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The Relationship between Socioeconomic Status and Health: A Review of the Literature

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OVER THE COURSE OF THE TWENTIETH CENTURY mortality rates have fallen sharply throughout the developed world, and life expectancy has increased dramatically. Although all segments of the population have participated in this improvement in health status and life expectancy, in most countries individuals of lower socioeconomic status have, throughout this period, faced higher mortality rates than individuals of higher status. Furthermore, there is at least some evidence, admittedly controversial, that such inequalities in health outcomes have not diminished over time, and may even have increased in recent decades. The continued existence of health inequalities violates many individuals' sense of social equity, and poses important challenges to policy makers.

The past 20 years have witnessed the growth of a substantial literature that studies the relationship between socioeconomic status and health, comparing the mortality and morbidity experiences of different socioeconomic groups within individual countries, contrasting health experiences across countries, documenting the extent of inequalities, and exploring possible explanations of differential health outcomes. I will provide a selective review of this literature, first discussing the principal empirical findings in the literature, and then providing a conceptual guide to and critical assessment of the major proposed explanations of health inequal-

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ities; based on my review, I conclude by suggesting a possible research agenda for future work in the United States on this topic. As I hope to make clear, the literature to date has succeeded far better in documenting the existence and extent of health inequalities than in explaining why these inequalities persist. Thus, there has been little progress either in understanding the relationship, at the individual level, between lifestyle habits that affect health and the utilization of formal health care services, or in quantifying the relative importance of resources, as opposed to behavioral factors, in explaining health inequalities. I hope this review will contribute to a further discussion of how to address these issues more effectively.

Beginning with the empirical literature of the United States, I review the pioneering epidemiologic work of Kitagawa and Hauser (1973), and then discuss Silver (1973), whose work exemplifies the economic approach to health popularized by Victor Fuchs and Michael Grossman, among others, during the 1960s and 1970s. Next I review two recent U.S. studies, by Feldman et al. (1989) and Menchik (n.d.); I conclude my overview of the U.S. literature by briefly discussing recent works by Palmer (1989), Wing et al. (1987; 1988), Logue and Jarjoura (1990), Haan, Kaplan, and Camacho (1987), and Hadley (1982; 1988). I then focus on the United Kingdom, beginning with an examination of the influential *Black Report* and summarizing the extensive literature that it has stimulated. Finally, I summarize the findings on health inequalities in other developed countries, emphasizing similarities and differences between nations. Lest the results I review be accepted uncritically, I also briefly discuss the studies' methodological flaws when these seem especially salient or have been raised in the literature itself.

Many possible explanations of inequalities in health outcomes have been proposed in the literature. I organize these various explanations along two dimensions. One dimension refers to the underlying characteristics of persons that may cause differences in health status, and divides these characteristics into two distinct groups: resource-dependent characteristics like wealth, home ownership, and automobile ownership; and non-resource-dependent behavioral characteristics, including psychological, genetic, and cultural factors. The second dimension refers to the stage of life experience in which inequalities are generated, and can also be conveniently divided into two groups: inequalities arising from different experiences over the "life span," such as differences in diet, smoking, exercise, and occupation; and inequalities that arise from differences in access to and utilization of formal "health care services."

Tying these two dimensions together leads to the identification of four distinct "boxes" (for example, one box links resource factors to differences in general life style, whereas a second box links resources to differences in health care services), each of which may contribute to unequal health outcomes. I discuss various methodological approaches for distinguishing which of these "boxes" is most important, review a representative set of studies, and argue that all four currently appear to exert at least some impact on health inequalities. I also argue that my conceptualization, and most of the models presented in the literature, fail to capture the deeper structural relationships that must be explored if we are to gain greater insight into the sources of inequalities and formulate a more effective policy response.

Finally, in the last section, I turn to the future and briefly consider the kinds of research that would most likely advance our understanding of inequalities and provide policy guidance. I emphasize the need for datasets and research agendas that will link information on daily life experiences, typically available in a panel data framework, with medical records on the diagnosis and treatment of disease, prognosis, and survival. I also suggest that richer models of health behavior might be fruitfully constructed.

I choose not to discuss several topics related to the literature on socioeconomic status and health. One is the relationship between race and health. Part of the reason is that this is a large topic in its own right and deserves separate consideration (see, for example, Manton, Patrick, and Johnson 1987). In part, however, I believe consideration of race may obscure other issues, and I note that several recent studies (Menchik [n.d.] and Logue and Jarjoura [1990]) find that, once income, education, and other socioeconomic variables are included in a model, race has little explanatory power. A second topic I do not address is infant mortality. There is little doubt that infant mortality alone accounts for a good deal of the differential mortality and life expectancy between social classes. Again, I feel this topic deserves separate consideration.

Review of Principal Findings in the Literature

Because the literature is so large, I have been forced to be selective in my overview of it, particularly for the United States and the United King-

dom. After reviewing in detail the more influential or representative older studies, I concentrate on recent work (for an excellent review of the earlier literature, see Antonovsky [1967, 1968]). Further, I focus on summarizing each study's principal findings and reviewing possible methodological criticisms of them; possible explanations of health inequalities are mostly left to the next section.

The United States

The Findings of Kitagawa and Hauser. In 1973 Evelyn Kitagawa and Philip Hauser published their classic work, *Differential Mortality in the United States: A Study in Socioeconomic Epidemiology*. In their book Kitagawa and Hauser present results from two studies based on two distinct datasets: the 1960 Matched Records Study and the Chicago Area Study.

The 1960 Matched Records Study linked death certificates with census information on the educational attainment and household income for some 340,000 individuals who died during May–August 1960 in the United States. Table 1, taken from Kitagawa and Hauser's analysis, illustrates the relationship between education and mortality for several different population subgroups defined according to age, sex, and race. The table shows that, among all four race and sex classes aged 25 to 64, there was a strong inverse (and monotonic) relationship between years of schooling and mortality in 1960; in quantitative terms, the difference in standardized mortality rates between the least and best educated subgroups is at least 65 percent for each of the four classes. In contrast, the table reveals that, among those over age 65, there was little relationship between education and mortality, except among white women. Two possible explanations of this pattern come to mind: one is a cohort effect—schooling may have begun to teach "healthy habits" only some time after the turn of the century; alternatively, the effects of education may "wear off" as a person ages. The results translate into a difference of approximately five years in life expectancy at young adulthood between the most and least educated.

Table 2 describes comparable findings for the relationship between income and mortality, for both members of families and unattached individuals. The table shows a clear inverse relationship between income and mortality for both men and women. Quantitatively, the effect of income on mortality is stronger than the effect of education for men,

TABLE 1
Relationship between Education and Mortality

Years of school completed	Mortality ratios			
	White men		White women	
	25–64 years	65+ years	25–64 years	65+ years
All persons	1.0	1.0	1.0	1.0
0–4 years	1.15	1.02	1.60	1.17
5–7 years	1.14	1.00	1.18	1.04
8 years	1.07	1.00	1.08	1.03
High school				
1–3 years	1.03	.99	.91	.94
4 years	.91		.87	
College				
1–3 years	.85	.98	.82	.70
4 years or more	.70		.78	
	Nonwhite men		Nonwhite women	
	25–64 years	65+ years	25–64 years	65+ years
All persons	1.0	1.0	1.0	1.0
0–4 years	1.14	1.04	1.26	1.05
5–8 years	.97	.93	1.06	.93
High school or college	.87	.97	.74	1.01

Source: The 1960 Matched Records Study, reported in Kitagawa and Hauser 1973, tables 2.1, 2.2.

but weaker for female family members. In interpreting these results, it is important to note that income refers to household income in 1960, which is different from household wealth. As Kitagawa and Hauser point out, if sick individuals become unemployed or are forced to switch to less demanding jobs in the years preceding death, they earn less in that year than those who remain healthy; but in this case poor health "causes" low income, rather than the reverse, invalidating the model lying behind table 2, which is predicated on the opposite causality (within families this argument has more validity when applied to men, the main earners at that time, than when applied to women). Kitagawa and Hauser go on to state: "In our judgment, the education differentials

TABLE 2
Relationship between Income and Mortality

Family income	Mortality ratios: White male family members, 25–64 years	White male family members, 65+ years	White female family members, 25–64 years	White female family members, 65+ years
All persons	1.0	1.0	1.0	1.0
<$2,000	1.51	1.10	1.20	.96
$2,000–$3,999	1.20	.99	1.12	.96
$4,000–$5,999	.99	.92	1.00	1.05
$6,000–$7,999	.88		.98	
$8,000–$9,999	.93	.96	.92	1.01
$10,000 or more	.84		.86	
	White male unrelated individuals, 25–64 years	White male unrelated individuals, 65+ years	White female unrelated individuals, 25–64 years	White female unrelated individuals, 65+ years
All persons	1.0	1.0	1.0	1.0
<$2,000	1.26	1.0	1.27	1.05
$2,000–$3,999	1.02	1.01	.73	.80
$4,000 or more	.77		.79	

Source: The 1960 Matched Records Study, reported in Kitagawa and Hauser 1973, table 2.5.

probably provide more reliable indicators of socioeconomic differentials in mortality in the United States in 1960 than do the income differentials" (1973, 23). Taken at face value as a comment meant to apply only to Kitagawa and Hauser's results, this statement is possibly correct. However, in my judgment, the problem of reverse causality is less likely to afflict household wealth than household income measures, primarily because wealth accumulates over time and hence is less affected by a single episode of sickness (although a large wealth spend-down in the last year before death could pose a problem); hence, recent studies that use wealth as a measure of economic status, like those by Menchik (who in fact uses a predetermined wealth measure) and Palmer, both of which

are reviewed below, are less susceptible to this criticism (see also Wilkinson 1986c).

