Socioeconomic Differences in Adult Mortality and Health Status

Samuel H. Preston and Paul Taubman

INTRODUCTION

In most populations, people with more schooling, higher income, and more prestigious occupations enjoy better health and longer lives. It would be surprising if this were not so because healthiness and longevity are nearly universal goals, and higher-ranking social groups have, on average, more resources with which to pursue those goals.

Although the direction of relations between health and socioeconomic attributes accords with common sense, the magnitude of these relations has been the object of intense scientific scrutiny. There appear to be three major reasons for this attention. First and foremost, societies are concerned not only with the average levels of welfare-related variables such as income and health but also with their distribution among social groups. Although views may differ about the desirable or appropriate extent of inequality, few would argue that inequality is irrelevant or outside the suitable domain of government action. Second, the widely available data on socioeconomic differentials in mortality and health sometimes provide important clues regarding the etiology of particular diseases, as in the case of polio, breast and cervical cancer, and coronary heart disease. Third, evidence about

The authors are grateful to Ingrid Waldron for generously sharing her wisdom and her library with us. Her comments were instrumental in improving the chapter.
socioeconomic differentials helps to identify high-risk groups to which health programs can be most efficiently directed.

This chapter reviews recent evidence about the extent and sources of socioeconomic differences in mortality and health among older persons in the United States, with some reference to other countries. That is, the principal focus is on the first concern addressed above, rather than on the use of socioeconomic information for epidemiologic or programmatic purposes. With the proliferation of well-designed epidemiologic studies of precisely measured risk factors, there is less and less need to use the rather crude information provided by socioeconomic variables to identify etiologic factors in disease. Indeed, some of the early efforts to do so yielded interpretations that proved to be seriously misleading (e.g., the supposed link between highly demanding intellectual activities and coronary heart disease in Ryle and Russell, 1949). And socioeconomic groups are also a rather amorphous basis for designing health interventions, for which geographic or organizational detail is often more salient.

Even if the focus is on inequality, we have to justify a concern with inequality among groups arrayed on variables such as education or income. Other measures of inequality, such as the variance in ages at death, are also available and make no reference to such variables (Illesley and LeGrand, 1987). The concern with \textit{structured} inequality—that associated with an individual’s socioeconomic position—appears to derive from a belief that society at large has some influence on the structure of social positions and on who occupies them. If inequalities in the outcomes associated with that structure are too great, a sense of collective responsibility can generate efforts to reduce inequality. No similar reaction would be generated if the principal source of variation in mortality were, say, the ownership of a motorcycle or left-handedness.

Unfortunately, the measurement of inequality in health and mortality is not straightforward. The principal issue is not choosing one of the many inequality measures available but rather deciding, as Sheps (1958) put it, whether to count the living or the dead. In comparing the extent of inequality across times and places, this distinction is often critical. For example, if the probability of death for manual workers declines from .10 to .05, and for nonmanual workers from .05 to .02, then the ratio of manual to nonmanual death probabilities has risen but the ratio of manual to nonmanual survival probabilities has also risen. Which group has become relatively worse off after the change? This question is hardly academic, since these kinds of changes are widely observed. Hanslouwka (1986) shows, for example, that Gini coefficients of social class inequality in infant mortality in England and Wales rose between 1921 and 1970-1972 when expressed in terms of mortality, but fell when expressed in terms of survivorship. We believe that differences in age-specific survivorship—the desideratum—are more salient

\( \text{(and certainly more analogous to inequalities in other desiderata such as income and nutrition). Nevertheless, we must conduct this review by reference mainly to negative indicators such as mortality and disability because that is the convention in nearly all writings on the subject. It is worth noting that neither relative nor absolute differences in survival can be recovered from estimates of relative risk; it is the difference between mortality rates, not their ratio, that determines the ratio of survival rates.} \)

\textbf{Socioeconomic Measures}

The principal indicators of one’s position in contemporary society are income, occupation, and educational attainment. These are closely related to Weber’s (1946) more abstract conception of social position in terms of the three dimensions of class (a primarily economic concept), status (associated with occupational prestige), and power (a function of one’s ability to mobilize resources on one’s behalf). Liberatos et al. (1988) provide a useful discussion of how the three indicators have been used in epidemiologic studies. They find that epidemiologists are much more likely to use education as a “control variable” than either income or occupation. The disadvantages of occupation are that many people do not have one (e.g., retired people, housewives) and that one’s occupation—and labor force participation—may be determined by one’s health status as an adult (Fox et al., 1985). Such reverse causation creates problems of interpretation; in particular, it is not sensible to treat one variable as dependent and the other as independent. This problem is even more serious for income, since disabilities can affect not only occupation but also hours of work. Unlike occupation, education is measured on an interval scale. Unlike income, it is not derived from multiple sources with very different implications (or, in the case of family income, from multiple individuals). Because of its stability,

\[ p_{sx} = \int_{x}^{\infty} \mu_{i}(a) da. \]

where \( \mu_{i}(a) \) = death rate for group \( i \) at age \( a \). Therefore, the log of the ratio

\[ \frac{n_{S1x}}{n_{S2x}} \]

is equal to

\[ \int_{x}^{\infty} (\mu_{1}(a) - \mu_{i}(a)) da. \]

the cumulative absolute difference in death rates between groups 1 and 2.
educational attainment is an especially valuable measure among those over age 65. However, even the amount of education one obtains may be influenced by a long-lasting disability, which can affect subsequent mortality and morbidity. So the use of education does not resolve all problems of reverse causation.

Educational attainment has also become the measure of choice among demographers and statisticians who study socioeconomic differences in mortality (e.g., Kitagawa and Hauser, 1973). But we must be aware that although they are correlated with one another, education, income, and occupation tap different features of socioeconomic position that are relevant to health. Most directly, income indicates the amount of resources available to purchase health-related goods and services, including medical services themselves. It may also reflect on-the-job health risks. Occupation is associated with a variety of physical and psychosocial features of the workplace. Educational attainment is associated with the availability of information and with cognitive skills. Perhaps by virtue of these connections, there is evidence that education is more closely associated with health behaviors and with cardiovascular risk factors than are the other two variables. Winkleby et al. (1992) show that educational attainment is the only socioeconomic variable having a significant relationship to cigarette smoking, blood pressure (women only), and high-density lipoprotein (HDL) cholesterol in a cross-sectional study of 2,380 participants in the Stanford Five-City Project. This may be the only study of their joint effects.

**RECENT EVIDENCE ON THE EXTENT OF SOCIOECONOMIC DIFFERENCES IN MORTALITY AND HEALTH STATUS**

After being for many years one of the industrialized countries with the poorest data on socioeconomic differences in mortality, the United States now has two large and high-quality data sources: the National Health and Nutrition Examination Survey (NHANES), which includes the National Health Epidemiologic Follow-up Study (NHEFS), and the National Longitudinal Mortality Study (NLMS). Both are probability samples of the entire U.S. noninstitutionalized population that have been followed forward from initial interviews. Both have overall mortality levels close to, but slightly better than, national vital statistics levels; the lower mortality level is likely to result primarily from their initial restriction to noninstitutionalized persons.

NHEFS consists of 14,407 persons aged 25-74 when surveyed in 1971-1975 who were followed to 1982-1984. Feldman et al. (1989) have described educational differentials in mortality in this data set and compared them to the 1960 differentials based on a census-vital statistics matching study (Kitagawa and Hauser, 1973). Figure 8-1 displays the magnitude of educational differentials for older white persons, as well as trends in them, between the two observations.

