*8.9*	*16.6*	*9.5*	*4.9*	
London									
25–29	31	60	37	17	15	53	27	48	288
30–34	47	107	74	25	30	88	48	74	494
35–39	88	180	115	50	50	114	67	99	763
40–44	121	246	167	68	64	152	100	96	1,014
45–49	150	305	171	92	98	218	114	108	1,256
50–54	187	455	278	176	126	322	189	123	1,857
55–59	248	572	375	269	222	429	307	143	2,565
Total	873	1,925	1,216	698	606	1,377	850	692	8,237
Percentage	*10.6*	*23.4*	*14.8*	*8.5*	*7.4*	*16.7*	*10.3*	*8.4*	

1 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

2 Includes full-time students, never worked, long-term unemployed, inadequately described and not classified for other reasons.

Table A1 continued **Number of deaths by NS-SEC[1] and age, women aged 25–59, 2001–03**

Government Office Regions of England, Wales — Numbers

	Higher managerial and professional	Lower managerial and professional	Intermediate	Small employers and own account workers	Lower supervisory and technical	Semi-routine	Routine	Others[2]	Total
South East									
25–29	29	54	34	8	14	46	28	32	246
30–34	61	108	57	22	30	70	44	39	431
35–39	102	177	87	36	61	90	63	57	673
40–44	155	226	129	78	82	150	82	59	961
45–49	217	334	170	112	116	197	115	70	1,330
50–54	345	643	306	192	206	298	187	103	2,280
55–59	456	871	412	304	339	479	310	127	3,297
Total	1,365	2,414	1,195	752	848	1,329	828	486	9,218
Percentage	*14.8*	*26.2*	*13.0*	*8.2*	*9.2*	*14.4*	*9.0*	*5.3*	
South West									
25–29	10	20	18	6	10	26	20	18	128
30–34	22	59	40	14	11	38	28	17	229
35–39	49	87	51	30	45	58	44	28	393
40–44	76	127	64	45	48	107	52	38	559
45–49	107	232	109	91	92	158	102	48	939
50–54	170	391	160	166	146	236	142	61	1,472
55–59	217	518	218	285	225	318	212	78	2,071
Total	651	1,434	660	638	578	940	601	289	5,791
Percentage	*11.2*	*24.8*	*11.4*	*11.0*	*10.0*	*16.2*	*10.4*	*5.0*	
Wales									
25–29	6	14	12	5	5	17	13	13	84
30–34	9	40	25	13	15	28	19	24	174
35–39	16	55	30	12	21	51	38	33	255
40–44	34	92	49	40	30	61	64	35	405
45–49	49	149	65	59	71	107	88	45	632
50–54	86	213	92	85	113	158	140	49	936
55–59	126	312	166	161	191	239	233	71	1,499
Total	*326*	*873*	*439*	*375*	*445*	*661*	*596*	*270*	*3,985*
Percentage	*8.2*	*21.9*	*11.0*	*9.4*	*11.2*	*16.6*	*14.9*	*6.8*	

1 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.
2 Includes full-time students, never worked, long-term unemployed, inadequately described and not classified for other reasons.

Table A2 **Number of deaths by NS-SEC,[1] cause[2] and age, women aged 25–59, 2001–03**

England and Wales — Numbers

	Higher managerial and professional	Lower managerial and professional	Intermediate	Small employers and own account workers	Lower supervisory and technical	Semi-routine	Routine	Others[3]	Total
All malignant neoplasms									
25–29	54	99	58	21	30	64	32	28	387
30–34	138	270	137	60	65	123	83	44	921
35–39	270	477	218	133	156	248	145	79	1,727
40–44	472	774	366	260	228	423	270	105	2,897
45–49	730	1,289	574	439	468	721	430	182	4,832
50–54	1,142	2,363	1,035	857	867	1,217	843	245	8,568
55–59	1,589	3,110	1,439	1,316	1,371	1,805	1,349	327	12,307
Total	4,395	8,383	3,827	3,086	3,186	4,600	3,150	623	31,639
Percentage	*13.9*	*26.5*	*12.1*	*9.8*	*10.1*	*14.5*	*10.0*	*2.0*	
Breast cancer									
25–29	12	15	9	5	5	5	5	2	59
30–34	47	79	43	17	15	30	24	10	266
35–39	129	197	93	45	51	102	50	24	691
40–44	198	321	143	90	85	136	92	34	1,098
45–49	292	455	192	120	155	207	121	59	1,601
50–54	410	738	305	229	241	341	201	61	2,526
55–59	484	881	380	314	286	372	278	76	3,072
Total	1,572	2,687	1,165	821	839	1,194	771	265	9,313
Percentage	*16.9*	*28.9*	*12.5*	*8.8*	*9.0*	*12.8*	*8.3*	*2.8*	

1 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.
2 Younger age bands have been amalgamated where necessary due to avoid statistical disclosure issues.
3 Includes full-time students, never worked, long-term unemployed, inadequately described and not classified for other reasons.

Table A2 continued

Number of deaths by NS-SEC,[1] cause[2] and age, women aged 25–59, 2001–03

England and Wales

Numbers

	Higher managerial and professional	Lower managerial and professional	Intermediate	Small employers and own account workers	Lower supervisory and technical	Semi-routine	Routine	Others[3]	Total
Cancer of trachea, bronchus and lung									
25–39	10	22	11	8	12	14	21	8	107
40–44	24	55	29	23	23	45	28	10	238
45–49	67	137	69	72	72	130	72	27	646
50–54	121	326	155	145	155	229	183	46	1,359
55–59	182	462	232	255	280	420	349	76	2,257
Total	405	1,003	496	503	541	838	653	168	4,607
Percentage	*8.8*	*21.8*	*10.8*	*10.9*	*11.8*	*18.2*	*14.2*	*3.6*	
All circulatory diseases									
25–29	15	38	23	6	8	34	17	22	162
30–34	19	57	54	22	37	65	39	39	333
35–39	57	136	85	53	59	129	78	65	663
40–44	92	216	134	85	113	221	168	83	1,111
45–49	144	385	207	148	195	376	252	119	1,826
50–54	188	590	316	270	298	558	424	171	2,816
55–59	355	840	457	483	577	895	753	235	4,594
Total	870	2,261	1,276	1,068	1,287	2,277	1,730	735	11,505
Percentage	*7.6*	*19.7*	*11.1*	*9.3*	*11.2*	*19.8*	*15.0*	*6.4*	
Ischaemic heart disease									
25–34	4	13	7	3	10	16	10	9	72
35–39	15	23	21	17	16	37	21	16	166
40–44	26	54	42	19	37	72	65	30	345
45–49	41	114	70	54	81	154	112	48	675
50–54	66	220	120	103	132	238	203	77	1,160
55–59	160	374	217	213	285	433	394	122	2,198
Total	311	798	477	409	562	951	806	303	4,616
Percentage	*6.7*	*17.3*	*10.3*	*8.9*	*12.2*	*20.6*	*17.5*	*6.6*	
Cerebrovascular disease									
25–29	5	9	10	3	3	16	4	8	57
30–34	5	27	23	7	13	19	13	11	118
35–39	20	57	31	18	18	40	28	19	230
40–44	38	89	46	32	41	78	49	24	396
45–49	56	168	71	49	61	119	76	32	632
50–54	73	201	104	94	92	166	122	43	894
55–59	106	239	129	152	155	224	173	54	1,232
Total	303	789	413	355	383	661	465	190	3,559
Percentage	*8.5*	*22.2*	*11.6*	*10.0*	*10.8*	*18.6*	*13.1*	*5.4*	
All respiratory diseases									
25–29	3	10	16	5	5	20	9	11	79
30–34	9	19	16	11	16	30	15	16	132
35–39	13	30	20	10	18	37	26	28	183
40–44	21	58	30	23	33	64	45	29	303
45–49	24	64	50	42	41	97	74	50	443
50–54	65	159	88	74	123	198	185	76	968
55–59	91	281	172	139	224	354	309	115	1,686
Total	226	621	393	306	460	800	663	325	3,794
Percentage	*6.0*	*16.4*	*10.3*	*8.1*	*12.1*	*21.1*	*17.5*	*8.6*	
All digestive diseases									
25–29	5	6	12	4	6	19	7	12	72
30–34	16	37	34	11	17	58	36	35	244
35–39	30	75	63	24	39	78	68	54	430
40–44	40	139	93	50	71	146	116	79	733
45–49	81	196	119	80	102	180	188	98	1,045
50–54	91	292	165	105	137	243	188	91	1,311
55–59	103	290	168	151	192	274	225	84	1,487
Total	367	1,035	653	424	564	998	827	454	5,322
Percentage	*6.9*	*19.5*	*12.3*	*8.0*	*10.6*	*18.8*	*15.5*	*8.5*	

1 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.