Kitagawa and Hauser present several other results based on the Matched Records Study, of which I will mention two. First, they report the results of multivariate models that link health simultaneously to both education and income. These results demonstrate that the effects of education and income are largely independent of one another. Second, they disaggregate overall mortality into 23 major causes of death, and examine how educational attainment relates to each. In general, they find a persistent inverse relationship between educational attainment and mortality from heart disease (degenerative, vascular lesions, hypertension, rheumatic fever, and other) for both men and women, which generally is stronger among persons aged 25 to 64 than among those aged 65 and over. The situation is more complex for malignant neoplasms. Whereas cancers related directly to smoking—of the lung, bronchus, and trachea—as well as stomach and intestinal-rectal cancers show a strong inverse relationship, other cancers do not; thus, for example, neither cancer of the prostate in men nor breast cancer in women shows a persistent inverse relationship.

The Chicago Area Study collected information on census tracts in the Chicago metropolitan area and surrounding suburbs for each of 1930, 1940, 1950, and 1960. For each time period, the study used data on the median rental payment in each tract to divide the tracts in the metropolitan area into five categories (the suburbs were, collectively, a sixth category), ranked from highest to lowest socioeconomic status; the study linked this ranking with data on the mortality rate (standardized by age and sex) of each tract.

Table 3 depicts the basic relationship between class and mortality that emerges from this dataset. As expected, overall mortality is decreasing over time for essentially all groups. More interestingly, the study shows a sharp negative relationship between class and mortality: in each time period, for both men and women the lowest socioeconomic class has a mortality rate that is approximately 60 percent higher than the rate of the highest class. In addition to providing strong evidence of differential mortality, these findings also indicate that the inequality in mortality is approximately stable over time, a result that contrasts with the findings of the *Black Report* for the United Kingdom, reviewed below.

The Chicago Area Study suffers from two major drawbacks that are

TABLE 3
Relationship between Socioeconomic Class and Mortality over Time

Group by race, sex, and socioeconomic class	Age-adjusted mortality rate			
	1929–31	1940	1950	1960
White men				
United States	12.8	11.6	9.6	9.2
Chicago SMSA	—	—	10.6	9.9
City of Chicago	14.4	12.6	11.4	11.0
SE 1 (low)	18.8	16.6	14.6	16.0
SE 2	15.4	13.4	11.6	11.3
SE 3	13.6	11.5	9.7	10.1
SE 4	12.4	10.8	9.4	9.2
SE 5 (high)	11.6	11.0	8.7	9.6
Suburbs	—	—	9.1	8.4
White women				
United States	10.6	8.8	6.5	5.6
Chicago SMSA	—	—	7.1	6.1
City of Chicago	11.6	9.4	7.5	6.7
SE 1	14.5	12.2	9.1	9.0
SE 2	12.5	10.1	7.8	7.0
SE 3	11.3	9.1	7.0	6.2
SE 4	10.5	8.3	6.6	5.8
SE 5	9.0	7.6	6.0	5.9
Suburbs	—	—	6.4	5.5

Source: The Chicago Area Study, reported in Kitagawa and Hauser 1973, table 4.3.
Abbreviations: SMSA, standard metropolitan statistical area; SE, socioeconomic class.

common to all small area studies. First, it uses aggregated data (in this case at the census tract level), rather than individual records; because mortality is an individual experience, and socioeconomic characteristics like income are fundamentally attached to the household, this aggregation is likely to introduce biases into the analysis, and to make it more difficult to link the empirical evidence directly to underlying theoretical models. Second, migration in and out of the small areas may tend to introduce problems of endogeneity or reverse causality, whereby sicker individuals move to poorer areas.

In summary, Kitagawa and Hauser provide extensive and compelling evidence of the existence of differential mortality by socioeconomic status in the United States over the period 1930–60. However, their work suffers from a number of drawbacks, perhaps the most important of which is the absence of data on a host of variables that are central to a more penetrating analysis of differential mortality, such as access to medical care, reimbursement coverage, smoking, diet, and family upbringing.

Silver and the Early Econometrics Literature. Contemporaneous with the study by Kitagawa and Hauser was Morris Silver's area study of differential mortality (Silver 1973), which drew upon the insights of Victor Fuchs (collected in Fuchs [1972; 1986]), Michael Grossman (1972), and other economists who had become interested in health care issues in the 1960s. Silver works with two different area datasets: (1) a collection of SMSAs, and (2) the states, each covering the period 1959–61. His dependent variable is mortality in the area, standardized by sex and race, just as in the Chicago Area Study of Kitagawa and Hauser.

One strength of Silver's work lies in the specification of a rich set of independent variables; in this domain he goes far beyond the Chicago Area Study of Kitagawa and Hauser. In particular, he includes in his regressions measures of median household total income in the area: median household labor income, median education, marital status, fertility (number of children per woman), smoking, psychological stress (measured by the prevalence of duodenal ulcers in the area), public welfare expenditures, public health expenditures, climate, air pollution levels, and the number of physicians per 1,000 population.

Many of the variables that Silver includes in his regressions are likely to be endogenous. As an example, consider the variable measuring the density of physicians in an area. On the one hand, a higher density of physicians may be expected to lower mortality in an area; this causal pathway is accounted for in Silver's specification of the mortality equation. On the other hand, however, an area of higher mortality may be expected to attract more physicians; this causal pathway would emerge only from a second regression equation, in which the density of physicians was the dependent variable, and mortality rates (and other relevant factors) were independent variables. It is a second strength of Silver's work, and the econometric methodology he employs, that he controls for possible endogeneity by utilizing standard "two stage least squares" techniques, which were introduced into health economics by Victor Fuchs.

Generally, Silver's findings are consistent with those of Kitagawa and Hauser and with the earlier work of Fuchs. He finds a significant negative relationship between median household income and mortality for at least some demographic groups and specifications, and consistently finds a significant negative relationship between education and mortality. He also finds a strong positive correlation between cigarette smoking and mortality, and between "stress" and mortality. Finally, he reports that the number of physicians per 1,000 population has a negative relationship to mortality, but is not statistically significant.

Silver was remarkably prescient in considering a range of issues that foreshadow many current concerns, including psychological and behavioral traits, and availability of medical care. However, his approach to measuring these variables and including them in his model is not sufficiently well structured to provide the policy guidance desired. An example of this problem is his treatment of health care: the density of physicians in an area is undoubtedly one measure of health care availability, but it is far too crude to deal with issues of hospitalization, reimbursement, or medical education, which have become central in recent policy debates.

Recent U.S. Studies. The Work of Feldman and Coauthors. Feldman et al. (1989) focus on the relationship between educational attainment and mortality and how it changes over time, comparing results from the 1960 Matched Records Study with results over the period 1971–84 from the National Health and Nutrition Examination Survey (NHANES I), and the National Health Epidemiologic Followup Study (NHEFS) of white men and women aged 55–84 at death.