It is clear that except for men aged 75-84 in 1960, those with more education have lower death rates for all ages and both sexes in each year. It is also clear that apart from men aged 65-74 with 0-7 years of schooling, death rates declined over the period of observation for each age-sex-education category. What is perhaps most striking about the figure is the widening of educational differences in mortality for males between these dates. Such a tendency was earlier described by Taubman and Rosen (1979) based on a 1973 Current Population Survey matched to Social Security death records through 1976. No widening of differentials is evident for females, whose declines are essentially equiproportionate. After being much smaller, male differentials (as indicated by the educational range in the log of death rates) are roughly as large as female differentials by 1971-1984. A final tendency evident in the figure is a narrowing of the range of educational differences in mortality as age advances, particularly after account is taken of the expansion of education categories for the two oldest age groups. This observation is consistent with much observed human experience; in comparing the typical age pattern of mortality of a high-mortality population to that of a low-mortality population, proportionate differences narrow above age 40 or so as age advances (Coale and Demeny, 1982).

Table 8-1 shows that much of the widening of educational differentials for white males aged 65-84 is attributable to a massive change in the educational distribution of heart disease mortality. Heart disease death rates declined by 57 percent for college-educated men and by 5 percent for men with less than 8 years of schooling. With 1960 education differences in heart disease mortality substituted for those in 1971-1984, the ratio of death rates from all causes for the two education groups would have been 1.20 in 1971-1984 instead of its actual value of 1.73.

The second major source of data on socioeconomic differences in mortality is the NLMS. The study population consists of 1,281,475 people who were included in various Current Population Surveys of the Census Bureau.
TABLE 8-1 Annual Death Rates per 1,000 Population, by Cause of Death, Sex, and Educational Attainment, Among White Persons Aged 65-84 Years, United States, 1960 and 1971-1984

<table>
<thead>
<tr>
<th>Cause of Death and Years of School completed</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>All causes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-7</td>
<td>66.2</td>
<td>66.8 (4.1)</td>
</tr>
<tr>
<td>8</td>
<td>65.5</td>
<td>53.1 (4.0)</td>
</tr>
<tr>
<td>9-12</td>
<td>64.9</td>
<td>47.0 (3.2)</td>
</tr>
<tr>
<td>13+</td>
<td>64.2</td>
<td>38.7 (4.1)</td>
</tr>
<tr>
<td>Heart disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-7</td>
<td>30.6</td>
<td>29.2 (2.7)</td>
</tr>
<tr>
<td>8</td>
<td>31.5</td>
<td>27.0 (2.8)</td>
</tr>
<tr>
<td>9-12</td>
<td>31.2</td>
<td>18.6 (2.0)</td>
</tr>
<tr>
<td>13+</td>
<td>30.3</td>
<td>13.0 (2.4)</td>
</tr>
<tr>
<td>Other than heart disease</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-7</td>
<td>35.6</td>
<td>35.8 (3.0)</td>
</tr>
<tr>
<td>8</td>
<td>34.0</td>
<td>25.2 (2.7)</td>
</tr>
<tr>
<td>9-12</td>
<td>33.6</td>
<td>27.9 (2.5)</td>
</tr>
<tr>
<td>13+</td>
<td>33.9</td>
<td>25.2 (3.3)</td>
</tr>
</tbody>
</table>

*Cause of death is missing for 2 percent of deaths among males and 4 percent of deaths among females in 1971-1984. These deaths were included in calculating death rates for all causes, but excluded for cause-specific death rates.

NOTE: SE = standard error.


from 1973-1985, except for 10 percent of the participants who were drawn from the 1980 U.S. census of population. The cohorts were followed forward for a maximum of 7 years or to January 1, 1986, whichever came first (Rogot et al., 1992b:Table A). Records for these individuals were matched to the National Death Index beginning in 1979, yielding a total of 44,828 deaths. This study thus provides a firm basis for inferring the magnitude of socioeconomic differences in mortality.

Table 8-2 presents educational differences in mortality from this study in the form of ratios of actual to expected deaths, where expected deaths are developed by applying the average probability of dying in a particular-sex, race, and 5-year age group to each individual’s years of exposure. Because the study is much larger than NHIFS, estimates can be made for blacks and the very old (85+). It is clear that educational differences in mortality among blacks are similar to those among whites. However, the lowest-
### TABLE 8-2  Ratio, Actual to Expected Deaths by Age and Education in the National Longitudinal Mortality Study

<table>
<thead>
<tr>
<th>Education (years)</th>
<th>White Males</th>
<th>White Females</th>
<th>Black Males</th>
<th>Black Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25-64</td>
<td></td>
<td>65+</td>
<td></td>
</tr>
<tr>
<td>0-4</td>
<td>119</td>
<td>143</td>
<td>115</td>
<td>113</td>
</tr>
<tr>
<td>5-7</td>
<td>134</td>
<td>127</td>
<td>113</td>
<td>119</td>
</tr>
<tr>
<td>8</td>
<td>121</td>
<td>120</td>
<td>105</td>
<td>105</td>
</tr>
<tr>
<td>9-11</td>
<td>124</td>
<td>109</td>
<td>113</td>
<td>116</td>
</tr>
<tr>
<td>12</td>
<td>98</td>
<td>94</td>
<td>89</td>
<td>90</td>
</tr>
<tr>
<td>13-15</td>
<td>92</td>
<td>94</td>
<td>88</td>
<td>72</td>
</tr>
<tr>
<td>16</td>
<td>70</td>
<td>78</td>
<td>60</td>
<td>47</td>
</tr>
<tr>
<td>17+</td>
<td>58</td>
<td>83</td>
<td>51</td>
<td>63</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

| Age 65+           |             |               |             |               |
| 0-4               | 106         | 110           | 98          | 97            |
| 5-7               | 106         | 103           | 101         | 110           |
| 8                 | 108         | 104           | 123         | 108           |
| 9-11              | 105         | 99            | 97          | 104           |
| 12                | 94          | 100           | 102         | 83            |
| 13-15             | 94          | 91            |             |               |
| 16                | 85          | 88            | 68          | 75            |
| 17+               | 75          | 76            |             |               |
| Total             | 100         | 100           | 100         | 100           |

| Age 85+           |             |               |             |               |
| 0-4               | 107         | 110           | 102         | 93            |
| 5-7               | 93          | 101           | 101         | 115           |
| 8                 | 103         | 101           |             |               |
| 9-11              | 107         | 95            |             |               |
| 12                | 100         | 96            |             |               |
| 13-15             | 105         | 95            |             |               |
| 16                | 93          |               |             |               |
| 17+               | 82          | 105           |             |               |
| Total             | 100         | 100           | 100         | 100           |

**NOTE:** Categories with 40 or fewer expected deaths have been combined with adjacent categories.

**SOURCE:** Derived from Rogot et al. (1992a:Table 6).

Educational category (0-4 years of schooling) suffers less disadvantage among blacks, perhaps because it is a less precise marker of physical and mental handicaps in a population where restricted education is as much a product of social forces as of personal attributes. Likewise, blacks who attend college—a highly selective group—have relative mortality ratios lower than their white counterparts. Thus, the black data reveal a similar gradient (slope of the education/mortality relation) to that of whites, but one that begins and ends at a lower level. Unfortunately, the manner in which source data are presented makes it impossible to compare directly the mortality rates of blacks and whites having the same educational attainment.

Table 8-2 reveals that educational differences in mortality are virtually absent among the population aged 85 and older. This tendency is consistent with narrowing differentials with age revealed by NHEFS for younger ages. White females aged 85+ do show small but persistent differentials in the expected direction up to the level of college graduates. On the other hand, white males aged 65+ in 1960 also showed no educational differentials in mortality, but those differentials have emerged subsequently in this age span. It is intriguing that the “cohort” aged 65+ in 1960 is much the same as the cohort aged 85+ in the early 1980s, which suggests that cohort approaches to studying socioeconomic differences may have some merit.

