SOCIAL CLASS, LIFE EXPECTANCY AND OVERALL MORTALITY

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> . . . recalling what happened when an "unsinkable" trans-Atlantic luxury liner, the *Titanic,* rammed an iceberg on her maiden voyage in 1912 . . . The official casualty lists showed that only 4 first class female passengers (3 voluntarily chose to stay on the ship) of a total of 143 were lost. Among the second class passengers, 15 of 93 females drowned; and among the third class, 81 of 179 female passengers went down with the ship.[1]

Death is the final lot of all living beings. But, as the tragic experience of the *Titanic* passengers dramatically illustrates, the time at which one dies is related to one's class. The intent of this paper is to examine the evidence which bears upon the closeness of this relationship, ranging as far back as the data will allow. It will first focus on the question of life expectancy at birth, and subsequently turn to that of overall mortality.

STUDIES OF LIFE EXPECTANCY

The average infant born today in the Western world can look forward, barring unforeseen events and radical changes in present trends, to a life span of about 70 years. That this has not always been the case for the human infant—and still is not for by far most infants born today—is well known. Whatever the situation prior to the era of recorded history, for the greater part of this era, that is,

until the nineteenth century, most men lived out less than half their Biblical span of years.

In what is probably the first study of a total population, Halley, using data for the city of Breslau, Germany, for 1687 to 1691, calculated an average life expectancy at birth of 33.5 years.[2] Henry's estimate for the expectation of life of Parisian children born at the beginning of the eighteenth century was 23.5 years.[3] Half a century later, in the Vienna of 1752 to 1755, of every 1,000 infants born alive, only 590 survived their first year, 413 their fifth year, and 359 their fifteenth year.[4] Henry further cites an estimate, which he regards as "too pessimistic," of 28.8 years for the total French population toward the end of the Ancien Regime.[5]

In the nineteenth century, Villerme, in a careful first-hand study, reported a life expectancy at birth for the total population of the city of Mulhouse, France, of seven years and six months, based on the period 1823 to 1834. However, he also cites Penot's data for Mulhouse, from 1812 to 1827, which show an average life expectancy of 25 years.[6] Ansell found a life expectation at birth for the total British population in 1874 of about 43 years.[7] At about the same time, the reported figures for Italy were somewhat lower: 35 years (1871 to 1880); 36.2 years for males, 35.65 years for females (1881–1882).[8]

Whatever the discrepancies and unreliabilities of these various sets of data, they consistently paint a picture of the Western world up to recent centuries which is quite similar to that of the world of presently "developing" societies until the last decade or two. Moreover, in the period of recorded history prior to the eighteenth century, no sizable increment had been added to the average life span. But if, from Greco-Roman times through the eighteenth or perhaps even the nineteenth century, the mythical "average" infant could anticipate living some 20 to 30 years, does any evidence indicate that dramatic class differences existed? Though the evidence is perforce limited, the answer would seem to be no.

Two studies of male property owners in England of the generation born before 1276, and of a population born between 1426 and 1450, show average lengths of life being 35.3 and 33 years, respectively.

Dublin, *et al.*, who report these studies, also cite a study by Peller of men in the "ruling classes of Europe" from 1480 to 1579 in which a life span of 30 years is given as the average.[9] In Peller's paper, the average life expectancy of males at birth in a population of "Europe's ruling families," which included a total of 8,500 individuals, was 32.2 years in the sixteenth century, declined to 28.1 in the seventeenth century, rose considerably to 36.1 in the next century and, from 1800 to 1885 was 45.8 years. (In each case the female figure was higher.)[10]

A somewhat similar study, covering 1,908 individuals born between 1330 and 1954 as legitimate offspring of British kings, queens, dukes or duchesses, shows a corresponding increase in the eighteenth century, as can be seen in the following data:[11]

Period of birth	Expectation of life at birth (years) Males	Females
1330–1479	24	33
1480–1679	27	33
1680–1729	33	34
1730–1779	45	48
1780–1829	48	55
1830–1879	50	62
1880–1954	55	70

At the opposite end of the social scale, the reported life expectancy at birth for a British Guiana slave population between 1820 and 1832 was 22.8 years.[12] A reasonable assumption, keeping in mind that the life expectancy at birth of countries such as India, Burma and Cambodia in the late 1950's ranged from 35 to 44 years,[13] is that class differences prior to the eighteenth century were relatively limited. In other words, given a society which, though it manages to survive, does so at or near what might be called a rock-bottom level of life expectancy, one is not likely to find great differences among the strata of that society.