Their comparison of the mortality patterns revealed by these two datasets demonstrates that mortality differentials increased substantially for white men (of all ages) between 1960 and 1971–84. As an example of this trend, among men aged 65–74 years at death, in 1960 the mortality rate of those with the least education (0 to 7 years) was only 10 percent higher than the mortality rate of those with the most education (13 or more years), whereas over the period 1971–84 the mortality of the least educated was nearly 100 percent higher; in comparing these results with Kitagawa and Hauser, it is well to remember that Feldman et al. focus on an older population. This change in the mortality differential resulted from the sharp decline in mortality rates among men of greater educational attainment between 1960 and 1971–84, largely owing to a sharp

drop in mortality from heart disease, whereas mortality rates remained approximately constant for men of lower educational attainment.

Compared with the white men, the mortality rate among white women with the least education was substantially higher than among persons with the most education in 1960 (anywhere from 25 to 80 percent higher depending on age at death), and remained at that level over the period 1971–84.

In an attempt to explain more fully the causes of death over the years 1971–84, Feldman and his colleagues report results from Cox proportional hazard regression models, which relate the risk of mortality from heart disease to a battery of explanatory variables recorded in NHANES I. Included in the variables for 1971 were the following: whether the individual smoked, was overweight, had high serum cholesterol, and had high blood pressure; because these variables were assessed at the start of the sample period, in 1971, they can be viewed as exogenous variables in the regression models. In table 4 I show the results of these regressions for each of the four age and sex categories reported by Feldman. The results show that educational attainment exerts a large and statistically signifi-

TABLE 4
Education and the Relative Risks of Death from Heart Disease in the United States during the Years 1971–84

	Relative risk			
	Men		Women	
Baseline characteristics	45–64 years	65–74 years	45–64 years	65–74 years
Education (years)				
0–7 vs. 12+	2.27	1.38	1.97	1.48
8–11 vs. 12+	1.85	1.25		1.37
Current smoker	2.21	1.50	2.75	1.79
Overweight	1.38	1.00	0.89	1.25
Systolic blood pressure ≥160 mm Hg	1.93	1.40	2.49	1.82
Serum cholesterol >260 mg/dL	1.79	1.27	1.17	0.99

Source: The NHANES I and NHEFS as reported in Feldman et al. 1989, table 6.

cant effect on heart disease mortality even when the other risk factors are included. Thus, among younger men and women, the relative mortality risk of the least educated was approximately twice that of the best educated over this time period. Unfortunately, although the model specifications reported by Feldman include education, they do not include either any measures of income or a variety of other socioeconomic indicators; hence we cannot use these results to help untangle the influence of educational attainment from other socioeconomic factors.

The Work of Menchik. Menchik (n.d.) uses data from the National Longitudinal Survey over the period 1966–83 to study the relationship between household wealth and mortality. Menchik's specification is innovative in several ways. First, and most significantly, he uses carefully constructed direct measures of household wealth, instead of relying on contemporaneous income data; the use of wealth instead of income circumvents the problems of endogeneity, which I discussed in my review of Kitagawa and Hauser, and provides a better overall measure of resource availability. Second, he controls for parental status by incorporating two variables: a measure of parental education (the number of years of schooling of the subject's head of household when the subject was 15) and the number of parents alive as of 1966. Finally, Menchik addresses the problem of endogeneity, or "initial values." This problem might arise if subjects differed according to a health attribute in 1966 that is not included in his models but that correlates with certain other variables (such as household assets) that are. Menchik partitions his sample into disjoint groups according to self-reported health status in 1966 and estimates his models separately for each group.

Menchik reports results of logit specifications in which the dependent variable is whether the individual was alive or dead at the time of the 1983 survey, and the independent variables are household wealth and parental status, as discussed above, together with age, whether the individual lives in a poverty area, resides in a small town, lives in the South; whether the person is black; whether he or she is married; and, in some specifications, what level of education the person has reached. Table 5 reports the results from the most comprehensive of these regressions and reveals Menchik's measures of household assets and permanent earnings to be negative and significant. Roughly, his parameter estimates suggest that an increase of $35,000 in household wealth (measured in 1976 dollars) in 1966 would have reduced mortality by 1 percent over the sample period (from a baseline of 30 to 29 percent). Column 4 of the table

reports results when education is included in the model, and shows that it is not statistically significant; although this finding might appear to contradict the earlier work of Kitagawa and Hauser, this is not the case, because Menchik's dataset is restricted to older individuals, among whom Kitagawa and Hauser found education to exert only a minor impact on mortality. Finally, a comparison of columns 2 and 3 shows that conditioning on initial health status has only a slight impact on Menchik's main results.

Menchik's work establishes the clearest link between wealth and mortality of which I am aware. Further, his inclusion of a variety of parental and health controls is helpful. However, he has not fully utilized the time series nature of his data, and has not been able to incorporate variables measuring either behavioral tendencies (such as smoking) or health care access and utilization (such as insurance).

Other U.S. Studies. Palmer (1989) presents results from Cox proportional hazard models of mortality risk that were estimated using data from the Longitudinal Retirement History Survey over the period 1969–79 (the survey interviewed respondents every two years during this time). Palmer's sample is restricted to men who were heads of households throughout the period, and his data record information about both income and total assets at each survey date, as well as information about educational attainment. Although Palmer's methodological approach is somewhat different from Menchik's, and his variable construction is slightly less clean, his results are similar. In particular, he finds that both income and wealth exert a negative and significant impact on mortality, whereas the effect of education is negative but insignificant.

In a series of papers, Wing and his colleagues have provided evidence on the variation in ischemic heart disease across small areas (Wing et al. 1987; 1988). In their 1987 study, Wing and his coauthors use data at the county level to examine changes in ischemic heart disease during the time period 1968–82. They measure socioeconomic status as the percentage of the labor force that is "white collar" in the county, and find that although the relationship between this percentage and mortality was only slightly negative in 1968, it gradually became more so over time. In a related 1988 study, Wing and colleagues divide somewhat more than 500 state economic areas into two categories: those experiencing an "early" onset of decline of heart disease and those experiencing a "late" onset of decline. They then report the results of logit estimations in which the dependent variable is this categorization into early or late onset of

TABLE 5
Relationship of Wealth and Other Socioeconomic Controls to Mortality in the United States during the Years 1966–83

	Logit specification dependent variable: whether alive in 1983			
		Initial health status		
Variable	Parental controls	Fair or better	Good or excellent	Education
Constant	−4.22	−4.26	−4.43	−4.88
	(6.36)[a]	(7.97)	(7.24)	(9.31)
Age in 1966	.069	.075	.078	.085
	(5.69)	(7.89)	(7.21)	(9.36)
Wealth in 1966	-1.54×10^{-6}	-2.44×10^{-6}	-2.46×10^{-6}	-2.28×10^{-6}
	(2.05)	(3.28)	(2.92)	(3.11)
Permanent earnings	-2.26×10^{-5}	-1.36×10^{-5}	-1.35×10^{-5}	-1.45×10^{-5}
	(2.83)	1.88	(1.65)	(1.91)
Parental education	.020	—	—	—
	(.854)			
Number of parents alive in 1966	−.246	−.260	−.256	—
	(3.36)	(4.32)	(3.76)	
Poverty experience		.359	.437	.337
		(2.06)	(2.05)	(2.00)

Dummy—lives in the South		−.020	.086	−.021
		(.249)	(.91)	(.250)
Dummy—lives in small town		−.216	−.187	−.237
		(2.43)	(1.82)	(2.72)
Marital status		−.279	−.381	−.242
		(2.49)	(2.94)	(2.19)
Dummy—black		—	—	.167
				(1.80)
Years of schooling		—	—	−.0076
				(.649)
Chi square	95.45	191.0	166.1	191.8
(*df*)	(5)	(8)	(8)	(9)
N	2,438	3,834	3,058	3,945

[a] The numbers in parentheses are *t*-statistics.
Source: The National Longitudinal Survey, reported in Menchik n.d., tables 2 and 4.

decline, and among the independent variables are the percentage of the population in the area that has graduated from high school and the percentage whose income was above $10,000 in 1960. They find that both of these variables have a strong positive relationship to an "early" onset of decline.

Logue and Jarjoura (1990) investigate the relationship between social class and heart disease mortality in 1,200 census tracts located in eight Ohio counties. They find lower-middle-class tracts to have approximately twice the mortality of upper-middle-class tracts, and working poor tracts to have more than four times the mortality of upper-middle-class tracts. (For related discussions see Cassel [1971] and Gold and Franks [1990].)

