Yearbook of Population Research in Finland 31 (199?–199?), pp. 101–110

The Social Patterning of Mortality in a Cohort of Elderly Swedes

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Abstract

Social class differences in mortality among the elderly have received only limited interest. In this paper we analyze the impact of social class on mortality from mid-life onwards.

In 1968 1,860 persons born between 1892 and 1915 were interviewed and followed in the national cause of death registry for the period 1968–1991. In addition, 537 of the 563 survivors were re-interviewed in 1992. We employ proportional hazard regressions to analyze the impact of social class on death risks over time.

There are fairly small class differences in the probability of reaching old age. However, it appears that mortality differentials were steeper before retirement age than after. Still, the size of class differences in mortality seem smaller than expected on the basis of other studies. At the same time steep class gradients in illness and functional abilities exist among survivors. Some possible explanations for these somewhat contradictory findings are discussed.

Keywords: social classes, mortality, aged, Sweden

Introduction

Inequalities in health have been an issue of lively debate during the past 10 to 15 years. Sociologists, social epidemiologists and public health researchers have looked at differences in mortality and illness between social classes, regions, ethnic groups and men and women, just to mention a few aspects of health inequalities studied (for overviews see e.g. Whitehead 1992). A central theme in this stream of research has

been differences in health and mortality between social classes. Although specific age groups have been focused on in some cases (Leon, Vågerö and Otterblad Olausson 1992; Östberg 1992; Vågerö and Östberg 1989; West 1988; Rahkonen and Lahelma 1992), inequalities in health, illness and mortality among older people, in general, i.e. those being 65 years or older, and the oldest old, in particular, i.e. those over 80 years, have not been major issues in this debate (for exceptions, see Fox, Goldblatt and Jones 1986; Otterblad Olausson 1991; Arber and Ginn 1993; Martelin 1994).

If the elderly, and especially the oldest old, have generally been overlooked in research on social class inequalities in health, inequality issues have certainly been overlooked in gerontological health research, as well, until quite recently (see Markides 1989; Victor 1989; Arber and Ginn 1991; Thorslund and Lundberg 1994). Therefore, social class differences in illness and mortality among the old and oldest-old have been a neglected issue, both within inequalities research and gerontology.

Studies on class inequalities in mortality have shown that class differences in mortality exist throughout the course of life, although the peak in class differences occurs between the ages of 30 and 40, and that differences tend to decrease gradually from there on (Vågerö 1992; Valkonen et al. 1993). If the relative difference in mortality risk between workers and non-manual employees is comparably small among persons aged 65 and over, workers still have a higher mortality risk also at these ages. This will mean a selection of elderly with – at least – a lack of fatal diseases, and, in most countries, probably also an overrepresentation of former white-collar employees. These findings may reflect an effect of differential survival that weakens the relation between class and mortality in the oldest age groups (Longino, Warheit and Green 1989). Of course, such a line of reasoning rests on the assumption that the occurrence of new fatal health problems in an aging group of people at a certain point becomes unrelated to the class position of the surviving individuals. There is no evidence indicating that this is actually the case.

Even if class differences in fatal diseases diminish as a cohort reaches advanced ages, leading to a decrease in the relative mortality differences, there are differences in health and well-being among the oldest old. For example, large class inequalities could be demonstrated among the oldest-old in Sweden in both health, functional ability and wealth (Thorslund and Lundberg 1994; Thorslund, Lundberg and Parker 1993). In order to better understand these differences, longitudinal follow-up of class differences in mortality in the cohorts now old and old-old today have to be undertaken.

Data and methods

The data-set employed is the Swedish Panel Study of Living Conditions of the Oldest Old (SWEOLD) (Lundberg and Thorslund 1996).The purpose of SWEOLD was to follow up old persons who had participated in earlier waves of the Swedish Level of Living Surveys (LLS) (Erikson and Åberg 1987), but who had been left out because they had passed 75 years. The sample consisted of 1,936 persons born between February 15, 1892 and February 15, 1915 who had previously been interviewed at least once in the level of living surveys in 1968, 1974, and 1981. Due to the sample criteria used, 175 persons of the specified birth cohorts that had been in the LLS sample at least once, but who had not responded, were excluded. Of the selected 1,936 persons, 563 persons aged 77 to 98 years old were still alive in the beginning of 1992. A survey based on personal interviews covering health, functional ability, social relations, housing, economy etc. was administered to the survivors during the spring of 1992. An extremely low non-response rate has obtained, only 4.6 percent (26 persons) (Lundberg and Thorslund 1996).

