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The present paper has two specific aims: first to summarize, as succinctly as possible, the present state of our knowledge concerning the nature of this differential in the United States today; and second to suggest the kinds of research that still needs to be done to increase our knowledge of this differential so that we may take further steps to eliminate it. The paper is divided into two main sections: the first will consider the relationship between socioeconomic status and mortality in general, whereas the second will look at the situation as it pertains to infant mortality. I make this distinction for three reasons: (1) infant mortality has long been recognized as the most sensitive mortality indicator of group differences in social and economic wellbeing; (2) it is the aspect of mortality on which my own research has concentrated and with which I am most familiar; and (3) perhaps most important, very different kinds of research are needed for a more adequate understanding of the different "causes" of the infant mortality/socioeconomic status relationship as opposed to those characterizing total mortality and socioeconomic status.

SOCIOECONOMIC STATUS AND MORTALITY IN THE UNITED STATES

It has been over a decade since anyone has presented a review of the research findings on this topic. At that time (early 1960's) two reviews were published which seemed to suggest that there was some basis for optimism with regard to the future course of the socioeconomic mortality differential. In the first of these (Stockwell, 1961) it was noted that although most of the studies that had been carried out in the post-World War II era revealed the existence of a fairly pronounced inverse relationship between mortality rates and socioeconomic status, there nevertheless seemed to be emerging differences 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 1950 decade, as well as on the results of some of my own research (Stockwell, 1963), it was concluded that both the extent of the socioeconomic differential and the nature of its trend depended on such things as the area under investigation, the particular variables used to measure socioeconomic status, and the nature of the methodological procedures followed. Further, the very fact that what had previously been a consistent and pronounced inverse association had become so variable was sufficient to encourage speculation about an emerging trend toward a closing of the socioeconomic status mortality gap.

In the second review (Antonovsky, 1967), somewhat similar conclusions were reached. Although it was emphasized that a socioeconomic differential still existed, there was clearly a trend toward a blurring of the traditional pattern. Specifically, it was noted that the differentials then observed were pretty much limited to a difference between the lowest class and all others. That is, what had once been a fairly smooth inverse gradient across several socioeconomic class levels was now one in which similar low death rates characterized all the upper and middle class groupings, with a much higher death rate prevailing in the lowest group. This blurring of the traditional inverse relationship was explained in terms of the continuation of the historical decline of mortality in our society. That is, it was suggested that when mortality levels are extremely high or extremely low (i.e., at the two extremes when men either have very little control over their life chances or when they have achieved a great deal of success in controlling mortality), social class differences will be small; and further that it is during the transitional phase from high to low death rates, when the fruits of health progress filter slowly down from the richer to the poorer classes, that the socioeconomic differential is most apparent. This being the case it would suggest the hypothesis 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 fact that the mortality levels of all other classes had blurred clearly suggested that this differential was not inevitable and that it could become even more blunted with further advances in the control or mortality.

Research Since 1960: Basically we can distinguish between two kinds of studies that have examined the relationship between socioeconomic status and mortality: those which have collected data for individuals, and those which 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 cost differences in carrying out these two kinds of studies and, related, the relative absence of funding to support social research on mortality). Nevertheless, at least two noteworthy efforts of the first type are represented by (1) the National Mortality Surveys and birth/death linkage studies done by the National Center for Health Statistics during the 1960's, and by (2) the fairly detailed censusdeath certificate matching study reported by Kitagawa and Hauser (1973). While such studies using individual data are necessary for a full understanding of the nature and causes of the socioeconomic mortality differential, the fact that there have been so few of them (especially the Lack of comparable studies over time) seriously limits the kind of conclusions that can be drawn from them.