The most disturbing feature of Table 8-2 is that education differences in mortality are much smaller than in NHEFS. For example, in the NHEFS the ratio of death rates of white males aged 75-84 for those with less than 8 years of schooling to those with some college is 1.95 (Table 8-1), whereas in the NLMS the ratio of actual/expected death ratios for the two groups is only 1.17 (not shown). There is no apparent reason why these ratios, and those for other age-sex groups, would be so different. NHEFS observations are centered around 1978 and NLMS ratios around 1983, but it is surely unlikely that differentials would have widened and then contracted so dramatically. Since NLMS has roughly 70 times the number of person-years of exposure as NHEFS, it seems to provide a firmer foundation for assessing educational differentials.

Evidence of the plausibility of NLMS educational differentials is their consistency with international patterns. Valkonen (1987) has provided a masterful review of socioeconomic differences in mortality in Europe. He assembles data from different countries on educational differentials in mortality for men and women age 35-54 during 1976-1980. These are also based on census samples followed forward into death records. We have plotted rates from NLMS for whites in the United States based on Valkonen's figures (Figures 8-2 and 8-3). Although the actual rates are not recoverable from NLMS publications, the ratio of deaths to expected deaths is a multiplicative transformation of the death rates themselves. Since the figures are on a log-linear scale, their slope is invariant to a multiplicative transformation. We have simply chosen a “level” for the U.S. ratios that presents them in a convenient plotting range.4

It is clear that U.S. patterns are congruent with those in Europe for both

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4In particular, we have multiplied the ratios of actual to expected deaths, assembled from Rogot et al. (1992a:Table 6), by a factor of 0.006 for males and 0.003 for females.
males and females. As in Europe, the educational differentials in the prime working ages are much sharper for males than for females (see Valkonen, 1989, for a more rigorous confirmation). An obvious explanation of this sex difference, which may not be correct, is that personal (and family) economic standing is more closely associated with men's than with women's education. It is also possible that health-related behaviors are more closely associated with men's than with women's education.

Educational differences in mortality have tended to widen in Europe, as they have probably done in the United States as well (Valkonen, 1987, 1992). A widening of socioeconomic differences in England and Wales (measured principally by occupation rather than by income) has evoked a storm of controversy, in part because the National Health Service instituted after World War II was expected by some to mute class differences in

Space does not permit an adequate review of the causes of death principally responsible for educational differentials in mortality in the United States. The issue is not which cause of death exhibits the largest differentials but which cause contributes the most to the education differential for all causes combined. Table 8-3 uses NLMS data to begin addressing this question. For a particular cause of death category, it sets observed equal to expected deaths for all education groups and shows the impact of such equalization on differentials from all causes combined. Lung cancer deaths clearly contribute a minor amount to overall differentials; that is, setting observed equal to expected deaths from lung cancer for each group would lead to relatively little contraction in educational differentials from all causes combined. The same is true for “all other cancers” in the principal source of this countervailing pattern.

The NLMS has also yielded information on differences in mortality by employment status (Sorlie and Rogot, 1990), occupation, and family income (Rogot et al., 1992a). Sorlie and Rogot (1990) show that employed persons have mortality that is much lower than average, even at ages above 65, and that those classified as unable to work have mortality rates two to seven times higher than average. By synthesizing age-specific death rates in particular socioeconomic categories, Rogot et al. (1992a) calculate lifetable values for persons with different characteristics. Life expectancies at age 25 differ by 10.0 years between white men in the lowest ($5,000 per year in 1980 dollars) and the highest ($50,000 per year) family income categories, though as noted earlier this may occur in part because sicker people earn less. The difference for white women is only 4.3 years, another indication of smaller class differences among women. Occupational differences in mortality in the NLMS have not been analyzed. Tabulations appearing in the NLMS sourcebook show the predictable gradient for white men (professional-technical mortality is 22 percent below average, laborers are 26 percent above average at ages 25-64) and a weak and irregular gradient for employed women (Rogot et al., 1992b:336-337).

The most authoritative source of national data on socioeconomic differences in health status is the Health Interview Survey, a probability sample of the civilian noninstitutionalized population. Table 8-4 presents the prevalence of activity limitations and of persons in poor or fair health in the 1989 survey, which contained data on 122,310 persons. No distinction by sex is possible, but sex differences are relatively small once age and education are controlled (House et al., 1990).

It is clear that educational differentials in disability and ill health are extraordinarily large and that by middle age their prevalence is already very high among the poorly educated. At age 45-54, more than a third of people with fewer than 8 years of schooling are in “fair” or “poor” health, com-

<table>
<thead>
<tr>
<th>Deaths and</th>
<th>Cause of Death for Which Actual Deaths Are Set Equal to Expected</th>
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</thead>
<tbody>
<tr>
<td>Years of</td>
<td>None</td>
</tr>
<tr>
<td>Schooling</td>
<td>Cancer</td>
</tr>
<tr>
<td>White Males, 25-64</td>
<td></td>
</tr>
<tr>
<td>0-8</td>
<td>125</td>
</tr>
<tr>
<td>9-11</td>
<td>124</td>
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<td>12</td>
<td>98</td>
</tr>
<tr>
<td>13+</td>
<td>76</td>
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<td>White Males, 65+</td>
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<tr>
<td>0-8</td>
<td>107</td>
</tr>
<tr>
<td>9-11</td>
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<td>13+</td>
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<td>White Females, 25-64</td>
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<td>0-8</td>
<td>125</td>
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<tr>
<td>9-11</td>
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<td>White Females, 65+</td>
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<td>100</td>
</tr>
<tr>
<td>13+</td>
<td>88</td>
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</table>

SOURCE: Compiled from Rogot et al. (1992a)
TABLE 8-4  Percentage of Persons With Activity Limitation Due to Chronic Conditions and of Persons in Fair or Poor Health: United States, 1989

<table>
<thead>
<tr>
<th>Years of Schooling</th>
<th>Age (years)</th>
<th>All</th>
<th>&lt;4</th>
<th>4-7</th>
<th>8-11</th>
<th>12</th>
<th>13-15</th>
<th>16</th>
<th>17+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persons with limitation in activity due to chronic conditions</td>
<td>25-34</td>
<td>8.0</td>
<td>27.4</td>
<td>9.6</td>
<td>13.5</td>
<td>8.2</td>
<td>7.5</td>
<td>4.3</td>
<td>4.8</td>
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<td></td>
<td>35-44</td>
<td>12.3</td>
<td>30.1</td>
<td>22.1</td>
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<td>45-54</td>
<td>17.1</td>
<td>41.3</td>
<td>35.1</td>
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<td>49.4</td>
<td>46.7</td>
<td>38.5</td>
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<td>24.0</td>
<td>17.1</td>
<td>17.6</td>
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<td></td>
<td>65+</td>
<td>38.3</td>
<td>58.6</td>
<td>49.6</td>
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<td>33.7</td>
<td>34.0</td>
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<td>Persons in fair or poor health</td>
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<td>14.5</td>
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<td>12.6</td>
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<td>47.1</td>
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<td>13.9</td>
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<td>6.5</td>
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<td></td>
<td>65+</td>
<td>28.5</td>
<td>53.3</td>
<td>43.2</td>
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<td>23.6</td>
<td>19.8</td>
<td>15.7</td>
<td>16.3</td>
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</tbody>
</table>


pared to less than 5 percent of those who finished college. More than a third of the poorly educated are also limited in their major activity because of a chronic condition, compared to 10 percent of those who completed college. These differentials dwarf those pertaining to mortality. As a result, people with low levels of schooling spend many more years with an activity limitation or poor health than do people with more schooling, though this may be related to the type of work or the incentives associated with disability. House et al. (1990) point out that Fries’ notion of a “compression of morbidity” at the very end of a long life is much closer to being realized for the well educated than for the poorly educated. Whereas Keshudishin (1964) suggested that people in lower socioeconomic groups may simply feel sicker, this position has not been validated (Conover, 1973; Mechanic, 1978). Blaxter (1989) reviews European evidence and finds that unskilled occupational groups have a nearly universal disadvantage on measures of health status.

