

Social inequalities in adult female mortality by the National Statistics Socio-economic Classification, England and Wales, 2001–03

Ann Langford and
Brian Johnson
Office for National Statistics

This analysis of mortality in women aged 25–59 in 2001–03 found that those in the least advantaged social economic class had a mortality rate around twice that of women in the most advantaged class. This article uses the National Statistics Socio-economic Classification (NS-SEC) and examines the relative merits of classification based on a woman's 'own' occupation as opposed to a 'combined' classification which also takes into account the husband's NS-SEC class, where available. The results demonstrate a strong socio-economic gradient in mortality for adult women under both classification methods. Under the 'combined' classification, women in the least advantaged NS-SEC class had a mortality rate 2.6 times that of those in the most advantaged class. Based on the women's 'own' occupation, the comparable ratio was 1.9. These results set a benchmark for the future monitoring of socio-economic mortality inequalities in women, and also provide a comparison between inequalities affecting women and men.

Introduction

This article describes social inequalities in the all-cause mortality rates by socio-economic classification for women aged 25–59 in England and Wales in the period 2001–03. It is the fourth in a series of articles measuring mortality using the final version of the National Statistics Socio-economic Classification (NS-SEC). Earlier articles covered social inequalities by NS-SEC for men aged 25–64 over the period 2001–03 for all-cause mortality,¹ mortality by cause of death² and by Government Office Region.³ This study adopts a similar methodology to that described in the first article in the series.¹ Death registrations and 2001 Census data are used to calculate mortality rates while, the ONS Longitudinal Study (LS) is used both to adjust for known biases and to provide a comparator to help validate the results.

This is the first time that the final version of NS-SEC has been used to analyse female mortality rates, and this article discusses the alternative methods of assigning women to an occupation-based classification and the effect on resultant mortality rates. Results are presented both for NS-SEC derived from a woman's own occupation, and for a combined classification based on the most advantaged NS-SEC class of a woman and her husband.

Background

The study of health inequalities by socio-economic classification in England and Wales has a long history. The influential Black Report⁴ identified that there had been a striking lack of improvement in the health experience of the lower social classes. The Acheson Report⁵ in 1998 again 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*⁶ aspired to ‘address the inequalities that are found across different geographical areas, between genders ... and between different social and economic groups’. The subsequent *2007 Status Report on the Programme for Action*⁷ 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,^{8,9,10,11} most of which focuses on male mortality. 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. There are conceptual difficulties because many women have weaker ties to the labour market than men, which reduces the potential effectiveness of basing socio-economic class on occupation. There are also practical difficulties, since on the death registers a substantial minority of female occupations are either inadequately described or, in many cases, not recorded at all. This would be the case for instance if a woman was solely recorded as a ‘housewife’ at death, or had been unoccupied at death and had previously worked only in a part-time capacity.¹²

As a result of these difficulties, methods have been developed to classify women according to a ‘family’ or ‘household’ measure. The conventional approach for many years was to use the husband’s social class for married women, and a classification based on a woman’s own occupation for all other women.¹³ More recent studies have used an ‘individualistic’ approach where social class is based on the woman’s occupation alone.¹⁴ It can be argued that this latter approach is more suitable in a society where more married women work and where fewer people get married. This approach also has the advantage of conceptual clarity, since it avoids the difficulties of ‘combining two gender-differentiated occupational structures’.¹⁴

An alternative ‘dominance’ approach was suggested by Erikson.¹⁵ In this approach a woman’s classification is determined by considering both the woman’s own class, and her husband’s. The most advantaged class is then chosen to represent the woman’s socio-economic class, on the basis that the life-chances of individuals in a family unit are more likely to be aligned with that of the most advantaged individual in that unit.

Despite the difficulties, there have been some studies of inequalities in female mortality rates. The Black Report⁴ revealed that the death rate for women in the most disadvantaged social class was two-and-a-half times higher than the comparable rates for women in the most advantaged social class. Subsequent studies^{11,16} reported similar inequalities for the 1990s, with women in social classes IV and V having a mortality rate approximately one-and-a-half times that of women in classes I and II. An ONS study of life

expectancies by social class¹⁷ confirmed this pattern of inequality among women, reporting a fairly consistent two to three year advantage for non-manual compared to manual classes over the last thirty years.

Most of the above mentioned studies use the Registrar General’s Social Class based on occupation. This was replaced for the purposes of official statistics in 2001 by the new NS-SEC classification, following a review of social classifications undertaken by the Economic and Social Research Council.¹⁸ Both the 2001 Census and death registrations post-2001 used NS-SEC as their socio-economic classification. This article is the first to analyse inequalities in mortality among women according to this new schema.

The National Statistics Socio-economic Classification

The Registrar General’s Social Class was the principal social classification used in the UK during the 20th century. While it provided continuity, it was criticised for lacking a coherent theoretical basis and insensitivity to the changing patterns of industry and employment in modern economies.¹⁹ The non-manual/manual divide inherent in the classification was seen as increasingly irrelevant to modern service economies and did not identify the unique position of the non-professional self-employed.²⁰ It was also seen as increasingly inappropriate to the classification of women by occupation, as for example ‘the manual/non-manual divide has little relevance for women’s jobs’.²¹

To address these criticisms, the National Statistics Socio-economic Classification (NS-SEC) was developed. The conceptual basis of the NS-SEC is the structure of employment relations operating in modern developed economies.²⁰ 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.

Box A1 in the Appendix shows the operational version of NS-SEC and the various aggregated versions in use. This study will use the eight analytic class version (seven occupied classes and the ‘other’ group), and will also present age-standardised mortality rates for the five and three class versions.

Further information on the rationale, derivation and application of the NS-SEC is available on the Office for National Statistics website.²²

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

Analytical approach

In order to estimate mortality rates by NS-SEC it is necessary to estimate a set of numerators and denominators. There are two approaches that can be used:

- a cross-sectional approach: where numerators and denominators are both derived for a particular time period using unlinked sources of data, or
- a longitudinal approach: where a cohort is observed through time, and mortality rates are calculated for various sub-populations such as socio-economic classes

This study uses a cross-sectional approach with numerators derived from death registrations and denominators from 2001 Census data. The advantage of this approach is that it makes maximum use of the available data. The disadvantage is that serious numerator-denominator biases can exist if the two sources are not aligned. The ONS Longitudinal Study (LS) was used to quantify the biases, and calculate appropriate adjustment factors which were obtained in a similar manner to that used in the first article in the series, relating to male mortality.¹ The LS was also used to act as a comparator for the results.

There is a substantial degree of under-reporting of the occupations of women at death. In the age range 25–59, around 42 per cent of women are not assigned to an NS-SEC occupied class at death. This is partly because the death registers only record a woman's last full-time occupation if not in employment at the time of death.¹² According to the 2001 Census, 28 per cent of women in this age group were economically inactive, and a further 29 per cent were part-time workers. In both cases it is possible that the woman left full-time employment many years previously and therefore that the information on her last full-time occupation was either not seen as relevant or perhaps not known by informants. The LS was used to construct a sample of women who were assigned an occupied NS-SEC class at the Census, but not classified at death. From this sample, suitable adjustments to the NS-SEC classification at death could be made.

Owing to the difficulties associated with the socio-economic classification of women, a number of options were examined. Ultimately it was decided that the following classification schemes would be used:

- woman's '**own**' NS-SEC based on her current or last occupation as recorded on the census or death register, and
- a '**combined**' classification where the most advantaged of the woman's NS-SEC class and that of her husband was used. If a woman was not married then her own classification was used

The 'combined' classification method is a variant of Erikson's 'dominance' rule¹⁵ whereby a member of a household is classified by the person in the household who is 'dominant' in the labour market. So, for example, if a woman is classified to a routine occupation herself (NS-SEC class 7) and her husband is self-employed (NS-SEC class 4) then she would be deemed to belong to NS-SEC class 4. Approximately 60 per cent of women were married and assigned to either their own class or their husband's according to which was the most advantaged. The remaining 40 per cent of non-married women were classified according to their own occupation.

The terminology 'own' and 'combined' will be used to refer to these two approaches to classification. The rationale for opting for these two approaches is explained in more detail in the Discussion section of this article.

Methods

Data sources

The raw data for the numerators were deaths of women aged 25–59 occurring in 2001–03 obtained from death registrations. This source included occupational details for both the woman and her spouse, if she was married or widowed, but not for a 'partner'. The denominators were based on the 2001 Census, and ONS mid-year population estimates for 2001–03. The LS was used to quantify and correct for potential biases. The LS contains linked census and vital event data for one per cent of the population of England and Wales. Information from the 1971, 1981, 1991 and 2001 censuses has been linked together, along with information on events such as births, deaths and cancer registrations.

