The Socioeconomic Distribution of Mortality Rates in Des Moines, Iowa, 1974

R. SCOTT FREY, PhD

THE ECONOMIC POSITION of a population group determines its life chances (*1–3*). Consider, for example, mortality: mortality rates of groups vary inversely with socioeconomic status (*4–10*). This generalization and the observation that cities consist of relatively distinct geographic areas inhabited by people who share similar socioeconomic characteristics (*11*) suggest the following hypothesis: the lower the socioeconomic status of the population in an area, the higher the mortality rates. This hypothesis is consistent with research findings reported over the past 100 years for cities in this country and abroad (*5,7,8, 12–36*).

Despite a substantial body of research examining the posited relationship, relatively little research has been based on data collected since 1970 (*27, 29–36*). Moreover, the findings of several recent studies suggest an increase in socioeconomic differentials of various cause-specific forms of mortality over the past few decades (*34,35*). Although it is not possible to examine the validity of the reported increase in socioeconomic differentials, a consideration of data collected since 1970 would add to the understanding of the current status of the relationship. Thus, with this objective in mind, I report the results of an examination of variations in the 1974 rates for 15 categories of death (including total mortality) across socioeconomic areas within Des Moines, Iowa.

Tearsheet requests to Dr. R. Scott Frey, Assistant Professor, Department of Sociology, George Washington University, Washington, D.C. 20052.

Data and Methods

Mortality data. All deaths that occurred in the incorporated city of Des Moines in 1974 were identified from records supplied by the Des Moines-Polk County Health Department. The census tract was the unit for the geographic classification of each death. In the enumeration of the 1970 census (*37*), Des Moines was divided into 47 tracts. Four of the 1,846 reported deaths and 1 census tract (No. 35) were omitted from this analysis because of incomplete data. Each of the remaining 1,842 deaths was assigned to 1 of the 46 tracts according to residence and a general cause of death according to the Ninth Revision of the International Classification of Diseases, Clinical Modification (*38*).

Socioeconomic areas. The 46 census tracts were aggregated into 3 socioeconomic areas. Three areas were constructed because (*a*) the small number of cases for several causes of death necessitated using a small number of socioeconomic areas and (*b*) previous researchers have used three areas in their analyses (*14,19,30*). In effect, the use of three socioeconomic areas is defensible for methodological reasons.

Aggregation of census tracts proceeded in two steps. First, Shevky-Bell (*39*) social rank scores were computed for each tract according to the following formula:

$$SRS_i = OSS + ESS \div 2$$

where, SRS_i = social rank score for census tract i ($i = 1, \ldots, 46$); $OSS = 100 - [x\ (r - o)]$, OSS = occupation standardized score for census tract in 1970, r = occupation ratio score for census tract (number of craftsmen, foremen and kindred workers, operatives except transport, and laborers except farm per 1,000 employed persons), x = 100 ÷ range of occupation ratios (r) for all census tracts, and o = lower limit of distribution of occupation ratios (r) for all census tracts; ESS = $100 - [x(r - o]$, ESS = education standardized score for census tract in 1970, r = education ratio score for census tract (number of persons completing a maximum of 8 years of education per 1,000 persons 25 years and older), x = 100 ÷ range of education ratio (r) for all census tracts, and o = lower limit of distribution of education ratio (r) for all census tracts. Shevky-Bell social rank scores were used because they were used by previous researchers (*16,17,25,26*). Second, tracts were ranked from low to high according to social rank scores and then ag-

gregated into three groups, consisting of a relatively equal number of tracts and representing areas of low (I), middle (II), and high (III) socioeconomic status. The three socioeconomic groups, social rank scores, population figures, and number of deaths are presented in table 1.