The data suggest the possibility that the trend in the nineteenth century, and perhaps even earlier, was toward a substantial widening of class differences. No report is available comparing the life expectancies of social strata of the population prior to the nineteenth century. Titmuss quotes Milne as saying, in 1815, that "There can . . .

be no doubt but that the mortality is greater among the higher than the middle classes of society."[14] Villerme's study of Mulhouse, which was based on an analysis of the occupation of the head of household of 5,419 deceased out of a total of 6,085 registered deaths from 1823 to 1834, shows a life expectancy at birth which ranges from 28.2 years for "manufacturers, merchants, directors, etc." through 17.6 years for "factory workers, unspecified" and 9.4 years for day laborers, to 1.3–1.9 years for spinners, weavers and locksmiths. (Consideration of the life expectancy at age one of the same occupations indicates far smaller occupational differences.) Villerme concludes that "One sees here that most infants reach adulthood or die at a young age depending upon the condition or occupation to which they belong . . ."[15] At about the same time (1832), an observer of the British scene remarked that members of the peerage had a lower expectation of life than the general population.[16]

Morris cites Gavin's analysis of the average age at death of 1,632 deceased in Bethnal Green (a suburb of London) in 1839 by social strata. "Gentlemen, professional men and their families" died, on the average, at age 45; "tradesmen and their families," at age 26; and "mechanics, servants, labourers and their families," at age 16. Very similar data are quoted by Titmuss for the years 1839 to 1841 for the city of York. For near-identical social groups, the average ages at death were: 48.6, 30.8 and 23.8. Morris also refers to Clay's report for the 1840's on chances of survival in the town of Preston, Lancastershire, among 1,000 infants born into each of the families of gentry, tradesmen and operatives. Among the gentry, not until well past the fortieth year did more than one-half of those infants die. The average infant of families of tradesmen survived until just past his twentieth year. Among operatives' families, however, more than half of those born had died by their fifth year. Titmuss also reports, for this period, that a "gentleman" in London lived, on the average, twice as long as a "labourer." The corresponding figures for Leeds were 44 and 19 years, and for Liverpool 35 and 15.[17]

A study by Bailey and Day, published in 1861, is referred to in the same context by Titmuss, though their data are not cited. Collins, however, does cite the data, which show a narrower gap than

the aforementioned studies. Bailey and Day studied the life tables of 7,743 members of families of British peers from 1800 to 1855, and compared them with deaths in the total population from 1838 to 1844. The mean duration of life for the two groups was 52 and 40.4 years, respectively.[18]

A further cautionary note on the class gap is sounded by William Farr, the great pioneer of English mortality statistics. In his discussion of the life expectancy of laborers employed by the East India Company compared with that of English peers over the course of centuries, using data for the latter published by Edmonds in 1838, Farr notes little difference in annual average mortality between the two groups, especially after age 50. "Are we," Farr comments, "to infer that the mortality among peers is now higher than among labourers, crowded within the metropolis? Should we not rather infer, that as the investigation extends far back into the centuries of bloodshed and pestilence, that the lives of peers were then shorter, and are now longer, than the lives of labourers? The plague, which was born in huts, and nursed by famine, rioted in luxurious halls, and smote the highborn."[19]

In the same cautionary direction, Ansell found that "the expectation of life at birth in the upper and professional classes was 53 years indicating an advantage of about 10 years over the expectation for the general population [in 1874]."[20]

Very few later investigators have dealt with class differences in life expectancy, preferring to concentrate on differences in mortality rates. A search of the literature has revealed only four such studies, whose data are presented in Table 1. The published data for Chicago refer only to the two extreme groups of census tracts with the highest and lowest median rentals. Because, after World War I, Chicago witnessed a tremendous influx of Negroes, most of whom were lower class, the available data for whites only has also been presented. From 1920 to 1940, the difference between the extreme groups seesawed, but did decline to a difference in life expectancy for whites, in both sexes, of 7.6 years. In England and Wales of about 1930, a direct gradient between class and life expectancy of males is evident, the extreme groups being separated by

