

The Effects of Occupation-Based Social Position on Mortality in a Large American Cohort

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ABSTRACT

Objectives. Four occupation-based measures were used to derive estimates of social position's effect on all-cause mortality among men and women in a large national cohort.

Methods. The National Longitudinal Mortality Study provided information on principal occupation and 9-year follow-up for 229 851 persons aged 25 through 64 years. Cox's proportional hazards model was used to estimate the age-adjusted risk of death relative to six ordinal categories of social position. The Slope Index of Inequality described average change in death rates across categories.

Results. Risk of death was consistently elevated among persons at lower positions in the social hierarchy. Estimates comparing lowest with highest categories varied within a narrow range (1.47–1.92 for men and 1.23–1.55 for women). However, several discrepancies among analyses were noted. The analysis by US census groups revealed nonlinear associations, whereas those using other scales found incremental increases in risk. Effect modification by sex was observed for analyses by two of the four measures. Race/ethnicity did not modify the underlying association between variables.

Conclusions. Our analysis complements previous findings and supports, with few qualifications, the interchangeability of occupation-based measures of social position in mortality studies. Explanations for why relative risk estimates were modified by sex are offered. (*Am J Public Health*. 1997;87:1472–1475)

Introduction

By virtue of their location within the social hierarchy, individuals bear differential risks of dying from many causes.^{1–7} Numerous and disparate studies report that mortality rates are greater among persons at lower levels of the social hierarchy, suggesting a complex etiology of material and social deprivation, workplace hazards, degraded environments, unhealthy lifestyles, inadequate health care, and exploitative social policies.^{8–10} As work proceeds to disentangle causal mechanisms, three questions remain¹¹: How is social position best measured? What is the overall strength of the association? and Are effects modified across subcategories of the population? Conclusions thus far have drawn heavily on the experiences of employed White men and may not be applicable to women, persons of other race/ethnicity, and those out of the labor force.^{8,11}

This analysis presents relative risk estimates of all-cause mortality for men and women within a large American cohort, using four distinct occupation-based measures of social position. Comparisons across the range of estimates can inform us about how social position affects mortality and whether any group is particularly vulnerable to those effects.

Methods

The National Longitudinal Mortality Study⁶ provides information from the US Census Bureau's Current Population Surveys (1979 through 1981) on the occupations of 1.3 million Americans, with 9-year follow-up of their vital status through the National Death Index.¹² Our analysis considered 229 851 individuals from the National Longitudinal Mortality Study Public Use Data File who were 25

to 64 years old with primary occupations at baseline surveys. Deaths were recorded for 9065 individuals (4%) during 2.03 million person-years of follow-up.

Four occupation-based indicators of social position were used to categorize job titles that individuals reported on Census Bureau surveys.¹³ The US census groups aggregate 429 jobs into a six-item ordinal hierarchy of functional attributes: managerial and professional; sales, technical, and administrative; service; farming, forestry, and fishing; precision production, craft, and repair; and operators, fabricators, and laborers.¹⁴ The Nam-Powers Socioeconomic Status Score classifies 409 of those occupations (most apprentice positions in craft and skilled labor occupations were not coded) into an interval scale according to their respective median education and income levels.¹⁵ Duncan's Socioeconomic Index uses education and income attributes of 419 jobs as proxies for an interval scale of social prestige.¹⁶ Siegel's Prestige Score measures prestige directly on an interval scale based on public opinion polling about the desirability and value of those 419 occupations.¹⁷ The Nam-Powers score offers subscales for men and women; the original Duncan index was for men, although an updated generic version can be used for

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Note. The views expressed in this paper are the authors' and do not necessarily reflect those of the agencies that supplied the data (the National Heart, Lung, and Blood Institute, which supplied data from the National Longitudinal Mortality Study, and the US Bureau of the Census).

TABLE 1—Numbers of Persons at Risk and All-Cause Mortality during 9-Year Follow-Up for Persons Aged 25 through 64 Years, by Social Position and Occupation-Based Indicator of Social Position: National Longitudinal Mortality Study, 1979 through 1989