Standardized mortality ratios. Sex-specific standardized mortality ratios (*40*) were computed for each of 15 general categories of death (table 2) by socioeconomic area according to the indirect method. The formula for the ratio follows:

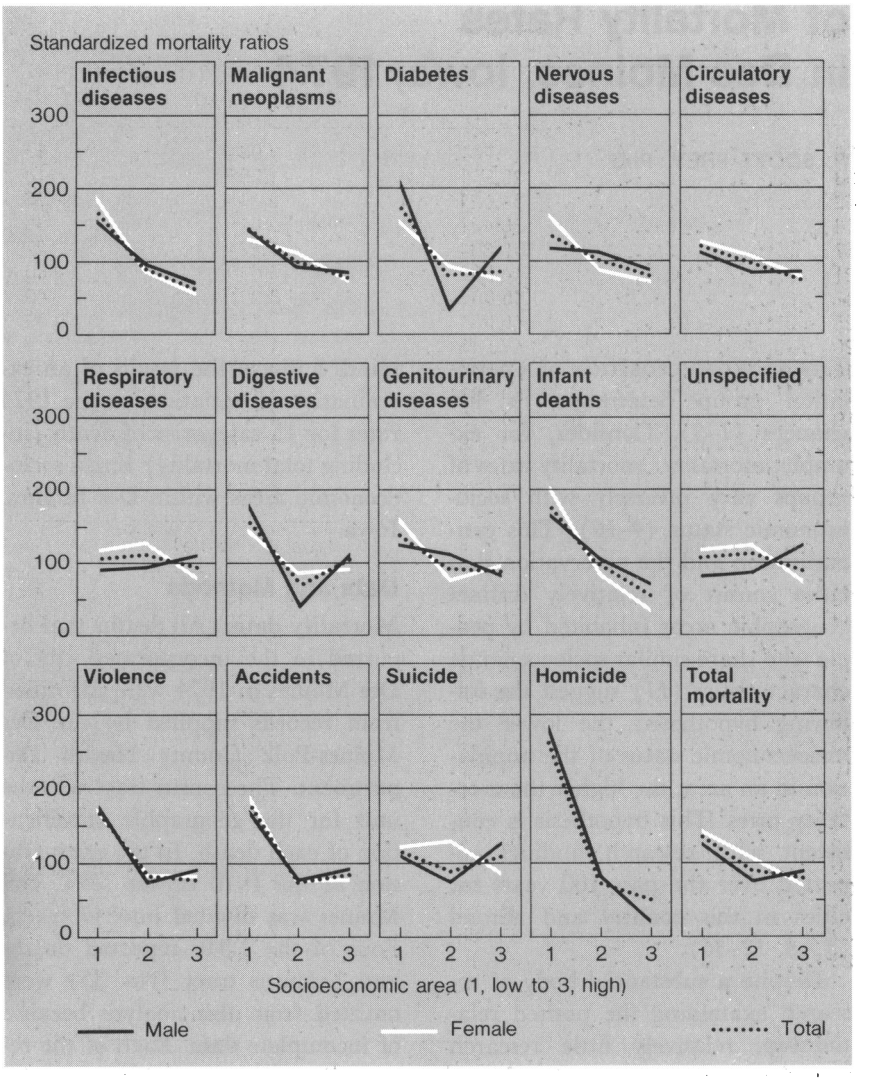
$$SMR_i = \frac{\sum_{j=1}^{9} m_j p_j}{\sum_{j=1}^{9} M_j p_j} \times 100$$

where, SMR_i = standardized mortality ratio for socioeconomic area i (i = I, II, III); j = age category (1 = under 5 years, 2 = 5–14, 3 = 15–24, 4 = 25–34, 5 = 35–44, 6 = 45–54, 7 = 55–64, 8 = 65–74, 9 = 75+); m_j = death rate in age group j in 1974; p_j = population in age group j in 1970 (*37*); M_j = death rate in age group j in 1974 for standard population (Des Moines).

As used here, the standardized mortality ratio is an age-standardized ratio that compares the extent to which observed deaths in a socioeconomic area vary as a percentage of the expected number of deaths if age-specific rates for the city occurred in the socioeconomic area. The ratio is 100 when observed and expected deaths are equal, and a score of less or more than 100 indicates a rate deviating from the expected rate.