TABLE I. LIFE EXPECTANCY AT BIRTH FOR SELECTED POPULATIONS, BY SEX AND SOCIAL CLASS, IN THE TWENTIETH CENTURY[21]

Population, Place and Time	*I (highest)*	*II*	*Class* III*	*IV*	*V (lowest)*	*Difference Between I and V (years)*
England and Wales, 1930–32						
all males	63.1	60.8	60.0	57.3	55.7	7.4
Chicago, 1920						
all males	60.6	—	—	—	49.6	11.0
Chicago, 1930						
all males	63.0	—	—	—	49.5	13.5
white males	63.0	—	—	—	51.3	11.7
Chicago, 1935						
all males	60.9	—	—	—	53.5	7.4
Chicago, 1940						
all males	65.4	—	—	—	56.5	8.9
white males	65.4	—	—	—	57.8	7.6
Buffalo, 1939–41						
all males	65.7	65.5	63.4	62.2	58.2	7.5
Baltimore, 1949–51						
white males	68.5	66.4	65.4	63.9	61.4	7.1
Chicago, 1920						
all females	62.9	—	—	—	52.5	10.4
Chicago, 1930						
all females	67.1	—	—	—	54.5	12.6
white females	67.1	—	—	—	56.2	10.9
Chicago, 1935						
all females	66.6	—	—	—	58.3	8.3
Chicago, 1940						
all females	70.3	—	—	—	61.0	9.3
white females	70.3	—	—	—	62.7	7.6
Buffalo, 1939–41						
all females	69.6	68.3	66.4	64.8	61.8	7.8
Baltimore, 1949–51						
white females	73.1	72.4	71.2	69.8	68.4	4.7

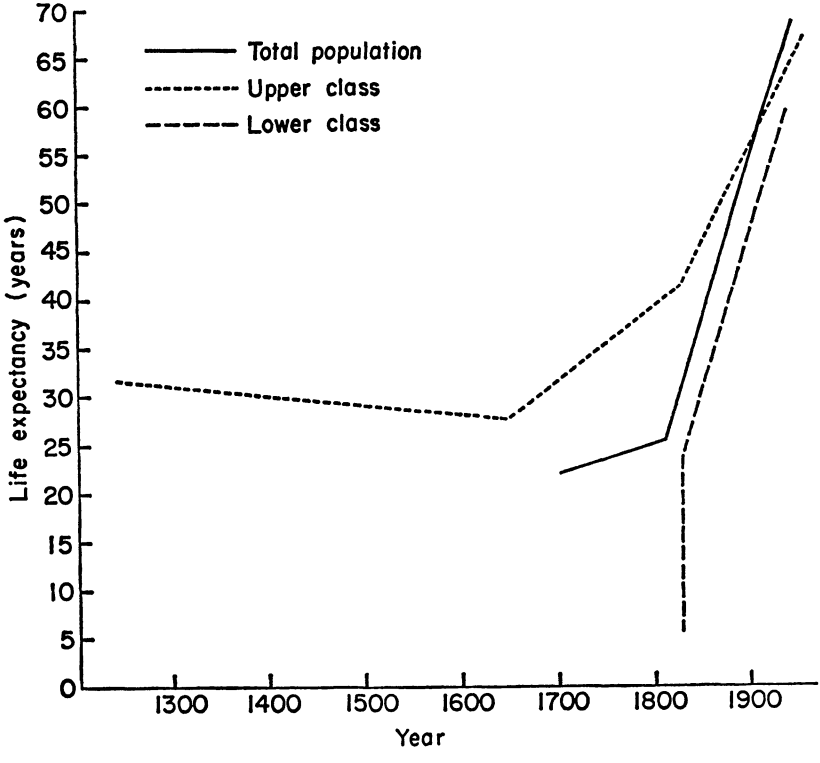
* "Class" in the British data refers to the Registrar-General's system of classification based on occupation, into which Tietze introduced a number of modifications. In the three American cities, "class" refers to the division of the city census tracts into quintiles based on the median rental in each tract.