| Category of Social Position | Occupation-Based Indicator of Social Position | | | | | | | |
|-----------------------------|---|---------------|--------------------------|---------------|----------------------|---------------|----------------------|---------------|
| | US Census ¹⁴ | | Nam-Powers ¹⁵ | | Duncan ¹⁶ | | Siegel ¹⁷ | |
| | No. at Risk | No. of Deaths | No. at Risk | No. of Deaths | No. at Risk | No. of Deaths | No. at Risk | No. of Deaths |
| Men | | | | | | | | |
| 1 (High) | 40 010 | 1618 | 12 841 | 443 | 15 234 | 523 | 15 244 | 522 |
| 2 | 18 269 | 975 | 25 926 | 1038 | 31 131 | 1382 | 32 529 | 1416 |
| 3 | 9 174 | 668 | 30 482 | 1542 | 16 867 | 890 | 23 912 | 1150 |
| 4 | 7 014 | 391 | 14 477 | 783 | 16 882 | 844 | 13 874 | 751 |
| 5 | 28 176 | 1366 | 24 554 | 1368 | 23 052 | 1199 | 25 748 | 1390 |
| 6 (Low) | 27 906 | 1546 | 21 597 | 1349 | 26 882 | 1701 | 18 741 | 1310 |
| Total | 130 549 | 6564 | 129 877 | 6523 | 130 048 | 6529 | 130 048 | 6539 |
| Women | | | | | | | | |
| 1 (High) | 24 445 | 492 | 4 856 | 84 | 4 427 | 74 | 13 218 | 227 |
| 2 | 41 206 | 945 | 17 816 | 316 | 31 650 | 633 | 17 914 | 379 |
| 3 | 17 415 | 632 | 19 421 | 431 | 19 989 | 459 | 18 640 | 410 |
| 4 | 1 900 | 46 | 15 501 | 343 | 18 327 | 486 | 12 325 | 330 |
| 5 | 1 903 | 34 | 14 746 | 392 | 9 856 | 315 | 13 381 | 353 |
| 6 (Low) | 12 433 | 352 | 24 318 | 825 | 15 020 | 533 | 20 512 | 709 |
| Total | 99 302 | 2501 | 96 208 | 2391 | 99 269 | 2500 | 96 900 | 2408 |

women¹⁸; the US census groups and Siegel's Prestige Score are generic scales for use with both groups.

For comparability across indices, the original US census groups were compared with the Nam-Powers, Duncan, and Siegel scales, which were recorded as six-item ordinal hierarchies of roughly equal numbers of job titles per category. Category 1, designating the highest-status jobs, was the reference used for each analysis. The distributions of populations at risk and deaths from all causes by category of social position are presented for each scale in Table 1.

Our preliminary analysis found, as have others,^{7,19-22} that men, persons other than White non-Hispanics, the unemployed, and aging adults had different occupational profiles and significantly higher risks of death than their respective reference categories. Confounding of the effect of social position on mortality was assessed with the Cox proportional hazards function of SPSS to compare crude and adjusted relative risks.²³ The effect of age was measured as a continuous variable of years. A sex effect was evaluated with men (57% of the sample) as the reference category. Race/ethnicity was coded as White non-Hispanic (83% and the reference category) or Other race/ethnicity (of whom one half were Black non-Hispanic).

Current employment status was coded as employed (85% and the refer-

ence category) or unemployed (of whom roughly one quarter were permanently out of the labor force). Crude and adjusted risks differed when we controlled for age and sex but not when we controlled for race/ethnicity or employment status. To evaluate effect modification, we used multivariate hazard functions with interaction terms for sex and social position.²³

In this paper we report point estimates and 95% confidence intervals of the relative risks of all-cause mortality for men and women. Within strata, age-adjusted effects are reported. For each analysis, the overall mortality differential by social position was summarized by means of the Slope Index of Inequality, which associated age-adjusted mortality rates for categories of social position with their proportionate shares of the sample.²⁴ The Slope Index of Inequality estimates the average change in age-adjusted death rates per category and describes the advantage of holding a higher social position within society.²⁵

Results

A consistent pattern of increased risk of death for persons at lower positions in the social hierarchy was observed across analyses (see Table 2). However, several disparities were noted. Point estimates based on US census groups suggested nonlinear associations for both men and women. Among men, risk of death

increased incrementally for persons in categories 2 and 3 (36% and 74%, respectively, higher than category 1), returned to unity for category 4 (relative risk [RR] = 1.08), and increased incrementally once again for persons in categories 5 and 6 (24% and 47%, respectively). In the analysis based on US census groups, risk for category 3 significantly exceeded estimates based on the Nam-Powers or Siegel scores, while risks for categories 4 and 5 were significantly lower than those based on the Nam-Powers, Duncan, or Siegel measures. The Slope Index of Inequality for US census groups indicated nonsignificant average changes in the age-adjusted mortality rate attributable to social position (i.e., average decreases per higher category of 3.7 deaths per 1000 men and 2 deaths per 1000 women).