2 Younger age bands have been amalgamated where necessary due to avoid statistical disclosure issues.

3 Includes full-time students, never worked, long-term unemployed, inadequately described and not classified for other reasons.

Table A3 **Population[1] by NS-SEC[2] and age, women aged 25–59, 2001–03**

Government Office Regions of England, Wales — Thousands

	Higher managerial and professional	Lower managerial and professional	Intermediate	Small employers and own account workers	Lower supervisory and technical	Semi-routine	Routine	Others[3]	Total
North West									
25–29	69	170	109	22	40	98	50	55	611
30–34	110	209	116	41	54	116	61	42	749
35–39	127	227	115	55	61	117	62	34	798
40–44	118	214	103	57	60	101	54	27	733
45–49	103	195	89	54	56	84	47	22	650
50–54	96	188	93	64	59	93	53	19	666
55–59	74	157	87	62	60	95	58	18	612
Total	697	1,361	712	354	389	704	384	218	4,819
Percentage	*14.5*	*28.2*	*14.8*	*7.4*	*8.1*	*14.6*	*8.0*	*4.5*	
North East									
25–29	20	55	39	7	15	39	21	21	218
30–34	31	70	42	13	23	48	27	16	270
35–39	38	81	44	18	27	50	29	13	300
40–44	38	80	41	18	28	45	26	11	287
45–49	33	74	35	17	26	36	23	9	253
50–54	30	69	33	19	27	39	25	8	249
55–59	23	55	29	17	25	36	26	8	218
Total	212	485	263	107	172	293	178	85	1,795
Percentage	*11.8*	*27.0*	*14.7*	*6.0*	*9.6*	*16.3*	*9.9*	*4.7*	
Yorkshire and The Humber									
25–29	51	123	75	18	32	74	44	38	455
30–34	77	150	79	35	45	91	53	28	558
35–39	88	162	78	44	51	91	52	21	586
40–44	83	156	72	44	50	80	45	17	546
45–49	73	142	62	42	45	65	39	14	481
50–54	68	138	66	49	48	75	43	12	500
55–59	52	112	62	46	47	78	47	12	455
Total	492	983	494	278	317	554	323	141	3,581
Percentage	*13.7*	*27.5*	*13.8*	*7.8*	*8.9*	*15.5*	*9.0*	*3.9*	
East Midlands									
25–29	46	107	61	15	28	57	35	26	374
30–34	75	133	66	29	40	70	45	20	478
35–39	88	142	64	37	43	70	44	16	504
40–44	79	132	59	38	42	62	39	12	465
45–49	69	122	53	37	38	55	34	9	418
50–54	66	119	56	44	42	61	39	8	435
55–59	52	102	54	43	42	66	44	9	413
Total	476	857	413	243	277	440	280	100	3,087
Percentage	*15.4*	*27.8*	*13.4*	*7.9*	*9.0*	*14.3*	*9.1*	*3.2*	
West Midlands									
25–29	55	134	79	19	35	78	41	39	479
30–34	87	163	87	35	46	94	51	29	591
35–39	101	171	83	44	50	93	48	23	614
40–44	94	160	72	44	49	82	42	18	561
45–49	83	148	65	44	45	72	38	15	509
50–54	78	140	66	51	49	77	43	13	517
55–59	66	125	69	50	52	86	51	12	512
Total	565	1,041	520	286	325	581	313	149	3,781
Percentage	*15.0*	*27.5*	*13.7*	*7.6*	*8.6*	*15.4*	*8.3*	*3.9*	
East of England									
25–29	74	158	87	20	33	64	33	28	497
30–34	118	189	92	39	41	73	37	21	609
35–39	138	201	88	52	45	75	36	17	653
40–44	123	186	80	52	43	68	30	13	595
45–49	106	174	75	50	40	61	27	11	544
50–54	101	175	84	61	44	70	32	9	577
55–59	79	151	83	59	45	80	37	10	543
Total	739	1,234	588	334	291	491	233	110	4,020
Percentage	*18.4*	*30.7*	*14.6*	*8.3*	*7.2*	*12.2*	*5.8*	*2.7*	
London									
25–29	209	349	165	32	39	90	43	106	1,033
30–34	236	332	153	51	41	96	44	72	1,026
35–39	206	303	138	64	43	94	43	57	946
40–44	151	243	114	61	40	84	37	41	771
45–49	114	205	96	54	34	68	31	29	630
50–54	96	188	95	54	33	67	31	21	585
55–59	72	158	91	47	35	71	34	17	525
Total	1,084	1,777	852	363	263	571	263	342	5,516
Percentage	*19.7*	*32.2*	*15.5*	*6.6*	*4.8*	*10.3*	*4.8*	*6.2*	

1 Population optimised for mortality analysis as described in Methods.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.
3 Includes full-time students, never worked, long-term unemployed, inadequately described and not classified for other reasons.

Table A3 continued **Population[1] by NS-SEC[2] and age, women aged 25–59, 2001–03**

Government Office Regions of England, Wales — Thousands

	Higher managerial and professional	Lower managerial and professional	Intermediate	Small employers and own account workers	Lower supervisory and technical	Semi-routine	Routine	Others[3]	Total
South East									
25–29	126	239	124	28	44	84	45	43	734
30–34	207	287	132	55	55	94	45	30	905
35–39	243	309	129	75	61	97	47	25	986
40–44	222	288	116	75	58	88	40	19	906
45–49	188	265	108	72	52	78	34	15	810
50–54	174	268	123	85	57	89	37	13	847
55–59	137	238	124	83	60	102	45	13	802
Total	1,298	1,894	856	474	386	632	292	158	5,989
Percentage	*21.7*	*31.6*	*14.3*	*7.9*	*6.5*	*10.6*	*4.9*	*2.6*	
South West									
25–29	51	126	68	18	32	62	31	25	413
30–34	84	161	75	38	41	71	36	19	526
35–39	101	175	74	50	45	73	35	16	570
40–44	98	168	68	53	42	67	30	12	539
45–49	86	159	65	54	38	60	26	10	500
50–54	84	162	72	67	41	68	30	9	532
55–59	68	144	71	68	42	78	36	10	518
Total	573	1,096	494	348	283	480	224	101	3,598
Percentage	*15.9*	*30.5*	*13.7*	*9.7*	*7.9*	*13.3*	*6.2*	*2.8*	
Wales									
25–29	23	67	40	9	19	41	22	22	245
30–34	37	85	43	19	27	49	27	17	303
35–39	44	93	42	25	30	50	28	14	326
40–44	42	92	39	26	29	45	23	11	307
45–49	39	86	35	27	26	39	21	10	282
50–54	38	85	35	33	28	41	24	9	295
55–59	31	73	33	32	28	43	25	10	275
Total	254	581	267	172	187	308	171	93	2,033
Percentage	*12.5*	*28.6*	*13.1*	*8.5*	*9.2*	*15.2*	*8.4*	*4.6*	

1 Population optimised for mortality analysis as described in Methods.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have been applied as described in Methods.
3 Includes full-time students, never worked, long-term unemployed, inadequately described and not classified for other reasons.