Deriving population denominators

Mid-year population estimates 2001–03 by NS-SEC

The proportions of the population in each NS-SEC class and five-year age group at the 2001 Census were applied to the three mid-year population estimates to obtain the estimates of population by NS-SEC for the period 2001–03. This process was analogous to that used for men in the first article of this series.¹ Special census tables were commissioned in order to compute the proportions by NS-SEC for the 'combined' classification.

Population numbers (rounded to thousands) by age group and NS-SEC class from the 2001 Census are shown in Appendix Table A1 and the equivalent estimates for 2001–03 using the ONS mid-year population estimates are shown in Table A2, for both the 'own' and 'combined' rule classifications.

Denominator adjustments

The denominators were subject to two adjustments. Firstly an adjustment was calculated to account for the Filter X rule.¹ This rule was applied at the 2001 Census and, as a consequence, all people who had not worked since 1996 were allocated to the residual category 'not classifiable for other reasons'. When occupations were recorded on the death registers, no such time limit was applied: this difference in recording is likely to cause bias if not corrected. The LS was used to estimate the effect of this rule and calculate correction factors. (More details of this methodology can be found in Appendix Box A2.)

The second adjustment was to compensate for the effect of health selection. This phenomenon is well documented,^{8,23,24} and is a particular problem for mortality analysis. The hypothesis is that health status influences social position, leading to a selection out of the labour market of those in poor health, which may disproportionately affect occupied NS-SEC class denominators. The LS, by linking data between censuses, makes it possible to obtain the previous occupation of a person who was in an unoccupied class in 2001 by reference to the 1991 Census. The proportions of those unoccupied at 2001 assigned to each NS-SEC class in 1991, allows the calculation of adjustment factors for the denominator. (More details of this methodology can be found in Appendix Box A2.)

The adjustments described above are based on a sample of 132,304 women from the LS and follow the methodology described in the analysis of male mortality rates by NS-SEC in the first article in this series.¹ The final adjusted 'optimised population estimates' using both classification rules described above ('own' and 'combined') are shown in Table 1.⁴³

Table 1

Optimised population estimates¹ (person years at risk) by NS-SEC and age, women aged 25–59, 2001–03

England and Wales											Thousands
Age (years)	NS-SEC analytic class									Total	
	1	2	3	4	5	6	7	FTS ²	Others ³		
'Own' classification											
25–29	484	1,420	954	133	263	836	449	205	314	5,059	
30–34	552	1,592	1,118	259	322	1,136	613	126	297	6,014	
35–39	513	1,628	1,136	346	346	1,296	661	98	261	6,284	
40–44	407	1,502	1,024	348	318	1,212	616	69	214	5,710	
45–49	317	1,383	913	332	292	1,061	565	38	178	5,078	
50–54	259	1,300	976	372	305	1,164	651	17	159	5,203	
55–59	189	1,060	913	358	292	1,169	731	10	151	4,874	
Total	2,722	9,885	7,034	2,149	2,137	7,873	4,286	563	1,573	38,221	
Percentage	7.1	25.9	18.4	5.6	5.6	20.6	11.2	1.5	4.1	100.0	
'Combined' approach											
25–29	724	1,528	846	187	318	688	365	182	221	5,059	
30–34	1,062	1,780	886	354	411	803	427	95	198	6,014	
35–39	1,175	1,865	855	464	456	811	423	64	172	6,284	
40–44	1,049	1,719	764	468	440	722	367	44	137	5,710	
45–49	895	1,570	681	452	400	618	319	25	117	5,078	
50–54	831	1,532	724	528	429	680	358	11	110	5,203	
55–59	655	1,316	703	508	437	734	403	8	112	4,874	
Total	6,391	11,309	5,459	2,960	2,891	5,055	2,661	429	1,067	38,221	
Percentage	16.7	29.6	14.3	7.7	7.6	13.2	7.0	1.1	2.8	100.0	

1 Adjusted for 2001 Census 'Filter X' rule and health selection.

2 Full-time students.

3 Others includes never worked, long-term unemployed, inadequately described, not classifiable for other reasons.

Source: Office for National Statistics, 2001 Census (custom table provided by ONS Census Division), mid-year population estimates for 2001, 2002 and 2003, ONS Longitudinal Study

Table 2

Percentage distributions of population by NS-SEC from different data sources, women aged 25–59

England and Wales										Percentages
NS-SEC analytic class	'Own' classification				'Combined' approach					
	Census ¹	LS ²	LS ³	Optimised ⁴	Census ¹	LS ²	LS ³	Optimised ⁴		
1 Higher managerial and professional	6.8	6.8	7.1	7.1	16.3	16.7	17.0	16.7		
2 Lower managerial and professional	24.0	23.9	25.6	25.9	28.3	28.2	29.4	29.6		
3 Intermediate	16.3	16.3	18.1	18.4	13.0	12.8	13.9	14.3		
4 Small employers and own account workers	5.2	5.3	5.7	5.6	7.7	7.9	7.9	7.7		
5 Lower supervisory and technical	4.8	4.9	5.6	5.6	7.0	7.2	7.7	7.6		
6 Semi-routine	17.1	17.3	20.2	20.6	11.4	11.5	13.0	13.2		
7 Routine	8.2	8.4	10.8	11.2	6.0	6.0	6.7	7.0		
Full-time students	1.5	1.4	1.4	1.5	1.1	1.1	1.0	1.1		
Other ⁵	16.1	15.8	5.5	4.1	9.3	8.7	3.2	2.8		
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		

1 Census adjusted by mid-year population covering period 2001–03.

2 ONS Longitudinal Study based on 2001 classification of NS-SEC covering period 2001–05, applying the 'Filter X' rule.

3 ONS Longitudinal Study based on 2001 classification of NS-SEC covering period 2001–05, (fully coded, ie without the 'Filter X' rule).

4 Optimised population estimates.

5 Other includes never worked, long-term unemployed, inadequately described, not classifiable for other reasons.

Source: Office for National Statistics, 2001 Census (custom table provided by ONS Census Division), mid-year population estimates for 2001, 2002 and 2003, ONS Longitudinal Study

A comparison of the NS-SEC distribution of the 2001 Census adjusted by the mid-year population estimates, the optimised population estimates and for comparison purposes the LS is shown in Table 2 for both NS-SEC classification rules. This shows that under both 'own' and 'combined' rules, the optimised population percentage distribution is similar to that of the fully coded LS. In the case of the 'own' NS-SEC classification approach those classified as never worked, long-term unemployed, not classified or inadequately described reduced from 16 per cent to 4 per cent as a result of these adjustments. For the 'combined' approach the corresponding reduction was from 9 per cent to 3 per cent.

Deriving numerators

There were 65,276 deaths to women aged 25–59 recorded on the death registers over the three-year period 2001–03, and 920 deaths on the

LS sample which covered a four-and-a-half year period. There were two adjustments made to the numerators, one for misallocation between NS-SEC classes 2 and 3, and one for the under-recording of occupation on the death registers.

Misallocation between NS-SEC classes 2 and 3

As for the analysis of men, an examination of the LS data revealed that there was an apparent misallocation between two of the NS-SEC analytical categories at death registration. A number of individuals with occupations such as 'Personal assistants and other secretaries' have been recorded at death as 'Intermediate clerical and administrative', part of NS-SEC class 3, on the basis that they had no supervisory role. However, subsequent examination of their employment status at census indicated that they were supervisors and hence at census would have been allocated to 'Higher Supervisory', part of NS-SEC class 2. In the death registration

process someone's employment status is assumed to be 'employee' where there is insufficient information to classify them otherwise. It therefore appears likely that those individuals in the LS sample with the same occupation code at death and at the census, and who were described as supervisors at census, should have been coded to class 2. Appropriate adjustment factors were calculated from the LS data and applied to the numbers of deaths in classes 2 and 3.

Numerator adjustment for under-recording by occupation

Only 58 per cent of women aged 25–59 were assigned an occupied NS-SEC class at death in the period 2001–03. Of the women not assigned to an occupied class, 59 per cent were married, of which 93 per cent to men in occupied classes. When the 'combined' method is used, and the spouse's NS-SEC is taken into account, 19 per cent of women were still not assigned an occupied NS-SEC at death (The probable reasons for this are given above under 'Analytical approach').