Shortcomings. The following shortcomings are associated with the data and methods used in the analysis:

Standardized mortality ratios for 15 categories of death (including total mortality) by socioeconomic area and sex, Des Moines, Iowa, 1974



—the reliability of mortality data (*41*) and census tract data (*42*),

—the use of 1970 census tract population characteristics and 1974 tract mortality rates when population characteristics of tracts may have changed between 1970 and 1974,

—census tract homogeneity (*43, 44*),

—the manner in which mortality rates were computed (*45–47*),

—standardizing infant deaths (children under 1 year old) according to the population under 5 years old because data for the number of live births were not available,

—the use of a small number of cases in computing mortality ratios for several causes of death, and

—the inability to generalize aggregate findings to the individual level (*48,49*).

However, I assume that these shortcomings do not vitiate the results reported here regarding the socioeconomic distribution of mortality rates. Such an assumption is realistic because the results presented in the next section are consistent with previous research findings.

Results

The results are presented in table 2 and the chart. The data reveal

Table 1. Census tracts grouped into three socioeconomic areas by Shevky-Bell social rank (SR) scores, Des Moines, Iowa, 1970

Tract	SR scores	Population	Deaths
	Area I (low)		
36	.001	1,034	16
38	22.961	1,393	16
42	34.624	2,396	26
18	38.431	2,828	31
17	42.304	2,694	27
21	44.562	5,696	66
37	45.006	3,204	40
25	46.254	647	38
20	47.645	1,687	19
13	54.044	4,195	48
12	54.987	4,928	62
19	54.990	4,637	35
14	55.059	2,510	38
27	55.166	3,091	42
23	56.689	1,454	37
	Area II (middle)		
33	57.713	2,949	40
44	58.272	4,102	19
46	58.311	8,240	57
5	58.404	5,632	52
3	59.405	4,025	31
39	60.284	1,524	9
43	61.249	6,674	41
15	61.979	3,284	39
2	62.715	7,518	60
1	63.465	9,069	41
4	63.884	5,427	55
6	65.428	4,697	50
34	65.515	2,558	43
16	65.747	2,262	43
47	65.928	4,934	25
26	66.023	2,687	25
	Area III (high)		
24	69.033	2,012	16
45	70.708	6,351	44
11	73.819	5,976	43
41	75.706	3,661	37
40	79.870	3,694	25
29	83.084	4,712	72
8	84.406	12,412	92
9	84.750	8,586	80
7	85.858	14,163	78
28	85.915	4,437	53
10	85.958	5,485	53
31	97.433	2,239	9
30.01	97.683	2,667	17
20.02	97.991	4,208	35
32	100.000	2,573	19

partial support for the hypothesis—partial in the sense that not all forms of mortality vary inversely and monotonically with socioeconomic status. For instance, an inverse and monotonic pattern is seen for deaths of males due to infectious diseases, malignant neoplasms, nervous diseases, circulatory diseases, genitourinary diseases, infant deaths, and homicide. Females show a pattern consistent with that of males for total mortality and mortality due to infectious diseases, malignant neoplasms, diabetes, nervous diseases, circulatory diseases, infant deaths, and violence. Similarly, the total population shows an inverse and monotonic pattern for total morbidity and mortality from infectious diseases, malignant neoplasms, nervous diseases, circulatory diseases, genitourinary diseases, infant deaths, and homicide.

Although several categories of death do not vary inversely and monotonically with socioeconomic status, ratios for the lowest socioeconomic area (I) are higher than the ratios for the upper two areas for most categories of death. Males from area I display higher ratios than males from areas II and III for 12 of 15 categories of death: infectious diseases, malignant neoplasms, diabetes, nervous diseases, circulatory diseases, digestive diseases, genitourinary diseases, infant deaths, violence, accidents, homicide, and total mortality. The ratios for females in area I are higher than those in the upper two areas for 11 of 14 categories of death: infectious diseases, malignant neoplasms, diabetes, nervous diseases, circulatory diseases, digestive diseases, genitourinary diseases, infant deaths, violence, accidents, and total mortality. The total population's pattern is similar to that of males and females for 12 of 15 categories of death: infectious diseases, malignant neoplasms, diabetes, nervous diseases, circulatory diseases, digestive diseases, genitourinary diseases, infant deaths, violence, accidents, homicide, and total mortality. In effect, the findings indicate that most categories of death vary as an inverse function of socioeconomic status.