Appendix B

Table B1 **Age Standardised mortality rates[1] by NS-SEC[2] without adjustments for under-recording of occupation at death, women aged 25–59, 2001–03**

Government Office Regions of England, Wales — Rate per 100,000

	NS-SEC analytic class							Socio-economic gradient[3]	
	1	2	3	4	5	6	7	Without adjustments	With adjustment
North East	112	139 H	133	171	200 H	183	271 H	2.4	2.6
North West	112	143 H	136 H	171 H	200 H	201 H	294 H	2.6	3.0
Yorkshire and The Humber	109	128	117	155	163	168	238	2.2	2.4
East Midlands	113	133	117	154	155 L	169	215 L	1.9	2.1
West Midlands	109	127	114 L	147	188	177	240	2.2	2.5
East of England	113	116 L	123	139	150 L	163	194 L	1.7	2.1
London	105	122	135 H	164 H	168	185 H	233	2.2	3.0
South East	107	121 L	118	120 L	170	153 L	208 L	2.0	2.5
South West	106	120 L	110 L	133 L	165	150 L	206 L	1.9	2.4
Wales	115	136	136	160	183	162	276 H	2.4	2.7
England and Wales	110	128	124	148	175	172	239	2.2	2.6

1 Directly standardised rate using the European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have NOT been applied as described in Methods.
3 Ratio of mortality rates of NS-SEC class 7 to the mortality rate of NS-SEC class 1.

H Rate is statistically significantly higher than that for England and Wales.
L Rate is statistically significantly lower than that for England and Wales.

Table B2 **Age-standardised mortality rates[1] from selected malignant neoplasms by NS-SEC,[2] women aged 25–59, 2001–03**

England and Wales — Rate per 100,000

NS-SEC analytic class	All malignant neoplasms			Trachea, bronchus and lung			Breast cancer		
	Rate	Lower 95% confidence interval	Upper 95% confidence interval	Rate	Lower 95% confidence interval	Upper 95% confidence interval	Rate	Lower 95% confidence interval	Upper 95% confidence interval
1 Higher managerial and professional	73	71	75	7	6	7	26	25	27
2 Lower managerial and professional	75	73	76	9	8	10	24	23	25
3 Intermediate	66	63	68	8	7	9	20	19	22
4 Small employers and own account workers	82	79	85	13	12	14	22	21	24
5 Lower supervisory and technical	92	89	96	15	14	17	25	23	26
6 Semi-routine	77	75	80	14	13	15	20	19	22
7 Routine	98	95	102	21	19	22	24	22	26
Ratio 7:1	1.4	1.3	1.4	3.0	2.7	3.4	0.9	0.9	Rate

1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have NOT been applied.

Table B3 **Age-standardised mortality rates[1] from selected circulatory diseases by NS-SEC,[2] women aged 25–59, 2001–03**

England and Wales — Rate per 100,000

NS-SEC analytic class	All circulatory diseases			Ischaemic heart disease			Cerebrovascular diseases		
	Rate	Lower 95% confidence interval	Upper 95% confidence interval	Rate	Lower 95% confidence interval	Upper 95% confidence interval	Rate	Lower 95% confidence interval	Upper 95% confidence interval
1 Higher managerial and professional	13	12	14	5	4	5	5	4	5
2 Lower managerial and professional	19	18	20	7	6	7	7	6	7
3 Intermediate	19	18	20	7	6	8	7	6	7
4 Small employers and own account workers	27	25	28	10	9	11	9	8	10
5 Lower supervisory and technical	34	32	36	15	13	16	11	9	12
6 Semi-routine	35	34	37	15	13	16	11	10	12
7 Routine	51	48	54	24	22	26	14	13	15
Ratio 7:1	3.8	3.5	4.1	5.0	4.4	5.7	3.0	2.6	3.4

1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have NOT been applied.

Table B4 **Age-standardised mortality rates[1] from all respiratory and all digestive diseases by NS-SEC,[2] women aged 25–59, 2001–03**

England and Wales — Rate per 100,000

NS-SEC analytic class	All respiratory diseases			All digestive diseases		
	Rate	Lower 95% confidence interval	Upper 95% confidence interval	Rate	Lower 95% confidence interval	Upper 95% confidence interval
1 Higher managerial and professional	3	3	4	5	5	6
2 Lower managerial and professional	5	4	5	8	8	9
3 Intermediate	5	4	6	9	8	10
4 Small employers and own account workers	7	6	8	10	9	11
5 Lower supervisory and technical	11	10	13	14	13	15
6 Semi-routine	11	10	12	14	13	15
7 Routine	18	17	20	24	22	26
Ratio 7:1	5.8	4.9	6.8	4.5	4.0	5.2

1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have NOT been applied.

Table B5 **Age-standardised mortality rates[1] for selected causes and regions by NS-SEC,[2] women aged 25–59, 2001–03**

Rate per 100,000

NS-SEC analytic class	All cancers		All circulatory diseases	
	North West	South West	North West	South West
1 Higher managerial and professional	66	74	15	10
2 Lower managerial and professional	82	72	23	16
3 Intermediate	68	59	22	19
4 Small employers and own account workers	91	80	31	21
5 Lower supervisory and technical	95	90	43	33
6 Semi-routine	88	67	40	31
7 Routine	105	96	64	39
Ratio 7:1	1.6	1.3	4.1	3.8

1 Directly age-standardised using European standard population.
2 NS-SEC assigned by the 'combined' method whereby if married the most advantaged class of either the woman or her husband is used to represent the woman's classification. Adjustments for the under-recording of death have NOT been applied.

Demographic, behavioural and socio-economic influences on the survival of retired people – Evidence from a ten year follow up study of the General Household Survey, 1994

Brian Johnson and Ann Langford
Office for National Statistics

This article reports on a longitudinal analysis of a sample of residents who were aged 65 or over when interviewed for the 1994 General Household Survey. It investigates the associations between various personal characteristics as established at the interview and the probability of survival during a ten year follow-up period.

Smoking was the most important factor of those measured in determining the likelihood of survival. Smokers at the time of the interview had a mortality risk, on average, 78 per cent greater than non-smokers. Non-drinkers and those who had less than one unit of alcohol per week at the time of the interview appeared to have a higher mortality risk than those who drank between one unit and the recommended government maximum per week. However, further analysis suggested that this result might be a product of the health status of individuals at the time of the interview. Type of housing tenure and region of residence were better predictors of mortality risk than occupation-based social class.

Introduction

Analysis of factors determining health inequalities has traditionally focused on the working population, often as a consequence of the relative ease of data collection for people in those age ranges. It is also important from a policy perspective to measure determinants of ill-health and mortality at older ages and to ascertain whether the various factors have the same relative influence on health as for the working population.

The General Household Survey (GHS) questions a sample of people on a range of subjects relating to their life. These range from socio-economic status to health, car ownership, drinking and smoking habits. This article reports on a secondary analysis of respondents who were aged 65 and over when they were interviewed for the1994 General Household Survey.[1] By tracing the respondents at the National Health Service Central Register (NHSCR), it was possible to investigate the associations between the probability of survival of subjects during a ten year period from the date of the survey interview, and various personal characteristics as established at that interview. The variables in the analysis included personal characteristics such as sex and age, behavioural factors, such as drinking and smoking, and socio-economic factors such as Registrar General's social class, housing tenure and car ownership.

Background

In 1996, the Department of Health commissioned the Office for National Statistics (ONS) Social Survey Division to carry out a follow-up survey of people who were aged 65 and over when interviewed on the 1994 GHS. The aim of the survey was to investigate the feasibility of collecting longitudinal data from this population, with a view to measuring healthy life expectancy.

About 2,500 people aged 65 and over in England and living in private households were interviewed on the 1994 GHS and gave agreement in principle to being approached again. A sub-sample of about 1,000 elderly people were re-interviewed in March and April 1997, on average 2½ years after the original GHS interview. A technical report including a preliminary analysis of the data was published in 1998.[2] The data discussed in this article are exclusively from the original survey.

Respondents were initially interviewed for the GHS between April 1994 and March 1995. Prior to the follow-up interview, respondents to the original interview were traced and flagged on the National Health Service Central Register (NHSCR). The main reason for doing this was to allow the removal from the follow-up sample of respondents who had died since the GHS interview, but all eligible GHS respondents in England were flagged, not just those included in the follow-up. In all, 2,249 respondents were successfully traced and flagged – 92.5 per cent of the names supplied to NHSCR, and 87 per cent of the original sample of GHS respondents.

