Research Needed on Socioeconomic Differentials in U.S. Mortality

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THE PURPOSE OF THIS PAPER is first to summarize as succinctly as possible the present state of our knowledge about the socioeconomic mortality differential in the United States and second, to suggest the kinds of research that still need to be done to increase our knowledge of this differential, so that armed with sounder, more comprehensive data, we can seek ways to eliminate it. In the first of the paper's two main sections, we consider the relationship between socioeconomic status and mortality in general, whereas in the second, we consider the relationship between socioeconomic status and infant mortality. This distinction is made because (*a*) infant mortality has long been recognized as the most sensitive mortality indicator of group differences in social and economic well-being, (*b*) different kinds of research are needed for an adequate understanding of the different factors underlying the infant mortality-socioeconomic status relationship than the kinds of research that characterize total mortality and socioeconomic status, and (*c*)—a reason related to (*b*)—different kinds of programs will be needed to deal with the problems of infant mortality as opposed to overall mortality.

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Socioeconomic Status and U.S. Mortality

Research before 1960. More than a decade has passed since anyone has presented a review of the relationship of socioeconomic status and mortality in the United States. Two reviews published in the early 1960s seemed to suggest that there was some basis for optimism as to the future course of the socioeconomic mortality differential. In the first of these reviews (*1*), Stockwell noted that although most of the studies that had been carried out since World War II had revealed a fairly pronounced inverse relationship between mortality rates and socioeconomic status, disagreement seemed to be emerging among researchers as to the magnitude of the differential and as to whether or not it was narrowing. Based on a review of several studies done during the 1950s, as well as the results of some of the research of Stock-

well (*2*), we concluded that both the extent of the socioeconomic differential and its trend depended on such factors as the area under investigation, the particular variables used to measure socioeconomic status, and the methodological procedures followed. Further, the marked variability of what had previously been a consistent and pronounced inverse association encouraged speculation as to whether the emerging trend was not toward a closing of the socioeconomic status-mortality gap.

In the second review (*3*), Antonovsky reached somewhat similar conclusions. Although emphasizing that a socioeconomic differential still existed, he clearly saw a trend toward a blurring of the traditional pattern. Specifically, he noted that the differentials then observed were generally limited to a difference between the lowest socioeconomic class and all others. That is, whereas before there had been a fairly smooth inverse gradient across several socioeconomic class levels, now similar low death rates characterized all the upper and middle socioeconomic class groupings, while a much higher death rate prevailed in the lowest socioeconomic group.

Antonovsky explained this blurring of the traditional inverse relationship as being a continuation of the historical decline in mortality in our society. That is, he suggested that when mortality levels are extremly high or extremely low (namely, at the two extremes where people either have very little control over their life chances or else have achieved a great deal of success in controlling mortality), social class differences will be small. This author further suggested that it is during the transition from high to low death rates (when the fruits of health progress are slowly filtering down from the richer to the poorer classes) that the socioeconomic differential is most apparent. If this explanation is valid, one could hypothesize that as the overall death rate of a population was lowered further, the remaining class differences would decline. Although the lowest socioeconomic groups were still characterized by a notable mortality disadvantage, the blurring of the mortality levels of all other classes clearly suggested that this differential was not inevitable and could become even more blunted with further advances in the control of mortality.

Research since 1960. Basically we can distinguish between two kinds of studies in which the relationship between socioeconomic status and mortality has been explored: those in which data have been collected on individuals and those that have been based

on data for ecological units—particularly census tracts. By far most of the research on this topic has been of the second type (very likely reflecting the lower cost of ecological studies and the relative lack of funding to support social research on mortality). Nevertheless, at least two noteworthy efforts of the first type are represented by the National Mortality Survey of a sample of deaths that occurred during 1962 and 1963 (*4*) and by the fairly detailed study matching census and death certificate data that was reported by Kitagawa and Hauser (*5*). Both of these studies pointed to the existence of a clear socioeconomic mortality differential in the United States as measured by both education and income (but particularly by education). Kitagawa and Hauser also presented data showing that occupation was related to the mortality level—although this relation was fairly erratic and led the authors to conclude that in a study of differential mortality, occupation was the least desirable indicator of socioeconomic status (*5a*).