Table 2. Standardized mortality ratios [1] for 15 categories of death by socioeconomic area and sex, Des Moines, Iowa, 1974

Category of death [2]	Socioeconomic area I (low)	II (middle)	III (high)	$P(\chi^2)$
Infectious diseases (000–139)	174	96	63	NS
Male	[3] 159	[3] 98	[3] 68	NS
Female	189	[3] 95	[3] 58	NS
Malignant neoplasms (140–239)	139	100	79	.001
Male	139	91	85	.020
Female	135	110	75	.010
Diabetes (250)	162	77	86	NS
Male	[3] 202	[3] 38	[3] 104	NS
Female	150	98	76	NS
Nervous diseases (320–389)	130	101	83	NS
Male	[3] 111	[3] 104	[3] 90	NS
Female	[3] 152	[3] 97	[3] 76	NS
Circulatory diseases (390–459)	118	102	88	.010
Male	106	99	98	NS
Female	130	105	81	.001
Respiratory diseases (460–519)	101	104	96	NS
Male	90	94	111	NS
Female	112	116	81	NS
Digestive diseases (520–579)	160	60	101	.010
Male	170	42	110	.010
Female	150	81	91	NS
Genitourinary diseases (580–629)	141	93	84	NS
Male	127	106	78	NS
Female	152	[3] 77	92	NS
Infant deaths (760–779)	172	98	58	.020
Male	155	102	65	NS
Female	200	91	[3] 47	NS
Unspecified (780–799)	104	109	91	NS
Male	[3] 84	93	115	NS
Female	118	121	74	NS
Violence (E800–E969)	167	78	85	.001
Male	169	75	87	.010
Female	164	84	82	NS
Accidents (E800–E949)	177	76	81	.010
Male	173	76	84	.050
Female	184	75	77	.100
Suicide (E950–E959)	108	86	108	NS
Male	107	73	120	NS
Female	[3] 109	119	[3] 79	NS
Homicide (E960–E969)	256	[3] 72	[3] 48	.010
Male	273	[3] 77	[3] 21	.001
Female	...	..	..	...
Total mortality	129	97	87	.001
Male	123	91	95	.001
Female	135	104	79	.001

[1] Ratio of observed to expected deaths × 100.
[2] Categories based on the Ninth Revision of the International Classification of Diseases, Clinical Modification (*38*).
[3] Based on fewer than 5 cases.

Conclusions

This study was designed to test the hypothesis that, in 1974, mortality rates varied inversely over three socioeconomic areas in Des Moines. If the shortcomings of the data and the method are not viewed as overly problematic, the hypothesis cannot be rejected. That is, socioeconomic differentials in mortality rates continue to exist. However, the failure to find a pattern in which rates for all categories of death vary consistently as a negative and monotonic function of socioeconomic status suggests that several categories of death do not vary strongly with socioeconomic status.

