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STRATIFICATION AND MORTALITY – A COMPARISON OF EDUCATION, CLASS, STATUS AND INCOME

by

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Stratification and mortality – A comparison of education, class, status and income

Abstract

In many analyses of social inequality in health, different dimensions of social stratification have been used more or less interchangeably as measures of the individual's general social standing. This procedure, however, has been questioned in previous studies, most of them comparing education, class and/or income. In the present article, the importance of education and income as well as two aspects of occupation – class and status – are examined. The results are based on register data and refer to all Swedish employees in the age range 35-59 years. There are clear gradients in total death risk for all socioeconomic factors except for income from work among women. The size of the independent effects of education, class, status and income differ between men and women. For both sexes, there are clear net associations between education and mortality. Class and income show independent effects on mortality only for men and status shows an independent effect only for women. While different stratification dimensions – education, social class, income, status – all can be used to show a "social gradient" with mortality, each of them seems to have a specific effect in addition to the general effect related to the stratification of society for either men or women.

INTRODUCTION

A relationship between socioeconomic position and morbidity/mortality is more than well documented, but few have examined the simultaneous association between various socio-economic indicators and health. Prior studies comparing dimensions of social stratification have shown that different measures are not fully exchangeable (Duncan *et al* 2002; Geyer *et al.* 2006; Martikainen, Blomgren and Valkonen 2007; Stronks *et al* 1997). This earlier research has mainly focused on the relative significance of education, occupational class and/or income for health/mortality. Only a few studies have considered the impact of status on health, and then mainly in comparison with class (Bartley *et al.* 1999; Chandola 1998; Prandy 1999b; Sacker *et al.* 2000).

In the present paper, we explore the mortality relationship for four socioeconomic indicators: education, occupational class, occupational status, and income. Of course, education, class, status, and income to some extent reflect overlapping resources in terms of general social standing. But even though the socioeconomic indicators are interrelated and have common influences on an individual's longevity, there could also be some unique mechanism(s) that link each dimension to health. For example, knowledge of health-improving behaviour may be more easily accessible to those with a higher education, but there are also several indirect pathways between education and good health, e.g., through better jobs and higher incomes (Galobardes *et al.* 2006; Lahelma *et al.* 2004; Martikainen, Blomgren and Valkonen 2007; Mirowsky, Ross and Reynolds 2000). Thus, some of the socioeconomic effects on health and longevity are shared with other socioeconomic dimensions, and some of them are more specific. Previously suggested indicator-specific health mechanisms are knowledge for education, working circumstances for class, and material conditions for income (Erikson 2001; Lahelma *et al.* 2004; Lynch and Kaplan 2000).

It is perhaps less clear how the relationship between status and health should be interpreted. Status, often in combination with 'social' or 'socioeconomic', is frequently used as a general concept signifying an individual's social standing in society, not representing a certain dimension. However, what we here call status is more specific; it is a measure based on the occupational structure of marriage or cohabiting in the Swedish census of 1990, constructed in a similar way as the CAMSIS scale (Prandy and Lambert 2003), called the Cambridge Scale, if the basis is a structure of friendship (Prandy 1999a).

This scale is described as a measure of *general* advantage or disadvantage, reflecting combined material and social inequality (Prandy 1998; Prandy and Lambert 2003): The scale "integrates the economic and the social, class and status, rather than trying to distinguish them" (Prandy 1998). Recently, a similar occupationally based stratification dimension has been described as a "status order" different from the class structure (Chan and Goldthorpe 2007a; Chan and Goldthorpe 2004); status reflects social equality, inferiority or superiority, while class is grounded in employment relations. Status, in this sense, cannot be seen as a mere combination of education and income (Chan and Goldthorpe 2007a). Thus, "socio-economic status", as used in many American studies as a measure based on education and income (Duncan 1961), should not be assumed to be identical with status as used here.

The construction of the status scale is based on the assumption that people associate with and marry their social equals. A dimension reflecting the social closeness of occupational incumbents therefore provides a measure of social status. The notion that the status measure is derived from social interaction between equals might suggest that status mirrors similarities in lifestyles to a greater extent than, for instance, class or education. Thus, the four aspects of the individual's socioeconomic position of interest here could be supposed to differ in their relation to health and longevity. In sum, the main aim of the present article is to examine independent effects of each indicator (education, class, status and income) on

mortality. This will indicate how interchangeable the socioeconomic factors are as well as the importance of specific mechanisms.