By means of personal identification numbers, mortality data was collected from the national cause of death registry for the period 1968–1991. When using 1968 as a starting point for a prospective study, cases that are included in the sample but were non-respondents in 1968 or not in that sample are excluded. This leaves us with 1,860 persons at baseline.

Independent variables used in the analyses

The central independent variable in our analyses in this article is social class. Three problems arise in connection with the definition of social class, namely i) how class is conceptualized, ii) how the concept of class is operationalized, and iii) how persons are assigned to the different classes. The first of these issues in our case is the question of whether "class differences" should be conceptualized as differences between positions in a *class structure* or differences between levels in a *social hierarchy* (see Erikson and Goldthorpe 1992a, 29–35). We have adopted a structural view, i.e. we view social classes as positions in a social structure that is not unidimensional. A structural concept of social class is preferable since it does not mix indicators with different social meanings. In this sense we also follow a European tradition in the study of differences in living conditions (Erikson and Åberg 1987), as well as in analyses of social stratification (Erikson and Goldthorpe 1992b).

Given then that classes are conceived as locations in a structure, we would define these as positions that differ "in terms of the employment relations that they entail" (Erikson and Goldthorpe 1992a, 37). More specifically, the classification first differentiates between employees, on the one hand, and, the self-employed and employers, on the other. Among the employees we differentiate between blue-collar and white-collar workers, i.e. between those who are employed on the basis of a labor contract and others. Within each of these categories, a further categorization is made between groups with different skill levels. The employers and self-employed will mainly include small proprietors and farmers, since they differ from the employees primarily because they do not have a work contract, and also in terms of work autonomy, but *not necessarily* in terms of physical working conditions. Given these principles, we have formed a nine-class scheme, including upper, middle, and lower white-collar employees, the self- employed, farmers, skilled, semi-skilled and unskilled workers and a category of unclassifiable subjects. It should be noted that these categories cannot be arranged into a single hierarchy. There is considerable overlap in skill level between skilled blue-collar workers and white-collar employees, although the type of work contract clearly separates the two groups. Similarly, it is not not possible to rank farmers and the self-employed at all in relation to the other groups.

For people who were gainfully employed in 1968, the classification of individuals into different social classes is based on the occupation presently held, where occupations have been preassigned to different classes on the basis of their properties. People who were already retired at that time are classified according to the main occupation they held during their economically active years. Women who have mainly been housewives are classified according to the occupation of their husband.

The use of a 9-category class scheme can be somewhat troublesome given the size of the data set. We have therefore also conducted analyses with a four-class scheme, separating white-collars, workers, farmers and entrepreneurs, and the unclassifiable.

Age is important as a control variable. In the first part of the paper, where mortality is analyzed, age is used in 1-year categories. In the latter part of the paper, where the focus is on class differences among the oldest old, only three age groups are used (77–79, 80–84 and 85+).

Marital status in 1968 is included as an independent variable. The categories used are married (including cohabitants), unmarried (i.e. never married), divorced, and widowed.

Dependent variables used in the analyses

Information on the date of death is collected from the National Cause of Death Registry, which in turn is based on the death certificates. All causes of death have been analyzed together, since the assignment of death causes is likely to be less accurate among the older age groups. The number of persons at baseline, the number of deaths, as well as exposure time and death rates are presented by the four independent variables (Table 1).

Table 1. Number of persons 1968, occurrences (deaths), exposure time and death ratio 1968–1992.

	Persons	Deaths	Exposure time (days)	Death ratio (*1,000,000)
Age group				
53–55	225	91	1,617,260	56.27
56–60	507	267	3,498,412	76.32
61–65	417	289	2,550,371	113.32
66–70	370	327	1,793,117	182.36
71–76	341	335	1,265,298	264.76
Sex				
Men	928	705	5,001,924	140.95
Women	932	604	5,722,534	105.55
Social class (full version):				
Upper white-collar	90	46	590,298	77.93
Middle white-collar	176	122	1,036,609	117.69
Lower white-collar	187	133	1,164,922	114.17
Entrepreneurs	173	125	986,861	126.66
Farmers	200	149	1,063,883	140.05
Skilled workers	279	199	1,597,413	124.58
Semi-skilled workers	317	219	1,795,992	121.94
Unskilled workers	373	268	2,124,762	126.13
Unclassifiable	65	48	363,718	131.97
Social class (collapsed version)				
White-collar	453	301	2,791,829	107.81
Entrepreneurs + Farmers	373	274	2,050,744	133.61
Workers	969	686	5,518,167	124.32
Unclassifiable	65	48	363,718	131.97
Marital status				
Married	1278	862	7,574,174	113.81
Unmarried	238	185	1,263,418	146.43
Divorced	75	54	436,610	123.68
Widowed	269	208	1,450,256	143.42
Sum	1860	1309	10,724,458	122.06