Although studies using data on individuals are useful (even necessary) for a full understanding of the nature and causes of the socioeconomic mortality differential, the scarcity of such studies (especially the lack of comparable studies over time) seriously limits the kinds of conclusions that can be drawn from them.

Turning now to a brief consideration of the more common studies of socioeconomic status based on census tracts, we find that contrary to earlier optimistic speculations, the results seem to well warrant the conclusion that the socioeconomic mortality differential has changed little, if any, since the 1950s. Recent studies, in fact, have revealed that a strong socioeconomic mortality differential has characterized cities as diverse in size and characteristics and as widely separated in space as Lexington, Ky. (*6*), Columbus, Ohio (*7*), Chicago, Ill. (*5*), Hartford, Conn. (*8*), and Phoenix and Tucson, Ariz. Table 1 shows this differential for Chicago, Houston, Providence, Hartford, Phoenix, and Tucson for various years.

Beyond noting that the differential still exists, however, one has to conclude that its precise nature is still inadequately understood. To illustrate, there is disagreement as to whether this differential characterizes all segments of the population. In the study of Lexington, for example, in which three separate measures of socioeconomic status and a combined index were used (*6*), very little association was found between socioeconomic status and mortality for the young adult group (ages 20–39). This observation conflicts with both the results of a number of earlier studies (*3a*) and with more recent data (table 2) suggesting that the socioeconomic differential is most pronounced among the early adult ages. Similarly, although the same Lexington study revealed a positive association between socioeconomic status and mortality for nonwhites, data for Chicago in 1960

Table 1. Age-standardized average annual death rates per 1,000 population for whites for various U.S. cities and years, by sex and socioeconomic status area

City, year, and sex	Socioeconomic status area					Ratio V:I
	I (high)	II	III	IV	V (low)	
Chicago, 1930:						
Males	11.6	12.4	13.6	15.4	18.8	1.62
Females	6.6	7.2	8.4	9.9	13.2	2.00
Chicago, 1940:						
Males	11.0	10.8	11.5	13.4	16.6	1.51
Females	5.8	5.6	6.3	7.8	10.4	1.79
Chicago, 1950:						
Males	8.7	9.4	9.7	11.6	14.6	1.68
Females	4.2	4.9	5.1	6.4	8.6	2.05
Chicago, 1960:						
Males	9.6	9.2	10.1	11.3	16.0	1.67
Females	4.7	4.5	5.2	6.0	8.6	1.83
Houston, 1950:						
Males	7.5	7.9	9.1	11.1	9.9	1.32
Females	5.4	5.3	5.6	7.1	7.5	1.39
Providence, 1950:						
Males	10.8	11.8	11.2	12.7	14.0	1.30
Females	7.3	7.6	8.9	9.4	10.4	1.42
Hartford, 1950:						
Males	9.3	10.3	11.2	11.8	12.5	1.34
Females	6.6	7.5	7.5	8.2	8.3	1.26
Phoenix, 1970:						
Males	9.8	10.9	11.5	13.4	18.2	1.86
Females	6.4	6.6	6.4	7.2	8.9	1.39
Tucson, 1970:						
Males	8.8	9.9	9.5	11.5	15.1	1.72
Females	6.3	6.3	5.0	6.6	7.9	1.25

SOURCES: Chicago rates from reference 5; Hartford, Providence, and Houston rates from reference 3; Phoenix and Tucson rates calculated from data supplied by Arizona Department of Health.

Table 2. Age-specific death rates per 1,000 population for whites from highest and lowest socioeconomic status (SES) areas, by sex, Phoenix, Ariz., 1970

Age (years)	Males			Females		
	High SES area	Low SES area	Ratio low: high	High SES area	Low SES area	Ratio low: high
0–1	11.8	21.3	1.81	13.2	11.9	.90
1–9	0.8	1.2	1.50	0.3	1.3	4.33
10–19	0.8	1.3	1.63	0.4	0.7	1.75
20–29	2.7	4.0	1.48	0.7	1.2	1.71
30–39	1.6	7.6	4.75	0.8	3.8	4.75
40–49	3.2	16.3	5.09	2.6	5.9	2.27
50–59	9.6	30.7	3.20	5.3	11.6	2.19
60–69	36.6	56.9	1.55	13.1	21.4	1.63
70 and over	77.3	102.4	1.32	61.2	64.9	1.06

SOURCE: Rates calculated from data supplied by Arizona Department of Health.

and for Phoenix and Tucson in 1970 (table 3) indicate an inverse differential just as pronounced for nonwhites as for whites.