NHSCR supplied details of deaths notified up to June 2005. The information supplied included the date of death and the cause (coded to the International Classification of Diseases (ICD) Version 9 or 10, depending on the date of death). This additional information was added to the1994 GHS dataset for those aged 65 and over.

No information is available on the profile of those flagged and included in the study relative to those originally interviewed but not included or not traced at NHSCR, but the structure of the final dataset used, for example in terms of proportion of smokers, proportion in poor health, was similar to the total sample as reported in the GHS for 1994.[1]

Since work on this project began, a study using the English Longitudinal Study of Ageing (ELSA)[10] has produced a more detailed survival analysis on a larger dataset. The current study adds value by providing findings based on a different dataset to compare with the ELSA results. It also investigates the effect on the results of potential health selection by repeating the analysis excluding those respondents with reported poor health at the outset.

Methods

The first part of the analysis examines the effect of the variables shown in Box One on mortality rates. For each variable, the percentage of the sample population who died during the follow up period was calculated, along with an age-standardised annual mortality rates for both men and women. This was done using a survival analysis in Stata and the European standard population in five-year age bands.

The second part of the analysis examines the effect of combinations of variables on mortality rates using Cox proportional hazards models.[3] This technique was chosen since it takes account of both the outcome, in terms of whether or not a subject survives the term of the study, and the survival time for those who died during the course of the study. The models are multivariate and hence allow the examination of the effect of one variable while controlling for the effect of others.

The initial model was obtained using a forward stepwise approach to the Cox proportional hazards models. This was done by including age and sex in the initial model and then adding in the variables in Box One in turn and retaining them on the basis of their significance level in the explanation of survival. The order of inclusion was informed by the framework devised by Dahlgren and Whitehead 1991[9] which suggested the following 'layers of influence' on health:

- age, sex, hereditary factors
- individual lifestyle factors (or behaviours)
- social and community networks
- living and working conditions
- general socio-economic, cultural and environmental conditions

While all these factors are interdependent, with health being a cause as well as an effect, this is to some extent a hierarchical structure with the most powerful determinants those 'closest' and most specific to the individual (age and sex followed by behavioural factors).

Likelihood ratio tests were used to determine significance. In order to allow for the non-linear effect of age, methods of representing age were examined, including a quadratic effect and stratifying the model into three age groups. Using this latter method the model was compliant with the Cox proportional hazards assumption.[3]

Subsequent models examined the effect of the potential problem of health selection. This phenomenon is well documented,[4,5,6] and is a particular problem for survival analysis. The problem arises when a subset of the sample has a higher than average *ex ante* probability of death, which is not accounted for in the design of the model. Unless

Box one

Variables included in this analysis

Variables	Definition
Demographic variables	
Marital Status	Married/cohabiting or Other (single/divorced/separated/widowed)
Behavioural variables	
Smoking	Current smoker or non-smoker
Alcohol consumption	Average weekly units 'negligible' less than one unit per week 'moderate' 1 to 21 units per week (men) 1 to 14 units (women) 'heavy' greater than 21 units (men) greater than 14 units (women)
Socio-economic variables	
Tenure	Owns/rents
Availability of car	None/with car
Registrar General's Social Class (RGSC)	Own RGSC Occupation was originally classified to Socio-economic Group (SEG): this was subsequently mapped to RGSC
General environmental variables	
Region	Region of residence Northern and Western including the North, Yorkshire and Humberside North West and West Midlands Southern and Eastern including the East Midlands, East Anglia, Greater London, Outer Metropolitan area, Outer South East and South West.

this factor is corrected for, results examining longer-term mortality rates are likely to be biased and misleading. To examine the size of this effect, a secondary model was fitted solely for the population that was not suffering from a limiting longstanding illness at the beginning of the study, according to the response to a question on health, thus excluding most of those who were already ill when follow-up started. Those who were excluded were both more likely to die sooner and to have a higher propensity to modify their behaviour in response to illness or treatment.

Results

Part 1 Mortality percentages in relation to single variables

Ten years after the GHS interview, 43 per cent of the respondents in the study had died – 50 per cent of men and 39 per cent of women. As would be expected, mortality increased with age, so that 88 per cent of those aged 85 and over at the time of the GHS interview had died ten years later, compared with only 24 per cent of those aged 65–69 (Table 1).

Table 1 **Percentage of deaths during the analysis period and age-standardised[1] annual mortality rate by age group and sex**

England

Age range	Percentage who had died			*Base=100% unweighted sample*		
	Men	Women	Total	Men	Women	Total
65–69	31	17	24	*326*	*352*	*678*
70–74	44	34	39	*320*	*375*	*695*
75–79	68	41	52	*158*	*232*	*390*
80–84	72	58	63	*112*	*172*	*284*
85 and over	91	87	88	*58*	*120*	*178*
All aged 65 and over	50	39	43	*974*	*1,251*	*2,225*
Age -standardised annual mortality rate[1]	5.4	3.2	4.1			

1 Directly age-standardised using 5-year age bands and the European standard population. Rates are expressed as the number of deaths per 100 person years.

Demographic variables

Men who were widowed were more likely to have died than men who were married or those who were single, divorced or separated (66 per cent compared with 46 per cent and 48 per cent respectively). Women who were married at the outset had a lower annual mortality rate than those who were not married, a rate of 2.6 per 100 person-years relative to 3.5 per 100 person-years for non-married women (Table 2).

Table 2 **Percentage who died during the analysis period and age-standardised annual mortality rate[1] by sex and marital status**

England

Marital status	Percentage who had died			Age-standardised annual mortality rates[1]			*Base=100% unweighted sample*		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Married/cohabiting	**46**	**29**	**39**	**5.2**	**2.6**	**4.0**	***704***	***532***	***1,236***
Other	**60**	**45**	**49**	**6.0**	**3.5**	**4.2**	***270***	***719***	***989***
Single/divorced/ separated	48	48	48	4.8	4.5	4.7	*88*	*133*	*221*
Widowed	66	45	50	6.7	3.2	3.9	*182*	*586*	*768*
All aged 65 and over	**50**	**39**	**43**	**5.4**	**3.2**	**4.1**	***974***	***1,251***	***2,225***

1 Directly age-standardised using the European standard population. Rates are expressed as the number of deaths per 100 person years.

Behavioural variables

Men and women who were current smokers were more likely to have died than ex-regular smokers and those who had never smoked regularly. Both male and female current smokers had annual mortality rates more than twice those of sample members who had never smoked.

Table 3 **Percentage who died during the analysis period and age-standardised annual mortality rate[1] by sex and cigarette smoking**

England

Smoking status	Percentage who had died			Age-standardised annual mortality rates[1]			Base=100% unweighted sample		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Current smoker	**61**	**46**	**53**	**8.5**	**5.6**	**6.9**	***160***	***186***	***346***
Non-smoker	**48**	**37**	**42**	**4.9**	**2.6**	**3.6**	***814***	***1,064***	***1,878***
Ex-regular smoker	48	38	44	5.3	3.1	4.4	*562*	*388*	*950*
Never or only occasionally smoked	46	37	39	3.9	2.3	2.8	*252*	*676*	*928*
All aged 65 and over	**50**	**39**	**43**	**5.4**	**3.2**	**4.1**	***974***	***1,250***	***2,224***

1 Directly age-standardised using the European standard population. Rates are expressed as the number of deaths per 100 person years.

For men the lowest age-standardised mortality rates were found among those who drank 1–21 units per week, both non-drinkers and heavier drinkers having relatively higher mortality rates. For women the pattern differed in that the heaviest drinkers showed a surprisingly low age-standardised mortality rate (2.9 per 100 person-years compared with 2.7 per 100 person-years for lighter drinkers and 3.6 for non-drinkers) (Table 4). However, it should be noted that the figures for drinking more than 14 units for women were based on only 13 deaths.