Turning now to a brief consideration of the more common census tract based studies of socioeconomic status and mortality, the most overriding conclusion that seems to be warranted is that, contrary to the earlier optimistic speculations, <u>there has been little if any change in the situation since the 1950's</u>. Recent studies, in fact,

have revealed that a strong socioeconomic mortality differential characterizes cities as diverse in size and characteristics and as widely separated in space as Lexington, Kentucky (Quinney, 1965), Columbus, Ohio (Schwirian and Lagreca, 1971), Chicago, Illinois (Kitagawa and Hauser, 1973), Hartford, Connecticut (Nagi and Stockwell, 1973), and Phoenix and Tucson, Arizona (See Table 1). Beyond noting that it still exists, however, one has to conclude that the precise nature of this differential is still inadequately understood. To illustrate, there is disagreement as to whether it characterizes all segments of the population. In the study of Lexington, for example (Quinney, 1965), in which three separate measures of socioeconomic status and a combined index were used, very little association was found between socioeconomic status and mortality for the young adult group (ages 20-39). This observation conflicts with both the findings of a number of earlier studies (Antonovsky, 1967) and with more recent data (see Table 2) which suggest that the socioeconomic differential is very pronounced among the early adult ages, particularly ages 30-39. Similarly, although the same Lexington study revealed a positive association between socioeconomic status and mortality for nonwhites, data tor thicago in 1960and for both Phoenix and Tucson in 1970 indicate that the inverse differential is just as pronounced for nonwhites as it is for whites (see Table 3).

The particular index of socioeconomic status used does not seem to effect the existence of the relationship, but there is some variation as to its magnitude, and such variation could be significant for the kind of conclusions drawn. Most of these city socioeconomic areas are based on median family income (Chicago, Lexington, Phoenix and Tucson), and where several indices were used (Quinney, 1965), the highest correlation between socioeconomic status and mortality was found to characterize the income variable. In Columbus, Ohio, however, Schwirian and Lagreca (1971) found that housing conditions (percent of dwelling units in sound condition) were much more highly correlated with mortality rates than was median family income.

To cite one other illustration, the data presented in Table 1 would suggest that the nature of the socioeconomic differential by sex is also unstable. As would be expected, female death rates are everywhere lower than corresponding male rates; however, the relative difference between the lowest and highest economic areas is notably greater for females at every year in Chicago; but it is substantially more pronounced for males in both Phoenix and Tucson. Finally, with respect to the earlier postulated blurring of class lines above the lowest group, the data presented in Table 1 would suggest that this may be the trend for females, but that such a blurring has not characterized males to the same extent -- particularly in the two Arizona cities.

What these <u>isolated</u> <u>findings</u> from a few <u>selected</u> <u>studies</u> indicate, then, is that we are still pretty much where we were at the start of the 1960 decade. We know without question that a low socioeconomic status is associated with a higher than average death rate, but when it comes to making more specific conclusions there is still a good deal of variation from one area to another, from one population subgroup to another, and from one measure of socioeconomic status to another.

What is more important, however, is that we have not made much progress in explaining what it is about a low socioeconomic status that results in the higher death rates; and the unfortunate corrolary is the already noted fact that we have not made any real progress in eliminating or reducing this differential. Beyond some noteworthy attempts to isolate the socioeconomic status component that contributes most to the differences in mortality -- for example, the specification by Schwirian and Lagreca (1971: 585-587) that the effect of status on mortality operates through the housing variable, and likely reflects such concomitants of poor housing conditions as inadequate lighting, heating and sanitation, as well as the higher incidence of certain social problems like alcoholism, broken homes and drug addiction -- ... beyond such efforts there has been a lot of speculating and hypothesizing, but very little real research, relating to the influence of such things as genetic inheritance (Quinney, 1965), and to differences in health care knowledge and access to good medical care, especially preventive care (Antonovsky, 1967: 67). And the need for research with respect to these kinds of factors is especially important today as the influence of infectious diseases has declined and as the chronic diseases, particularly heart disease, have assumed a greater responsibility for the pronounced mortality disadvantage characterizing the lowest socioeconomic groups in our society (Quinney, 1965; Nagi and Stockwell, 1973).