As a result of this shortfall in classification, the LS sample was used to estimate the NS-SEC distribution of those who were 'not classified' at death but had an occupied classification at the census. The first part of Table 3 shows this distribution when women are classified by their own NS-SEC. It can be seen that the majority of those in the LS sample unclassified at death, had an occupied classification at the census. The distribution in Table 3 was used to reallocate the unclassified numerators among the classified groups as appropriate. The second part of Table 3 shows the analogous distribution using the 'combined' rule for the classification.

Table 4⁴³ shows the adjusted death counts used as numerators for this analysis, using both the 'own' NS-SEC and the 'combined' rules of classification. Table 5 compares the percentage distribution of deaths by NS-SEC on the death registers (pre- and post-adjustments) with distributions of deaths on the LS as classified at death, and at the 2001 Census.

Table 3 NS-SEC class at Census for those 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 ¹	Total	
'Own' classification in the 2001 Census										
Number	7	24	56	16	25	87	80	85	380	
Percentage	2	6	15	4	7	23	21	22	100	
'Combined' approach in the 2001 Census										
Number	6	12	19	7	14	32	22	46	158	
Percentage	4	8	12	4	9	20	14	29	100	

1 Other and FTS includes never worked, long-term unemployed, inadequately described, not classifiable for other reasons and full-time students.
Source: ONS Longitudinal Study

The distribution of deaths pre-adjustments is very similar to that of the sample members of the ONS Longitudinal Study (LS), based on occupation recorded at death. Both show approximately 42 per cent in an unoccupied classification when a woman's own occupation is used, and approximately 20 per cent when the husband's occupation is taken into consideration using the 'combined' rule. The effect of the adjustments was to move proportionately more deaths to the more disadvantaged classes. For example, the adjustments caused the number of deaths in the routine occupations class to more than double under the 'own' classification, while the number of deaths in the higher managerial and professional class increased by about a quarter. The distribution of deaths after adjustments is much closer to that seen for the LS sample members' 2001 Census classification. This provides part validation for the adjustments made, since they were applied solely to those who were assigned to an unoccupied class at death.

Table 4 Adjusted deaths¹ by NS-SEC and age, women aged 25–59, 2001–03

England and Wales		Numbers and percentages								
Age (years)	NS-SEC analytic class									
	1	2	3	4	5	6	7	FTS ²	Others ³	Total
'Own' classification										
25–29	84	326	304	45	82	409	237	70	188	1,745
30–34	134	615	522	92	167	693	427	52	321	3,023
35–39	212	985	768	164	268	1,089	615	49	484	4,635
40–44	305	1,429	1,115	282	384	1,618	943	33	657	6,765
45–49	398	2,193	1,562	431	658	2,430	1,391	28	932	10,022
50–54	500	3,600	2,612	737	1,007	3,861	2,284	14	1,464	16,080
55–59	708	3,947	3,710	1,440	1,372	4,979	4,607	9	2,235	23,006
Total	2,340	13,094	10,594	3,192	3,937	15,080	10,504	255	6,280	65,276
Percentage	3.6	20.1	16.2	4.9	6.0	23.1	16.1	0.4	9.6	100.0
'Combined' approach										
25–29	144	326	263	80	106	351	219	64	192	1,745
30–34	288	629	435	177	223	569	359	46	298	3,023
35–39	505	1,042	604	312	396	805	531	33	406	4,635
40–44	777	1,518	868	523	572	1,192	832	20	463	6,765
45–49	1,140	2,301	1,191	837	971	1,748	1,211	20	604	10,022
50–54	1,701	3,952	1,926	1,487	1,614	2,673	1,963	7	758	16,080
55–59	2,377	5,155	2,605	2,346	2,646	3,858	3,048	6	966	23,006
Total	6,930	14,922	7,893	5,762	6,527	11,196	8,163	196	3,687	65,276
Percentage	10.6	22.9	12.1	8.8	10.0	17.2	12.5	0.3	5.6	100.0

1 Death registrations adjusted for under-recording of occupation at death and misallocation between NS-SEC classes 2 and 3.
2 Full-time students.
3 Others including never worked, long-term unemployed, inadequately described, not classifiable for other reasons.
Source: Office for National Statistics, death registrations 2001–03, ONS Longitudinal Study

Table 5 Number and percentage distribution of deaths by NS-SEC, women aged 25–59, death registrations 2001–03 and LS sample 2001–05

England and Wales		Numbers and percentages							
NS-SEC analytic class	Death registrations				Longitudinal Study				
	Unadjusted		Adjusted ¹		At death		At 2001 Census		
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
NS-SEC using 'own' classification									
1 Higher managerial and professional	1,857	2.8	2,340	3.6	30	3.3	38	4.1	
2 Lower managerial and professional	10,151	15.6	13,094	20.1	147	16.0	183	19.9	
3 Intermediate	7,680	11.8	10,594	16.2	116	12.6	156	17.0	
4 Small employers and own account workers	2,107	3.2	3,192	4.9	25	2.7	52	5.7	
5 Lower supervisory and technical	2,106	3.2	3,937	6.0	28	3.0	54	5.9	
6 Semi-routine	8,700	13.3	15,080	23.1	119	12.9	201	21.8	
7 Routine	4,975	7.6	10,504	16.1	61	6.6	130	14.1	
Other	27,699	42.4	6,535	10.0	394	42.8	106	11.5	
Total	65,276	100.0	65,276	100.0	920	100.0	920	100.0	
NS-SEC using the 'combined' approach									
1 Higher managerial and professional	6,470	9.9	6,930	10.6	104	11.3	112	12.2	
2 Lower managerial and professional	13,246	20.3	14,922	22.9	168	18.3	214	23.3	
3 Intermediate	7,191	11.0	7,893	12.1	103	11.2	125	13.6	
4 Small employers and own account workers	5,225	8.0	5,762	8.8	57	6.2	78	8.5	
5 Lower supervisory and technical	5,453	8.4	6,527	10.0	68	7.4	81	8.8	
6 Semi-routine	8,742	13.4	11,196	17.2	132	14.3	151	16.4	
7 Routine	6,476	9.9	8,163	12.5	84	9.1	85	9.2	
Other	12,473	19.1	3,883	5.9	204	22.2	74	8.0	
Total	65,276	100.0	65,276	100.0	920	100.0	920	100.0	

¹ Incorporates adjustments to death counts for classes 2 and 3, and for under-recording of occupation at death (see Methods).
Source: Office for National Statistics, death registrations 2001–03, ONS Longitudinal Study

Outcome measures

To compare the mortality experience of NS-SEC classes, two measures of mortality were calculated for each classification method: age-specific mortality rates for five-year age groups, and directly age-standardised mortality rates standardised to the European standard population (Appendix Table A3). Age-standardised rates have also been produced for the five class analytic NS-SEC and the 'condensed' three class NS-SEC.

Results

Using women's 'own' NS-SEC classification

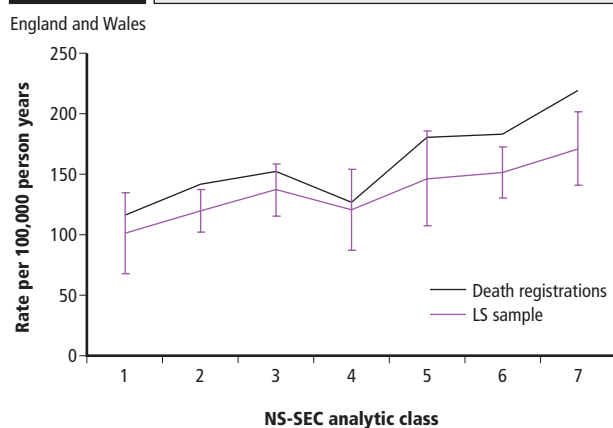
The age-standardised mortality rates are displayed in Table 6 and in Figure 1 for classification of women based on their 'own' NS-SEC only.

Table 6 Age-standardised mortality rates¹ by NS-SEC using 'own' NS-SEC classification, women aged 25–29, 2001–03

England and Wales		Rates per 100,000		
NS-SEC analytic class	Mortality rate	Lower 95 per cent confidence interval	Upper 95 per cent confidence interval	
1 Higher managerial and professional	116	99	134	
2 Lower managerial and professional	142	133	150	
3 Intermediate	152	138	166	
4 Small employers and own account workers	127	108	146	
5 Lower supervisory and technical	181	148	214	
6 Semi-routine	183	168	198	
7 Routine	220	198	242	
Ratio of classes 7:1	1.89	1.61	2.21	

¹ Rates are directly standardised using the European standard population. Numerators and denominators have been adjusted as described in article.
Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Figure 1 Age-standardised mortality rates¹ by NS-SEC, using 'own' classification, women aged 25–59, 2001–03



¹ Directly age-standardised rates using the European standard population. Death registration rates calculated from death registrations 2001–03, including adjustments, and optimised population estimates (see Methods). LS rates calculated from the ONS Longitudinal Study 2001–05.
Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Figure 1 shows an increase in mortality rates as NS-SEC class becomes less advantaged. The ratio of mortality rates between the least and most advantaged NS-SEC class was 1.9 indicating that mortality rates for women in routine occupations was almost twice that of women in higher managerial and professional occupations. The exception to the pattern of steadily increasing mortality rates occurred for women who are small employers or own account workers. These women experienced a mortality rate which was not statistically significantly different from that experienced by women in higher managerial and professional occupations.