Point estimates and confidence intervals based on the Nam-Powers, Duncan, and Siegel measures, on the other hand, were more consistent in describing incremental increases in risk for successively lower social positions. According to Siegel's Prestige Score, point estimates increased by 24% and 26% over baseline for men in categories 2 and 3, respectively; by 56% and 58% for those in categories 4 and 5, respectively; and by 92% for those in category 6. The risk estimated for men in category 6 according to the Siegel prestige score was approximately twice that estimated for men in

TABLE 2—Age-Adjusted Relative Risks of All-Cause Mortality (with 95% Confidence Intervals) for Persons Aged 25 through 64 Years, by Social Position and Occupation-Based Indicator of Social Position: National Longitudinal Mortality Study, 1979 through 1989

| Category of Social Position | Occupation-Based Indicator of Social Position | | | |
|--|---|--------------------------|----------------------|----------------------|
| | US Census ¹⁴ | Nam-Powers ¹⁵ | Duncan ¹⁶ | Siegel ¹⁷ |
| | Men | | | |
| | (n = 130 549) | (n = 129 877) | (n = 130 048) | (n = 130 048) |
| 1 (High) | 1.00 | 1.00 | 1.00 | 1.00 |
| 2 | 1.36** (1.25, 1.47) | 1.21* (1.08, 1.35) | 1.24* (1.12, 1.37) | 1.24** (1.12, 1.37) |
| 3 | 1.74 (1.59, 1.90) | 1.39 (1.25, 1.55) | 1.46 (1.31, 1.63) | 1.26** (1.13, 1.39) |
| 4 | 1.08 (0.96, 1.20) | 1.60 (1.42, 1.79) | 1.48 (1.33, 1.66) | 1.56** (1.39, 1.74) |
| 5 | 1.24 (1.16, 1.34) | 1.67 (1.50, 1.86) | 1.54 (1.39, 1.70) | 1.58 (1.43, 1.75) |
| 6 (Low) | 1.47* (1.37, 1.57) | 1.62 (1.46, 1.81) | 1.70* (1.54, 1.87) | 1.92 (1.73, 2.13) |
| Generalized interaction <i>P</i> | .01 | .39 | .14 | .02 |
| Slope Index of Inequality ^a | -3.7 | -5.8 | -5.1 | -7.2 |
| <i>P</i> | .21 | .003 | .003 | .003 |
| | Women | | | |
| | (n = 99 302) | (n = 96 208) | (n = 99 269) | (n = 96 900) |
| 1 (High) | 1.00 | 1.00 | 1.00 | 1.00 |
| 2 | 1.08 (0.97, 1.21) | 0.97 (0.77, 1.24) | 1.04 (0.82, 1.33) | 1.15 (0.98, 1.36) |
| 3 | 1.47 (1.30, 1.65) | 1.10 (0.87, 1.40) | 1.13 (0.89, 1.45) | 1.20 (1.02, 1.41) |
| 4 | 0.93 (0.69, 1.26) | 1.14 (0.90, 1.45) | 1.25 (0.98, 1.60) | 1.27 (1.07, 1.50) |
| 5 | 0.75 (0.53, 1.06) | 1.25 (0.98, 1.58) | 1.37 (1.06, 1.76) | 1.26 (1.06, 1.48) |
| 6 (Low) | 1.23 (1.07, 1.41) | 1.37 (1.10, 1.72) | 1.43 (1.12, 1.82) | 1.55 (1.33, 1.80) |
| Generalized interaction <i>P</i> | ... | ... | ... | ... |
| Slope Index of Inequality ^a | -2.0 | -2.5 | -2.6 | -2.6 |
| <i>P</i> | .19 | .001 | .001 | .008 |

Note. Point estimates differ according to sex of subjects: **P* < .10; ***P* < .05.

^aThe Slope Index of Inequality estimates the average decline (per 1000 persons) in the age-adjusted death rate per category of social position.²⁴

category 6 by US census groups. The Slope Index for the Siegel analysis indicated an average decrease in the age-adjusted death rate per social position category of 7.2 deaths per 1000 men.

Comparable increments in risk were found in estimates based on the Duncan and Nam-Powers measures. According to the former, risk of death increased by 24% for men in category 2; by 46% and 48% for men in categories 3 and 4, respectively; by 54% for those in category 5; and by 70% for those in category 6. Results based on Nam-Powers found increased risk for categories 2 through 4 (21% to 60%, respectively, over the reference category), with no appreciable change noted thereafter for categories 5 and 6. The average decrease in age-adjusted death rates of men across categories was estimated to be 5.8 per 1000 men in the Nam-Powers analysis and 5.1 per 1000 men in the Duncan analysis.