Much of the work I have reviewed focuses on either income and wealth, on the one hand, or education, on the other hand, as the primary determinant of differential mortality. An alternative view emphasizes that mortality is higher in "poverty areas," in which basic public services and health access may be substandard. Support for the view that residence in a poverty area is at least as important a determinant of elevated mortality as other socioeconomic factors comes from the Alameda County Study, part of which is reviewed by Haan, Kaplan, and Camacho (1987). These authors study mortality outcomes over 1965–74 among Oakland residents. In a multivariate regression in which the dependent variable measures mortality and that includes as independent variables a set of controls (age, sex, race, baseline physical health status, smoking, weight, and social support), income, education, and dummy variable for residence in Oakland's poverty area, they find that neither income nor education is statistically significant, but that the poverty area dummy is significant.

Hadley (1982, 1988) presents a small area econometric analysis of mortality rates that examines in some detail the impact of medical expenditures on mortality outcomes. Hadley's dataset includes mortality rates and socioeconomic data from 1970, and is restricted to a cross-sectional analysis. He finds that both income and education exert a negative and significant impact on mortality. He also finds that areas with increased medical expenditures have lower mortality rates: he estimates that a 10 percent increase in expenditures per capita will reduce mortality between 1 and 2 percent.

Finally, the *Journal of the American Medical Association* (1989) presents a brief description of aggregated data drawn from the National Mortality Followback Survey, which shows the relationship in the United

States between mortality from heart disease in 1986 and assets at time of death.

The United Kingdom

The Black Report. In 1977 Britain's Labour Government appointed a research working group, chaired by Sir Douglas Black, to assess the evidence on inequalities in health in the United Kingdom and provide policy recommendations. The group issued its report, now universally known as the *Black Report*, in 1980 (the report is published in Townsend, Davidson, and Whitehead [1988]), presenting controversial findings and sparking a lively and acrimonious debate that has lasted more than a decade. I will review the report's central findings, but I will not discuss its numerous policy recommendations.

The *Black Report* assesses inequalities on the basis of a classification of the British population into six social classes, with household status determined by the occupation of the head of household. Mortality rates for each class are then computed as follows: First, the total number of individuals employed in each occupation is taken from census figures. Next, the number of deaths in each occupational category is taken from the occupation recorded on death certificates. In both of these calculations, a spouse who is not employed is assigned to the same social class as his or her mate. Finally, the mortality rate is computed, separately for each sex, by dividing the total number of deaths (summed over all occupations that constitute the class) by the total population in the class (again computed by summing over all the occupations in the class). Note that the British use of occupation to assign socioeconomic status contrasts with the U.S. literature reviewed above, which invariably uses either income or education to assign status; as a result, it can be difficult to compare British measures of health inequality with U.S. measures.

Table 6 reproduces the *Black Report*'s basic finding about health inequalities in England and Wales, displaying mortality rates in 1971 in the United Kingdom, separately for men and women aged 15 to 64, by social class. The table reveals that in that year members of the lowest class (V) experienced a mortality rate more than twice as high as members of the highest class (I). Later tables in the report show that this inequality persists when age and race are controlled for, and that substantial regional inequalities also exist.

The fact that substantial mortality differentials existed in the United

TABLE 6
Inequalities in Mortality Rates in the United Kindgom in 1971 among Persons Aged 15 to 64

Social (occupational) class	Mortality rates per 1,000	
	Men	Women
I (Professional)	3.98	2.15
II (Intermediate)	5.54	2.85
IIIN (Skilled nonmanual)	5.80	2.76
IIIM (Skilled manual)	6.08	3.41
IV (Partly skilled)	7.96	4.27
V (Unskilled)	9.88	5.31

Source: Townsend, Davidson, and Whitehead 1988: *Black Report*, table 1.

Kingdom in 1971 was itself an important and politically charged finding. Even more controversial was the report's claim that health inequalities had actually widened in the United Kingdom during the preceding 30 years, despite the fact that the National Health Service had been introduced with the intent of equalizing health care access and outcomes. Table 7 reproduces part of the basic statistics on which this claim was based, depicting mortality among males aged 15 to 64 by social class for each of 1930–32, 1949–53, 1959–63, and 1970–72. As the table shows, the differential in mortality rates between the highest and lowest classes became markedly sharper between 1949–53 and 1959–63, and essentially remained at the higher level in 1970–72. Although this evidence of widening inequalities is important, it is also necessary to realize that mortality rates as a whole have fallen sharply in the United Kingdom throughout most of the twentieth century, from approximately 10 per 1,000 people per year in the 1930s to approximately 5 to 7 per 1,000 people in the 1970s. Thus, even in recent years, when inequalities have remained stable or have widened, the cause of this widening has not been an increase in mortality among the lower classes, but a particularly rapid fall in mortality among the upper classes.

For the most part, the basic message of the *Black Report* is compelling. However, the more detailed data analysis and quantitative conclusions of the report suffer from several limitations, which raise questions about the true extent of inequality. I will review these limitations; however, it

TABLE 7
Changes in Mortality Ratios over Time in the United Kingdom among Men Aged 15 to 64

Social (occupational) class	Standardized mortality ratios			
	1930–32	1949–53	1959–63 unadjusted[a]	1970–72 unadjusted
All persons	100	100	100	100
I (Professional)	90	86	76	77
II (Intermediate)	94	92	81	81
III (Skilled manual and nonmanual)	97	101	100	104
IV (Partly skilled)	102	104	103	114
V (Unskilled)	111	118	143	137

[a] The original table presents both unadjusted and adjusted (occupations reclassified according to the 1950 classification) numbers.
Source: Townsend, Davidson, and Whitehead 1988: *Black Report*, table 7.

is well to bear in mind that more recent work in the United Kingdom (reviewed in the next subsection) has addressed many of these limitations and has found that, when they are taken into account, the main conclusions of the *Black Report* remain valid.

Perhaps the most fundamental problem with the report is the quality of the data it uses. The calculation of mortality rates relies on two very different datasets for the calibration of numerator and denominator, with the numerator relying on occupation as recorded on death certificates, and the denominator relying on occupational status as recorded by the census. A further problem with the data is that information is available only about deaths among individuals aged 15 to 64; because the majority of deaths occur after age 64, the sample is relatively small and may not be representative of the mortality experience of the U.K. population as a whole. Particularly relevant is the finding of several U.S. studies, such as that of Kitagawa and Hauser, that socioeconomic mortality differentials are smaller between persons of greater ages, which suggests that the mortality ratios presented in the *Black Report* may overstate the extent of inequality in Britain.

The report's statistical analysis also poses difficulties—particularly regarding the possibility of endogeneity or reverse causality in the relationship between occupational class and mortality—similar to the diffi-

culties encountered in interpreting the relationship between income and mortality. In this case reverse causality refers to a situation in which individuals in poorer health move down the occupational scale, especially in the years just before death.

A third set of problems stems from the claim that inequalities have widened over time because of the changing compositions and sizes of social classes over time. During the period between 1930 and 1971, the proportion of the population assigned to class V fell, whereas the proportion assigned to class I rose. These movements raise doubts about the meaning of the apparent increase over time in the mortality rate of class V relative to the rate of class I; in particular, the reduction in the size of class V suggests that it has been increasingly restricted to the poorest members of the society. A related point is that the discriminatory abilities of the government's census officials may have improved over time as they gradually learned to identify the class to which each occupation belonged; if this is the case one would expect mortality differentials between classes to increase over time simply because of the improved "sorting" effect. Finally, the definitions of occupations themselves have changed over time as the Registrar General has modified and refined its methods; it is not clear, however, what sort of bias this may have introduced into the analysis.

A final significant limitation of the report is the lack of information on intervening variables that might help explain the link between social class and mortality. Thus the basic mortality differentials are corrected only for sex (and in some cases age, geographic region, and race), and do not correct for smoking prevalence, differences in diet and lifestyle between classes, variations in actual medical care utilization, or disparities in income and education. The information that is provided later in the report about many of these factors is not integrated into the mortality analysis.

After the Black Report *in the United Kingdom.* The publication of the *Black Report* unleashed in Great Britain a deluge of studies seeking to clarify the relationship between social class and health outcomes. Margaret Whitehead's *The Health Divide* (published in Townsend, Davidson, and Whitehead 1988) provides a comprehensive survey of much of this literature through 1988; other useful reviews have been published by Smith, Bartley, and Blane (1990) and Wilkinson (1986b) (see also Townsend [1990], Morris [1990], Leck [1990], and Main and Main [1990]).