Table 7

Age-standardised mortality rates¹ by five class NS-SEC using 'own' NS-SEC classification, women aged 25–59, 2001–03

England and Wales		Rate per 100,000	
NS-SEC five class schema	Mortality rate	Lower 95 per cent confidence interval	Upper 95 per cent confidence interval
1 Managerial and professional (1, 2)	137	130	144
2 Intermediate (3)	152	138	166
3 Small employers and own account workers (4)	127	108	146
4 Lower supervisory and technical (5)	181	148	214
5 Semi-routine and routine (6, 7)	197	186	207

1 Rates are directly standardised using the European standard population. Numerators and denominators have been adjusted as described in article.

Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Table 8

Age-standardised mortality rates¹ by three class NS-SEC using 'own' NS-SEC classification, women aged 25–59, 2001–03

England and Wales		Rate per 100,000	
NS-SEC three class schema	Mortality rate	Lower 95 per cent confidence interval	Upper 95 per cent confidence interval
1 Managerial and professional (1, 2)	137	130	144
2 Intermediate (3, 4)	145	134	157
3 Routine and manual (5, 6, 7)	194	185	204

1 Rates are directly standardised using the European standard population. Numerators and denominators have been adjusted as described in article.

Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Figure 1 also shows age-standardised rates calculated solely on the basis of the LS. The LS, which is based on a 1 per cent sample of the population, also shows a gently rising pattern of mortality as disadvantage increases, although the rates were generally lower for each class.

Tables 7 and 8 show age-standardised mortality rates for five and three class versions of NS-SEC. Both tables demonstrate an increase in mortality with increasing disadvantage. 'Small employers and own account workers' were again an exception to this rule, as this class seemed to experience similar mortality rates to 'Managerial and professional' women. The 'Routine and manual' class (Table 8) had statistically significantly higher mortality rates than the other classes in the three class version. The ratio of mortality rates of the 'Routine and manual' class to the 'Managerial and professional' class was 1.4.

Age-specific mortality rates are displayed in Figure 2. The routine occupations class had a higher mortality rate than the other classes for all age groups. The difference between the rates for the routine and the semi-routine occupations classes was relatively small up to the age of 50–54 but was statistically significantly greater at age 55–59. Overall, the socio-economic gradients, (ratio between the least and most advantaged classes), declined with age from around three for those aged 25–29 to less than two for those aged 55–59 (Appendix Table A4).

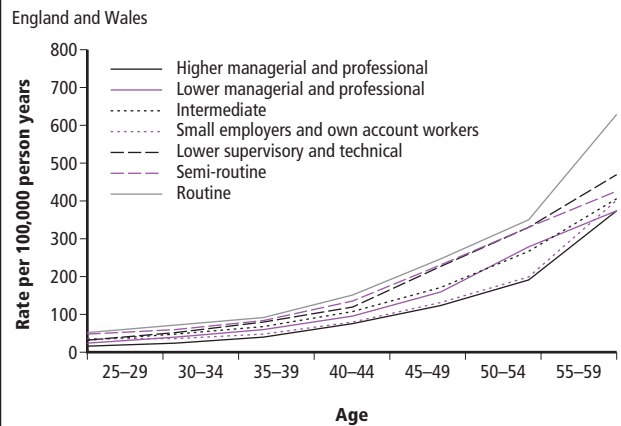
Mortality rates before the adjustment for under-recording of occupation at death can be seen in Appendix Table A5 and Figure A1.

Using the 'combined' rule for NS-SEC classification

The results are displayed in Table 9 and in Figure 3 for classification of women based on NS-SEC allocated using the 'combined' rule for classification.

Figure 2

Age-specific mortality rates¹ by five-year age groups and 'own' NS-SEC, women aged 25–29, 2001–03



1 Numerators and denominators have been adjusted as described in article.

Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Table 9

Age-standardised mortality rates¹ by NS-SEC using the 'combined' approach, women aged 25–59, 2001–03

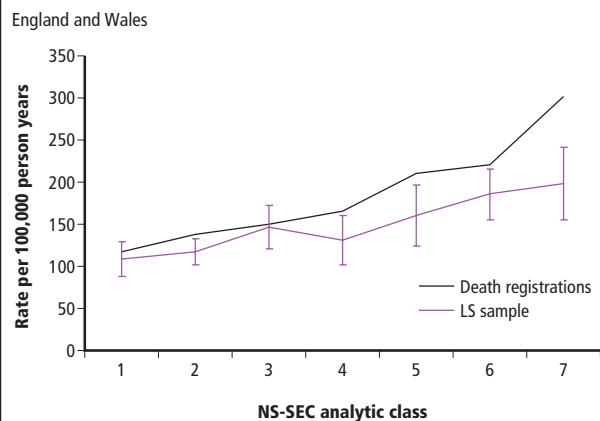
England and Wales		Rate per 100,000	
NS-SEC analytic class	Mortality rate	Lower 95 per cent confidence interval	Upper 95 per cent confidence interval
1 Higher managerial and professional	118	111	124
2 Lower managerial and professional	137	132	142
3 Intermediate	149	137	161
4 Small employers and own account workers	165	152	179
5 Lower supervisory and technical	210	192	229
6 Semi-routine	221	205	236
7 Routine	302	277	328
Ratio of classes 7:1	2.57	2.33	2.83

1 Rates are directly standardised using the European standard population. Numerators and denominators have been adjusted as described in article.

Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Figure 3

Age-standardised mortality rates¹ by NS-SEC, using the 'combined' approach, women aged 25–29, 2001–03



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

Death registration rates calculated from death registrations 2001–03, including adjustments, and optimised population estimates (see Methods).

LS rates calculated from the ONS Longitudinal Study 2001–05.

Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Figure 3 shows mortality rates increasing as disadvantage increases, each mortality rate is higher than the rate for more disadvantaged classes. The three most disadvantaged classes had statistically significantly higher mortality rates than the other more advantaged classes. Those assigned to routine occupations (NS-SEC class 7) had a particularly high mortality rate. Under this classification scheme, this class consists of two main groups:

- women whose own occupation assigns them to the routine occupations class and, if married, have husbands who also are either classified to routine occupations or are unoccupied, and
- women who are themselves unoccupied and married to a husband assigned to the routine occupations class

Figure 3 also compares these mortality rates with age-standardised rates calculated solely on the basis of the LS. The LS showed a similar rising pattern of mortality, but the estimated mortality rate for those classified to routine and semi-routine occupations at death was again statistically significantly higher than that found using the LS alone.

Tables 10 and 11 show age-standardised mortality rates for the three and five class versions of NS-SEC. Both tables show an increase in mortality with disadvantage, with most classes having statistically significantly higher mortality than the previous class. The ‘Routine and manual’ class (Table 11) had a markedly worse mortality rate than the other classes. The difference between the ‘Routine and manual’ class and the ‘Intermediate’ class was much greater than that between the ‘Intermediate’ class and the ‘Managerial and professional’ class. The ratio of mortality rates of the ‘Routine and manual’ class to the ‘Managerial and professional’ class was 1.8.