Related studies

Some studies have compared status and class in relation to health or mortality (Bartley *et al.* 1999; Chandola 1998; Prandy 1999b; Sacker *et al.* 2000). In all of them, the Cambridge Scale accounts for more of the variation in health than the EGP class schema or similar classifications do. Unfortunately, some of these studies make the comparison misleading by using the individual's own class position, but a household measure of status (Bartley *et al.* 1999; Sacker *et al.* 2000). This is problematic, as household position results in larger health/mortality differences than do individual measures, especially for women (Erikson 2006).

Studying one aspect of lifestyle – cultural consumption – Chan and Goldthorpe (Chan and Goldthorpe 2007b; Chan and Goldthorpe 2007c) conclude that it is more determined by the status than by the class position of the individual. Thus, if status reflects common lifestyles to a greater extent than education or class does, a particular effect of status on health could be expected. Another support for the status-lifestyle link is that CHD-related health behaviour seems to be determined by status to a greater extent than by class (Chandola 1998).

A recent study based on Swedish and German data shows that the three other indicators – education, class and income – all have independent associations with all-cause mortality (Geyer *et al.* 2006). Other studies comparing different measures of socioeconomic position have claimed that economic resources are more strongly related to mortality risk than is education or occupation (Duncan *et al.* 2002; Sundquist and Johansson 1997). For example, household income and wealth have strong associations with mortality even when other socioeconomic indicators are controlled for (Duncan *et al.* 2002; Ecob and Davey Smith

1999). This suggests that income has an independent effect on health, which is not confounded by education or occupation. However, one possible explanation for the more pronounced income-health association is selection (Stronks *et al.* 1997). A relatively large part of the relationship between material resources and health has been shown to be related to labour market status, i.e., non-healthy groups are excluded from paid employment (commonly called the 'healthy worker effect'). Moreover, because annual income is a volatile measure, only weakly related to permanent income, information from only one year may not be enough (Friedman 1957; Krieger, Williams & Moss 1997). Household income is often used, which becomes problematic if the household resources are not equally divided *within* the family (Lundberg, Pollak & Wales 1997; Young 1952).

When comparing social class and education, Davey Smith and colleagues (Davey Smith *et al.* 1998) find that, for working men, social class is a better discriminator of socioeconomic mortality differences than is education. If so, education has limited direct influences on health, and the education-health association is primarily a result of the well-educated having better material resources than do those who have only completed compulsory school. Conversely, others conclude that education is a stronger predictor than occupational class is when the two variables are included simultaneously in the analyses (Marmot *et al.* 1997; Winkleby *et al.* 1992).

In sum, previous studies on socioeconomic indicators' relative contributions to health inequality have presented rather disparate results. One starting point for the present study is that different indicators of socioeconomic position are not completely interchangeable, even though they measure the same latent dimension to some extent. However, they do not usually correlate strongly enough to support the use of one of them and not the other(s), except when there is a particular interest in a certain socioeconomic dimension. Furthermore, a specific socioeconomic measure may have varying impact on health for different groups in society. For example, earnings vary within the same educational level,

and this is particularly clear across social groups, e.g., ethnic, age and sex groups (Braveman *et al.* 2005). In addition, health selection is of varying importance regarding education, occupation and income. Compared to occupation and especially income, education is not affected by sickness late in life. However, while illness may lead to loss of income, it is more probable that it will lead to the person leaving the labour market than to a change in occupation and that, thus, the problem of health selection is most sensitive when used to estimate the effects of income among persons active in the labour market. We therefore use an income measure that is an average from a number of years before the start of the study period. In a paper related to the present one, we complete the picture of the importance of the individual's own position by analysing the impact of the partner's socioeconomic standing as well as the household position.