Much of this literature has extended the original approach of the *Black Report* to more recent years and alternative datasets, in many cases circumventing some of the methodological criticisms raised above. In *The Health Divide* Whitehead reviews evidence from the 1979–83 decennial supplement, which shows that overall life expectancy increased by about two years in the United Kingdom between 1971 and the early 1980s, but that the inequality in mortality rates across social classes was the same as, or slightly larger than before. A related study by Marmot and McDowall (1986) utilizing the same data collapses the six social classes into two groups—manual and nonmanual—and emphasizes the wide inequality in heart disease and lung cancer rates between the two groups (see also Marmot [1989] and Marmot et al. [1978]).

Whitehead also reviews the evidence from a longitudinal study undertaken by the British Government, in which a 1 percent sample of the population was identified in 1971 and then followed over time. This study overcomes a number of the criticisms of the *Black Report*. First, the study is based upon individual-level data. Second, the study assigned each individual in the sample a social class ranking in 1971 and has computed differential mortality rates in future years based on these initial assignments; as a result, reverse causality is less likely to undermine the statistical analysis (although it may still be a problem to the extent that it affected the initial assignments). Finally, because many of the individuals in the sample have passed age 65, the study has provided some of the first available evidence on differential mortality rates at older ages in the United Kingdom. According to Whitehead, this second study has in fact provided yet additional evidence that mortality inequalities remained at their earlier level at least through 1981; the study has also shown that substantial (although slightly reduced) differentials by social class exist between individuals of older ages.

Inequalities in health based on individual-level data have also been found in a study of Whitehall civil servants analyzed by Marmot and his colleagues (see Marmot, Shipley, and Rose [1984] and Marmot et al. [1991]). In this study civil servants were divided into four grades: administrative (highest), professional and executive, clerical, and other (lowest)—and their mortality experience followed over many years. The study reveals a mortality differential of more than three to one between the highest and lowest grades.

In addition to these two longitudinal micro datasets, others in the United Kingdom, like the 1946 birth cohort mentioned by Whitehead,

may well yield further evidence about socioeconomic differential mortality in the future; Blaxter (1986) provides an extensive review of these datasets.

The problems caused by occupational redefinition and shifting class compositions over time have been addressed by Pamuk (1985). She creates a single set of occupational groupings, based on the government's 1970 classification, and follows them over the 1921–23, 1930–32, 1949–53, 1959–63, and 1970 census reports. Pamuk finds levels of inequality similar to those of the *Black Report* and others.

Whereas the *Black Report* relied primarily on mortality statistics to quantify differences in health outcomes across social classes, the more recent U.K. literature has introduced a variety of alternative measures, including morbidity data on chronic and acute (number of sick days) illnesses. Simultaneously, the literature has broadened its approach to social class, moving from a definition based strictly on occupation to definitions that incorporate information about whether the household owns its home or rents, how many automobiles it has access to, whether any household members are unemployed, and whether the household resides in a poverty area. This list suggests that researchers in the United Kingdom have not thus far systematically incorporated measures of income or educational attainment into their analyses.

While examining alternative definitions of ill health, Whitehead reviews a number of representative studies demonstrating that health inequalities extend over most of these various health measures; I refer the interested reader to her discussion.

Whitehead discusses alternative measures of socioeconomic status, as do Haynes (1991) and Carstairs and Morris (1989) (see Smith, Bartley, and Blane [1990] for a review). Both Whitehead and Haynes argue that access to an automobile is an important determinant of health outcome, presumably because it substantially lowers the cost of seeking health care, and may allow the household to reside in a less crowded community; note, however, that automobile ownership, like most of the other measures of inequality I have discussed, also suffers from a potential endogeneity problem because healthier households may choose to live further away from services and therefore may have a higher demand for automobiles. Carstairs and Morris (1989) argue, in a fashion reminiscent of the U.S. Alameda County Study, that residence in a poverty area or region is an important contributor to higher-than-average mortality (for a more detailed regional analysis, see Whitelegg [1982]).

Finally, Arber (1989) uses data from the General Household Survey to circumvent difficulties that arise in measuring the social class of women who are not employed in the formal labor market; her results indicate that the female socioeconomic mortality gradient is as steep as the male gradient.

Other Countries

In recent years many social scientists and government bodies around the world have become interested in investigating the relationship between socioeconomic status and health. I will briefly review some of the main findings of this blossoming literature, confining my attention to developed "Western" countries. I discuss only the evaluation of health inequalities within countries; it may, however, be useful to note at the outset that researchers have found little relationship at the aggregate level between per capita income and life expectancy among the developed countries (although there is of course a marked difference in life expectancy between developed and less developed countries). My discussion draws primarily upon a series of articles published in *Social Science and Medicine*, the papers collected in Fox (1989), and the Whitehead review in *The Health Divide*.

Researchers have found health inequalities within every country studied thus far. They have also found that the magnitude of these inequalities varies considerably from country to country.

By most measures inequalities are least in Scandinavia, where average life expectancy is also highest. Lahelma and Valkonen (1990) (see also Diderichsen [1990] and Maseide [1990]) report that among men aged 20 to 64 the ranking of these countries, from least to greatest inequality (with socioeconomic status assigned on the basis of occupation), is Sweden, Norway, Denmark, and Finland. For women, the extent of inequality appears to be less than for men. Finally, inequality in these countries has remained approximately constant over time.

Kunst, Looman, and Mackenbach (1990) provide an excellent analysis of the extent of inequality in the Netherlands, discussing earlier work and presenting their own regional analysis. Two of the studies they review are of particular interest. One followed the 1932 birth cohort and found that on average the ratio of mortality rates between the most and least educated was approximately two-thirds; the other study tracked a sample of Amsterdam civil servants longitudinally and found that the

ratio of mortality between those of highest and lowest incomes was approximately 82 percent. These figures compare favorably with the United Kingdom, based on the results of two studies reviewed above that appear directly comparable to the Dutch studies: the 1971 longitudinal study and the Whitehall study, both of which have reported mortality differentials above 100 percent. Kunst, Looman, and Mackenbach also provide results from their own small area study of 39 Dutch regions over the years 1952, 1962, 1972, and 1982. Interestingly, they find that the relationship between socioeconomic status and mortality was actually positive in 1952 and 1962 among men (although negative among women), but became negative (for both men and women) by 1982. They conclude that health inequalities are significant in the Netherlands, but are somewhat less than those found in England and Wales.

Data on mortality differentials in France are scanty. Based on discussions by Whitehead and by Leclerc (1989), it appears that inequalities in France are similar to, or slightly larger than, those in the United Kingdom. Data on eastern and southern European countries are even scarcer and will not be reviewed here.

Finally, Araki and Katsuyuki (1986) report results of a small area study of the 46 prefectures of Japan. Their report found that residence in a rural area is strongly associated with increased mortality among all individuals, whereas lower income is associated with increased mortality among men and greater educational attainment is associated with lower mortality among women; in addition, the difference in mortality between social groups is largest for tuberculosis, suicide, and certain kinds of cancers.

Complementing the substantial evidence of inequalities in total mortality experience reviewed above are various studies that discuss other measures of health status. In a series of papers LeGrand (1987) has presented alternative measures of health inequalities for many countries; he focuses on the variability in age at death over a country's population, and computes indices in a fashion reminiscent of the computation of "gini" coefficients and other measures of income inequality. Leclerc provides interesting evidence of variations across countries in the relationship between social status and specific causes of death. Thus, in Norway, the major causes of differential mortality rates are accidents and, to a lesser extent, cancer; in Denmark the major causes are accidents and diseases of the respiratory system; and in Finland the major causes include accidents, diseases of the respiratory system, cancer and heart disease. In

sharp contrast to all three of these countries, in the United Kingdom accidents are not a cause of differential mortality; instead the leading factors are diseases of the respiratory system and cancer. In France all of the above factors contribute to differential mortality, together with cirrhosis of the liver.

Morbidity varies across social classes in all countries that have been studied. Blaxter (1989) provides a good discussion of the issues that arise in measuring morbidity, and presents data showing that morbidity differentials are more extreme in most European countries than corresponding mortality differentials. Thus, for example, the lowest social groups in France experience four times the rate of chronic illness of the highest groups, and the lowest groups in Denmark experience nearly three times the rate of the highest. (Interestingly, the incidence of chronic illness is not so unequal across social groups in the United Kingdom.)

The many international comparisons of health inequalities that I have reviewed (representing only a small fraction of the total number of studies performed) indicate that substantial progress has been made in quantifying how inequalities vary across countries. However, in interpreting these results, it is well to bear in mind that international comparisons in this area are treacherous because countries vary extensively in the kinds of data available, the way social status is measured, and the cultural interpretation of such social indicators as occupation.