Table 10 Age-standardised mortality rates¹ by five class NS-SEC using the ‘combined’ approach, women aged 25–59, 2001–03

England and Wales		Rate per 100,000	
NS-SEC five class schema	Mortality rate	Lower 95 per cent confidence interval	Upper 95 per cent confidence interval
1 Managerial and professional (1, 2)	130	126	134
2 Intermediate (3)	149	137	161
3 Small employers and own account workers (4)	165	152	179
4 Lower supervisory and technical (5)	210	192	229
5 Semi-routine and routine (6, 7)	249	237	261

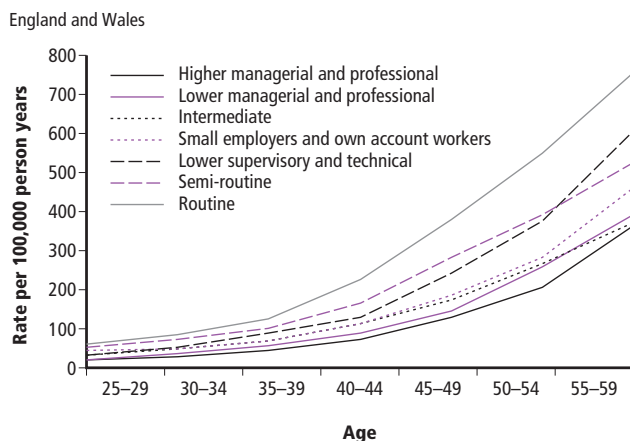
¹ Rates are directly standardised using the European standard population. Numerators and denominators have been adjusted as described in article.
Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Table 11 Age-standardised mortality rates¹ by three class NS-SEC using the ‘combined’ approach, women aged 25–59, 2001–03

England and Wales		Rate per 100,000	
NS-SEC three class schema	Mortality rate	Lower 95 per cent confidence interval	Upper 95 per cent confidence interval
1 Managerial and professional (1, 2)	130	126	134
2 Intermediate (3, 4)	156	147	164
3 Routine and manual (5, 6, 7)	238	229	247

¹ Rates are directly standardised using the European standard population. Numerators and denominators have been adjusted as described in article.
Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Figure 4 Age-specific mortality rates¹ by five-year age groups and NS-SEC using ‘combined’ NS-SEC classification, women aged 25–59, 2001–03



¹ Numerators and denominators have been adjusted as described in article.
Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Age-specific mortality rates using the ‘combined’ rule are displayed in Figure 4. Those classed as lower supervisory and technical, semi-routine and routine, the so-called ‘labour contract’ classes, had higher mortality rates for all age groups above 30–34. Absolute differences between these and the more advantaged groups increased with age. There was less evidence of a decline in socio-economic gradients with age, relative to the ‘own’ classification (Appendix Table A6).

Mortality rates before the adjustment for under-recording of occupation at death can be seen in Appendix Table A7 and Figure A2.

Discussion

This study presents two sets of results, one using women’s ‘own’ NS-SEC classification, and one using a ‘combined’ classification. Both suggest substantial socio-economic inequalities in the mortality rate of women of working age. The ratio of the mortality rate of the least advantaged class to the most advantaged, or ‘gradient’ was 1.9 using women’s own class, and 2.6 using the ‘combined’ approach.

The ‘own’ and ‘combined’ approaches can be viewed as reflecting two conceptually distinct causal mechanisms which are potentially equally useful depending upon the research question of interest. The ‘combined’ approach best reflects household social and economic resources which will be of interest in relation to health inequalities among women. Women’s own occupational class is a truer reflection of the employment relations experience of women, and so may be more useful in making comparisons between men and women.

There have been relatively few studies of female mortality by occupation-based socio-economic class in England and Wales. Direct comparison of the figures from the current study using NS-SEC with those using social class is not possible but the results presented here can be put in the context of earlier work. Estimates were published in the ONS *Health Inequalities Decennial Supplement*,¹⁶ suggesting a mortality rate ratio of 1.55 for social classes IV and V relative to classes I and II for women aged 35–64 in the period 1986–92. A later study¹¹ showed a value of 1.41 for the corresponding ratio in the period 1997–99. Both studies were based on the LS, and used a hierarchical approach to classification, whereby the woman’s own classification was used if available, and the spouse’s classification was used if the woman was in an unoccupied class.

Women's 'own' NS-SEC class

As stated in the Methods section, only 58 per cent of women within the age range studied, whose deaths occurred in the period 2001–03, were classified to an occupation. Estimates obtained using women's own NS-SEC class are sensitive to any adjustment made to the numerators (numbers of deaths by class). The effect of the adjustment for the under-recording of death is substantial, although based on information from a relatively small sample of 380 deaths from the LS. (Appendix Table A5 and Figure A1 show the mortality rates prior to the adjustment.) The effect is to alter the mortality rate ratio of the least to most advantaged class from 1.2 to 1.9. The adjustment reduces the potential bias but the effect of using a small sample is to increase substantially the confidence intervals associated with the age-standardised estimates, particularly for the least advantaged classes. Despite these wider confidence intervals, the mortality rates produced show a clear gradient, with higher managerial and professional workers having a statistically significantly lower mortality rate than those in intermediate occupations who, in turn, have a statistically significantly lower rate than those for semi-routine and routine occupations.

The mortality rates produced were also similar to those obtained purely on the basis of the LS (Figure 1). However, routine and semi-routine occupations both had statistically significantly higher mortality rates than those based on the LS alone. A similar pattern was found in the analysis of male mortality by NS-SEC¹ where rates obtained for routine occupations using death registrations and adjusted census-based denominators were also found to be substantially higher than those based on the LS alone.

The principal reason for the difference in the two analyses was the difference in coding of the classes at census and at death. The LS analysis sample was classified according to the 2001 Census. There was a potential health selection effect whereby many of those in poor health were classed at the census as being long-term unemployed or not classified for other reasons. This typically produces a downward bias on the socio-economic gradient in the period immediately following classification.²⁴ More importantly, in the context of this study, was the difference in treatment at census and at death of the 'labour contract' classes and of routine occupations in particular. Within the occupied classes, there were 151 LS sample members allocated to routine occupations at death, compared to only 120 at the census. This implies a greater chance of 'demotion' to the routine occupations class at death than 'promotion' from it. A similar, but smaller, effect exists for semi-routine occupations. The effect of this was to depress the relative gradient of the LS mortality rates, based on the census classification, compared with the main estimates which were based on death registrations.

The results presented here suggest a strong relationship between mortality rates and own occupation-based class for women. By comparison, a study which examined the LS for the period 1971–81²⁵ found that although own social class (at the level of manual/non-manual) did have some discriminatory power for both single and married women, factors such as husband's class, car ownership and tenure were better discriminators of mortality rates for married women.

It is possible that social changes since the 1970s have increased the validity of own occupation-based class as a measure of the socio-economic status of women relative to alternative indicators. In studies of societies where a higher proportion of women are in employment than in the UK, inequalities in mortality based on own occupation are substantial²⁶ and (for non-married women), 'at least as large as men's'.²⁷

The results presented here seem broadly consistent with other studies of health inequalities in women using their own NS-SEC as a classification schema. One study²⁸ based on the General Household Survey suggested class differences in self-reported health as 'clearly evident for women based on their own occupation', with a socio-economic gradient between the least and most advantaged groups of approximately

2.5 times. Another study²⁹ of women aged 16–60 in the period 1986–96, using the interim NS-SEC classification, found a mortality risk ratio of approximately 1.5 for women in routine occupations relative to those in higher managerial and professional occupations.

Using the 'combined' rule to assign women to a NS-SEC class

The concept underlying this approach is that a person may be classified by their family or household class position. Erikson³⁰ summarised the idea 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.' To use this approach it is necessary to assume that NS-SEC, although based on the employment relations status of an individual, can be used as a proxy for the life chances of their spouse or other members of their household.

Support for the household-based approach can be found in a study³¹ which examined a selection of individual and household measures of social position as explanatory factors for self-rated health. For the economically active, it found that an individual's own NS-SEC class was the strongest predictor, while for the economically inactive, NS-SEC class derived according to the subject's last occupation was a less strong predictor of health than a household-based measure (the Cambridge scale³²). This is consistent with an earlier study which found significant variation in mortality rates among 'unoccupied' women according to husband's social class.²⁵ Since many married women who have no occupation are classed as economically inactive this suggests that a household-based approach is preferable for an analysis of married women. Further support for the household-based approach can be found in a study²⁹ of mortality over the period 1986–96. It found that 'general social advantage of the household' was more important as a predictor of mortality in women aged 16 to 60 than the own NS-SEC class of the women.

Other authors, however, have had concerns about the use of a family- or household-based measure. Some^{33,34,35} are concerned that socio-economic inequality between men and women may be hidden, or that the increase in divorce over time may have invalidated the assumption that everyone in the family unit benefits equally from the household class position. Another author³⁶ concluded from a study using Finnish data that the advantages of cross-classifications between own and spouse's socio-economic characteristics were 'very limited'. There is, however, considerable support for schemas involving the use of a family-based classification.^{15,29}

Although by convention the husband's socio-economic class has been used as a proxy for household classification in the case of married women,¹³ this has been controversial.^{21,37} In addition, an examination of LS data for 2001 does not support this approach. Where both spouses are classified to an occupied NS-SEC class, the most advantaged classification is held by wives in 31 per cent of cases and by husbands in 47 per cent of cases (in the remaining 22 per cent of cases, both spouses have the same class). Thus selection of the husband's class to represent the socio-economic position of the household would be misleading for a substantial minority of households.