DATA AND METHODS

The data emanate from registers covering the entire Swedish population, where the different records have been matched using unique personal numbers. The following registers are used: (1) the Cause of Death Register 1991-2003, with information on underlying causes and timing of death; (2) the Census of 1990 for information on individuals' occupations; (3) LISA 1990, a database for labour market studies containing information on, e.g., education and income; (4) the Income and Assessment Register 1981-1989 with income information for several years; and (5) the Migration Register in order to identify those who have emigrated from Sweden and, consequently, should be censored in the analyses.

The final dataset consists of all employed men and women, with information on education (1990) and income any year 1981-89, who at the time of the census in 1990 were between 35 and 59 years of age. One reason for the rather narrow age span is that we want to take account of incomes for several years before 1990, and therefore excluded individuals too young to have reliable incomes in 1981. The total number of individuals with information on all socioeconomic variables is more than 2.1 million (Table 1).

Some of the socioeconomic variables are continuous in nature and some are categorical. To make them comparable, we have distinguished five educational groups and five occupational classes, and the continuous measures income and status are divided into quintiles.

Socioeconomic variables

Education is measured as highest educational level in 1990. Five levels are distinguished: (1) Compulsory/elementary school; (2) upper secondary school, 2 years or shorter; (3) upper secondary school, 3 years or more; (4) college/university, less than 3 years; (5) college/university, 3 years or more (including postgraduate studies).

The *class* division is based on the official Swedish occupational classification, which is very similar to the EGP class schema (Erikson and Goldthorpe 1992). Five classes of employed persons are distinguished: (1) Unskilled manuals (EGP VII) and routine non-manuals (EGP IIIb); (2) skilled manuals (EGP VI); (3) intermediate occupations (EGP IIIa); (4) lower managerials and professionals (EGP II); and (5) higher managerials and professionals (EGP I). Routine non-manual occupations are included in the first group, because their working conditions are similar to those of unskilled manual workers in terms of skill demands and monitoring possibilities. Farmers and other self-employed are excluded due to the problem of comparing incomes of employed and self-employed persons.

The *status* scale is the first dimension score from a correspondence analysis conducted by Paul Lambert (Stirling University). It is based on a cross-tabulation of the wife's and the husband's occupations (or the occupations of cohabiting partners) in a data set of married/cohabiting Swedish men and women in 1990. Thus, the scale is based on the assumption that the frequencies in the table reflect the relative distances in status between occupations. The result is one major stratification dimension with an ordering of occupations based on marriage and cohabiting patterns. The range of the scale is set to 1 to 999 (mean 336.7, SD 235.8). The scale is the same for women and men, but sex-specific quintile groups are used in the analyses.

Income is measured as the average individual income from work for the period 1981 to 1989 (recalculated according to CPI 1989). Wage-related benefits such as parents' allowance and sickness benefit are included. Because income is a volatile concept and long-term income affects health to a greater extent than does current income (Benzeval and Judge 2001), a more stable income measure is desired, e.g. the individual's annual earnings taken as an average over several years. Annual income may be affected by health status – and more so than is education or occupation. However, some of the impact of reversed

causation on the income-mortality association could be avoided with this income measure. Income is divided into quintile groups based on the income distribution for the total sample (aged 35 to 59 years in 1990). The lowest quintile group includes the 20 per cent with the lowest income, etc. Because men on average earn more than women do, we have constructed sex-specific income quintiles to obtain equally large groups for both sexes. For a description of the socioeconomic variables, see Table 1.

In total, the dataset contains information on slightly more than 2.1 million men and women. All educational groups are well represented among both sexes. The majority have not attained a higher educational level than at most two years of upper secondary schooling. About 25 percent among the men and slightly more among the women have a tertiary education (irrespective of length). The largest occupational group is unskilled manuals (including routine non-manuals). Occupations that are classified as skilled manual are more frequent among men than among women. Conversely, women more often occupy intermediate occupations (and routine non-manual occupations that are included in the first category). Higher managerial and professional occupations are more common among men than among women. Looking at Table 1, it is clear that while men on average have considerably higher incomes than women do, women actually on average have slightly higher status than men do.