One example of the difficulties created by heterogeneous data is the study by Lahelma and Valkonen. This study reports that mortality differentials between the lowest and highest occupational classes are larger in Finland than in Denmark, Norway, and Sweden. However, in Finland, the lowest class contains only 11 percent of the population, whereas in each of the other three countries the lowest class includes more than 20 percent of the population. Hence, much of the difference in inequality between Finland and the other countries may simply be due to the fact that the lowest class in Finland is a relatively poorer segment of the population. More generally, the meanings of a given socioeconomic measure may differ by country. Further, countries often differ in their measures of social status; for example, the United States relies heavily on educational attainment and income to define status, whereas the United Kingdom and most European countries have traditionally relied on occupation. Finally, the fact that countries may vary significantly in such cultural traits as smoking prevalence suggests that controlling for behavioral and other characteristics is especially important for international comparisons;

unfortunately, few international comparison studies have incorporated such controls. As improved data become available—notably panel datasets that follow individuals over time and incorporate a large battery of control variables, including biological indicators of risk factors—comparisons across countries will become more meaningful.

Education is one socioeconomic variable that does seem to generate comparable inequalities across countries. Thus both Lahelma and Valkonen and Valkonen (1989) find that the rate at which each additional (standardized) year of education decreases mortality is similar across England and Wales, the Scandinavian countries, and Hungary. My own rough comparison of these results with those of Feldman et al. (1989) for the United States suggests that the gradient is significantly steeper in the United States (somewhat less than twice as steep).

Explanations of Health Inequalities

In this section I review the most widely discussed explanations of both inequalities in health outcomes and the relationship between socioeconomic status and health, focusing primarily on issues and studies relevant in the United States.

I believe these various explanations can usefully be organized along two dimensions, as depicted in figure 1. One dimension refers to the underlying characteristics of persons (or households) that may cause differences in health status, and divides these characteristics into two distinct groups: materialist or resource-dependent characteristics like wealth, home ownership, and automobile ownership; and non-resource-dependent behavioral characteristics, including psychological, genetic, and cultural factors. The second dimension refers to the stage of life experience in which inequalities are generated, and can also be conveniently divided into two groups: inequalities arising from different experiences over the "life span," such as differences in diet, smoking, exercise, and occupation; and inequalities that arise from differences in access to and utilization of formal "health care services."

In figure 1 the two rows of the box represent the division between materialist and behavioral characteristics of individuals, whereas the two columns represent the division of health and mortality life experience into the two broad categories of life span and formal health care services.

Type of explanation	Source of inequality: Life span	Source of inequality: Access to and utilization of health care system
Materialistic (access to resources)	Housing, overcrowding, sanitation, transit mode, occupational hazards, environmental hazards	Ability to purchase health care, ability to purchase pharmaceuticals, regular physician
Behaviorial (psychological, genetic, cultural)	Diet, smoking, exercise regime, leisure activities, risk taking, alcohol and substance abuse	Comprehensive medical information, "playing the system," following instructions, self-diagnosis, and awareness of recurrence

FIG. 1. Conceptual decomposition of factors explaining health inequalities.

The four disjoint boxes in the figure refer to the various combinations of these categorizations: materialist lifestyle effects (for example, quality of housing); materialist health care effects (for example, ability to purchase health insurance); behavioral lifestyle effects (for example, smoking habits); and behavioral health care effects (for example, ability to follow physician instructions). Within each box are a collection of phrases summarizing some of the main effects for the box that have been identified in the literature.

Throughout much of this section I will follow the conceptual structure outlined in figure 1. I will argue that, based on the results in the literature, all four boxes contain factors that contribute to health inequalities in the United States and elsewhere. I will also claim that presently it is difficult to quantify the relative importance of the different boxes, or to clearly rank the various explanations within each box (for a related discussion, see Garber [1989]). Although I will not discuss policy in detail, I will note here and later that the fact that little is known about which box or boxes contribute the most to health inequalities makes formulating policy in this area difficult because the policy response to health inequalities differs depending upon "which box one is in." Ultimately, I will suggest that the structure of figure 1, although helpful and reflective of many of the distinctions and disagreements reverberating through the recent literature, is inadequate and should be expanded to include certain "deeper" structural parameters.

Contrasting Behavioral and Materialist Explanations of Inequality

Life-span Issues. Most researchers agree that life-span effects play a larger role than formalized health care both in mortality and morbidity experience (see Fuchs [1979]), and in generating differences in mortality and morbidity rates across social classes.

As depicted in figure 1, life span can affect health through two distinct pathways: materialist and behavioral. I will describe these two pathways in more detail and then review the debate in the literature about the importance of each one, concluding with a discussion of the possibility of finding "deeper" variables that might explain and link components of these two factors.

Definition of Materialist and Behavioral Pathways. In the literature, materialist explanations of lifestyle health outcomes involve both personal (or household) financial resources needed to purchase general (nonmedical) goods and services, which are in turn used to "produce" good health (such as housing and automobiles), and public resources, including both those needed to ensure sanitary living conditions, public housing, and public transportation, and those used to reduce environmental pollution and occupational safety and health hazards. A proper specification of materialist conditions should separate the effects of private and public resource expenditures in the same way, for example, that Hadley (1982) does. Unfortunately, many studies do not make this distinction; at best, they may control for area of residence, using this variable as a proxy for relevant government expenditures.

Furthermore, a correct specification of a household's ability to purchase "healthy" goods and services should recognize that these purchases are made on an open market where quality, which often includes health-related characteristics, is usually positively related to price (a good example is the housing market), so that the capability of using more resources to purchase healthier goods and services depends on the slope linking price to quality, which may vary across regions, countries, and over time. None of the studies that I review in this article fully addresses this issue.

As I use the term, behavioral explanations of health outcomes over the life span cover a wide range. They are distinguished from materialist explanations by their connection to individual characteristics for which achieving a healthy state does not necessarily require a greater expenditure of financial resources, or for which a healthy state cannot be pur-

chased directly with money. Perhaps the most important example of such a behavior is smoking; a second example of such a behavioral characteristic is diet: a healthy diet can be obtained at relatively low cost and does not require a large monetary expenditure. Other examples include exercise habits, driving habits, and consumption of alcohol and various drugs. Genetic traits, biological and psychological dispositions (such as reaction to stress), cultural norms, and the ability to understand and retain general knowledge about health are all also considered to be behavioral.

The Relative Importance of Materialist and Behavioral Factors. The research community has reached no consensus about the relative importance of materialist versus behavioral explanations of health inequalities. The *Black Report* argues that in the United Kingdom materialist factors are most important, stating that "while cultural and genetic [what I have called behavioral] explanations have some relevance—the latter is particularly important in early childhood—more of the evidence is explained by what we call 'materialist' or 'structural' explanations than by any other" (Townsend, Davidson, and Whitehead 1988, 125). I refer the reader to the report for an illuminating discussion and defense of this claim (see also Marmot [1986]). In contrast to this view stands the opinion of a number of U.S. authors. Kitagawa and Hauser, quoted earlier, suggest that educational attainment is the single most reliable indicator of differential mortality in the United States, a position that suggests the importance of behavioral factors. Further, Tarlov and Kehrer (1989) write that "much of the ill health experienced by Americans can be attributed to individual behaviors, such as smoking, dietary habits, sedentary lifestyles, and self-destructive behaviors (such as violence) . . . ."

Alternative Statistical Approaches. Researchers have used several different statistical techniques in their attempt to distinguish between materialist and behavioral explanations of health inequalities.

Many studies report the results of mortality or morbidity regression models that include independent variables reflecting both materialist and behavioral concerns. This approach is evident in the studies by Kitagawa and Hauser (1973—includes income and education), Menchik (n.d.—includes measures of wealth, educational attainment, parental educational attainment, and parental health status), Palmer (1989—includes measures of education and wealth), and Feldman et al. (1989—includes education, smoking habits, and several biological risk factors). Although results across studies differ substantially, the cumula-

tive evidence suggests that wealth (resources), smoking, and certain biological factors exert a significant effect on mortality, but that the impact of education is less clear. It is noteworthy that no study to date has included a full complement of both sets of characteristics.

A second way in which researchers have tried to distinguish between materialist and behavioral explanations of differential mortality is by segmenting a sample in terms of one important risk factor, and examining the impact of remaining factors on each subsample. This approach is more flexible because it allows the coefficients of all included variables to differ between the different subsamples (it is similar, although not identical, to the use of interaction effects). I have discussed the work of Marmot, Shipley, and Rose (1984), which divides a sample according to smoking status. In his study, Menchik (n.d.) divides the sample according to initial health status. Insufficient work has been done to allow a conclusion about the superiority of this method to the simpler method of including dummy variables.