References

1. Weber, M.: Class, status, party. *In* From Max Weber: essays in sociology. Oxford University Press, New York, 1946, pp. 180–195.
2. Duberman, L.: Social inequality: class and caste in America. J. B. Lippincott Company, Philadelphia, 1976.
3. Blau, P. M.: Inequality and heterogeneity: a primitive theory of social structure. Free Press, New York, 1977, pp. 45–75.
4. Benjamin, B.: Social and economic factors affecting mortality. Mouton, Paris, 1965.
5. Antonovsky, A.: Social class, life expectancy, and overall mortality. *In* Patients, physicians and illness: a sourcebook in behavioral science and health. Free Press, New York, 1972, pp. 5–30.
6. MacMahon, B., Kovar, M. G., and Feldman, J. J.: Infant mortality rates: socioeconomic factors, United States. DHEW Publication No. (HSM) 72-1045. Vital and Health Statistics Series 22, No. 14. U.S. Government Printing Office, Washington, D.C., 1972.
7. Kitagawa, E. M., and Hauser, P. M.: Differential mortality in the United States: a study in socioeconomic epidemiology. Harvard University Press, Cambridge, Mass., 1973.
8. Antonovsky, A., and Bernstein, J.: Social class and infant mortality. Soc Sci Med 11: 453–470, May 1977.
9. Kitagawa, E. M.: On mortality. Demography 14: 381–389, November 1977.
10. Mare, R. D.: Socioeconomic effects of child mortality in the United States. Am J Public Health 72: 539–547, June 1982.
11. Berry, B. J. L., and Kasarda, J. D.: Contemporary urban ecology. Macmillan Company, New York, 1977, pp. 85–93, 108–157.
12. Sheps, C., and Watkins, J. H.: Mortality in socioeconomic districts of New Haven. Yale J Biol Med 20: 51–80, October 1947.
13. Yeracaris, C. A.: Differential mortality, general and cause specific in Buffalo, 1939–41. J Am Stat Assoc