Before we can suggest realistic remedial programs we need to know a lot more about the problem with which we are confronted. Part of the problem to date stems from the past heavy reliance on the use of ecological data to study the relationship between socioeconomic status and mortality, and this in turn is at least partly due to a deficiency of monies available for social epidemiological research on mortality. In order to isolate the specific factors involved and to arrive at a more adequate understanding of the underlying causes of the socioeconomic mortality differential (for the general population and for particular ethnic subgroups within it) we need both the extensive surveys and the intensive case studies of the kind that we have so long had with respect to fertility.

INFANT MORTALITY AND SOCIOECONOMIC STATUS Although the infant mortality rate has long been recognized as an extremely sensitive index of differences in the levels of social and economic well-being characterizing various geographic areas or population subgroups (Newshoime, 1910; Woodbury, 1925), and although numerous studies suggest that infant mortality continues to be highly sensitive to socioeconomic differences on an international level (Ekanem, 1972; Stockwell, 1960 and 1966; Stockwell and Hutchinson, 1975), a number of studies published in the early 1960's raised questions concerning the precise status of this traditionally inverse relationship within an advanced, relatively low mortality country such as the United States (Donabedian, et al., 1965; Stockwell, 1962; Willie, 1959). These questions have arisen largely as a consequence of the marked declines in infant mortality rates in modern, industrial societies (Chase, 1967), particularly the declines in the postneonatal component of infant mortality. These latter studies suggested that in countries where infant mortality was low, and where the major proportion of infant deaths occur in the neonatal period and are attributed to endogeneous causes (e.g., immaturity, birth injury, congenital malformations, postnatal asphxia), the traditional negative correlation between infant mortality and socioeconomic status would be blunted. On the other hand, for those few deaths that do take place between the ages of one month and one year, where the major causes of death are further removed from the physiological processes of gestation and birth, mortality levels would continue to exhibit an inverse relationship to socioeconomic status. At least one of these studies 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 in the postneonatal period, blunt the traditional association even further -- and perhaps even eliminate it (Stockwell, 1962).

What has happened to the traditional inverse relationship between infant mortality and socioeconomic status? Once again, an examination of the findings and conclusions of more recent studies does not yield a definitive answer. To illustrate, although a longitudinal study of infant mortality in the Chicago area showed a marked narrowing of the socioeconomic differential between 1930 and 1960 (Kitagawa and Hauser, 1973: 66-67), other data for New York City (National Academy of Science, 1973), Toledo, Ohio (Adamchak, et al., 1976), San Antonio, Texas (Markides and Barnes, 1977), the state of Ohio (Stockwell and Laidlaw, 1977), and for the nation as a whole (Kitagawa and Hauser, 1973: 28-29; MacMahon et al., 1972), suggest that the traditional relationship is just as pronounced as ever. Furthermore, still other-research has noted that the inverse relationship is also characteristic of the neonatal component of infant mortality, not only in the United States (Shapiro, et al., 1968; Brooks, 1975; Shin, 1975; Adamchak and Stockwell, 1977; Stockwell and Laidlaw, 1977) but also in other industrialized low mortality countries (Douglas, 1966; de Haas-Posthuma and de Haas, 1968; Hirst et al., 1968).

The preceding discussion clearly reveals a lack of consistency among conclusions pertaining to the relationship between infant mortality and socioeconomic status. Some of the confusion, of course, reflects the fact that the studies cited are based on a variety of units of analysis (matched records, census tracts, states) and have used different measures of socioeconomic status (mother's education, father's occupation, family income). It may also reflect real differences among the population groups studied (i.e., the earlier studies that questioned the traditional relationship were all carried out in the urban northeastern region of the United States, and those national data that are available indicate the relationship is least pronounced in the northeast) (MacMahon, et. al., 1972:5). Further, those studies that have talked about the changing pattern of this relationship have generally been cross-sectional in nature, inferring change by comparing their findings with those of earlier studies (most of which were carried out in different areas and based on different methodologies). In short, this is clearly a topic where additional research is sorely needed.