The particular index of socioeconomic status does not seem to affect the existence of the relationship between socioeconomic status and mortality; the magnitude of the relationship, however, varies somewhat, and such variation could significantly affect the kinds of conclusions drawn. Quinney (*6*) found the highest correlation between socioeconomic status and mortality when the variable used to characterize socioeconomic status was median family income; this variable was also used to delineate most of the urban socioeconomic areas studies (Chicago, Lexington, Phoenix, and Tucson). In Columbus, however, Schwirian and Lagreca (*7*) found housing conditions —percentage of dwelling units in sound condition— correlated much more closely with mortality rates than median family income.

The data in table 1 suggest that the socioeconomic differential by sex is likewise unstable. Although, as would be expected, female death rates for every city are lower than the corresponding male rates, for Chicago the relative difference between the lowest and highest economic areas for every year studied is notably greater for females; in Phoenix and Tucson, however, the relative difference is substantially more pronounced for males. Finally, with respect to the earlier postulated blurring of class lines above the lowest socioeconomic group, the data in table 1 suggest that although this blurring may be the trend for females, it has not characterized males to the same extent—particularly in the two Arizona cities.

What these isolated results from a few selected studies indicate, then, is that we are still about where we were at the start of the 1960s. We know without question that a low socioeconomic status is associated with a higher than average death rate, but when it comes to drawing more specific conclusions, there is still considerable variation from one area to another, from one population subgroup to another, and from one measure of socioeconomic status to another.

Table 3. Age-standardized death rates per 1,000 population for nonwhites from highest and lowest socioeconomic status (SES) areas of 3 U.S. cities, 1960 or 1970

City and Year	Age-standardized death rates		Ratio low: high
	High SES area	Low SES area	
Chicago, 1960:			
Males	9.8	16.7	1.70
Females	8.1	11.6	1.42
Phoenix, 1970	7.3	12.0	1.64
Tucson, 1970	5.7	9.6	1.68

SOURCES: Chicago rates from reference 5 (see table 1); Phoenix and Tucson rates calculated from data supplied by Arizona Department of Health.

What is more important, we have not made such progress in explaining what it is about a low socioeconomic status that results in the higher death rates, and the unfortunate corollary is the already noted fact that we have not made any real progress in eliminating or reducing the socioeconomic differential in mortality. There have been some noteworthy attempts to isolate the particular socioeconomic status component that contributes most to the differences in mortality—for example, the specification by Schwirian and Lagreca (*7*) that the effect of socioeconomic status on mortality operates through the housing variable and likely reflects such concomitants of poor housing as inadequate heating and sanitation, as well as the higher incidence of certain social problems like alcoholism, broken homes, and drug addiction. Beyond such efforts, however, there has been a lot of speculating and hypothesizing, but very little real research relating to the influence of such factors as genetic inheritance (*6*) and to differences in health care knowledge and the access to good medical care, especially preventive care (*3a*). And the need for research on these kinds of factors is especially urgent today as infectious diseases continue to decline and chronic diseases, particularly heart disease, have assumed a greater responsibility for the pronounced mortality disadvantage characterizing the lowest socioeconomic groups in our society (*6,8*).

Before we suggest realistic remedial programs, however, we need to know a lot more about the problem that confronts us. This problem stems in part, we suggest, from our past heavy reliance on ecological data in the study of the relationship between socioeconomic status and mortality—a dependence at least partly due to a lack of funds for social epidemiologic research on mortality. To isolate the specific factors involved in the socioeconomic mortality differential (for the general population and for particular ethnic subgroups within it) and to arrive at a more adequate understanding of its underlying causes, the same kind of extensive surveys and intensive case studies are needed that we have long had with respect to fertility.