Table 8-5 identifies some of the major chronic conditions for which differences in prevalence among education groups are largest. As with mortality differentials, morbidity differentials contract as age advances beyond 55 or 65. House et al. (1990) estimate regression models predicting the number of chronic conditions, an index of functional status, and an index of limitations of daily activity as functions of age and education.

TABLE 8-5  Prevalence of Selected Chronic Conditions (per 1,000 persons) by Education: United States, 1989

<table>
<thead>
<tr>
<th>Condition</th>
<th>Under 65</th>
<th>65 Years and Older</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than High School Education</td>
<td>High School and Above</td>
<td>Less than High School Education</td>
</tr>
<tr>
<td>Arthritis</td>
<td>138.8</td>
<td>67.4</td>
</tr>
<tr>
<td>Hearing impairment</td>
<td>86.4</td>
<td>49.7</td>
</tr>
<tr>
<td>Diabetes</td>
<td>37.0</td>
<td>14.8</td>
</tr>
<tr>
<td>Heart disease</td>
<td>71.6</td>
<td>44.1</td>
</tr>
<tr>
<td>Hypertension</td>
<td>128.8</td>
<td>67.5</td>
</tr>
<tr>
<td>Emphysema</td>
<td>14.4</td>
<td>2.4</td>
</tr>
<tr>
<td>Deformity or impairment of back</td>
<td>79.6</td>
<td>64.1</td>
</tr>
<tr>
<td>Frequent indigestion</td>
<td>35.7</td>
<td>17.3</td>
</tr>
</tbody>
</table>

SOURCE: National Center for Health Statistics (1991:Table 17).

They show that interactions between age and education are significant for all three dependent variables.

National Health Interview Survey data also describe other differences in health status among educational groups. Table 8-6 summarizes some of these differences using age-adjusted measures. Years of schooling are positively associated with the incidence of acute conditions, perhaps because of differences in reporting patterns. They are negatively associated with days of restricted activity, days spent in a hospital, and number of hospital discharges. The number of annual physician contacts shows a weak positive relation to education. In view of the poor reported health of people with little schooling, the fact that they do not visit physicians more frequently than better-educated people is surprising. One might hypothesize that they are more often deterred by doctor’s costs, but the relation is no different above age 65, where physicians’ services are heavily subsidized, than below. Benzeval et al. (1993) show that lower occupational groups in England make more use of health services than higher groups, but that the gradient is reversed when morbidity is controlled.

**SOURCES OF SOCIOECONOMIC DIFFERENTIALS IN MORTALITY AND HEALTH STATUS**

In order to infer whether and how a policy to reduce socioeconomic differences should be pursued, it is obviously important to understand their sources. The factors contributing to the differences just described have-
been studied in a number of investigations. Too often, however, the investigations pursue a kitchen-sink approach, haphazardly throwing variables into a multivariate analysis to see what happens to coefficients. It is useful to take a step back and consider several theoretical approaches or frameworks that can shed light on the causal processes involved. In this section we review the two major frameworks that have been used to investigate the processes that create differences in mortality and health status by social class and describe some of the evidence that has been developed with the aid of those frameworks.

Economic Models

The most systematic model that addresses the relevant questions is derived from economics. From an economic perspective, individuals make decisions that help to determine their healthiness or stock of health \( (H) \) in any time period. Death occurs when \( H \) falls below some critical level, \( H' \). Except in extreme situations such as suicide, individuals are not viewed as making direct decisions about age at death but rather decisions about investments (e.g., exercise) and consumption (e.g., tobacco) that affect \( H \) and, in turn, affect age at death.

The standard economic approach to morbidity and mortality assumes that the individual maximizes a utility function, whose value depends on the amount of various items that are consumed. Some of these items are fully or partially related to health, and some have no relationship to health. In allocating resources among consumption goods, consumers are constrained by two equations. The first is a budget equation, according to which the sum of the price times the quantity of each purchase must equal a person’s income, which is in turn equal to hourly earnings times hours worked plus transfers and returns from savings. The second is a “health production function.” This production function shows how \( H \) varies with certain inputs. The main inputs in the health production function are the quantity of each health-related consumption item; the amount of medical knowledge of health care providers; the availability of medical facilities; a person’s genetic endowment; and features of the environment in which one lives. Apart from the quantity of health-related items consumed, other inputs in the health production function are typically assumed to be exogenous to the individual, though perhaps subject to governmental policy. This assumption is at times questionable. For example, one can choose to live in more or less polluted areas or those with better health care facilities. The assumption that individuals maximize utility then yields predictions about how health \( (H) \) will respond to changes in various exogenous variables.

Given this model, the analyst attempts empirically to relate healthiness or age at death to the exogenous price and wage terms in the budget con-
strain and to estimate separately the health production function based on its inputs. Some attempt is made to include in the health or mortality function all the exogenous, measured variables from both the budget constraint and the production function. Relevant studies are Sickles and Yazbeck (1991), who present a dynamic version of the above model, and Rosenzweig and Schultz (1983).

A vexing statistical problem is to obtain unbiased estimates of the coefficients of these variables. For example, acute conditions can reduce current income and chronic conditions long-run income. Thus, as noted earlier, causation between health and income runs in both directions, and more complicated estimation techniques are required. In principle, it is possible to adopt statistical methods that allow the researcher to surmount these difficulties. However, the assumptions required by these methods are often heroic. Longitudinal data with frequent observation of subjects are often critically important in sorting out issues of causation.

The main virtues of the economic model are its separation of endogenous variables (the consumption of health-related goods and services) from exogenous variables and the careful distinctions drawn among types of exogenous variables. It is these latter variables for which issues of causation are most clear-cut.

**Income/Wages/Education**

People with higher levels of education have, in general, higher potential wages and hence higher potential income levels. They are thus able to purchase more health-enhancing goods and services, such as physicians' and hospital services (or, less directly, better health insurance to subsidize such purchases), healthier foods, larger living space, and more leisure. They are also more able to afford to live in less polluted areas with better public services.

There have been scores of studies relating personal or family income to health status (see Sickles and Taubman, 1992, for a brief review). For example, Menchik (1993) uses the longitudinal survey of older men (45-64 in 1966) to study mortality up to 1983. In a logit model predicting the odds of survival to 1983, he obtains significant effects of both household wealth in 1966 and individual permanent earnings. Unfortunately there is some attrition in the sample, which makes the sample used by Menchik slightly nonrandom. Madans et al. (1986) find that in the NHANES follow-up study, those living in poverty have higher probabilities of dying. A recent study contains more temporal detail than others and is better able to sort through problems of causation. Zick and Smith (1991) use the Panel Study of Income Dynamics data to show that recent spells of poverty (controlling

changes in marital status) increased the hazard of dying for both men and women.