Preliminary Results of an On-going Study: 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, one phase of which is a longitudinal study of the trend with respect to infant mortality within the major metropolitan areas of Ohio. Data from this study are presently available for the city of Toledo, for 1950 and 1970, and some preliminary results of our analysis are included here in Table 4. The zero order correlation coefficients presented here for 1950 would clearly tend to support the conclusions of earlier studies that postulated a blunting of the traditional infant mortality/socioeconomic status association -- a blunting that seemed to be explainable 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 projected further blunting of the overall association has not been realized. In fact, the relationship for total infant mortality is more pronounced in 1970 than it was in 1950 for all three socioeconomic indicators.

Further examination of these data indicates that the relationship with respect to postneonatal mortality has declined (although not significantly) for two of the three socioeconomic indexes, whereas the relationship with respect to neonatal mortality has increased significantly for all socioeconomic measures. The net effect of these two trends has been to create a situation in 1970 where, with the exception of the income measure, the strength of the mortality/ socioeconomic status relationship is greater for the neonatal death rate than it is for the postneonatal. (The difference between neonatal and postneonatal with respect to the income measure is so small it can be regarded as inconsequential).

These findings, are consistent with those of at least one other recent study (Brooks, 1975), and 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 emergence of the neonatal component as the major contributor to the overall relationship?

With respect to the first question, one factor may be the nature of recent migration patterns and the changing composition of the urban population -- particularly the increase in the proportion of Blacks among the infant deaths in Toledo (from 17 percent in 1950 to 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 Black infant deaths (Kleinman, et al., 1976), an increasing proportion of Blacks in the study population may be contributing to the stronger association during the more recent period. This is a question that is currently being explored further.

The second question poses greater difficulties. On the one hand, it may be that the increase in the magnitude of the neonatal/socioeconomic relationship is also explainable, 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 the white population, then the sizable increase in the Black fraction could very easily be "overpowering" the lesser relationship among whites in the more recent period, (e.g., low birth weight, a major contributor to infant death, is about twice as prevalent among Blacks). On the other hand, the changing patterns of the association between infant mortality and socioeconomic status may reflect some as yet undetected changes with respect to the role of particular causes of death. For example, our data indicate that for Toledo, in direct contrast to the national trend, there has been an increase in the proportion of infant deaths occurring in the postneonatal period. Why this should be the case is still unclear to us, and is one of the key questions still under investigation. (Again there is probably an association with the changing composition of the population in many of our urban centers).

Another explanation that has been suggested 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's diet during pregnancy, as it is known that lower socioeconomic groups have a nutritionally poor diet relative to that of the general population (Belli, 1971; Chabot et al., 1975), and this could be a factor contributing to the higher incidence of low birth weight babies among low socioeconomic groups.

In conclusion we would emphasize that we still do not have a definitive answer to the general question "What is happening to the relationship between infant mortality and socioeconomic status?" This evidence from our very preliminary work to date suggests that there has indeed been a major shift away from what appeared, 10 to 15 years ago, to be a contracting association back to a clear-cut and very pronounced negative relationship. The explanation of this changing pattern is far from clear, however; and it is this that will be the major focus of our continuing research on this topic. It is very doubtful, however, if our research will provide answers to all of the relevant questions. On the one hand, data on such things 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 on an individual basis. As with mortality in general, such ecological analyses are clearly insufficient. Birth-death record link studies are a positive step in the right direction (Armstrong, 1972; Chase, 1972), but they too are insufficient (e.g., they do not get at maternal habits and life style). What we really need in order to increase our knowledge of the relative effect of the specific factors responsible for higher infant death rates among the lower socioeconomic groups is extensive studies that look at infants who die at various ages and those who survive the first year of life in terms of a wide variety of individual and family life style characteristics.