Smoking. Despite a lack of consensus at the broadest conceptual level about the relative importance of materialist and behavioral factors, there is agreement that one of the most important lifestyle factors tending to produce differential mortality rates across social classes is smoking behavior. Smoking has a large impact for two reasons. First, smoking has a strong effect on life expectancy. Second, it is far more common among individuals belonging to lower socioeconomic classes, at least in the United States and the United Kingdom; for example, the *Black Report* provides data showing that more than twice as many men and women smoke in the lowest British social class (class V) as in the highest.

Two studies that demonstrate the importance of smoking habits are by Feldman et al. (1989) and Marmot, Shipley, and Rose (1984). Feldman and his colleagues report that in their hazard model estimates of heart disease mortality, smoking is the single most important risk factor, elevating mortality rates by anywhere from 150 percent to 275 percent, depending on sex and age. Marmot, Shipley, and Rose work with data from the Whitehall Study in the United Kingdom. These authors divide their sample into subgroups according to smoking habits, forming the categories of nonsmokers, exsmokers, and several categories of smokers that differ in amount of smoking. They then examine mortality rates due to heart disease and lung cancer among the four social classes defined in the study (see discussion of the U.K. literature above), and

find that, within each class, mortality rates are at least twice as high (and, for some classes, more than three times as high) among heavy current smokers as among nonsmokers. Coupled with the fact that smoking prevalence is more than twice as great in the lower classes as in the upper classes, their results show that smoking is a significant cause of differential mortality. Unfortunately, neither of these studies controls for wealth and two of the better studies that do control for wealth, by Menchik (n.d.) and Palmer (1989), do not control for smoking.

Although it is generally agreed that smoking habits are an important contributor to differential mortality, researchers disagree about the quantitative magnitude of this effect, and about how it interacts with other lifestyle factors. Thus, in the study of Marmot, Shipley, and Rose (1984), the authors argue that differential mortality rates across social classes are high even within smoking subsamples: for example, among nonsmokers mortality from heart disease is still significantly lower in the highest class than in the lowest class. Nonetheless, it can be argued that formal measures of smoking understate the true extent to which smoking contributes to differential mortality. First, even if an individual does not smoke himself, he may have grown up in a home with smokers or live among smokers; such passive smoking, for which data are rarely available, is undoubtedly more common in lower socioeconomic groups. Second, smoking may affect health more strongly when it synergizes with other behaviors, such as stress or drug and alcohol abuse, which are more common among the lower-status groups.

Poverty Areas. A number of authors have focused on "poverty areas" as a primary cause of differential mortality rates. Carstairs and Morris (1989), Silver (1973), and Hadley (1982) offer examples of the finding common to many small area studies that residence in a poverty area is often a powerful determinant of mortality. In related work in Belgium, Lagasse et al. (1990) found that certain regions had lower mortality than others, even after controlling for all measurable socioeconomic traits. One individual-level study, the Alameda County Study of Haan, Kaplan, and Camacho (1987), discussed earlier, found that residence in a poverty area was a more powerful determinant of mortality than income, education, or any other socioeconomic measure. Unfortunately, the finding that poverty areas have an inherently higher mortality level is not sufficient by itself to distinguish between the materialist and behavioral hypotheses. Thus Lagasse et al. argue that lower mortality

areas possess a "health culture," whereas Carstairs and Morris argue that poverty areas possess unmeasured characteristics of materialist deprivation, including poor sanitation or pollution.

Comment: Alternative Structural Models. The approach that the literature has taken to untangling materialist and behavioral effects on health is somewhat restrictive and does not incorporate many, possibly important, subtle and indirect effects. The discussion by Harris (1989) and the collection of articles in Higgins and Luepker (1988) illustrate just how subtle the interrelations between lifestyle, genetics, and disease can be. In particular, Harris's review of the epidemiologic literature on cancer reveals the many stages and chemical–behavioral factors that play a role during the genesis and multistage development of most tumors.

The interesting work of Lindgarde, Furu, and Ljung (1987) also shows how relatively subtle and easily overlooked life experiences can influence health. Drawing on rich data from a longitudinal study of the 1928 male birth cohort in Malmo, Sweden, these authors examine the factors associated with the onset of hypertension. They find that a person's social class, current or childhood, does not by itself predict hypertension, but that when the father's education level is high and the child's education level (and measured IQ) is lower than the father's, hypertension is more likely. Interactive effects of this sort are plausible, and may be important factors in health over the life span, but they are unlikely to be picked up by standard regression models run on typical datasets. As this study makes clear, one way to introduce a richer structure is to link factors to specific disease; see, for example, recent work by Matthews et al. (1989) linking education to heart disease in the United States, and Morgan et al. (1989) connecting dietary fat to heart disease in the United Kingdom.

Finally, the literature has, with a few notable exceptions, been unwilling to explore deeper structural explanations of health inequalities, involving unobserved "deep" parameters (for an exception, see Grossman [1972]). Most of the statistical models that have been estimated involve only "two levels," fit into a regression context: the first level refers to the health outcome itself (usually mortality), which generally serves as a dependent variable; the second level refers to the various factors that may "cause" health outcomes and serve as independent variables. Such a structure often possesses two related flaws. First, it tends to assume that the factors under investigation are exogenous and should simply be taken as given fixed characteristics of individuals. Second, the

two-level approach fails to model the possible interrelations between factors.

A clear example of an alternative "deeper" model of mortality that does propose such interrelations is Fuchs's time preference theory (Fuchs 1982, chap. 3). Fuchs conjectures that a single unobserved variable—the rate at which individuals discount the future (or alternatively their willingness to invest now for future rewards)—can explain both lower educational attainment and poor health experience, because both activities require investment for better future outcomes.

Fuchs's model is almost certainly too simple, as shown by the fact that there is not a perfect correlation between education, income, and health in actual data. A better model would introduce more than one unobserved factor (a second that comes to mind is attitude toward risk) and develop a richer structural model. To estimate either Fuchs's model or more complex models of this class requires (1) moving from a standard regression framework to more structured statistical models that specifically incorporate multiplicative "stages" of disease, and (2) fitting these models using (most likely) maximum likelihood techniques. In such a system the first stage will include certain strictly exogenous variables, like biological risk factors, as independent variables that generate as outcomes (dependent variables) behaviors like smoking; the second and subsequent stages will take these behaviors themselves as independent (though endogenous) variables, which in turn generate further behaviors and health outcomes.

The Health Care System. The second major life experience that contributes to differential mortality rates across socioeconomic groups is access to and utilization of health care services, including pharmaceuticals and information about health provided through medical channels.

Research in this area has addressed a series of questions: Do some individuals possess better insurance and medical coverage than others? To what extent do differences in coverage and access correlate with socioeconomic status? Are some physicians clearly better than others, and do these physicians disproportionately serve patients of higher socioeconomic status? Do some individuals "work the system" more effectively than others? How do individuals of different socioeconomic status fare once they have entered the system and been diagnosed and treated? Do some individuals comply more fully with physicians' instructions than others?

Although these questions have been addressed in the United Kingdom (see in particular the *Black Report* and *The Health Divide*) and a number of other European countries, they have been most fully investigated in the United States; accordingly, I will confine my discussion to the U.S. case. I will not devote much attention to the vast area of health management systems (HMOs), health insurance coverage plans, and financial considerations, which deserve a separate review. Instead, I will concentrate on behavioral pathways.

We may usefully divide utilization of health care services into four sequential stages:

1. Preventive care, including an ongoing relationship with a physician and health care organization, routine checkups, diagnostic screening for such conditions as breast cancer (women), cervical cancer (women), prostate cancer (men), skin cancer and heart disease, and awareness of relevant new medical knowledge
2. Diagnosis and entry into the health care system, including both diagnosis by a health care professional and self-diagnosis, access to a hospital, and admission criteria
3. Treatment efficacy, including information about treatment options, decision-making skills, and quality of care
4. Follow-up and readmission, including survival, receiving and following physicians' advice, tracking and follow-up by a health care professional or organization, discharge to a long-term-care facility, self-diagnosis of recurrence, and ability to obtain required pharmaceuticals

For all four stages, there is at least some evidence that lower socioeconomic groups have poorer experiences. In what follows, I review a handful of recent and representative studies.