Socioeconomic Status and Infant Mortality

Possible changes in inverse relationships. The infant mortality rate has long been recognized as an

extremely sensitive index of the differences in the levels of social and economic well-being that characterize various geographic areas or population subgroups (*9,10*). Also, numerous studies suggest that infant mortality continues to be highly sensitive to socioeconomic differences between countries (*11–14*). Yet a number of recent studies have raised questions about the precise status of this traditionally inverse relationship within an advanced country such as the United States with relatively low mortality (*15–17*). These questions have arisen largely because of the marked declines in infant mortality rates in modern, industrial societies (*18*), particularly the declines in the postneonatal component of infant mortality. The authors of the more recent studies have suggested that in countries where infant mortality is low and where the major proportion of infant deaths occur in the neonatal period and are due to endogeneous causes (for example, immaturity, birth injury, congenital malformations, postnatal asphyxia), the traditional negative correlation between infant mortality and socioeconomic status would be blunted. On the other hand, for those few deaths that occur between the ages of 1 month and 1 year (for which the major causes are further removed from the physiological processes of gestation and birth), mortality levels would continue to exhibit an inverse relationship to socioeconomic status. In at least one of these studies, the author went even further and suggested that continued progress in the public health and medical professions could, by contributing to still greater reductions in the proportion of infant deaths occurring during the postneonatal period, blunt the traditional association even further—and perhaps even eliminate it (*16*).

What has happened to the traditional inverse relationship between infant mortality and socioeconomic status? Again, an examination of the results and conclusions of more recent studies does not yield a definitive answer. Although a longitudinal study of infant mortality in the Chicago area showed a marked narrowing of the socioeconomic differential between 1930 and 1960 (*5b*), other data for New York City (*19*), Toledo, Ohio (*20*), the State of Ohio (*21*), San Antonio, Tex. (*22*), and the nation as a whole (*5c, 23*) suggest that the traditional relationship is just as pronounced as ever. Furthermore, in still other research, it has been noted that the inverse relationship is also characteristic of the neonatal component of infant mortality, not only in the United States (*21, 24–27*), but also in other industrialized countries of low mortality (*28–30*).

The preceding discussion reveals the lack of consistency among the conclusions of various researchers as to the relationship between infant mortality and socioeconomic status. Some of the inconsistency, of course, reflects the variety of units of analysis (matched records, census tracts, States) and the different measures of socioeconomic status (mother's education, father's occupation, family income) used in the cited studies. It may also reflect real differences among the population groups studied. For example, the earlier studies in which the traditional relationship was questioned were all carried out in the urban northeastern region of the United States. Further, those studies in which the changing pattern of this relationship was discussed have generally been cross-sectional—inferring change by comparing their results with those of earlier studies (most of which had been carried out in different areas with different methodologies). In short, this relationship is clearly a topic on which additional research is sorely needed.

Preliminary results of ongoing sudy. Staff members of the Department of Sociology at Bowling Green State University are presently engaged in a fairly broad study of the relationship between socioeconomic status and mortality, of which one phase is a longitudinal study of the trend in infant mortality within the major metropolitan areas of Ohio. Since data from this phase are available for Toledo for 1950 and 1970, some preliminary results of our analysis are included in table 4. The zero order correlation coefficients for 1950 clearly tend to support the conclusion of earlier studies in which a blunting of the traditional association between infant mortality and socioeconomic status association was postulated —a blunting that seemingly could be explained in terms of the lack of any significant relationship between socioeconomic status and the neonatal component of infant mortality. However, it is equally clear that the further blunting of the overall association that was projected had not taken place. In fact, the relationship of socioeconomic status to total infant mortality was more pronounced in 1970 than in 1950 for all three socioeconomic indicators.