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		cities and dates.						
City and Year			Socioeconomic					Ratio
			I (High)	II	III	IV	V (Low)	V:1
Chicago,	1930	M F	11.6 6.6	12.4 7.2	13.6 8.4	15.4 9.9	18.8 13.2	1.62 2.00
Chicago,	1940	M F	11.0 5.8	10.8 5.6	11.5 6.3	13.4 7.8	16.6 10.4	1.51 1.79
Chicago,	1950	M F	8.7 4.2	9.4 4.9	9.7 5.1	11.6 6.4	14.6 8.6	1.68 2.05
Chicago,	1960	М	9.6 4.7	9.2 4.5	10.1 5.2	11.3 6.0	16.0 8.6	1.67 1.83
Houston,	1950	M F	7.5 5.4	7.9 5.3	9.1 5.6	11.1 7.1	9.9 7.5	1.32 1.39
Providence,	1950	М	10.8 7.3	11.8 7.6	11.2 8.9	12.7 9.4	14.0 10.4	1.30 1.42

Table 1. -- Age-standardized average annual death rates per 1,000 population for five social rank areas, white population by sex, for various cities and dates.

14

City and Year			Socioeconomic					Ratio
			I (High)	II	II III	IV	V (Low)	V:I
Hartford,	1950	M F	9.3 6.6	10.3 7.5	11.2 7.5	11.8 8.2	12.5 8.3	1.34 1.26
Phoenix,	1970	M F	9.8 6.4	10.9 6.6	11.5 6.4	13.4 7.2	18.2 8.9	1.86 1.39
l'ucson,	1970	M F	8.8 6.3	9.9 6.3	9.5 5.0	11.5 6.6	15.1 7.9	1.72 1.25

SOURCES: Chicago data (Kitagawa and Hauser, 1973, p. 53); Hartford, Providence, and Houston (Antonovsky, 1967, p. 54); Phoenix and Tucson (calculated by authors from data supplied by the Arizona Department of Health).

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Table 2. -- Age-specific white death rates, by sex, for highest and lowest social rank areas in Phoenix, 1970

Age	High SES	Low SES	Ratio Low:High	High SES	Low SES	Ratio Low:High		
	h	Thite Males		W	WHITE FEMALES			
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+	77.3	102.4	1.32	61.2	64.9	1.06		

SOURCE: Calculated by authors from data supplied by the Arizona Department of Health.

Table 3. -- Age-standardized death rates of nonwhites, for high and low social rank areas, for various cities and dates.

City and Year	High SES	Low SES	Ratio Low:High
Chicago, 1960			
Male Female	9.8 8.1	16.7 11.6	1.70 1.42
Phoenix, 1970	7.3	12.0	1.64
Fucson, 1970	5.7	9.6	1.68

SOURCES: Chicago (Kitagawa and Hauser, 1973, pp. 54-55); Phoenix and Tucson (calculated by authors from data supplied by the Arizona Department of Health).

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

lnfant mortality				
component and	<u>Correlation</u> c	oefficients	Difference	<u>, 1950–1970</u>
socioeconomic	1950	1970	Absolute	Level of
measures ¹			difference	significance
Total infant mortality				
Education	297*	500***	+.203	.11%
Occupation	288*	549***	+.211	.10
Income	267*	667***	+.400	.004
Neonatal				
Education	113	430**	+.317	.04
Occupation	120	451***	+.331	.03
Income	119	528***	+.409	.01
Postneonatal				
Education	435**	356**	079	. 32
Occupation	402**	328*	074	.33
Income	357**	530***	+.173	.14

* = Significant at .05 percent.
** = Significant at .01 percent.

*** = Significant at .001 percent.

 <u>Education</u>, the median number of school years completed by persons age 25 years and over; <u>occupation</u>, the percent of the employed population engaged in white collar occupations; and <u>income</u>, median income of families and unrelated individuals. The unit of analysis is the census tract of mother's residence.

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