The 'combined' rule used in this study is based on Erikson's 'dominance' approach. This is similar to the 'gender neutral household class measure' recommended by other authors³⁸ for epidemiological studies of class inequalities. The authors propose a measure based on the most dominant individual level occupational class position of the woman and all adults in the household. In the current study it was not possible to implement this approach fully, as the death registers did not record the occupational details of a partner, nor any other adults in the household. However, it was possible to construct a measure based on a woman's occupation and her husband's.

Several options are available for rules determining the most advantaged classification of the husband and the wife in a household. One suggested

hierarchy²⁰ for this purpose, based on Erikson's approach,¹⁵ places self-employment above employment (even employment as a manager or professional). A more straightforward approach is to deem the member of the household with the most advantaged NS-SEC class to be the class representative person for the household, and this was the method adopted for the combined approach.

The 'dominance' approach has been advocated as being a more effective discriminator of class differences in mortality for both men and women than an individual or 'own' approach.³⁰ The results presented here suggest that the 'combined' approach distinguishes well between classes when the three or five class schema is used. Each mortality rate was higher than that of the preceding class, and statistically significantly higher for all but one class. This was not the case when a woman's 'own' NS-SEC classification was used. Under the 'combined' approach, the estimated mortality rate ratio between the least and most disadvantaged class was statistically significantly greater than that found using women's 'own' NS-SEC class.

In contrast to the 'own' approach, women in the small employers and own account workers class had a statistically significantly higher mortality rate than those in managerial and professional occupations. This is partly because a high proportion of the married women whose occupation assigned them to this class were married to men in the managerial and professional classes and consequently assigned a different class under the 'combined' approach.

The approach is sensitive to the adjustments made to compensate for the under-recording of occupation on the death registers, but less so than the approach using 'own' NS-SEC class. The adjustment changes the resultant socio-economic gradient from 2.2 to 2.6.

As for the 'own' approach, the LS analysis suggests a lower gradient than the main estimates (Figure 3). Health selection was a less important factor for the combined approach, since a high proportion of women in the study were assigned their husband's class. As found for the 'own' approach, within the occupied classes, there was a higher propensity for an LS member to be 'demoted' to routine occupations at death from other classes at the census, than the propensity to be 'promoted' from that class. This tended to depress the relative gradient resulting from the longitudinal analysis since the latter was based on the census classification.

Marital status

Marital status is a consideration in the interpretation of the results. According to census data, the proportion of 'not married' women aged 25–59 increased from 18 per cent in 1981 to around 40 per cent in 2001. In addition, the proportion of women aged 25–59 who are economically active increased from around 60 per cent in 1981 to 72 per cent in 2001. Under the 'combined' classification, married and non-married women are treated differently. This may hide systematic differences in mortality rates based on marital status. Appendix Figure A3 shows mortality rates by NS-SEC for single women, for married women using their 'own' class, for married women using the 'combined' approach, in addition to the overall results for the 'own' and 'combined' approaches.

Figure A3 suggests that there is a steeper socio-economic gradient for single than for married women using their 'own' classification. This is consistent with a study using the LS over the period 1976–81²⁵ which found that socio-economic differences were greater for single women than for occupied married women using their 'own' class. Another study,¹⁶ examining the period 1986–92, estimated that for women in manual classes who were not married, 'mortality is 70 per cent higher than their non-manual counterparts'.

Figure A3 also suggests that under the 'combined' approach, married women had similar mortality rates to all women, except for NS-SEC class 7 (routine occupations). Over 75 per cent of this group consisted of women who were not assigned an occupied class and whose husband

was classified to NS-SEC class 7. This is also consistent with a previous LS study²⁵ which found that the group of women classified as not in paid employment and married to men in manual social classes had the highest mortality rate of any combination of cross-classifications, except for where both spouses are not classified to an occupation.

Further work is required to investigate in more depth the interactions between marital status and NS-SEC in the determination of mortality rate risk.

Comparison with the estimates for men

Under both methods of classification, mortality rates for each NS-SEC class were statistically significantly lower than the corresponding rate for men.

The mortality rate ratio between least and most advantaged was 1.9 under the 'own' approach and 2.6 under the 'combined' approach, compared with a similar figure of 2.6 from the recent analysis of male mortality.¹ The overall gradients depend critically on the rates for those classified to routine occupations. If the condensed (three class) version of NS-SEC is used the gradients are based on larger units, and the measured inequality for women is less than that for men. The ratio of mortality rates between the 'Routine and manual' and the 'Managerial and professional' classes is 2.0 for men, and 1.8 for women under the 'combined' approach, and 1.4 under the 'own' approach. Thus it appears that women have a narrower socio-economic mortality gradient than men if 'own' classification is used, and a similar one if the 'combined' approach is used.

The dependence of mortality gradients on the classification system used implies that gender differences in the socio-economic mortality gradient are sensitive to the system of classification and measurement chosen. However, this is not the same as attributing the differences solely to artefact. It is possible that the results obtained using women's 'own' NS-SEC class reflect the impact of differences in their occupation-based status, whereas those obtained using the 'combined' rule reflect variations in access to a range of social and economic resources.

There are a number of potential explanations for generally lower observed mortality differences by occupation-based class for women than for men. One is that women are exposed to fewer occupational hazards than men in the same socio-economic class.³⁹ Another is that it might be the result of diseases responsible for a high proportion of premature deaths in women, such as breast cancer, having a small or inverse gradient.^{11,27} Further analysis of female mortality by NS-SEC and major cause is planned for a future article in this series.

Reasons for socio-economic gradients in mortality

A number of factors have been used to explain gradients in mortality rates for both men and women in the literature. For example, Bartley⁴⁰ listed four main potential explanations, which are not necessarily mutually exclusive:

- material explanations suggest that individuals in disadvantaged classes are likely to have lower incomes and will tend to suffer poor health brought on, for example, by poor diet, poor quality housing, polluted environments and dangerous workplaces
- cultural-behavioural explanations suggest that individuals in less advantaged social groups are more likely to indulge in 'risky behaviours', for example, smoking, drinking, poor diet and lack of exercise
- psycho-social explanations suggest that individuals who are exposed to psychological stress at work brought on by, for example, lack of autonomy, poor reward structures and job strain, are more likely to experience poor health
- life-course explanations suggest that individuals exposed to risks earlier in life carry the risk with them through their lifetimes

The results presented here, using the 'own' classification approach, lend some support to psycho-social explanations, since NS-SEC itself is based conceptually on this theory, and has been shown to discriminate on the basis of a woman's 'own' classification. The 'combined' approach, which is the more effective discriminator of mortality, is more consistent with material and cultural-behavioural explanations, since the effects of income and status operate on the individual via the socio-economic position of the household rather than directly through the employment relations status of the individual. For example, there is evidence that women in the less advantaged classes are more likely to smoke, and this has been shown to be a major contributor to excess mortality.⁴¹

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. This restriction had a more severe effect on the analysis than the analogous one for men.

The under-recording of occupations at death is a difficulty in any measurement of female mortality using an occupation-based classification.

The results are sensitive to the LS-based adjustment of the deaths not classified to an occupied NS-SEC class. This adjustment was, of necessity, based on a relatively small sample (only 158 in the case of the 'combined' approach). The resultant wider confidence intervals presented than those for men¹ reflect the size of the sample upon which this adjustment was based. (An illustration of the effect of adjustments can be found in Appendix Tables A5, A7 and Figures A1, A2, and are discussed above.)

The outcome measure used throughout this series of articles (age-standardised mortality ratios) was the most straightforward, but does not take account of the size of each class. This means that the comparison of the 'most advantaged' and 'least advantaged' class mortality rates had an arbitrary component dependent on the degree of subdivision of the class.

The range of inequalities presented here has not considered the rate for women who were 'unoccupied' according to their own classification. Given the known predictive power of unemployment in the analysis of premature mortality in men,⁴² women who are not in the labour market potentially have a higher mortality risk than women assigned to routine occupations. Since these are excluded from the analysis when the 'own' classification is used, this may result in a reduction in the measured level of inequality.

The death registers during the period of this study did not recognise partnerships, and thus women in such partnerships have been treated as 'single'. The same definition was used to obtain the census populations, so the results presented above are internally consistent. However, there is an argument for treating women in partnerships in the same way as married women. The LS sample indicates that a maximum of 11 per cent of all women and 8 per cent of the women who died during the study period could change class under the broader definition of a family.