Statistical analyses

Cox regressions (Cox 1972) are used to calculate hazard ratios. The Cox regression, like other survival models, allows for taking into account time (here: age) until an event (here: death) occurs. The hazard ratio can be interpreted as the risk of dying (during a short period of time) compared to the corresponding risk for the reference group, controlling for age and other covariates. The analyses are conducted for men and women separately. Individuals who are alive at the end of the study period, i.e., in December 2003, will be censored at this

time, and those who have emigrated before the end of 2003 will be censored at the time of emigration.

RESULTS

Spearman's rank order correlations between education, class, status and income are shown in Table 2. Not surprisingly, all socioeconomic indicators correlate positively, although the correlations are of different strength. The highest correlated forms of stratification are those based on occupation, i.e., class and status (0.80 for both men and women). For education and class/status, correlations are about 0.6. Thus, education, class, and status show rather high correlations with each other, but not too high not to be included simultaneously in the coming analyses, owing to the large number of cases. The correlations of income and education, class and status, respectively, are lower (between 0.31 and 0.41 for women and 0.38 and 0.54 for men). Income is measured here at an earlier point in time than occupation is, which could result in lower correlations for income compared to the other factors, but the correlations between income from 1990 and the other socioeconomic dimensions are about the same for the men (although slightly higher for the women, between 0.38 and 0.47, not shown in table).

In the next step, the relations between these socioeconomic indicators and mortality are explored. To start with, each variable is analysed one by one (Table 3).

Generally, there are clear gradients for all socioeconomic variables. The differences between the highest and lowest group are smaller, and the gradients are flatter among women than among men for every indicator. This has also been consistently shown in earlier studies (Erikson 2006; Koskinen and Martelin 1994; Martikainen 1995). The highest relative risk is found for men in the lowest income quintile group (2.29 compared to the highest quintile). There seems to be a non-linear relationship between income and mortality among men, given the comparatively high death rate in the lowest income group. Apart from men with the lowest incomes, the gradient for income seems slightly flatter than the gradients for the other factors. It is probable that reversed causality is the explanation for the exceptionally high risk of dying among men with low incomes, even though this

problem ought to be reduced for more stable income measures. For example, income from 1990 yields larger risk differences than does the average during the 1980s used here (not in the table).

On the contrary, for women there are relatively small differences in death risk by income. And moreover, there is no clear decrease in death risk for every income group. However, all income groups show higher death risks than does the highest income group. Another deviation from a decrease in death risks for higher groups is found among women in lower managerial/professional occupations (RR=0.98, not significant).

In spite of the substantial variation in mortality between the socio-economic groups, the differences between them are actually underestimated, due to the 'healthy worker effect', as it is particularly potent among those in lower positions. Thus, differences between educational groups among all persons, i.e. also including those outside the labour market, are clearly greater than those previously reported. That is, the hazard ratio for all men and women with only compulsory education is 2.04 and 1.79, respectively, as compared to 1.76 and 1.48 for men and women in the labour market.

Separate analyses (not shown in table) on class differences within some selected educational groups show that mortality differences are larger among individuals with a university education than among those with a compulsory education, at least for men. A similar result is found for status for different educational groups. These greater mortality differentials by class and status among those with tertiary education could possibly depend on loss being a greater cost than the corresponding gain is a win. That is, the burden of not finding a high status job when one has a university education may have a greater negative effect than the positive effect of finding a salariat job when one has only a compulsory education (Keller and Zavalloni 1964; Tversky and Kahneman 1991).

The results from a regression with *only* class and status included show that both occupational aspects have a remaining effect on death risk when the other factor is included

in the model (not in table). The relative risks for unskilled manuals and the lowest status quintile are 1.7 and 1.2, respectively, for men. The corresponding numbers for women are 1.1 and 1.4. Thus, the class influence is more prominent for men and the status influence for women. Nevertheless, both class and status have independent associations with death risk.

In Table 4, all four indicators are included simultaneously in the Cox model. One prominent feature is that education seems to have significant independent relationships with death risk for both women and men, e.g., women with only compulsory school have a relative risk of 1.30, and the corresponding risk for men is 1.27.

The class effect more or less disappears for women, but not for men, in the multivariate analyses. On the contrary, a clear association between status and death risk appears only among women, where the hazard ratio for the group with the lowest status is 1.28. The corresponding ratio is 1.09 for the lowest status group compared to the highest among men, while there are no clear differences among the other groups.