Table 4 **Percentage who died during the analysis period and age-standardised mortality rate[1] by sex and average weekly alcohol consumption**

England

Alcohol consumption	Percentage who had died			Age-standardised annual mortality rates[1]			*Base=100% unweighted sample*		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Alcohol (0–1 unit)	**57**	**45**	**49**	**6.3**	**3.6**	**4.3**	***259***	***654***	***913***
None in last year	59	53	54	7.2	4.2	5.1	*100*	*271*	*371*
Less than 1 unit	56	40	45	5.8	3.1	3.9	*159*	*383*	*542*
Alcohol (1–21/14 units)	**46**	**33**	**40**	**4.9**	**2.7**	**3.9**	***553***	***513***	***1,066***
1–10/1–7 units	47	32	39	4.9	*2.5*	*3.7*	*381*	*396*	*777*
11–21/8–14 units	44	37	41	4.9	*3.5*	*4.3*	*172*	*117*	*289*
More than 21/14 units	**51**	**20**	**40**	**6.9**	**2.9**	**4.8**	***162***	***84***	***246***
All aged 65 and over	**50**	**39**	**43**	**5.4**	**3.2**	**4.1**	***974***	***1,251***	***2,225***

1 Directly age-standardised using the European standard population. Rates are expressed as the number of deaths per 100 person years.

Socio-economic variables

Those who owned their home were less likely to have died than those whose accommodation was rented (Table 5). The difference was greater for women than for men.

Those living in households with access to one or more cars were less likely to have died than those with no car (Table 6). Those with access to two cars had lower mortality than those with one.

Table 5 Percentage who died during the analysis period and age-standardised mortality rate[1] by sex and tenure of accommodation

England

Tenure	Percentage who had died			Age-standardised annual mortality rates[1]			*Base=100% unweighted sample*		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Owns	46	34	40	5.1	2.5	3.7	*682*	*808*	*1,490*
Rents	58	48	52	6.4	4.8	5.3	*288*	*435*	*723*
All aged 65 and over	50	39	43	5.4	3.2	4.1	*970*	*1,243*	*2,213*

1 Directly age-standardised using the European standard population. Rates are expressed as the number of deaths per 100 person years.

Table 6 Percentage who died during the analysis period and age-standardised mortality rate[1] by sex and access to car(s)

England

Number of cars	Percentage who had died			Age-standardised annual mortality rates[1]			*Base=100% unweighted sample*		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
None	**60**	**46**	**50**	7.3	3.7	4.9	***322***	***709***	***1,031***
With car	**45**	**29**	**37**	**4.9**	**2.5**	**3.7**	***652***	***542***	***1,194***
One	48	30	39	5.1	2.6	3.8	*543*	*473*	*1,016*
Two or more	30	19	26	4.2	2.5	3.6	*109*	*69*	*178*
All aged 65 and over	**50**	**39**	**43**	**5.4**	3.2	4.1	***974***	***1,251***	***2,225***

1 Directly age-standardised using the European standard population. Rates are expressed as the number of deaths per 100 person years.

Table 7 presents mortality as classified by the Registrar General's Social Class (RGSC), although the occupation data were originally coded using socio-economic group (SEG). The conversion was made so that tests could be made for a conventional socio-economic 'gradient' in mortality which is not possible with SEG. Both men and women were classified using their own social class. Patterns in mortality appeared to be dissimilar between men and women. Among men, those whose main occupation had been a manual one were more likely to have died than those whose job had been non-manual. Among women, however, an increase in mortality with decreased advantage in social class was not apparent.

Table 7 Percentage who died during the analysis period and age-standardised mortality rate[1] by sex and social class

England

Social class	Percentage who had died			Age-standardised annual mortality rates[1]			*Base=100% unweighted sample*		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
RGSC I/II	44	35	41	5.0	3.0	4.2	*374*	*270*	*644*
RGSC IIIN	44	36	38	4.7	3.4	3.5	*63*	*370*	*433*
RGSC IIIM	52	35	47	5.7	3.6	5.0	*339*	*108*	*447*
RGSC IV/V	57	41	46	6.4	3.1	4.0	*195*	*444*	*639*
All aged 65 and over	50	38	43	5.4	3.2	4.1	*971*	*1,192*	*2,163*

1 Directly age-standardised using the European standard population. Rates are expressed as the number of deaths per 100 person years.

General environmental variables

Individual regional differences in mortality rates did not show a clear pattern and were not similar for men and women, but sample sizes in individual regions were small. Among both men and women, those who lived in the northern and western regions had a higher mortality rate compared to those in the southern and eastern regions (Table 8).

Table 8 Percentage who died during the analysis period and age-standardised mortality rate[1] by sex and region

England

Region	Percentage who had died			Age-standardised annual mortality rates[1]			Base=100% unweighted sample		
	Men	Women	Total	Men	Women	Total	Men	Women	Total
Northern and Western regions[2]	**53**	**40**	**45**	**6.6**	**3.9**	**5.0**	***399***	***519***	***918***
North	50	49	50	5.3	4.0	4.5	*94*	*116*	*210*
Yorkshire/Humberside	52	36	43	6.0	2.6	4.2	*86*	*115*	*201*
North West	51	35	42	7.0	4.4	5.3	*131*	*175*	*306*
West Midlands	58	40	48	9.1	4.4	6.3	*88*	*113*	*201*
Southern and Eastern regions[3]	**48**	**38**	**42**	**4.5**	**2.6**	**3.4**	***575***	***732***	***1,307***
East Midlands	59	43	50	6.0	3.0	4.3	*86*	*101*	*187*
East Anglia	47	34	41	3.9	2.2	3.0	*53*	*41*	*94*
Greater London	46	41	43	5.0	3.6	4.3	*103*	*133*	*236*
Outer Metropolitan Area	48	37	42	4.1	2.4	3.0	*110*	*131*	*241*
Outer South East	44	34	38	3.9	2.3	2.9	*112*	*167*	*279*
South West	44	38	40	4.8	2.2	3.2	*111*	*159*	*270*
All aged 65 and over	**50**	**39**	**43**	**5.4**	**3.2**	**4.1**	***974***	***1251***	***2225***

1 Directly age-standardised using the European standard population. Rates are expressed as the number of deaths per 100 person years.
2 Includes: North, Yorkshire/Humberside, North-West, West Midlands.
3 Includes:East Midlands, East Anglia, Greater London, Outer Metropolitan Area, Outer South East, South West.

Part 2 Multivariate survival analysis

Table 9 displays the optimum models from the Cox multivariate analysis. For each variable the 'hazard ratio' is reported, this ratio can be interpreted as comparing the risk of death between various values of the variable concerned. For example, if a variable in the analysis has three categories, the first category is taken as a reference or baseline and the ratio in the other two categories are compared to the first. Thus, the interpretation of a hazard ratio of 1.20 would be a 20 per cent increase in the risk of death as compared to the reference category.

Table 9 Hazard ratios with respect to mortality over ten years for socio-economic and behavioural variables

England

	Male and female		Males only		Females only	
	Hazard ratio	95% CI	Hazard ratio	95% CI	Hazard ratio	95% CI
Sex						
Male	1.00					
Female	0.56***	*(0.49,0.64)*				
Smoking						
Current	1.00					
Non-smoker	1.78***	*(1.51,2.09)*	1.64***	*(1.30,2.06)*	1.98***	*(1.07,1.13)*
Alcohol						
Negligible	1.00					
Moderate	0.77***	*(0.67,0.88)*	0.80*	*(0.66,0.98)*	0.74***	*(0.61,0.98)*
Heavy	0.85	*(0.68,1.06)*	1.00	*(0.77,1.32)*	0.55**	*(0.35,0.87)*
Tenure						
Owns	1.00					
Rents	1.22**	*(1.07,1.39)*	1.16	*(0.96,1.41)*	1.29**	*(1.08,1.54)*
Region						
Southern and Eastern	1.00					
Northern and Western	1.18**	*(1.04,1.33)*	1.26**	*(1.05,1.50)*	1.10	*(0.92,1.32)*

*p <0.05 **p <0.01 ***p <0.001

The most powerful explanatory variables were behavioural, current smokers having a 78 per cent higher risk of death than non-smokers. The pattern for alcohol consumption implies that for men and women in the sample who were moderate drinkers, the risk of death was lower than those whose drinking was negligible.

The socio-economic effect was best captured by the tenure variable, with those who rent having a 22 per cent higher mortality rate than those who own their accommodation. This effect was greater for women than for men. Region of residence was also a significant variable, with those living in the northern and western regions having an 18 per cent higher death rate. This effect was also sex specific, being more important for men than for women.