There is only one experimental study of the effect of income change on health status. Elesh and Lefcowitz (1977) examine the New Jersey-Pennsylvania Negative Income Tax Experiment for evidence of changes in health status and health care utilization. The experiment lasted 3 years and resulted in average increases in annual income of 18 percent for "treatment" families. The authors conclude that "no effects of any kind are observed" on health status or health care utilization. The short duration of the experiment does not permit inferences about the health consequences of more permanent income changes.

The straightforward economic predictions of the relationships among health, income, and education are sometimes termed the "deprivation" model: poor people suffer ill health and premature death because they are poor.

**Prices of Health-Related Goods and Services**

Prices are central to economic models. They are a possible source of socioeconomic differences in mortality for two reasons. First, although all groups face a roughly similar set of prices in market economies for doctors and medicine, about 15 percent of the population does not have any health insurance, which generally subsidizes the market price. Second, part of the cost of health care is the opportunity cost of time spent to obtain such care. This cost depends on the wage rate one could receive and the hours spent waiting for the doctor. An 8-hour wait in the emergency room can be quite costly even if valued only at the minimum wage rate. An experimental study of health insurance provisions demonstrated that lower prices for medical services (i.e., lower copayment rates) produced higher rates of physician visitation. However, there was little evidence of change in health status measures, apart from greater prescription of eyeglasses and slight reductions in blood pressure (Brook et al., 1983). England's National Health Service has not eliminated or even reduced class differences in morbidity or mortality (see the Black Report in Townsend and Davidson, 1982).

Changes in price levels can produce changes in socioeconomic differentials. In particular, the heavy subsidy of hospital services provided by Medicare (introduced in 1966) should have led to greater behavioral changes and greater improvements in health for poorer persons above age 65, who were previously unable to afford medical insurance. We have already reviewed evidence that socioeconomic differences widened rather than narrowed during this period. Such a widening occurs above age 65 for males even if NLMS data are used because the earlier study by Kitagawa and Hauser showed negligible educational differentials in mortality for this group in 1960 (Kitagawa and Hauser, 1973). Of course, a contractionary effect of
Medicare could have been obscured by other changes, such as widening differentials in cigarette smoking.

Levels of Medical Knowledge and Technique

The nature of medical knowledge and technique, in combination with patterns of access to various medical practices, affects the size of social class differentials in mortality. For example, the development of an inexpensive method for curing AIDS would undoubtedly benefit lower-status groups more than higher-status groups, since that health problem is heavily concentrated in the former.

Since the level of medical technology at a moment in time is by definition a systemic variable, it can affect the size of social class differences only if patterns of access to that technology are differentiated by class. The departures from equal access are most efficiently viewed as a function of income differences: poorer people may not be able to afford more expensive forms of treatment. Social policy may intervene to reduce differentials in access, for example, by changing the prices for medical services faced by different groups. Medicaid is one such example. But it is rare that such intervention would be completely successful in equalizing access. For example, the price cap imposed in the Medicaid program has induced two behavioral responses by physicians. Some doctors—about one-third in Pennsylvania—will not treat patients who use Medicaid insurance, whereas others give very hurried examinations to squeeze more patients through. Similar responses to publicly funded patients are reported in Britain (Benzeval et al., 1993).

A more sophisticated model would recognize that all households and people are not equally skillful in allocating scarce resources. Although some aspects of medical technology can be "delivered to" households (e.g., sewer systems), others require the active involvement of household members in their implementation. For example, improved knowledge of the etiology of infectious diseases and of the personal health measures that can prevent them is a likely source of the sharp expansion of class differentials in American child mortality between 1900 and 1930 (Ewbank and Preston, 1991). In this connection, educational attainment is often singled out as the feature that is most predictive of success in introducing health-enhancing techniques into the household (e.g., Pratt, 1971; Winkleby et al., 1990). In this more complex model, education is not related to health simply through its connection with earnings but also through its association with managerial expertise. According to this approach, medical technique interacts not only with aggregate features that affect access, but also with many household characteristics, to influence the pattern of social class differentials in health status.

Personal Endowments

Adults who make decisions about health-related behaviors carry marks from the past. Not only are their educational levels essentially determined by late adolescence, but so are their physique and their exposure to infectious diseases of childhood. Studies showing a strong inverse correlation between adult height and cardiovascular disease indicate that these mechanisms may be important. So do cohort studies demonstrating that susceptibilities to certain diseases are established early in life and persist through adulthood (Elo and Preston, 1992). Failure to control these early influences on adult health can lead to misspecifications and bias. Since a poor health environment in childhood is undoubtedly associated with low levels of schooling, the direct effects of schooling on adult health status can be overestimated without proper controls on earlier experience. However, in the only individual-level multivariate study of these relations of which we are aware, Mare (1990) shows that the excess mortality of men whose fathers were in low occupational groups is eliminated when the man’s years of schooling are controlled.

Other childhood endowments that are not direct manifestations of health status may also be important to adult health. These include such factors as cognitive skills and personality variables that may affect health through both income and household management. They also include a predisposition to various health habits. Waldron and Lye (1989) show that men of lower occupational status were more likely to smoke but that smoking differences by class were established before the age of labor force entrance. Subsequently, they show that high school seniors with less educated parents and lower educational aspirations were more likely to smoke cigarettes (Waldron and Lye, 1990). Failure to control these early life factors can lead to mis specification and biased estimates of coefficients on observed adult socioeconomic variables.

Other early life influences on adult mortality may be present at conception. The role of genetic variation in social class mortality differentials has been emphasized by Illsley (e.g., 1955), but there has been no convincing demonstration of the role of genetic factors in fashioning class differentials in mortality. Here, we will briefly note several studies that bear on the question. The studies rely on a model developed by Fisher (1918), in which any outcome (phenotype) depends on one’s genotype and environment (everything else). In his model, many genes each have a small impact on the phenotype. The methodology used to implement the model generally relies on a comparison of identical and fraternal twins, with the two groups often distinguished by the answer to a question such as, When you were children were you as alike as two peas in a pod or of only ordinary family resemblance? (see Behrman et al., 1980). Based on a comparison with a detailed
analysis of blood samples, this question classifies twins correctly in more than 95 percent of the cases in the studies discussed below.

The few available studies indicate that both genetic endowment and the early environment affect adult social class. These include Behrman et al. (1980), Lykken et al. (1990), and Behrman et al. (1992). Mortality is also related to genotype and environment. Identical twins have a smaller variance in age of death than other twins, and differential smoking behavior between twins strongly affects the risk of death over a given time interval (Behrman et al., 1980; Kaprio and Koskenvuo, 1990). These research traditions have developed independently of one another, and their implications for understanding social class differences in mortality are unclear.

These mechanisms are sometimes referred to as selection effects or unobserved heterogeneity: people are selected into statuses on the basis of variables whose values are often unobserved. The question of whether adult socioeconomic mortality differences in England and Wales principally reflect the operation of "selection effects" has generated a great deal of interest, including the bulk of an entire issue of Social Science and Medicine (Volume 32(4), 1991). The evidence brought to bear on the issue is mainly indirect and circumstantial (e.g., patterns of mortality differentials by age and cause of death). One direct attempt to estimate an adult mortality model that includes an explicit allowance for unobserved heterogeneity uses longitudinal data from the U.S. Retirement History Survey. The authors find that coefficients on education and income are very robust to the introduction of an allowance for unobserved heterogeneity (Behrman et al., 1993).

A demonstration that socioeconomic differences in adult health were principally a reflection of socioeconomic differences in child health, operating via selection effects, would obviously not alleviate social responsibility for such differences, although it would change the age focus of social concern.

Environmental Factors

One’s environment can affect one’s health status independently of personal characteristics. For example, the incidence of communicable diseases in a community affects an individual’s risk of contracting one. An investigation using data from the Alameda County Study finds that residents of a federally designated poverty area in Oakland had mortality rates that were 55 percent above those of residents in other areas, when age, sex, race, and...