Conclusions

This analysis has estimated standardised mortality rates by NS-SEC for women aged 25–59 in the period 2001–03 using data from the 2001 Census and from death registrations. The results were refined using information from the ONS Longitudinal Study to adjust for

known biases and for under-recording of occupational status. The age-standardised mortality rate for women classified to the routine occupations NS-SEC class in 2001–03 was 1.9 times that of those classified as higher managers and professionals when women's own occupation was used to assign them to an NS-SEC class. This ratio was 2.6 when a 'combined' measure was used for assignment, similar to the corresponding ratio for men.

A clear social gradient was evident under both methods of classification. The exception was women classified by their own occupation as small employers and own account workers (NS-SEC class 4), who had a mortality rate no higher than women classified as higher managerial and professional (NS-SEC class 1). Overall, the differences between the classes were not as well defined as those found in the analysis of male mortality.

The dependence of the results on the classification method illustrates the need to be clear on the conceptual basis underlying the two methods. Using a woman's NS-SEC based on her own occupation has a conceptual basis in employment relations, and is therefore more suitable for application in studies where the focus is on the role of occupational factors, or on comparisons with male mortality. Using the 'combined' measure best reflects access to social and economic resources, and may be more appropriate to other applications, such as the study of health inequalities among women.

Key findings

- The National Statistics Socio-economic Classification (NS-SEC), can be used effectively as a basis for the analysis of mortality in adult women
- In the period 2001–03, the age-standardised mortality rate of women aged 25–59 in routine occupations according to their own NS-SEC class was 220 per 100,000 population, 1.9 times the rate of 116 per 100,000 for women in higher managerial and professional occupations
- Using a combined classification incorporating information on husband's class, the age-standardised mortality rate of women aged 25–59 in the least advantaged class, was 302 per 100,000 population, 2.6 times the rate of 118 per 100,000 for women in the most advantaged class
- A clear social gradient is evident under both methods of classification. The exception was women classified by their own occupation as small employers and own account workers (NS-SEC class 4) who have a mortality rate no higher than women classified as higher managerial and professional (NS-SEC class 1)
- Using the combined classification, mortality rates increased with disadvantage for all classes. The increase was statistically significant between each of the following classes: higher managerial and professional, lower managerial and professional, small employers and own-account workers, semi-routine and routine occupations
- There were statistically significant differences in mortality rates between all classes using the three class condensed NS-SEC in a clear socio-economic gradient, when the combined classification was used
- The relative variation in mortality among women when classified to NS-SEC according to the combined classification was similar to that for men classified to NS-SEC by their occupation

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Box A1

National Statistics Socio-economic Classification – Operational categories and analytic classes

Operational categories	Eight class version	Five class version	Three class version
1 Employers in large establishments	1 Higher managerial and professional occupations	1 Managerial and professional occupations	1 Managerial and professional occupations
2 Higher managerial occupations			
3 Higher professional occupations			
4 Lower professional and higher technical occupations	2 Lower managerial and professional occupations	2 Intermediate occupations	2 Intermediate occupations
5 Lower managerial occupations			
6 Higher supervisory occupations			
7 Intermediate occupations	3 Intermediate occupations	3 Small employers and own account workers	3 Routine and manual occupations
8 Employers in small organisations	4 Small employers and own account workers		
9 Own account workers	5 Lower supervisory and technical occupations	4 Lower supervisory and technical occupations	3 Routine and manual occupations
10 Lower supervisory occupations	6 Semi-routine occupations	5 Semi-routine and routine occupations	
11 Lower technical occupations	7 Routine occupations		
12 Semi-routine occupations	8 Never worked and long-term unemployed	Never worked and long-term unemployed	Never worked and long-term unemployed
13 Routine occupations			
14 Never worked and long-term unemployed			

Source: NS-SEC User Manual

Box A2

Details of the calculation of Filter X and Health Selection Adjustments

The denominators were subject to two adjustments. Firstly an adjustment was calculated to compensate for the Filter X rule.¹ This rule was applied at the 2001 Census, and as a consequence, all persons who had not worked since 1996 were allocated to the residual category ‘not classifiable for other reasons’. When occupations are recorded on the death registers, no such time limit is applied: this difference in recording is likely to cause bias if not corrected.

The LS sample of 132,304 females covering the period from Census day 2001 to 31 December 2005 was used to produce a matrix of person-years by reduced NS-SEC and five-year age bands. The LS was fully coded at Census, that is, the Filter X rule was not applied. However, it is possible to simulate the effect on each individual record of the operation of the Filter X rule by changing the classification to ‘Not Classified’ if the year last worked was recorded on the LS as before 1996. Using this simulated variable, another matrix of person-years by reduced NS-SEC and five-year age bands was produced. Using the two matrices it was possible to identify the proportion of person-years in each age band assigned to ‘Not Classified’, that would have been in each NS-SEC class had the Filter X rule not been applied. These proportions were then applied to the census based mid-year 2001–03 population estimates of the ‘Not Classified’ person-years in each age band.

The second adjustment was to compensate for the potential effect of health selection bias.^{23,24} The hypothesis is that health status influences social position, leading to a selection out of the labour market of those in ill-health which may have a disproportionate effect across NS-SEC class denominators. The LS, by linking data between censuses, makes it possible to obtain the previous occupation of a person who was in an unoccupied class in 2001 by reference to the 1991 Census.

A further matrix of person-years by five-year age band and NS-SEC can now be produced, with 1991 occupied classes, if available, substituted for unoccupied classes for relevant LS members. This was compared to the matrix of reduced NS-SEC produced without these corrections, but with the Filter X adjustments made. Using the two matrices it was possible to estimate the proportion in each age band of ‘unoccupied’ person years, that would have been in each NS-SEC class had the hypothesised ‘health selection’ not have occurred. The resultant reallocation proportions were then applied to the (Filter X adjusted) census based mid-year 2001–03 population estimates of the number of ‘Not Classified’ women in each age band.

Following correction for the Filter X bias, the remaining corrections for health selection were small.

Table A1

2001 Census populations by age and NS-SEC classification, women aged 25–59

England and Wales											Thousands
Age (years)	NS-SEC analytic class										
	1	2	3	4	5	6	7	FTS ¹	Other ²	Total	
'Own' classification											
25–29	167	486	319	44	87	258	128	71	190	1,750	
30–34	184	521	352	84	97	320	154	42	277	2,031	
35–39	164	505	337	108	96	358	162	32	312	2,074	
40–44	123	449	292	105	90	333	152	22	277	1,841	
45–49	98	418	264	100	82	297	140	12	252	1,663	
50–54	84	408	290	116	87	333	163	6	324	1,810	
55–59	50	267	215	94	65	266	142	3	394	1,495	
Total	869	3,053	2,068	651	604	2,164	1,040	190	2,027	12,666	
Percentage	6.9	24.1	16.3	5.1	4.8	17.1	8.2	1.5	16.0	100.0	
'Combined' approach											
25–29	249	524	283	65	107	214	109	63	135	1,750	
30–34	356	589	280	120	133	228	118	32	174	2,031	
35–39	383	597	260	154	143	226	115	21	175	2,074	
40–44	333	535	223	153	133	199	102	14	149	1,841	
45–49	287	492	201	148	122	178	91	8	136	1,663	
50–54	279	503	223	178	137	208	109	4	169	1,810	
55–59	179	348	178	150	111	191	108	2	228	1,495	
Total	2,067	3,587	1,648	967	887	1,445	753	145	1,166	12,666	
Percentage	16.3	28.3	13.0	7.6	7.0	11.4	5.9	1.1	9.2	100.0	

1 Full-time students.

2 Including never worked, long term unemployed, inadequately described, not classifiable for other reasons.

Source: Office for National Statistics, 2001 Census (custom tables provided by ONS Census Division)

Table A2

Population estimates for 2001–03 by age and NS-SEC classification, women aged 25–59

England and Wales											Thousands
Age (years)	NS-SEC analytic class										
	1	2	3	4	5	6	7	FTS ¹	Other ²	Total	
'Own' classification											
25–29	482	1,404	923	128	251	745	370	205	550	5,059	
30–34	545	1,542	1,041	250	286	948	457	126	819	6,014	
35–39	497	1,531	1,021	326	291	1,085	490	98	946	6,284	
40–44	382	1,391	906	324	278	1,031	470	69	858	5,710	
45–49	299	1,277	805	305	250	905	429	38	770	5,078	
50–54	240	1,172	832	335	251	956	468	17	932	5,203	
55–59	162	869	699	306	213	867	462	10	1,286	4,874	
Total	2,607	9,187	6,227	1,974	1,820	6,539	3,144	563	6,161	38,221	
Percentage	6.8	24.0	16.3	5.2	4.8	17.1	8.2	1.5	16.1	100.0	
'Combined' approach											
25–29	721	1,515	819	187	310	620	315	182	391	5,059	
30–34	1,055	1,745	828	355	394	676	351	95	515	6,014	
35–39	1,162	1,809	787	466	433	686	349	64	529	6,284	
40–44	1,031	1,657	693	473	413	617	317	44	463	5,710	
45–49	877	1,501	615	450	372	543	279	25	414	5,078	
50–54	801	1,445	642	512	394	599	313	11	486	5,203	
55–59	583	1,136	579	489	361	623	353	8	742	4,874	
Total	6,231	10,807	4,962	2,932	2,679	4,364	2,276	429	3,541	38,221	
Percentage	16.3	28.3	13.0	7.7	7.0	11.4	6.0	1.1	9.3	100.0	