Statistical methods

The method used in the first part of the paper is most commonly called "duration analysis", "event history analysis" or "hazard regressions" (Blossfeld, Hamerle and

Mayer 1989; Lancaster 1990). Duration analysis is a multivariate method that measures the impact of an individual's characteristics on his or her risk over time for a certain event. More specifically the method accounts for both the number and the timing of events – here their deaths. We employ parametric proportional hazard regressions to analyze the impact of an individual's characteristics on his or her death risk over time. The proportional hazard means that for any two individuals with given characteristics, the ratio of their hazard is constant. A Gompertz distributed base-line intensity gives the best fit to data. The hazard rate then has the form: $r(t) = b \cdot e^{ct}$ where t is the time at risk. Time at risk is the number of days from the interview in 1968 until the person dies or the time of censuring – the interview in 1992. The Gompertz hazard rate has been proven useful for calculating natural mortality rates since Gompertz originally introduced it in 1825. The software used is TDA (Rohwer 1993).

Results

Initially, the full class model is employed in order to analyze differences in mortality from 1968 onwards. A model including year of birth and sex is taken as the baseline (Model 1 in Table 2. NB. Estimates for age are not reported in the tables).

Table 2. Relative mortality risks as estimated by intensity regression (using a Gompertz distributed base line intensity) during the period 1968–1991, by sex, social class (full version), and marital status, controlling for age (1-year classes) among persons born in 1892–1915 (aged 53–75 in 1968).

	Model 1		Model 2		Model 3	
	Risk	*p*-value	Risk	*p*-value	Risk	*p*-value
Sex		0.000		0.000		0.000
Men (ref.)	1.00	–	1.00	–	1.00	–
Women	0.67	0.000	0.67	0.000	0.67	0.000
Social class				0.045		0.087
Upper-collar (ref.)	–	–	1.00	–	1.00	–
Middle white-collar	–	–	1.46	0.029	1.42	0.045
Lower white-collar		–	1.33	0.098	1.29	0.151
Entrepreneurs	–	–	1.54	0.013	1.51	0.018
Farmers	–	–	1.55	0.010	1.53	0.013
Skilled workers	–	–	1.39	0.044	1.37	0.057
Semi-skilled workers	–	–	1.42	0.034	1.37	0.056
Unskilled workers	–	–	1.54	0.008	1.49	0.013
Unclassifiable	–	–	2.07	0.000	1.94	0.002
Marital status						0.120
Married (ref.)	–	–	–	–	1.00	–
Unmarried	–	–	–	–	1.14	0.115
Divorced	–	–	–	–	1.34	0.043
Widowed	–	–	–	–	1.01	0.926

Women have a lower mortality risk than men, which is exactly as expected. This difference is also unrelated to the other variables studied, since the male excess mortality risk is 50 % in all three models presented (1/0.67 = 1.493).

Social class differences are large enough to be significant for the distribution as a whole (p = 0.045), and all categories except the lower white-collar groups have significantly higher mortality risks than the reference category (upper white-collars). How-

ever, the pattern is one of similarity rather than differences. Indeed, all classes, except two, have a similar mortality risk during the follow-up period. The two exceptions are the upper white-collar group, where mortality is clearly lower, and the unclassifiable category where the mortality risk is substantially higher than in other groups.

Although all p-values for social class increase, this pattern is unchanged when marital status is introduced as a control variable. Only among the divorced is a significantly raised mortality risk found, as compared to those who are married. The stability in the estimates for social class means that differences in divorce rates, if such differences exists, cannot account for the mortality differences found (or for the lack of differences between most of the classes, for that matter).

Similar results are produced if the large number of categories distinguished are collapsed into a four-class model (Table 3). Still, class is significant as a variable, but workers do not differ significantly from the combined white-collar category. On the other hand, farmers and entrepreneurs appear to have elevated mortality, as indeed does the unclassifiable category. Again, the pattern is unchanged when controlling for marital status.

T a b l e 3. Relative mortality risks as estimated by intensity regression (using a Gompertz distributed base line intensity) during the period 1968–1991, by sex, social class (collapsed version) and marital status, controlling for age (1-year classes) among persons born in 1892–1915 (aged 53–75 in 1968).