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5The basic identifying assumption is that the expected value of the (unobserved) correlation of the environment of twin pairs is the same for the identical and fraternal twin pairs.
basic needs for food, clothing, and shelter causes them to place lower priority on more distant dangers (Williams, 1990:87).

Social-Psychological Approaches

As we begin to discuss tastes, lifetime satisfactions, and unobserved personality factors that can influence relations between health and class, we have entered the domain of social psychology. The economist’s models produce a straightforward prediction about the relation between expected future utility and health behaviors, but testing such predictions benefits from having more direct measures of these variables. In the case of tastes and personality factors, economists have little to offer. Furthermore, they omit altogether what most sociologists consider a key component of utility or satisfaction, the quality of interpersonal relations. Economic man maximizes utility by selecting items of consumption. In other precincts, men and women get married, have babies, develop friendships, and interact with neighbors and relatives.

Psychologists who study health have scales rather than models. Individuals are not seen as pursuing goals or having traits, some of which influence health. Little attention is paid to issues of causation: where the traits came from and whether health events can influence the trait, for example. Trait-bearing individuals are viewed as being subject to stressors that can affect health. These operate principally in the domain of workplace and family. The stressors are typically viewed as exogenous to the individual, although it is clear that avoidance of stress is to some extent subject to personal choice. For example, risk premiums can induce people into hazardous or stressful occupations.

Individuals possess varying amounts of coping skills that allow them to deal with stress. Social relations can facilitate coping and are an important influence on health in their own right. Social relations are also typically treated as exogenous to the individual, although once again it is clear that people are not passive participants in the formation and maintenance of social ties.

There is abundant evidence from hundreds and even thousands of studies that personality traits, exposure to stressors, and social relations are powerful influences on the risk of contracting and dying from chronic diseases, especially heart disease. Useful reviews include House et al. (1988), Marmot and Theorell (1988), and Cohen and Syme (1985). The studies include elaborations of the physiological mechanisms through which psychological variables influence health, sometimes involving other species.

For our purposes, the immediate question is what influence these variables have on socioeconomic differences in mortality and health status. There is much less information about this matter because it has not been an important question in social-psychological studies of health. At times, socioeconomic variables appear in cameo roles as “controls”; at other times they are ignored altogether. For example, a massive volume on Social Support and Health contains not a single reference to education, income, social class, or occupation in its 10-page subject index (Cohen and Syme, 1985). Williams (1990) is a notable exception to the bifurcation of literatures (see also House et al., 1990).

The connection between socioeconomic status and stress would appear to be conceptually most straightforward. People with low levels of schooling or low incomes are simply less able to place themselves in low-stress situations. Stressful life events such as unemployment, illness or death of a family member, and divorce are clearly more frequent among people of lower socioeconomic standing (Williams, 1990:89). Such people are also less capable of buying into placid neighborhoods or jobs with high autonomy and low performance pressures. When some indicator of stress is introduced into a multivariate health model that includes a socioeconomic variable, it appears reasonable to treat it as intervening between socioeconomic standing and health.

This conceptual clarity is missing for most personality variables (e.g., sense of self-efficacy). Although such variables may be a product of one’s economic circumstances, it is also reasonable to view those circumstances as a function, at least in part, of personality variables. Standard multivariate analysis is not helpful in sorting out such issues of causality. If the introduction of a personality variable into an equation predicting health reduces the coefficient on education, it may mean that education is working “through” the personality variable; that the original coefficient was biased upwards because personality affects education and has its own direct effect on health; or that both are correlated with a third, unmeasured variable that affects each of them as well as health itself.

Similar problems arise for social relations. It is now recognized that personal networks are useful in achieving many goals in addition to better health, including better jobs and neighborhoods. To further complicate interpretation, social networks can be created and activated to perform some of the functions that markets perform by people who cannot afford market solutions (e.g., using a grandparent for babysitting, friends for transportation, a spouse for entertainment). On the other hand, people with higher incomes can afford to pursue social relations in more pleasant venues, perhaps increasing their durability and strength (probably a very salient factor in spousal relations). Finally, one suspects that good social relations are a function of some of the same traits that are related to job success, such as sociability and self-control. Sorting out causal pathways in the connections among social relations, socioeconomic status, and health is clearly difficult. Using longitudinal data, Johnson (1991) finds that poor mental health in-
increased the risk of breaking primary relationships, whereas weak primary relationships increased the subsequent risk of mental distress.

Empirical Studies

People with lower levels of education, income, and occupational status have an adverse distribution on most of the biomedical and behavioral variables related to health. The behavior to which the largest number of excess deaths are attributable in the United States is cigarette smoking. Table 8-7 shows recent differences in smoking patterns by education and family income in the United States. By 1987, there was a huge negative educational gradient in smoking for males and a somewhat milder one for females. These sex differences are likely to be related to the milder mortality gradient for women than men, demonstrated earlier. If we adopt the estimate of relative risk from smoking of approximately 1.7 that has emerged from many epidemiologic studies (see Rogers and Powell-Griner, 1991, for recent figures), then smoking differences alone could account for a male mortality differential of 15 percent between those who did not complete high school and those who completed college. Income differences in smoking are substantially smaller than educational differences, consistent with the conclusion of Winkleby et al. (1992) about the dominant impact of education on smoking in a multivariate analysis of data from a nonnational sample.

Shea et al. (1991) examine educational differentials for a variety of risk factors in a 1989 New York State sample. They find that better-educated people are significantly more likely to engage in aerobic exercise and to know their blood pressures, and less likely to smoke or be overweight. Using 1979-1986 data from the Stanford Five City Project, Winkleby et al. (1990) find that schooling is significantly associated with cigarette smoking, hypertension, serum cholesterol, body mass index, height, and health knowledge (a 17-item scale of knowledge about cardiovascular risk factors). In all cases, the risk factor distribution of poorly educated persons is more adverse. In the Alameda County Study, persons of lower socioeconomic standing were three to four times more likely to report bad health habits (Berkman and Breslow, 1983). Scherwitz et al. (1991) show that scores on a hostility scale, sometimes found to be related to the incidence of coronary heart disease, were higher for people with less schooling and suggest that the distribution of hostility scores reflects the incidence of negative life events and the availability of social support.

The larger, nationally representative NHEFS data set also demonstrates that more poorly educated persons are more likely to smoke, to have high blood pressure, and to be overweight (among females). However, differences in mean serum cholesterol levels are small and irregular (Feldman et al., 1989:Table 5). Sorel et al. (1992) find that the inverse univariate correlation between blood pressure and education reported in the Second National Health and Nutrition Examination Survey and its Hispanic counterpart is substantially attenuated or becomes statistically insignificant once age and a body mass index are controlled. With these controls, the only significant negative relationship between education and blood pressure occurs for white male’s systolic pressure. A new biomedical factor that has begun to receive attention as a potentially important mediating variable in the relation between class and coronary heart disease is plasma fibrinogen, a blood protein related to clotting. Evidence suggests it is an important independent risk factor for cardiovascular disease; in Finland, levels are significantly associated with both childhood and adult socioeconomic status (Wilson et al., 1992).