The income-mortality association for men remains strong when education, class and status are controlled for (relative death risk for second lowest quintile group=1.23). For women, the association between income and mortality for some groups shows a reversed pattern, thus, income *per se* does not play an important role in women's survival.

It is important to note that, here, income refers to earnings from work, which to some degree could be considered a measure of the status related to the job. This interpretation would make understandable the finding that income, but not status, is important among men, when both variables are included in the model, while the opposite is true for women. The difference between the sexes in this respect could be due to income being a more important status marker for men than for women.

DISCUSSION

In the present article, we simultaneously introduce four stratification variables – education, social class, income from work, and status, based on marriage patterns – in the analysis of mortality. The aim is to explore their total and independent relationship with mortality in order to evaluate how interchangeable they are in health inequality research. The data refer to the whole Swedish population aged 35 to 59, active in the labour market in 1990. The relative risks of dying in the years 1991-2003 within separate stratification groups were analysed using Cox regression.

Each of the four stratification variables, when introduced as the only factor in the model, generally shows a clear association with the risk of death for both women and men. This result can be seen as an example of Paul Lazarsfeld's suggested "interchangeability of indices" (Lazarsfeld 1939; 1958), according to which any reasonable indicator of a latent dimension will do the job of measuring the dimension in question. On the other hand, if the indicators have a meaning in themselves and not just in mapping the latent factor, then content will be lost and associations blurred if the various indicators are assumed to provide the same information.

However, the four stratification variables are not full substitutes for each other. Each one of them, while they do indicate the effect on mortality of the general stratification order in society, is in fact related to separate mechanisms by which socioeconomic differences influence mortality. When education, class, income and status are all included in a multivariate regression model, we find that while education shows a strong effect for both women and men, the effects of class and income only remain among men, while the effect of status only remains among women.

Although education is an important determinant of social class, status and income, meaning that much of the effect of education is channelled through these other factors, it has a substantial direct effect on mortality. One possible interpretation is that more education

provides women and men with better instruments for understanding health risks, and perhaps for evaluating the plethora of advice on health matters and/or for getting more benefits from health services.

Social class has a clear independent effect on mortality among men. It is far from evident what the mechanisms are that account for this effect, but the generally more advantageous working conditions of the higher classes represent a plausible candidate. That no independent effect of social class appears among women may be related to the observation that the individual occupation of married or cohabiting women is a weak indicator of their social class position (Erikson 1984; Erikson 2006). Another explanation is the larger proportion of women who are working part-time and thus are less exposed to (adverse or favourable) working conditions. The importance of social class among women may appear to be different when the situation of the family is taken into account.

Income from work has a clear and strong independent effect on mortality among men, while it has no or even a reversed effect among women. Two hypotheses can be raised in relation to this result. Income from work is a better indicator of the material conditions of men than of those of women, as men's incomes account for a greater part of the consumption power of the household. The effect of income may be different for both men and women if disposable income, i.e. consumption power, or household income is introduced in the models rather than income from work. This later factor, on the other hand, may be more important for self-esteem and self-respect among men than among women, assuming that work stands for a greater part of the life world of men.

Social status, on the other hand, appears to have a strong independent effect among women, but hardly any effect among men. One possible hypothesis concerning why this should be the case is related to the second hypothesis for income above. If self-respect and self-esteem among women are related to their general social standing in society, which we assume that status as measured here indicates, while income from work is more important in this respect

for men, then we should expect to find results such as the present ones. Furthermore, the social status of women may be more related to their lifestyle than what is the case for men. Women's lifestyle may also be more important for that of the family, which could be part of the observation that the individual social status of men hardly has any independent effect on their mortality.

In essence, the results of the present analyses suggest that while mortality has a gradient on any of the variables class, education, income and status, on the one hand, great caution should be exercised when considering various possible indicators of 'socioeconomic status' in the analysis of mortality, on the other. Education, social class, income and status all seem to have slightly different effects on and associations with mortality and should thus be separately identified rather than merely used as indicators of the stratification of societies.

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Table 1: Socioeconomic position. Distribution of the population (35 to 59 years of age) by education, class, status, and income.