	Model 1		Model 2	
	Risk	*p*-value	Risk	*p*-value
Sex		0.000		0.000
Men (ref.)	1.00	–	1.00	–
Women	0.68	0.000	0.68	0.000
Social class		0.022		0.035
White-collar (ref.)	1.00	–	1.00	–
Entrepreneurs + Farmers	1.18	0.051	1.19	0.040
Workers	1.11	0.114	1.11	0.149
Unclassifiable	1.58	0.004	1.51	0.009
Marital status				0.079
Married (ref.)	–	–	1.00	–
Unmarried	–	–	1.15	0.090
Divorced	–	–	1.37	0.028
Widowed	–	–	1.01	0.910

The relatively small over-all differences in mortality risk between social classes found here are somewhat surprising in view of earlier findings. There has been a consistent finding of decreasing inequalities in mortality with increasing age, however. To test if this is the case, we included a dummy variable dividing age into two categories, younger than 67 vs. 67 and older. Since the public pension age in Sweden was 67 until 1975, this division will roughly allow us to compare class differences in mortality in the cohorts under study before and after retirement. This was done by estimating the interaction term between the age-dummy and social class (Table 4).

As can be seen from Table 4, class differences in mortality occurring before the age of 67 are more pronounced than are the differences in mortality risks after that age. In the younger category, i.e. in the age span 53–66, the non-manual categories all have higher mortality risks than the reference category, although they do not differ much from each other. In order to compare the broader categories of workers/white-collars, average risks are computed. The ratio of these average risks is 1.25, implying

Table 4. Social class variations in mortality risks among those younger than 67 as opposed to those 67 and older during the period 1968–1991. Averages for white-collar and blue-collar workers calculated as geometrical averages.

	Relative risk		Ratio
	< 67	≥ 67	≥ 67/<67
Upper white-collar	1.00 (ref.)	0.84	0.84
Middle white-collar	1.17	1.42	1.21
Lower white-collar	0.97	1.45	1.49
Entrepreneurs	1.33	1.39	1.05
Farmers	1.67	1.09	0.65
Skilled workers	1.20	1.29	1.08
Semi-skilled workers	1.33	1.13	0.85
Unskilled workers	1.39	1.31	0.94
Unclassifiable	2.14	1.56	0.83
Average white-collar	1.04	1.20	1.15
Average workers	1.30	1.24	0.95
Ratio workers/white-collars	1.25	1.03	0.82

that the risk of dying between 53 and 66 years of age is 25% higher among workers as compared to the non-manual employees.

On the other hand, there is no difference in average mortality risk between non-manual employees and workers after retirement age. This is mainly due to relative increases in mortality risks among middle and lower white-collar categories, while the position of workers relative to the reference category remains largely the same. It should be noted that the reference category itself (upper white-collars) retains its low mortality risk also after the age of 66.

Discussion

In this study we have analyzed men and women born between 1892 and 1915, interviewed in 1968 and followed until the end of 1991. We found differences in mortality between those in the extreme positions of the social structure, but otherwise the mortality pattern was rather similar over social classes. Especially when collapsing classes into broad categories, differences traditionally found between workers and non-manual categories were small and nonsignificant. When dividing the analysis by age of death, however, it was found that deaths occurring before the age of 67 were more clearly class-related.

How can these findings be understood? Ideally a study of class differentials in mortality or survival based on cohorts should be able to take into account differences in mortality throughout the life course, i.e. data on cohort mortality from birth by social class should be available. This is not the case. Instead, our data covers mortality from 53 years on among those members of the birth cohorts of 1892–1915 who were still alive (and living in Sweden) in 1968. Hence, any class differences in the mortality experience of these cohorts prior to 1968 is not known to us. Such data is not available, but some basic information on cohort mortality is at hand (Bolander 1970).

In Table 5 the survival rates at 1, 5, 25, and 50 years are reported for men and women separately for five selected birth cohorts. In addition, the percentage still alive at the time of the first interview in 1968 is estimated.

First, we may note the high levels of infant and child mortality that prevailed in Sweden around the turn of the century. In 1900, 11.2% of the boys and 9% of the girls

Table 5. Percentage of different birth cohorts that survived to ages 1, 5, 25, and 50, and percentage of respective birth cohort that were still alive in 1968. Men and women separately.