British studies also demonstrate that people in higher occupational classes are more likely to be tall, to be physically active, and to have good respiratory function, and less likely to smoke or be overweight (MacIntyre, 1988; Marmot et al., 1984). Once again, serum cholesterol differentials are negligible. Oakley and Rajan (1991) also show that working-class women in England have fewer close friends and receive less support from their husbands than middle-class women and are no more closely involved with relatives.

| TABLE 8-7 Socioeconomic Differences in the Prevalence of Cigarette Smoking: United States, 1987 |
|---------------------------------|-----------------|-----------------|-----------------|
| Indicator                      | Males (%)       | Females (%)     |
|                                | Current Smoker  | Former Smoker   | Never Smoker    |
|                                | Current Smoker  | Former Smoker   | Never Smoker    |
| Years of schooling             |                 |                 |                 |
| <12                            | 40.5            | 32.3            | 27.1            |
| 12                             | 35.9            | 27.6            | 36.6            |
| 13-15                          | 26.8            | 26.5            | 46.7            |
| 16+                            | 17.4            | 29.7            | 52.9            |
| Family income (dollars)        |                 |                 |                 |
| <10,000                        | 35.9            | 23.2            | 40.9            |
| 10,000-19,999                  | 36.3            | 30.1            | 33.6            |
| 20,000-34,999                  | 33.7            | 27.1            | 39.3            |
| 35,000-49,999                  | 26.5            | 31.0            | 42.5            |
| 50,000+                        | 23.2            | 31.4            | 45.4            |
| All                            | 31.2            | 28.9            | 39.9            |
In order to determine the impact of these and other "proximate determinants" of health on class gradients in mortality and health status, we examine four studies that are unusually rich in the array of variables considered. Problems of identifying causal relations are not fully resolved in these studies, but they suggest which mechanisms may be most important to clarify. The first is the well-designed NHEFS study reported by Feldman et al. (1989). The authors note that educational differentials in mortality are much greater for heart disease than for other causes of death. They proceed to introduce information on current smoking status, body mass index, systolic blood pressure, and serum cholesterol into a hazard model predicting the risk of death from heart disease. Each of these variables is a simple dichotomy. Although some reduction in relative risk for the poorly educated is observed for most age-sex-education groups, the reductions are small. For males ages 65-74, for example, the relative risk associated with the most poorly educated group (0-7 versus 12+ years) declines from 1.49 before the introduction of controls to 1.38 after their introduction. For females, the comparable change is from 1.53 to 1.48 (Feldman et al., 1989:926, 928).

The second study examines the mortality of 17,530 London civil servants over a 10-year period (Marmot et al., 1984). The principal socioeconomic dimension in the study was occupational grade: administrative, professional/executive, clerical, and other (the lowest grades). Very large differences in mortality were observed among these occupational classes, with the lowest class having an age-adjusted mortality probability of 15.6 percent, compared to 4.7 percent among the highest grade. The most important cause of death in producing the differential was coronary heart disease. Measures of important proximate determinants of mortality were available in this study. In a logistic regression predicting the risk of death from coronary heart disease, introducing information on smoking status, systolic blood pressure, serum cholesterol levels, blood glucose, and height reduced the risk associated with grade by less than 25 percent. Introducing physical activity levels and disability at baseline also had little effect on occupational coefficients.

The third and fourth studies have richer detail on social-psychological variables. In an exceptionally well-crafted study, Lundberg (1991) examines an index of physical health among 5,613 Swedes aged 15-75. A dichotomous health index was constructed from a 47-item list of symptoms and ailments; 41 percent were classified as ill. The prevalence of illness was sharply differentiated among eight occupational groups, which formed the principal socioeconomic variable studied. A wide array of additional variables were available, including "economically harsh" conditions in childhood, economic deprivation in adulthood, heavy labor on the job, dangerous work conditions, psychologically stressful job, high decision latitude on the job, weak social network, poor diet, heavy smoking, and heavy alcohol con-umption. Except for psychologically stressful work, each of these variables shows a distribution that is adverse to lower occupational grades.

The study uses dummy variables to indicate membership in a particular occupational group. The standard deviation of occupational coefficients is used as the basic measure of class inequity in health status. With controls only for age and sex, the standard deviation is 0.231. Introducing all of the above variables, including an interaction between stressful job and decision latitude suggested by Karasek et al. (1981), reduces the standard deviation to 0.147, or by 36 percent. Introducing variables one group at a time shows that the combination of heavy work and dangerous work conditions produced the largest reduction, 15 percent. The two psychological features of one's job, and their interaction, reduced class inequality by only 3 percent. Among these added variables, the highest relative risk was associated with having economic difficulties in one's family during childhood.

The fourth study is not explicitly addressed to socioeconomic status, which is treated as a control variable. However, a rich array of other variables is included, and the presentation allows an inference about the impact of these variables on socioeconomic differences. Kaplan (1985) reports on ischemic heart disease (IHD) mortality in an 18-year follow-up study of 6,928 adults in Alameda County, California. Adjusting for age, sex, and physical health status at baseline (1965), the study finds a relative risk of 1.40 for persons of low socioeconomic status, defined as having less than 8 years of schooling and low income. Adjustment for poor health practices (constructed from a scale including smoking, drinking, weight for height, physical activity, and hours of sleep) reduces the relative risk by 9 percent. Adjusting for social network (isolated versus connected) reduces the relative risk by 11 percent. Adjusting for "life satisfaction" reduces the relative risk by 3 percent, for "depression" by 5 percent, and for "helplessness" by 7 percent. Introducing all of these variables simultaneously, as well as "perceived health," reduces the relative risk to 1.03, which is insignificantly different from unity. The introduction of "perceived health" as an independent variable in the regression format is unfortunate because it seems more appropriately treated as an outcome variable than a predictor and may bias coefficients toward 1.00. Among the psychosocial variables introduced in this study, dichotomized life satisfaction and depression indices produce relative risks of IHD death of 1.49, and helplessness a relative risk of 1.77. Only the latter remains significant in multivariate analysis.

Thus, in three of these four studies the introduction of what might be considered intervening variables between class and health fails to reduce socioeconomic differentials by as much as 40 percent. The other study, which is rich in psychosocial variables, essentially "explains" all of the differential, although issues of causality (e.g., what causes helplessness) are not resolved in this study. In addition, it appears that socioeconomic differ-
ences are unusually narrow in the Alameda County population. In fact, at ages 60+, 17-year survival is not significantly associated with family income (adjusted for family size; Kaplan et al., 1987).

The persistent failure of intervening or proximate variables in existing studies to “account for” relations between class and health has led some analysts to postulate that there is some generalized factor that is primarily responsible for the observed differences (Cassel, 1976; Marmot et al., 1984). Marmot et al. suggest that dietary differences may be one such generalized factor. But factors related to diet such as serum cholesterol, blood pressure, and body mass index are clearly not principal channels connecting class and health. Access to, and quality of, medical care may be another such factor; surprisingly little research attempts to understand the contribution to class differences of variation in medical care. But the experimental studies described above, the widening of class differences in Britain after the National Health Service was introduced, and the widening of education differences above age 65 in the United States after Medicare was introduced all suggest that medical care does not hold the key to socioeconomic differences. So does the simple tabulation of the many chronic conditions that are more prevalent among lower-status groups (shown, for example, in Table 8-5). Clearly, the incidence of many diseases varies among groups, and by its nature, medical care has much less to offer in the way of prevention than of treatment.

The search for one generalized factor to explain the bulk of class differences is likely to prove fruitless. More and better studies of specific factors would seem a more promising path, within a causal framework that recognizes that individuals are not mere slices of cross-sectional characteristics but have histories and motivations.