Other variables failed to attain significance, including RGSC.

Table 10 shows the result of re-estimating the model excluding those who reported a limiting long-standing illness at the beginning of the study.

Table 10 **Hazard ratios with respect to mortality over ten years for socio-economic and behavioural variables: results when sample members with a limiting longstanding illness were excluded**

England

	Male and female		Males only		Females only	
	Hazard ratio	95% CI	Hazard ratio	95% CI	Hazard ratio	95% CI
Sex						
Male	1.00					
Female	0.51***	*(0.42,0.61)*				
Smoking						
Current	1.00					
Non-Smoker	1.65***	*(1.30,2.10)*	1.44*	*(1.04,1.99)*	2.06***	*(1.44,2.97)*
Alcohol						
Negligible	1.00					
Moderate	0.87	*(0.72,1.06)*	0.91	*(0.68,1.21)*	0.82	*(0.63,1.06)*
Heavy	0.96	*(0.70,1.31)*	1.15	*(0.79,1.69)*	0.49	*(0.24,1.01)*
Tenure						
Owns	1.00					
Rents	1.31**	*(1.08,1.58)*	1.25	*(0.95,1.65)*	1.34*	*(1.03,1.75)*
Region						
Southern and Eastern	1.00					
Northern and Western	1.20*	*(1.00,1.44)*	1.32*	*(1.03,1.69)*	1.07	*(0.82,1.40)*

*p <0.05 **p <0.01 ***p <0.001

Following the exclusion of those with a limiting long-term illness at the outset, standard errors of the alcohol coefficients were raised to the extent that the effects ceased to be statistically significant. This suggests that it is possible that the apparent reduced hazard associated with moderate relative to negligible drinking in the initial model may be an artefact of health selection.

Table 11 shows the relative importance to the model of all the factors included, once sample members with a limiting longstanding illness have been excluded.

Table 11 **Contributions to the model of various variables as measured by decrease in deviance**

England

Model		Deviance	Difference from deviance of adjusted model
Adjusted model (LLTI excluded but all other variables included)		5677.7	
Constrained without	Sex	5731.3	53.6
Constrained without	Smoking	5693.3	15.6
Constrained without	Tenure	5679.8	7.6
Constrained without	Region	5681.6	3.9
Constrained without	Alcohol	5685.3	2.1
Constrained without	Region and Tenure	5689.0	11.3

After age and sex, smoking had the strongest independent effect on mortality risk, controlling for the other covariates in the model. Tenure had the next strongest, and alcohol and region have the weakest effect. The alcohol effect is not statistically significant, but the regional effect is marginally significant.

Social class by occupation was not significant, although, before the other variables were included there were indications of a conventional gradient for men, but not for women (Table 12).

Table 12 **Hazard ratios for models with social class (RGSC) and age only, excluding those who reported a limiting longstanding illness at the beginning of the study**

England

Social class	Males only		Females Only	
	Hazard Ratio	95% CI	Hazard Ratio	95% CI
RGSC				
I/II	1.00		1.00	
IIIN	1.17	*(0.70,1.96)*	1.16	*(0.82,1.64)*
IIIM	1.27	*(0.96,1.68)*	0.85	*(0.52,1.39)*
IV/V	1.50*	*(1.08,2.08)*	1.00	*(0.70,1.43)*

*p <0.05 **p <0.01 ***p <0.001

Discussion

Framework for analysis

The World Health Organisation's Commission on the Social Determinants of Health devised a framework for understanding the factors determining relative levels of health within a society and the interactions between them[7]. 'The distribution of health and wellbeing is understood to be caused by material circumstances, social cohesion, psychosocial factors, behaviours and biological factors. These undergo complex interactions, and at times are mediated through the health system. These circumstances are in turn influenced by social position, itself a factor of education, occupation, income, gender, ethnicity and race; all influence and are influenced by the socio-political and cultural and social context in which they sit'.[8]

It is not possible within a small sample study like this one to quantify these various interactions, but it is useful to consider the results in the context of such a framework.

An earlier version of the model[9] suggested the following 'layers of influence' on health as stated in the methods section:

- age, sex, hereditary factors
- individual behaviours
- social and community networks
- living and working conditions
- general socio-economic, cultural and environmental conditions

Biological and behavioural factors

Behavioural factors, such as smoking, appeared to be the most important in their effect upon survival, after age and sex, beyond retirement age.

The importance of behavioural factors was also reported in a study of mortality of persons over fifty, based on the English Longitudinal Study of Ageing (ELSA).[10] That study reported on a Cox proportional hazard model constructed for a sample of almost 11,000 individuals. The model suggested that marital status, physical activity, smoking behaviour, alcohol consumption and wealth were all significant factors. The hazard ratio for smokers in the current study was 1.78, similar to that estimated from the

ELSA dataset, (1.78). The results were also similar to those from ELSA for alcohol consumption. The above estimates based on the GHS survey showed a hazard ratio of 0.77 for moderate drinking (defined as between 1 and 21 units per week for men and 1 and 14 units for women) while the ELSA results showed a ratio of 0.80 for 'drinks occasionally'. This apparent protective effect of moderate drinking for an older cohort was also found by a longitudinal study of men and women in Califiornia.[25] In both cases, more 'heavy' drinking, defined here as greater than 21 units per week for men and greater than 14 units for women, and as 'Drinks daily' for ELSA, had a risk not significantly different to non-drinkers. It would have been useful to further divide moderately heavy from heavy drinking (say 22–28 units and greater than 28 units per week for men), in order to determine whether the greater risk of heavy drinking is reflected in the results, but unfortunately the sample was not large enough to allow this.

When those sample members reporting a limiting long-standing illness at the start were excluded from the study, the effect of smoking remained almost unchanged but that of alcohol reduced and became statistically insignificant. This implies that the apparent protective effect of alcohol observed in the initial model may be an artefact brought about by the selective effect of pre-existing health circumstances. The authors of the ELSA report warn that 'the interpretation of the strength of these associations should be made cautiously, because behaviours may change after the onset of disease'. This cautionary note should be re-emphasised here.

A further confounding factor may be that that both men and women in managerial and professional households were more likely than others to drink alcohol regularly.[26] It is possible that drinking patterns among those in higher age groups are capturing other effects of socio-economic status.

Marital status

The WHO framework would suggest that marital status as a key part of an individual's social network should rank just behind behavioural factors in importance in determining health. Simple bivariate analysis of the dataset suggested that fewer married or cohabiting people died than their single counterparts. The current study had 46 per cent deaths for married men compared with 66 per cent for widowed and 48 per cent for other non-married men (followed-up over ten years). Among women, the numbers were 29 per cent for married or cohabiting women, 45 per cent for widowed and 48 per cent for other single women. The ELSA study[10] undertook a similar analysis and found a clearer advantage of marriage for both men and women. For example, the age 75 and over group had 23 per cent deaths among men who were married at the start of the study, and 47 per cent for those who were widowed and 39 per cent for those never married, when followed-up over a period of approximately six years. This apparent advantage of marriage found in the ELSA analysis translated into a significant protective effect when included in a multivariate model, with all non-married categories having significantly raised hazard ratios relative to the married sample members. In the current study, a dichotomous married or cohabiting/non-married (or cohabiting) variable was significant on a bivariate basis, but not when behavioural and other variables were included. This difference in the strength of results between the two studies may be in part a reflection of the greater sample size of ELSA.