50: 1235–1247, December 1955.
14. Patno, M. E.: Mortality and economic level in an urban area. Public Health Rep 75: 841–851, September 1960.
15. Seidman, H., Garfinkel, L., and Craig, L.: Death rates in New York City by socioeconomic class and religious group and country of birth, 1949–1951. Jew J Sociol 4: 254–273, December 1962.
16. Stockwell, E. G.: A critical examination of the relationship between socioeconomic status and mortality. Am J Public Health 53: 956–964, June 1963.
17. Quinney, R.: Mortality differentials in a metropolitan area. Soc Forces 43: 222–230, December 1964.
18. Kitagawa, E. M., and Hauser, P. M.: Trends in differential fertility and mortality in a metropolis—Chicago. *In* Contributions to urban sociology. University of Chicago Press, Chicago, 1964, pp. 59–85.
19. Valdes, M., et al.: Sudden unexpected death in infancy: a statistical analysis of certain socioeconomic factors. J Pediatr 73: 387–394, September 1968.
20. Pyle, G., and Lashof, J.: Geography of disease and death in two Chicagos. *In* Slum medicine: Chicago's apartheid health system. University of Chicago Press, Chicago, 1969, pp. 1–16.
21. Roberts, R. E., McBee, G. W., and MacDonald, E. J.: Social status, ethnic status, and urban mortality: an ecological analysis. Tex Rep Biol Med 28: 13–28, spring-summer 1970.
22. Griffins, M.: A geographic study of mortality in an urban area. Urb Stud 8: 111–120, June 1971.
23. Pyle, G. F., and Rees, P. H.: Modeling patterns of death and disease in Chicago. Econ Geog 47: 475–488, October 1971.
24. Schwirian, K. P., and Lagreca, A. J.: An ecological analysis of urban mortality rates. Soc Sci Q 52: 574–587, December 1971.
25. Newman, J. F., and Graves, W. L.: Neo-natal mortality and socioeconomic status in a metropolitan county. Sociol Symp 8: 37–49, spring 1972.
26. Nagi, M. H., and Stockwell, E. G.: Socioeconomic differentials in mortality by cause of death. Health Serv Rep 88: 449–456, May 1973.
27. Smith, D. M.: The geography of social well-being in the United States. McGraw-Hill Book Company, New York, 1973, pp. 120–133.
28. Struening, E. L., et al.: Family, ethnic and economic indicators of low birth weight and infant mortality: a social area analysis. Ann NY Acad Sci 218: 87–102, June 22, 1973.
29. Ventura, S. J., Taffel, S. M., and Spratley, E.: Selected vital and health statistics in poverty and nonpoverty areas of 19 large cities, United States, 1969–71. DHEW Publication No. (HRA) 76–1904. Vital and Health Statistics, Series 21, No. 26. U.S. Government Printing Office, Washington, D.C., 1975.
30. Lerner, M., and Stutz, R. N.: Mortality differentials among socioeconomic strata in Baltimore, 1960 and 1973. *In* Proceedings of the Social Statistics Section of the American Statistical Association Annual Meeting, 1975. American Statistical Association, Washington, D.C., 1976, pp. 485–490.
31. Briggs, R., and Leonard, W. A.: Mortality and ecological structure: a canonical approach. Soc Sci Med 11: 757–762, November 1977.
32. Markides, K. S., and Barnes, D.: A methodological note on the relationship between infant mortality and socioeconomic status with evidence from San Antonio, Texas. Soc Biol 24: 38–44, spring 1977.
33. Stockwell, E., Wicks, J. W., and Adamchak, D. J.: Research on the relationship between socioeconomic status and mortality in the United States: 1960–1975. *In* Proceedings of the Social Statistics Section of the American Statistical Association Annual Meeting, 1977. American Statistical Association, Washington, D.C., 1978, pp. 11–19.
34. Yeracaris, C. A., and Kim, J. H.: Socioeconomic differentials in selected causes of death. Am J Public Health 68: 342–351, April 1978.
35. Adamchak, D. J.: Emerging trends in the relationship between infant mortality and socioeconomic status. Soc Biol 26: 16–29, spring 1979.
36. Lerner, M.: Socioeconomic differentials in mortality in Baltimore, 1959–61 and 1969–71. *In* Proceedings of the Social Statistics Section of the American Statistical Association Annual Meeting, 1980. American Statistical Association, Washington, D.C., 1980, pp. 206–211.
37. U.S. Bureau of the Census: Census of the population and housing: 1970. Census tracts, Des Moines, Iowa SMSA. Final Report PHC (1)–57. U.S. Government Printing Office, Washington, D.C., 1972.
38. U.S. Department of Health and Human Services: The international classification of diseases, clinical modification. Ed. 9. DHHS Publication No. (PHS) 80–1260. U.S. Government Printing Office, Washington, D.C., vol. 1, 1980.
39. Shevky, E., and Bell, W.: Social area analysis: theory, illustrative application and computational procedures. Greenwood Press, Westport, Conn., 1955, pp. 54–55.
40. Hill, A. B.: Principles of medical statistics. Oxford University Press, New York, 1971, pp. 215–217.
41. Haberman, P. W.: The reliability and validity of the data. *In* Poverty and health: a sociological analysis. Harvard University Press, Cambridge, Mass., 1969, pp. 343–383.
42. Muhlin, G. L., and Milcarek, B. I.: Urban analysis and planning: a cautionary note on the utilization of census data. Urban Affairs Q 10: 212–222, December 1974.
43. Foley, D. L.: Census tracts and urban research. J Am Stat Assoc 48: 733–742, December 1953.
44. Myers, J. K.: Note on the homogeneity of census tracts: a methodological problem in urban ecological research. Soc Forces 32: 364–366, May 1954.
45. Kilpatrick, S. J.: Mortality comparisons in socioeconomic groups. Appl Stat 12: 65–86, June 1963.
46. Kitagawa, E. M.: Theoretical considerations in the selection of a mortality index, and some empirical comparisons. Human Biol 38: 293–308, September 1966.
47. Kleinman, J. C.: A new look at mortality indexes with emphasis on small area estimation. *In* Proceedings of the Social Statistics Section of the American Statistical Association Annual Meeting, 1976. American Statistical Association, Washington, D.C., 1976, pp. 485–490.
48. Robinson, W. S.: Ecological correlations and the behavior of individuals. Am Sociol Rev 15: 351–357, June 1950.
49. Berry, K. J., and Martin, T. W.: The synecdochic fallacy: a challenge to recent research and theory building in sociology. Pac Sociol Rev 17: 139–166, April 1974.