	Women		Men	
	%	N	%	N
Educational level				
Compulsory school	29.8	315,358	33.6	353,325
Upper secondary school ≤ 2 years	35.6	376,792	25.0	262,649
Upper secondary school >2 ≤ 3 years	7.0	73,859	16.0	168,511
College/university < 3 years	14.1	149,302	10.3	108,248
College/university ≥ 3 years	13.6	144,160	15.1	158,249
Total	100	1,059,471	100	1,050,982
Occupational class (EGP group)				
Unskilled manual (VII) & Routine non-manual (IIIb)	44.0	466,592	26.7	280,352
Skilled manual (VI)	10.1	106,785	23.2	243,681
Intermediate (IIIa)	13.9	147,462	8.8	92,373
Lower managerial/professional (II)	21.9	231,915	22.0	231,406
Higher managerial/professional (I)	10.1	106,717	19.3	203,170
Total	100	1,059,471	100	1,050,982
Status points	*Mean*	387.5	*Mean*	321.0
(Min 1 Max 999)	*SD*	215.9	*SD*	261.5
Average income 1981-1989	*Mean*	666.2	*Mean*	1070.9
(In 100 SEK)	*SD*	273.7	*SD*	443.9
Total number of individuals		1,059,471		1,050,982
Number of deaths 1991-2003		39,682		63,389

Table 2a and b. Spearman correlation coefficients. For all combinations of education, occupational class, occupational status, and income.

2a: Women

	Education	Class	Status	Income
Education	1.00			
Class	0.66	1.00		
Status	0.64	0.80	1.00	
Income	0.31	0.41	0.35	1.00

2b: Men

	Education	Class	Status	Income
Education	1.00			
Class	0.61	1.00		
Status	0.61	0.80	1.00	
Income	0.38	0.54	0.47	1.00

Table 3. Relative death risks. Results from bivariate Cox regressions.
All individuals 35-59 years 1990.
Bold face=significant (5 % level)

	Men	*Women*
Education	RR	RR
Compulsory school	**1.76**	**1.48**
Upper secondary school ≤ 2 y	**1.67**	**1.34**
Upper secondary school >2 ≤ 3 y	**1.26**	**1.23**
College/university < 3 y	**1.14**	1.04
College/university ≥ 3 y	1	1
Class		
Unskilled manual (VII) & Routine non-man (IIIb)	**1.87**	**1.36**
Skilled manual (VI)	**1.61**	**1.18**
Intermediate (IIIa)	**1.37**	**1.18**
Lower managerial/professional (II)	**1.17**	0.98
Higher managerial/professional (I)	1	1
Status		
1 Lowest quintile group	**1.80**	**1.49**
2	**1.69**	**1.27**
3	**1.36**	**1.23**
4	**1.19**	**1.05**
5 Highest quintile group	1	1
Income from work, average 1981-89		
1 Lowest quintile group	**2.29**	**1.14**
2	**1.55**	**1.07**
3	**1.38**	**1.12**
4	**1.18**	**1.14**
5 Highest quintile group	1	1

Table 4. Relative death risks. Results from multivariate Cox regressions. Education, class, status, and income.
All individuals 35-59 years 1990.

	Men	*Women*
Education	RR	RR
Compulsory school	**1.27**	**1.30**
Upper secondary school ≤ 2 y	**1.28**	**1.24**
Upper secondary school >2 ≤ 3 y	**1.13**	**1.17**
College/university < 3 y	**1.06**	**1.06**
College/university ≥ 3 y	1	1
Class		
Unskilled manual (VII) & Routine non-man (IIIb)	**1.18**	1.03
Skilled manual (VI)	**1.09**	**0.90**
Intermediate (IIIa)	**1.07**	1.01
Lower managerial/professional (II)	1.01	**0.94**
Higher managerial/professional (I)	1	1
Status		
1 Lowest quintile group	**1.09**	**1.28**
2	1.03	**1.09**
3	1.03	**1.11**
4	1.04	1.02
5 Highest quintile group	1	1
Income from work, average 1981-89		
1 Lowest quintile group	**1.81**	**0.91**
2	**1.23**	**0.89**
3	**1.14**	**0.95**
4	**1.07**	0.99
5 Highest quintile group	1	1