Further examination of these data indicates that the relationship to postneonatal mortality had declined, although not significantly, for two of the three socioeconomic indexes, whereas the relationship to neonatal mortality had become significantly stronger for all socioeconomic measures. The net effect of these two trends was to create a situation in 1970 in which, with the exception of the income measure, the strength of the mortality-socioeconomic status relationship was greater for the neonatal death

Table 4. Zero order correlation coefficients between infant mortality and 3 measures of socioeconomic status, Toledo, Ohio, 1950 and 1970

Infant mortality component and socioeconomic measures [1]	1950		1970	
	Correlation coefficient	Significance level	Correlation coefficient	Significance level
Total infant mortality:				
Education	−0.297	$P<0.05$	−0.500	$P<0.001$
Occupation	−0.288		−0.549	
Income	−0.267		−0.667	
Neonatal mortality:				
Education	−0.113	NS	−0.430	$P<0.01$
Occupation	−0.120		−0.451	$P<0.001$
Income	−0.119		−0.528	$P<0.001$
Postneonatal mortality:				
Education	−0.435	$P<0.01$	−0.356	$P<0.01$
Occupation	−0.402		−0.328	$P<0.05$
Income	−0.357		−0.530	$P<0.001$

[1] Education=median number of school years completed by persons 25 years and over; occupation=percentage of employed population engaged in white-collar occupations; income=median income of families and unrelated persons. Unit of analysis was census tract of mother's residence.

NOTE: NS—not significant.

rate than for the postneonatal. The difference between neonatal and postneonatal mortality with respect to the income measure was so small it can be regarded as inconsequential.

These results, although consistent with those of at least one other recent study (*25*), are clearly not in line with what would have been expected on the basis of research done 10 to 15 years ago, and they give rise to two important questions:

1. What has caused the overall relationship between infant mortality and socioeconomic status to increase?

2. What has caused the neonatal component to emerge as the major contributor to the overall relationship?

With respect to the first question, one factor may be the migration patterns of the past two decades and the resulting increase in the proportion of total deaths of black infants in Toledo (17 percent in 1950, 37 percent in 1970). Since blacks are overrepresented in the poorest socioeconomic areas and since the traditionally more sensitive postneonatal mortality accounts for a larger proportion of deaths of black infants than of white (*31*), the increasing proportion of blacks in the study population may have contributed to the stronger association during the later period. This hypothesis is being explored further.

The second question poses greater difficulties. On the one hand, the increase in the magnitude of the neonatal-socioeconomic relationship may also be explained, at least in part, by the increasing proportion of blacks in the study population. If, for example, the neonatal-socioeconomic relationship were to be more pronounced for blacks than for whites (low birth weight, a major correlate of premature infant death, being approximately twice as prevalent among blacks as among whites), then the sizable increase in the black fraction could easily be overpowering the weaker relationship among whites in the more recent period. On the other hand, the changing patterns of the association between infant mortality and socioeconomic status may reflect some as yet undected changes in the role of particular causes of death. For example, our data indicate that in Toledo, in direct contrast to the national trend, the proportion of infant deaths occurring in the postneonatal period has increased. Although this increase, too, is likely related to the changing ethnic and socioeconomic composition of the urban population, further research is needed on this question.

Another suggested explanation is that the exogenous causes of death more commonly associated with postneonatal mortality are now contributing to neonatal mortality. A specific factor here could be the nutritional status of the mother during pregnancy, as it is known that lower socioeconomic groups have a nutritionally poor diet as compared with the general population (*32,33*).

In conclusion, we would emphasize that we still do not have a definitive answer to the question, "What is happening to the relationship between infant mortality and socioeconomic status?" The evidence from our work to date suggests that there has indeed been a major shift away from what appeared 10 to 15 years ago to be a weakening association back to a clearcut and very pronounced inverse relationship. Since the explanation of this changing pattern is far from clear, this changing pattern is the major focus of our continuing research. It is doubtful, however, that this research will provide answers to all of the relevant questions. On the one hand, data on such factors as the quality of prenatal care, diet, and infant-care knowledge and practices are not available in ecological analyses such as ours. On the other hand, a lot of relevant data that are available on the birth record—parity, length of gestation, birth weight—are not readily accessible to us for individuals. As with mortality studies in general, such ecological analyses are clearly insufficient. Studies linking birth and death records are a step in the right

direction (*34,35*), but they, too, are not comprehensive enough (for example, they do not include maternal habits and lifestyle). To increase our knowledge of the relative effect of the specific factors responsible for higher infant death rates among the lower socioeconomic groups, we need extensive studies comparing infants who die at various ages with those who survive the first year of life in terms of a wide variety of individual and family lifestyle characteristics.

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