Consider first preventive care. An important example of such care is adherence to screening guidelines recommended for the monitoring of early signs of breast cancer (mammography screening), cervical cancer (pap smear), and other cancers. An article by Zapka et al. (1989) reviews evidence from several studies demonstrating that lower-status women are less likely to follow recommended screening guidelines than higher-status women. The study also presents new evidence supporting this claim, based on survey data that investigated the relationship between regular breast cancer screening and socioeconomic status. In models that control

for age, the authors find that lower income correlates with a much lower probability of having had a screen within the last year.

Second, consider the diagnosis of disease and admission into the health care system for treatment. There is considerable evidence that both diagnosis of illness and admission into a hospital occur at a later point in the development of an illness among lower social classes. Studies by Farley and Flannery (1989) and Walker et al. (1989) indicate that breast cancers are detected at later stages among women of lower socioeconomic groups. Each of these studies links data from breast cancer tumor registries to information on the median income in the census tract in which the patient lives (in the second study, census block was used instead of census tract), and shows that women residing in lower-income tracts tend to have their cancers detected at later stages. A study by Latour et al. (1991) finds that, among emergency-room admissions (from either the adjoining hospital or elsewhere), persons of lower socioeconomic status (as measured by occupational class) are generally more ill upon admission than individuals of higher socioeconomic class.

Next, consider patient awareness of treatment options, decision-making skills, and quality of care. Interesting evidence about some of these issues comes from the Rand study of Ware et al. (1986). In this study individuals were randomly assigned to either an HMO or a fee-for-service physician, and received health care from their assigned provider for the next three to five years. Ware and colleagues report that lower-income individuals who were sick at the start of the program did better in fee-for-service care, whereas the higher-income individuals who were initially sick preferred the HMO (the other, initially healthy groups showed no difference in outcome). The authors speculate that the bureaucratic nature of the HMO may pose difficulties for poorer individuals who have not learned how to "work the system." One might also speculate that such individuals are less able to take advantage of the greater range of treatment options offered under fee-for-service care.

Finally, several studies have shown that patients of lower socioeconomic status have lower survival probabilities following treatment or diagnosis. Thus Cella et al. (1991) examine outcomes across approximately 1,000 cancer patients, including patients diagnosed with lung cancer, breast cancer, myeloma, gastric and pancreatic cancers, and Hodgkin's disease. Controlling for age and initial prognosis, they find that higher income is highly correlated with longer survival time, whereas education is somewhat correlated with survival. They speculate

that this may be in part because the lower-income patients are less aware of treatment options, and in part because they are less aware of recurrence, side effects, or any other posttreatment abnormalities. Steinhorn et al. (1986) examine survival in women diagnosed with breast cancer. These authors report the results of Cox proportional hazard models, which include measures of age, the stage at diagnosis, whether the patient has low income (income below $10,000), and whether the patient graduated from high school. They find that membership in the lower-income group increases the likelihood of dying within five years by approximately 60 percent, whereas having failed to graduate from high school increases the likelihood of dying by approximately 40 percent (these effects are essentially independent of one another). Kogevinas et al. (1991) measure socioeconomic status by whether a patient owns or rents, and find that, for most cancers, renters have a lower probability of survival following diagnosis. Finally, Ruberman et al. (1984) report that men with lower educational attainment have a higher mortality following a myocardial infarction than men of greater educational attainment.

Related to differences in survival following treatment are differences in access to nursing homes and other long-term-care facilities following hospitalization or onset of chronic disabilities. Gruenberg and Willemain (1982) report that elderly patients who await discharge from a hospital to a nursing home must wait longer when their nursing-home stay will be financed by Medicaid rather than by a private payer or themselves; Norton (1992) examines nursing-home admission practices, and finds that nursing homes are least willing to admit patients who are quite sick (and unlikely to be discharged alive from the nursing home once admitted) and Medicaid financed. Both of these studies suggest that lower socioeconomic groups may have a more difficult time finding access to a nursing-home facility.

In summary, the evidence is convincing that individuals of lower socioeconomic status do less well in the health care system. It is also reasonably clear that both materialist and behavioral factors contribute to inequalities in health care. Thus (although I have not reviewed it in detail here), lower income and lower-status employment (or unemployment) restrict the choice of physician, health care plan, and treatment option (including pharmaceutical choice); lessened educational attainment reduces awareness and attenuates decision-making skills; and cultural idiosyncrasies may make it more difficult to communicate with health care workers, trust physicians, and play the system.

Future Research Prospects

Issues

In my opinion, research in this area should address two main concerns. The first is a more careful structural modeling of the underlying factors that cause inequalities in health outcomes. I think it could be argued that, since the work of Grossman (1972), there has been only modest headway in modeling individual health-related behavior. Perhaps the most important task for modeling is to decide how to link psychological and biological factors to economic decisions about consumption, savings, occupational choice, household formation, and health education and expenditures. Discussions such as that in Harris (1989) suggest that far more is known about the structural and dynamic processes behind disease than is currently included in most socioeconomic modeling. Although it is hard to say at this point how much can be learned by pursuing more detailed modeling, it is probably also the case that a modest investment might yield considerable information about the usefulness of further efforts. Work on this topic will need to be interdisciplinary, and might ultimately use computer simulation techniques to map out "life-span" risk and mortality portfolios.

The second and perhaps more important concern is with establishing a link between issues of lifestyle and health care utilization. My distinction in this article between life-span experience and formal health care utilization is not a rhetorical whimsy, but reflects a fundamental schism in the literature, which must be mended if we are to gain a complete understanding of what causes health inequalities and formulate an effective policy response. To date very few studies integrate both sets of factors into a common theoretical framework or examine empirically the relationships between the two sets of factors at the individual level with suitable data. Thus we have very little knowledge of how destructive lifestyle habits (with the possible exception of smoking) translate into increased health care utilization and costs, or how educational attainment in high school or college translates into effective comprehension of detailed medical information much later in life (see Mechanic [1989] for a related discussion). Nor are there extant in the literature standard economic models that might link data on material deprivation, savings, occupational choice, residential location, and household formation to data on medical care coverage, hospital utilization, medical costs, and so

on. It would be extremely helpful to policy makers to know how lifestyle behaviors affect utilization of health care systems and health care costs. Thus, although it is known that lower socioeconomic groups are less likely to possess health insurance, follow a regimen of preventive care, or survive surgery, we do not know how detailed individual characteristics, such as savings behavior, educational attainment, and occupational history, all of which are intensively studied in their own right, relate to health care utilization.

Data

What sort of data, and what kind of research agenda can contribute most to clarifying the relationship between life-span experience and health care utilization? Several different approaches may prove useful. One approach is to construct a single large and comprehensive dataset, which includes variables measuring both kinds of effects, and run large-scale statistical models on these data to try and disentangle the relative importance and interrelations between them. Such a dataset does not currently exist, but could be created by linking a standard "panel" (longitudinal) dataset of individuals (starting from childhood) to medical records and insurance claims, including hospitalizations, use of Medicaid, Medicare, or Medigap coverage, long-term-care utilization, and home care. Such a large dataset holds out the hope of allowing estimation of more sophisticated models than currently exist in the literature.

I believe a study of this sort would be extremely useful. (In fact, such a study is underway at the Rand Corporation.) It also must be recognized, however, that such an approach suffers from several potential flaws. First, the dataset would be costly and time consuming to collect. Second, emphasis on collecting data on a sample of persons for a single large study would inevitably take resources from efforts to collect data for other studies, which would in turn limit the range of persons on whom data was collected. Finally, for administrative reasons a large study would need to fix its selection of variables early in the collection process, which would limit the ability to respond to new issues or new research insights that might emerge during the study.

An alternative approach entails relying on a collection of smaller studies, each focused on a particular set of issues. Such an approach allows individual research groups independence and flexibility in choosing to study those aspects of the problem that they see as most relevant. Such

decentralization is likely to allow a more rapid response to emerging new issues. Presumably integrative reviews or meta-analyses could then be used to forge links between studies and extract common, relatively robust findings.

This second, decentralized approach also has disadvantages. In my opinion the primary disadvantage is that certain interrelations between measured variables, and covariances between unobserved stochastic terms, may never be determined if no single study links these variables or equations together in a single statistical estimation.

Ultimately, progress in our understanding of the relationship between socioeconomic status and health requires the synthesis of expertise from several different fields, ranging from biology through medicine, public health, health services, and statistics, to sociology, psychology, and economics. Only if research teams include expertise from several of these neighboring disciplines can they hope to address adequately the full complexity of this challenging area.

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