Socio-economic factors

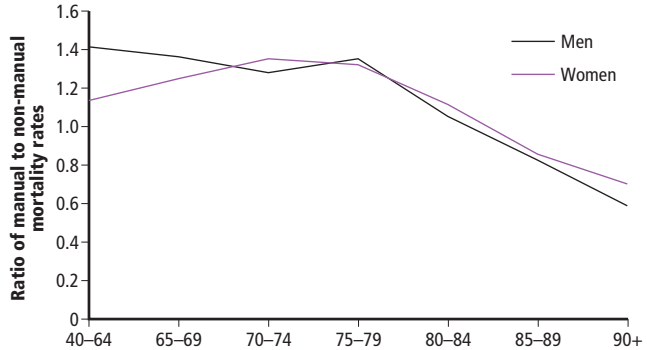
Socio-economic position might be expected to influence health via other factors including material and behavioural ones. It might also be predicted that occupation based socio-economic position would decline in importance after retirement when workplace factors are no longer an immediate influence. Figure 1 shows the ratio of manual to non-manual social class mortality rates for age 40–64 and then in five year age bands from age 65, taken from data published by ONS.[11] Rate ratios are essentially on a plateau around 1.4 between age 45 and 79, although for individual five year periods between 40 and 64 they fluctuate owing to relatively small numbers of deaths. There is a pronounced drop in the ratio from age 80 onwards for both sexes, down to about 1 (equality of non-manual and manual mortality rates), for the 90+ group.

Some studies reported a reduction in the influence on health and mortality of occupation based socio-economic position at older ages,[10,12] while other socio-economic factors remain important in later life[10,12,13] The dataset used in this study allowed us to estimate whether socio-economic differences in mortality persist into later life and how important they are to survival, relative to individual behavioural factors. Socio-economic position was measured by social class based on occupation, but this did not prove to be a powerful influence on relative mortality as it appears to be at younger ages[14,15]. However, there was an indication of a gradient for men suggesting that the effect persisted to some extent. By comparison, in the ELSA study,[10] socio-economic position was measured by three variables – wealth, educational qualifications and the three-class version of the National Statistics Socio-economic Classification (NS-SEC), but when all three of these factors were included in the multivariate model, only wealth was significant.

By contrast, another study of persons aged 50–74 investigating a quality of life indicator by NS-SEC[16] found that 'NS-SEC had greater predictive power for those who were retired than those who were employed… it is as though differences within the world of work become exaggerated after labour market exit'. It was suggested that employment relations during working life influence non-financial benefits, such as area of residence and quality of social networks during employment, and that these benefits become more important upon retirement.

Estimates reported in this article suggest that region (expressed as a dichotomous variable - south and east versus north and west), and tenure were significant influences on mortality and it is possible that these are more effective at capturing socio-economic differences at older ages than occupation based classifications. This is consistent with the findings of several studies which found that occupation based classifications have less explanatory power than alternative socio-economic measures after retirement.[12,17] Marmot and Shipley[12] concluded that 'social differentials in mortality based on an occupational status measure seem to decrease to a greater degree after retirement than those based on a non-work measure' (in this case car ownership). Several studies examining alternative socio-economic classifications found tenure to be a better and more persistent socio-economic indicator for poor health and mortality at older ages than an occupation based measure,[17,18] although tenure has been criticised for its poor level of discrimination, with the majority of people in the 'owner-occupied' group.[19] In a comparative study of European mortality,[20] tenure showed a rapid attenuation in its effect on mortality for English women above eighty years old, but was persistent up to that age. Wealth was also reported by several studies to be a more persistent discriminator than income or occupation based class[10,13]

Figure 1 Relative age-specific mortality rates for manual and non-manual social classes



Source: ONS Longitudinal Study

Access to a car was also found to be an effective discriminator at older ages in some studies[12,17,18] The current study found a difference in the simple percentages of sample deaths according to whether the sample member had access to a car, but this variable was not significant in the multivariate analysis.

The results presented here have some similarities with a study of an American cohort aged between 60 and 94 years old at the outset.[21] This found no effect of socio-economic position as measured by income on mortality, but persistence of the effect of behavioural factors up to the oldest ages with no attenuation.

The use of a combination of variables to measure health inequalities in older adults was proposed in another study,[19] where a range of individual, household and area socio-economic measures were selected according to criteria such as having a theoretical basis, ease of collection, number of gradations, and not likely to be an outcome of health (that is subject to 'reverse causality'). The authors found that a combination of variables – an individual socio-economic indicator such as social class or educational qualifications combined with an area deprivation indicator – produced the best results in terms of predicting self-reported health.

In general, the results of the current study suggest that residual socio-economic factors after the effect of behavioural factors have been taken into account, are not an important influence on survival at older ages. By contrast, the adverse effect of smoking is undiminished.

Limitations of the analysis

The sample of approximately 2,200 was smaller than ideal for testing a wide range of influences on mortality. In particular the capability of using finer gradations of alcohol consumption, particularly when those with a limiting long-term illness were excluded, would have enabled stronger conclusions to be drawn.

There may be coding difficulties with the assignment of RGSC used. The original data was coded according to ONS Socio Economic Group (SEG). An approximation to RGSC was made using the tables in the National Statistics Socio-economic Classification User Manual[22]. Social Classes I and II were combined, as were IV and V.

There were no available variables representing educational qualifications or wealth. These variables have proved useful elsewhere in representing the socio-economic effect in the analysis of mortality in the elderly population.[10,18,19]

Conclusions

The results of this study suggest that, of those factors measured, smoking is the most important in determining prospective mortality risk among the retired. Occupation based socio-economic classifications were not effective discriminators, but region and tenure were. The reduced risk associated with moderate alcohol consumption tended to confirm the results of the much larger ELSA study.[10] A note of caution in the interpretation was introduced when it was found that the measured reduction in mortality risk for moderate drinkers was no longer statistically significant when those with a limiting long-term illness at the beginning of the study were excluded from the follow up analysis, suggesting a possible artefactual explanation.

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Key findings

- The results of this study suggest that smoking is the most important of the factors measured in determining mortality risk among the retired
- Occupation based socio-economic classifications were not found to be predictive of mortality risk, but region of residence and housing tenure were
- Region was an important discriminator for men and tenure for women but not vice-versa
- The apparent reduced mortality risk found for moderate alcohol consumption supported the results of the much larger ELSA study
- However, there were indications that this result may have been caused by some of those with pre-existing health problems being unable to drink as a result of illness or treatment

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Tables

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Symbols

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: not applicable
- nil or less than half the final digit shown
blank not yet available