**SOURCES OF CHANGE IN SOCIOECONOMIC DIFFERENCES**

In most Western countries, differentials have widened in the past several decades, and some attention has been paid to the factors involved. The widening of class differentials in the United States and Britain during this period coincides with a widening of class differentials in cigarette smoking. Between 1974 and 1985, the prevalence of smoking in the United States declined five times faster among college graduates than among people with less than a high school education (Pierce et al., 1989). To our knowledge, no one has attempted an explicit quantitative assessment of the linkage between these trends. However, Marmot and McDowell (1986) demonstrate for Britain that between 1970-1972 and 1979-1983, mortality from smoking-related causes lung cancer and coronary heart disease rose among manual workers and fell among nonmanual workers. For all other causes, mortality rates fell by equal percentages in the two groups.
Blacks have a higher prevalence of most chronic conditions and of disability in all age groups (Manton et al., 1987). Recorded black-white mortality differences contract sharply above age 65 and are eliminated or reversed above age 80.

More studies have aimed at “explaining” black-white differences than at explaining other socioeconomic differences, and they have been far more successful. The principal reason is that the factors admitted into the explanation have included the other socioeconomic variables. In short, black-white differences in mortality and health status appear to be primarily a manifestation of racial inequality in education and income.

Otten et al. (1990) use NHANES follow-up data on persons aged 35-54 at baseline. An initial black-white mortality ratio of 2.3 with no controls is reduced to 1.4 after controls are instituted for six risk factors (e.g., blood pressure, smoking) and family income. By far the largest reduction in relative risk occurs when family income is introduced into the hazard model. At ages 55-77, a slight black mortality disadvantage is converted into a slight black advantage when these same factors are controlled.

Behrman et al. (1991) use longitudinal data from the Retirement History Survey to examine the degree to which black-white differences in male mortality are attributable to differences in income. This data source is especially useful in having measures of lifetime earnings, but is limited to persons who were heads of households at survey in 1969, when they were aged 58-63. In a later version of this analysis, Behrman et al. (1993) find that both Social Security and pension benefits have a highly significant effect on the mortality hazard rate. Using a regression-decomposition procedure, they find that differences in characteristics between blacks and whites account for 60-80 percent of the racial difference in hazard rates. Most of the contraction is attributable to differences in pension income, education, and marital status (Behrman et al., 1993:174).

In a study that draws on the 1986 National Mortality Followback Survey for numerators and the 1986 National Health Interview Survey for denominators of adult death rates, Rogers (1992) finds an odds ratio of 1.48 between black and white mortality when only age and sex are controlled. Controlling marital status and family size alone reduces the odds ratio to 1.29. Controlling family income class alone reduces it to 1.17. Controlling both variables together reduces the odds ratio to 1.01.

In a study using NLMS and confined to comparisons of age-adjusted death rates, Sorlie et al. (1992) show that controlling family income levels reduces the relative risk of death for black males aged 45-64 from 1.67 to 1.30 and for black females from 1.82 to 1.48. Racial differences were smaller above age 65 and not substantially modified by income controls.

Keil et al. (1992a) examine black-white differences in mortality from all causes and from coronary heart disease among men recruited into the Charleston Heart Survey in 1960. Educational level and occupational status at baseline served as socioeconomic control variables in a 28-year follow-up. Initially large black-white differences in all-cause and coronary heart disease mortality were reduced to insignificance when socioeconomic status was controlled. In a subsequent analysis of these data, Keil et al. (1992b) find that skin color within the black population is insignificantly related to mortality, although there is some tendency for lighter-skinned blacks to have lower survivorship.

Mutchler and Burr (1991) examine racial differences in disability and other indices of health status using the 1984 Survey of Income and Program Participation. They find no significant racial differences in self-assessed health status (proportion rating their own health as fair or poor) remains significant.

Other studies have examined cancer incidence and survival differences between blacks and whites. Devesa and Diamond (1983) find lung cancer incidence rates to be higher for black men than for white men in the Third National Cancer Survey. However, when the median income and median educational level of one's census tract are introduced into a regression equation, racial differences become insignificant. Bassett and Krieger (1986) note that blacks have poorer survival rates from breast cancer than whites, controlling stage and histology. Racial differences in survival are also common at other sites. Using data from the Western Washington Cancer Surveillance System, the authors find that an initial racial difference of 35 percent is reduced to 10 percent when socioeconomic characteristics of one's census tract are controlled.

Economic characteristics may affect cancer survival largely through the quality of care received; Page and Kuntz (1980) show that racial differences in survival are insignificant among patients treated in VA Administration hospitals for seven of the eight cancer sites investigated. Blendon et al. (1989) show that blacks are less likely to use physician services at a particular level of self-assessed morbidity as reported in a national telephone survey in 1986. They are also less likely to express satisfaction with the quality of care received. Use of a single dichotomous income variable, plus health insurance availability and demographic controls, reduces an initial difference of 26 percent in the mean number of annual ambulatory visits to physicians to a difference of 10 percent, which remains significant.

Four factors are likely to be significant in the narrowing of adult racial differences in mortality during the past two decades, although there has been no explicit examination of this phenomenon. First, racial differences in cigarette smoking have contracted (Manton et al., 1987). Second, there has been a huge reduction in the prevalence of hypertension among blacks,
especially black males. Nevertheless, blacks have an approximately 30 percent higher incidence of hypertension even when obesity and diabetes are controlled statistically (Svetkey et al., 1993). Third, the introduction of Medicare and Medicaid has been associated with a change in patterns of physician visitation and hospitalization, with black increases exceeding white (Manton et al., 1987). Finally, racial differences in income and poverty rates have narrowed, although there is some ambiguity about trends in racial income disparities (National Research Council, 1990). These sets of changes are clearly interrelated rather than independent.

Navarro (1990) notes that the United States has an explicit policy goal of narrowing racial differences in mortality and health status, but, unlike most other industrialized countries, has no explicit goals regarding socioeconomic differences. In light of careful research that demonstrates income, education, and occupational disparities to be the principal source of racial differences in mortality and health status, the policy emphasis would appear to be misplaced. Now that reliable national data on socioeconomic differences have become available, there is less reason to continue using race as a proxy for class.

SUMMARY

Mortality rates and the prevalence of ill health are higher among groups of lower social standing in all contemporary Western countries, including the United States. In most countries where evidence is available, social disparities in mortality have widened during the past two decades, although inconsistencies among data sources in the United States make this conclusion uncertain. Heart disease is the principal cause of death responsible for social class differences in mortality from all causes combined.

The principal approaches used to identify the sources of these differences are economic and social-psychological. Economic approaches have the virtue of conceptual clarity; social-psychological approaches have the advantage of focusing on variables that have substantial predictive ability. The former focuses on choice under constraints; the latter, on predispositions of unknown origin, stressors, and coping mechanisms. In neither case are individuals' personal histories well integrated into the analytic apparatus, which seems essential for a full appreciation of the sources of health differentials at any moment in time. A fruitful blending of the approaches seems possible in which the economist's focus on goods and services as the principal source of satisfaction is supplemented by attention to personal relationships as additional desiderata. Poverty and low status exact a health toll not only through absolute deprivation of material resources but also through interpersonal stresses and impaired relationships, some of which may reflect relative deprivation as much as absolute deprivation. These influences cumulate over a lifetime. Research designs need to be expanded to capture the broad array of class-related phenomena affecting the health of older persons.

Efforts to ascribe class differences in mortality or health status to various intervening biomedical variables such as smoking or elevated blood pressure have not been entirely successful. Although some reduction in class differences typically results from controlling these variables, the bulk of the differences remains. Whether this result reflects a deficiency in the array of variables considered, the activity of hitherto unidentified factors, or the futility of a strictly biomedical approach to studying a process with important cognitive, affective, and motivational elements, is not clear. In contrast, the bulk of black-white differences in mortality and health status are explicable in terms of the unequal distribution of the groups on variables such as education and income.

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