	Year of birth				
	1895	1900	1905	1910	1915
Men					
Percentage survived to 1	89.5	88.8	90.5	91.5	92.0
Percentage survived to 5	83.8	83.7	87.1	88.2	88.2
Percentage survived to 25	75.1	76.7	80.9	82.8	84.0
Percentage survived to 50	66.6	69.0	74.1	76.8	78.6
Percentage still alive in 1968[1]	46	56	66	73	78
Women					
Percentage survived to 1	91.3	91.0	92.4	93.3	93.6
Percentage survived to 5	85.9	86.1	88.9	90.1	89.9
Percentage survived to 25	77.7	79.2	82.7	84.6	85.9
Percentage survived to 50	69.8	72.1	76.4	79.6	81.7
Percentage still alive in 1968[1]	53	62	71	77	81

Source: Bolander 1970.

[1] The percentage still alive in 1968 is approximated from survivor curves and based on 5-year cohorts (1891–95, 1896–1900 etc.), which are followed to 1965.

died during their first year. Second, survival rates improved quite dramatically during the early years of the 20th century, both for men and for women. These improvements appear in all age groups, but seem to be more pronounced between 5 and 50 than during the first five years. As a result of both the difference in age between the cohorts in 1968, but also due to the decreasing mortality risks in the later cohorts, there are large differences in the percentage still alive in 1968 between the birth cohorts included in this study. Whereas around half of the cohort born in 1895 (54% among the men and 47% among the women) had already died at the beginning of our study, only 20% of those born in 1915 had died at that time. As discussed above, we do not have data on the social patterning of the mortality that occurred prior to 1968. It seems safe to assume, however, that a substantial difference in for instance infant mortality should have been present also in the beginning of this century. It is known, for instance, that illegitimate born children had an almost 60% higher mortality in Stockholm during the period 1895–1925 compared to legitimate births, and also that children living in small apartments had higher mortality in this period (Bernhardt 1994). Both of these factors are likely to have been unevenly distributed among families in different social classes.

In order for earlier mortality experiences in the cohorts under study to explain small class differences in mortality among the old, it has to be assumed that the factors that generate mortality are relatively evenly distributed after a certain age. As far as illness is concerned, this is certainly not the case.

In Table 6 earlier findings on the relationships between class and health among the oldest old (Thorslund and Lundberg 1994) are presented according to the social class held in 1968 (for definitions of variables included in the table see the original paper). As can be seen, steep differences in illness, both measured as self-rated health and as tested with a peak-flow meter, can be found. All of these illness indicators have been shown to predict mortality (see e.g. Idler and Kasl 1991; Lundberg 1990; Cook et al. 1991). It seems, therefore, that the factors generating class differences in illness (whatever they are) continue to affect people's lives also in high ages. Why, then, is this not reflected more clearly in our mortality data?

Table 6. Class differences in self-rated health, circulatory illness and low peak-flow values in 1992 by social class as reported in 1968. Risks relative to the upper white-collar category. standardized for age group (77–79, 80–84, 85+) and sex. (Peak-flow estimates also standardized for height.)

	Self-rated health less than good		Circulatory illness		Low peak-flow value	
	Risk	*p*-value	Risk	*p*-value	Risk	*p*-value
Social class		0.046		0.000		0.066
Upper white-collar (ref.)	1.00	–	1.00	–	1.00	–
Middle white-collar	1.00	0.996	1.18	0.786	1.62	0.699
Lower white collar	1.53	0.366	3.34	0.034	12.29	0.021
Entrepreneurs	1.28	0.624	2.87	0.071	3.67	0.275
Farmers	3.67	0.007	7.16	0.000	13.50	0.017
Skilled workers	1.95	0.132	1.91	0.244	10.30	0.029
Semi-skilled workers	2.11	0.079	2.95	0.040	10.27	0.028
Unskilled workers	2.92	0.037	3.82	0.010	9.41	0.034
Unclassifiable	3.13	0.100	9.69	0.001	12.64	0.054
Number of observations	475		534		411	

(For definitions of the illness indicators see Thorslund and Lundberg 1994.)

There are at least two possible sets of explanation for this. First, different patterns of cause-specific mortality might cancel each other out, leading to small differences in overall mortality. It is known, for instance, that the class pattern of smoking was reversed, i.e. white-collar categories in general smoked more than workers in 1968 (Lundberg 1992). If this is the case also in these cohorts, mortality related to smoking should be more common among white-collars, which in turn is likely to decrease the mortality advantage they otherwise would have had. Second, there may be some factor or factors that prevents ill workers from dying. Two possible factors are the health care system and the social insurance system. In other words, it is possible that good health care, distributed in accordance to need, is saving lives but is not preventing illness. It is also possible that public pension schemes, possibilities to get an early pension or to be on long-term sick leave have the same effect. It is our intention to try to explore these possibilities in further analyses.

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