For women, point estimates were somewhat smaller and confidence intervals wider (reflecting 62% fewer deaths among women), but overall patterns were consistent with those observed for men. Once again, estimates based on US census

groups were not linear; the adjusted risk of death did not differ from baseline among women in categories 2, 4, or 5 but was elevated for those in categories 3 and 6 (by 47% and 23%, respectively, over category 1). According to the Siegel score, risk was significantly greater (by 20% to 26%) among women in categories 3 through 5 and 55% greater for those in category 6. In the Nam-Powers analysis, an inverse trend was found, with a significant increase in risk noted for women in category 6 (37% above the reference). The pattern was similar for the Duncan index, with significant effects found for women in categories 5 and 6. Slope Index Estimates based on the Nam-Powers, Duncan, and Siegel analyses indicated significant changes in age-adjusted death rates of women per category of social position (i.e., 2.5 fewer to 2.6 fewer deaths per 1000 women).

A significant generalized interaction (evaluated by the Wald statistic²⁵) of social position and sex was found in the US census groups and Siegel analyses, suggesting that risk of death attributable to social position was stronger among men than among women. Effects of social

position were not modified by the sex of individuals when data were analyzed according to the Nam-Powers or Duncan measures. Differences between point estimates by sex were found in each analysis for category 2 (those for US census groups and Siegel were significant at the .05 level). Significant differences between effects were also found for category 6 in the US census groups analysis and for categories 3 and 4 in the Siegel analysis.

Discussion

Evidence of higher death rates among persons holding inferior positions within the social hierarchy has accumulated over 4 decades.⁴⁻⁷ Our analysis of an ongoing longitudinal sample of Americans complements those findings and underscores the seemingly invariant quality of that relationship. Notwithstanding conceptual and empirical distinctions among the measures,²⁶⁻²⁹ our findings support, with certain qualifications, the interchangeability of occupation-based measures of social position in mortality studies. The overall strength of that association, as reflected by the relative risk for lowest to

highest categories of social position, varied within relatively narrow ranges (i.e., 1.47–1.92 for men and 1.23–1.55 for women). As to whether effects differed across subcategories of the population, we discerned evidence of effect modification by sex in two of the analyses, those based on US census groups and Siegel, but overall patterns of effects were found to be similar for both sexes. Race/ethnicity was not found to modify the relationship between variables.

Despite the overall consistency of our results, we recommend judicious use of these and similar findings. For one thing, measuring social position by occupation neglects important aspects of status (e.g., education, income) that can influence mortality,^{8,11} a deficiency that may be particularly acute when the subjects are women, non-Whites, or persons outside the labor force.^{28,29} For another thing, generalization beyond adults with primary occupations could be problematic. We found age-adjusted relative risks to be significantly greater among persons who were unemployed or unable to work than among those who were employed (RR = 1.23 and 1.99, respectively). The young age and predominantly employed status of the National Longitudinal Mortality Study sample may understate the relationship between variables for the general population. Interpretation of effects for women is especially problematic. Roughly one third (36%) of the women in the sample did not report classifiable occupations (88% of these women identified themselves as homemakers). Women included in this analysis (i.e., those with occupations other than homemaker) had a considerably lower age-adjusted risk of death (0.61; 95% confidence interval = 0.58, 0.65) than those excluded (i.e., those without occupations). Of greater concern, however, is the knowledge that the occupational disadvantage of women (i.e., they tend to hold a smaller range of occupations, which also tend to have limited potential for advancement^{29,30}) is poorly reflected in current measures of social position (i.e., women and men appear to be more comparable than they really are).^{19,29,31} Prestige-based indicators (e.g., the Duncan and Siegel measures) may be especially prone to misspecification.^{29,31,32}

Hence, the effect modification noted here could reflect true variability of underlying exposures between groups that is not captured by the Nam-Powers or Duncan indicators, or, conversely, the inability of the Siegel and US census groups scales to discern occupational effects of employment on women's mortality as fully as they can for men. A pressing

need remains for a sex-specific indicator of social position that is sensitive to the dynamics of women in the workplace (patterns of and preferences for full- and part-time employment, career changes and employment interruptions in response to family constraints, the interrelationships between individual and household [i.e., spousal] attributes of status, etc.). Until such an indicator is defined, and in the absence of consensus about a way to adjust available measures to reasonably approximate women's social position (controlling for marital status, head of household status, etc.), investigators should be mindful of the importance of stratifying data when using these measures.

That effect modification by race/ethnicity was not observed here is consistent with arguments that effects of race/ethnicity on mortality are confounded by social position.^{21,22} However, we must acknowledge that the relatively small sample size and few outcomes among persons of Other race/ethnicity contributed to unstable point estimates.

Finally, we encourage reanalyses of these data with longer follow-up periods. Social position's effect on mortality, particularly among women, may change as deaths accumulate over time. □

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