1 Full-time students.

2 Including never worked, long term unemployed, inadequately described, not classifiable for other reasons.

Source: Office for National Statistics, 2001 Census (custom tables provided by ONS Census Division), mid-year population estimates for 2001, 2002 and 2003

Table A3 European standard population weights for age range 25–59 used in the calculation of age-standardised rates

Age (years)	European standard population weight
25–29	7,000
30–34	7,000
35–39	7,000
40–44	7,000
45–49	7,000
50–54	7,000
55–59	6,000

Table A4 Age specific mortality rates¹ and socio-economic gradients² by NS-SEC using 'own' classification, women aged 25–59, 2001–03

England and Wales Rate per 100,000

Age (years)	NS-SEC using 'own' classification							Gradient
	1	2	3	4	5	6	7	
25–29	17	23	32	34	31	49	53	3.1
30–34	24	39	47	36	52	61	70	2.9
35–39	41	60	68	47	78	84	93	2.3
40–44	75	95	109	81	121	133	153	2.0
45–49	125	159	171	130	225	229	246	2.0
50–54	193	277	268	198	330	332	351	1.8
55–59	375	372	406	402	470	426	630	1.7

1 Numerators and denominators have been adjusted as described in article.
 2 The ratio of mortality rates of NS-SEC class 7 to NS-SEC class 1.
 Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Table A5 Age-standardised mortality rates¹ by NS-SEC using 'own' classification before adjusting for under-recording of occupation at death, women aged 25–59, 2001–03

England and Wales Rate per 100,000

	Mortality rate	Lower 95 per cent confidence interval	Upper 95 per cent confidence interval
1 Higher managerial and professional	90	85	94
2 Lower managerial and professional	118	116	120
3 Intermediate	100	97	102
4 Small employers and own account workers	84	80	88
5 Lower supervisory and technical	96	92	100
6 Semi-routine	105	103	107
7 Routine	106	103	109

1 Rates are directly standardised using the European standard population. Numerators and denominators have been adjusted as described in article except the adjustments for under-recording of occupation at death (see Methods).
 Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1)

Table A6 Age-specific mortality rates¹ and socio-economic gradients² by NS-SEC using 'combined' classification, women aged 25–59, 2001–03

England and Wales Rate per 100,000

Age (years)	NS-SEC using the 'combined' approach							Gradient
	1	2	3	4	5	6	7	
25–29	20	21	31	43	33	51	60	3.0
30–34	27	35	49	50	54	71	84	3.1
35–39	43	56	71	67	87	99	126	2.9
40–44	74	88	114	112	130	165	226	3.1
45–49	127	147	175	185	243	283	379	3.0
50–54	205	258	266	282	376	393	549	2.7
55–59	363	392	371	462	606	526	757	2.1

1 Numerators and denominators have been adjusted as described in article.
 2 The ratio of mortality rates of NS-SEC class 7 to NS-SEC class 1.
 Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

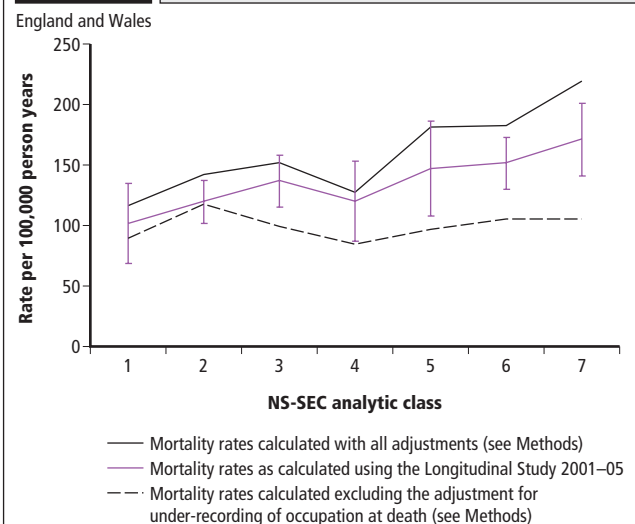
Table A7 Age-standardised mortality rates¹ by NS-SEC using 'combined' approach before adjusting for under-recording of occupation at death, women 25–59, 2001–03

England and Wales Rate per 100,000

	Mortality rate	Lower 95 per cent confidence interval	Upper 95 per cent confidence interval
1 Higher managerial and professional	110	107	113
2 Lower managerial and professional	128	126	130
3 Intermediate	124	121	127
4 Small employers and own account workers	148	144	152
5 Lower supervisory and technical	175	170	179
6 Semi-routine	172	168	176
7 Routine	239	233	245

1 Rates are directly standardised using the European standard population. Numerators and denominators have been adjusted as described in article except the adjustments for under-recording of occupation at death (see Methods).
 Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1)

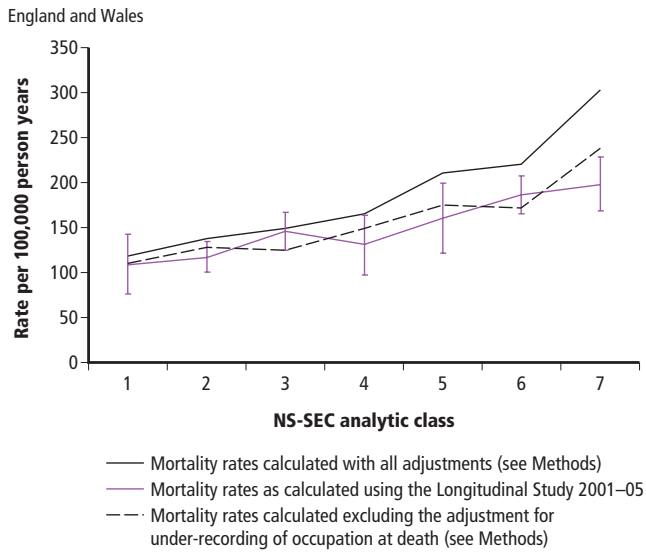
Figure A1 Age-standardised mortality rates by NS-SEC using 'own' classification, a comparison of adjusted and unadjusted results and those based on the LS, women aged 25–59, 2001–03



Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Figure A2

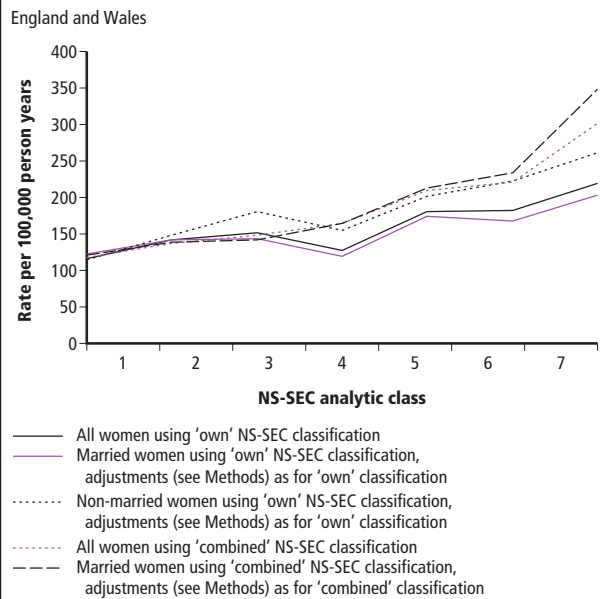
Age-standardised mortality rates by NS-SEC using the 'combined' approach, a comparison of adjusted and unadjusted results and those based on the LS, women aged 25–59, 2001–03



Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study

Figure A3

Age-standardised mortality rates by NS-SEC: comparison of mortality rates for all women, married women and non-married women by 'own' and 'combined' approaches to NS-SEC classification, women aged 25–59, 2001–03



Source: Office for National Statistics, death registrations 2001–03, optimised population estimates (see Table 1), ONS Longitudinal Study