Table 1.1 Population and vital rates: international

Selected countries — Numbers (thousands)/Rates per thousand

Year	United Kingdom	Austria	Belgium	Bulgaria	Cyprus[1]	Czech Republic	Denmark	Estonia	Finland	France	Germany[2]	Greece[3]	Hungary
Population (thousands)													
1971	55,780	7,501	9,673	8,540	610	9,810	4,963	1,369	4,612	51,251	78,313	8,831	10,370
1976	56,221	7,566	9,818	8,760	498	10,094	5,073	1,435	4,726	52,909	78,337	9,167	10,590
1981	56,344	7,569	9,859	8,891	515	10,293	5,121	1,482	4,800	54,182	78,408	9,729	10,712
1986	56,619	7,588	9,862	8,958	545	10,340	5,120	1,534	4,918	55,547	77,720	9,967	10,631
1991	57,338	7,813	9,979	8,982	587	10,309	5,154	1,566	5,014	57,055	79,984	10,247	10,346
1996	58,095	7,959	10,137	8,363	661[12]	10,315	5,262	1,416	5,125	58,026	81,896	10,709	10,193
2001	59,000	8,021	10,263	8,149	698[12]	10,267	5,349	1,367	5,181	60,964	82,260	10,931	10,200
2002	59,218	8,065	10,310	7,891	706[12]	10,206	5,368	1,361	5,195	61,399	82,440	10,969	10,175
2003	59,440	8,102	10,356	7,846	715[12]	10,203	5,384	1,356	5,206	61,832	82,537	11,006	10,142
2004	59,702	8,140	10,396	7,801	730[12]	10,211	5,398	1,351	5,220	62,252	82,532	11,041	10,117
2005	60,042	8,207	10,446	7,761	749[12]	10,221	5,411	1,348	5,237	62,638	82,501	11,083	10,098
2006	60,413	8,266	10,511	7,719	766[12]	10,251	5,427	1,345	5,256	62,999	82,438	11,125	10,077
2007	60,781	8,299	10,585	7,679	779[12]	10,287	5,447	1,342	5,277	63,392	82,315	11,171	10,066
2008	61,179	8,319	10,667	7,640	789[12]	10,381	5,476	1,341	5,300	63,983	82,218	11,214	10,045
2009	..	8,355	10,750[P]	7,607	797[12,P]	10,468	5,511	1,340	5,326	64,351[P]	82,002[P]	11,260[P]	10,031[P]
Population changes (per 1,000 per annum)													
1971–76	1.6	1.7	3.0	5.2	–36.7	5.8	4.4	9.6	4.9	6.5	0.1	7.6	4.2
1976–81	0.4	0.1	0.8	3.0	6.8	3.9	1.9	6.6	3.1	4.8	0.2	12.3	2.3
1981–86	1.0	0.5	0.1	1.5	11.7	0.9	0.0	7.0	4.9	5.0	–1.8	4.9	–1.5
1986–91	2.5	5.9	2.4	0.5	15.4	–0.6	1.3	4.2	3.9	5.4	5.8	5.6	–5.4
1991–96	2.6	3.7	3.6	–13.8	25.2	0.1	4.2	–19.2	4.4	3.4	4.8	9.0	–3.0
1996–01	3.1	1.6	2.1	–5.1	11.2	–0.9	3.3	–6.9	2.2	10.1	0.9	4.1	0.1
2001–02	3.7	5.5	4.6	–31.7	11.5	–5.9	3.6	–4.4	2.7	7.1	2.2	3.5	–2.5
2002–03	3.7	4.6	4.5	–5.7	12.7	–0.3	3.0	–3.7	2.1	7.1	1.2	3.4	–3.2
2003–04	4.4	4.7	3.9	–5.7	21.0	0.8	2.6	–3.7	2.7	6.8	–0.1	3.2	–2.5
2004–05	5.7	8.2	4.8	–5.1	26.0	1.0	2.4	–2.2	3.3	6.2	–0.4	3.8	–1.9
2005–06	6.2	7.2	6.2	–5.4	22.7	2.9	3.0	–2.2	3.6	5.8	–0.8	3.8	–2.1
2006–07	6.1	2.4	7.0	–5.2	17.0	3.5	3.7	–2.2	4.0	6.2	–1.5	4.1	–1.1
2007–08	6.5	2.4	7.7	–5.1	12.8	9.1	5.3	–0.7	4.4	9.3	–1.2	3.8	-2.1
2008–09	..	4.3	8.2	–4.3	10.1	8.4	6.4	–0.7	4.9	5.8	–2.6	4.1	-1.4
Live birth rate (per 1,000 population per annum)													
1971–75	14.1	13.3	13.4	13.2	17.7	17.8	14.6	15.4	13.1	16.0	10.5	15.8	16.1
1976–80	12.5	11.5	12.5	15.1	19.0	17.1	12.0	15.0	13.6	14.1	10.5	15.6	15.8
1981–85	12.9	12.0	12.0	13.7	20.2	13.5	10.2	15.6	13.4	14.2	10.7	13.3	12.3
1986–90	13.7	11.6	12.1	12.7	18.8	12.7	11.5	15.5	12.7	13.8	9.8	10.6	11.8
1991–95	13.2	11.8	12.0	9.8	16.9	11.1	13.1	10.7	12.9	12.7	10.9	9.9	11.7
1996–00	12.0	10.2	11.2	8.3	13.2	8.8	12.6	8.9	11.3	12.7	9.6	10.2	9.8
2001	11.3	9.4	11.1	8.6	11.6	8.9	12.2	9.3	10.8	13.0	8.9	9.3	9.5
2002	11.3	9.7	10.8	8.5	11.1	9.6	11.9	9.6	10.7	12.7	8.7	9.5	9.5
2003	11.7	9.5	10.8	8.6	11.2	9.2	12.0	9.6	10.9	12.6	8.6	9.5	9.3
2004	12.0	9.7	11.1	9.0	11.3	9.6	12.0	10.4	11.0	12.7	8.6	9.6	9.4
2005	12.0	9.5	11.3	9.2	10.9	10.0	11.9	10.7	11.0	12.7	8.3	9.7	9.7
2006	12.4	9.4	11.5	9.6	11.3	10.3	12.0	11.1	11.2	13.0	8.2	10.0	9.9
2007	12.7	9.2	11.4	9.8	10.9	11.1	11.7	11.8	11.1	12.7	8.3	10.0	9.7
2008	12.9[P]	9.2	11.7	10.2	11.6	11.5	11.8	11.1	11.2	12.8	8.2	10.3	9.9
Death rate (per 1,000 population per annum)													
1971–75	11.8	12.6	12.1	9.8	9.9	12.4	10.1	11.1	9.5	10.7	12.3	8.6	11.9
1976–80	11.9	12.3	11.6	12.9	10.4	12.5	10.5	12.1	9.3	10.2	12.2	8.8	12.9
1981–85	11.7	12.0	11.4	11.3	10.0	12.8	11.1	12.3	9.3	10.1	12.0	9.0	13.7
1986–90	11.4	11.1	10.8	11.9	10.2	12.4	11.5	11.9	9.8	9.5	11.6	9.3	13.5
1991–95	11.1	10.4	10.4	12.9	9.0	11.6	11.9	13.9	9.8	9.1	10.8	9.5	14.3
1996–00	10.6	9.7	10.3	14.0	7.7	10.8	11.2	13.1	9.6	9.2	10.4	9.7	13.9
2001	10.2	9.3	10.1	14.2	6.9	10.5	10.9	13.6	9.4	8.9	10.1	9.4	13.0
2002	10.2	9.4	10.2	14.3	7.3	10.6	10.9	13.5	9.5	8.9	10.2	9.5	13.1
2003	10.3	9.5	10.4	14.3	7.2	10.9	10.7	13.4	9.4	9.2	10.3	9.6	13.4
2004	9.7	9.1	9.8	14.2	7.1	10.5	10.3	13.1	9.1	8.4	9.9	9.5	13.1
2005	9.7	9.1	9.8	14.6	7.2	10.5	10.1	12.9	9.1	8.6	10.1	9.5	13.5
2006	9.4	9.0	9.6	14.7	6.7	10.2	10.2	12.9	9.1	8.4	10.0	9.5	13.1
2007	9.4	9.0	9.5	14.8	6.9	10.1	10.2	13.0	9.3	8.4	10.1	9.8	13.2
2008	9.4[P]	9.0	9.5	14.5	6.4	10.1	9.9	12.5	9.2	8.4	10.3	9.3	13.0

Note: Estimated population (as at 1 January) for European countries - see *Eurostat* Website. Estimated population (mid-year) for all other countries - see the *United Nations Monthly Bulletin of Statistics and the United Nations Demographic Yearbook*. Live birth and death rates – see the *United Nations Monthly Bulletin of Statistics* and the *United Nations Demographic Yearbook* (latest update October 2009)

1 Republic of Cyprus – Data refer to Government controlled areas.
2 Including the former GDR throughout.
3 Greece – Mid-year population excludes armed forces stationed outside the country but includes alien forces stationed in the area.
4 Malta – including work and resident permit holders and foreigners residing in Malta.
5 Poland – excluding civilian aliens within the country but including civilian nationals temporarily outside the country.
6 Portugal – including the Azores and Madeira Islands.
7 Spain – including the Balearic and Canary Islands.
8 For 1971 the European Union consisted of the 6 original member countries. This has since been expanded to include: 9 countries (1976-EU15); 10 countries (2004-EU25); 2 countries (2007-EU27). In this table, all totals include the EU27.
9 Including the Indian held part of Jammu and Kashmir, the final status of which has not yet been determined.
10 Japan – excluding diplomatic personnel outside the country and foreign military and civilian personnel and their dependants stationed in the area.
11 USA – excluding armed forces overseas and civilian citizens absent from the country for extended periods.
12 Indicates population estimates of uncertain reliability.
13 Data refers to 15 April.
14 Figures were updated taking into account the results of the 2002 All-Russian population census.
15 Mid-year estimates have been adjusted for under-enumeration.
16 For statistical purposes the data for China do not include those for the Hong Kong SAR, Macao SAR and Taiwan province of China. Data for the period 1996 to 2000 have been adjusted on the basis of the Population Census of 2000. Data from 2001 to 2007 have been estimated on the basis of the annual national sample surveys of Population Changes.
17 Rate is for 1990–1995.
p provisional