7.4 years. Just about the same number of years separates the highest and lowest groups in Buffalo in 1939–1941. Although this is also true for white males in Baltimore in 1949–1951, the difference among white females in that city is only 4.7 years. In both cities, the direct gradient is clear.[21]

Can any conclusion be drawn from these data, most of which are admittedly tenuous and not overly reliable? A crude picture, as

represented in Figure 1, could be inferred which indicates the following. The bulk of recorded history was one of high birth and high death rates, which offset each other and led to at most a very small increase in population. During the first 16 centuries of the Christian era, world population increased from about one-quarter to one-half billion people, an annual growth rate of about .005 per cent. Conceivably, throughout this period, no substantial differentials in life expectancy could be found among different social strata of the

FIGURE I. MODEL OF CLASS DIFFERENCES IN LIFE EXPECTANCY AT BIRTH IN VARIOUS POPULATIONS.



Data are derived from specific studies cited in the text and are plotted at the mid-year of each time period. The values for the last five years for the total United States population are from *The Facts of Life and Death*, Public Health Service publication no. 600, revised 1965, p. 21.

population. From 1650 to 1850 world population again doubled, most of the increase being in the Western world, representing an average annual increase of .05 per cent. These two centuries would seem to mark the emergence of an increasing class gap in life expectancy, starting slowly but gathering increasing momentum and reaching its peak about the time Malthus made his observations. On the one hand, the life expectancy of the middle and upper strata of the population increased at a rapid rate. On the other, the lowest strata's life expectancy may have increased much more slowly or, conceivably, even declined as an industrial proletariat emerged. At some time during the nineteenth century, probably in the latter half, this trend was reversed, and the class gap began to diminish. This is reflected in the doubling of the world's population, again mostly in the West, this time in the 80 years from 1850 to 1930. In recent decades, the class gap has narrowed to what may be the smallest differential in history, but evidence of a linear gradient remains, with a considerable differential, given man's life span.

This supposition—not claimed to be more than that, since Figure 1 is no more than a very crude representation—seems to be of more than historical interest. It is, for two important reasons, most germane to the concern of this paper. In the first place, the scientist, no less than the lay person, often seems, in considering the question of the relationship between class and health, to be beset by a nineteenth century notion of perpetual progress. Ideologically committed, in this area, to the desirability of the disappearance of the class gap, he tends to assume, with or without data, that the historical picture is unilinear; the history of mankind, in his view, shows steady progress in this respect. The realization that this may well be an inaccurate image, that the relationship is more complex, suggests a more cautious orientation. Such an orientation would suggest various possibilities: a narrowing gap being transformed into one which is widening; differing positions, on any given index of health, of different strata of the population at various times.

The second reason for stressing the possibility of a curvilinear relationship between class and life expectancy over time is that such a relationship may help in forming an adequate idea of the re-

lationship between class and health, and, more broadly, an adequate theory of disease. Once the search begins for explanations of why, in a given period, one stratum seems to be making more health progress than another, and less so in another period, factors are uncovered which must be integrated into a theory of disease.

Thus, for example, McKeown and Brown, arguing that the increase in the population of England in the eighteenth century was overwhelmingly due to the decline in mortality, attribute that decline to improvements in the environment (housing, water supply, refuse disposal, nutrition) rather than to any advances in medical care.[22] Supposedly, such improvements first appeared in the upper strata of society, and only slowly percolated downward. This would explain the increasing class differences in life expectancy. Once the environmental sanitation gap began to narrow, some reversal in the trend could be expected which, however, might soon be offset by other factors; e.g., the malnutrition of poverty. The point is that a very careful collection of data over time and the search for ups and downs may serve to pinpoint the various factors, and their modes of interaction, which influence overall mortality or the course of any specific disease.

CLASS DIFFERENCES IN MORTALITY BEFORE WORLD WAR II

Twentieth century investigators have by and large focused on class differences in mortality rates. Chapin's study of Providence, Rhode Island, probably provides the earliest relevant information.[23] Using census and tax records of 1865, he located all but about 200 of the 2,000 taxpayers, covering a total of 10,515 individuals. Every deceased person in that year was assigned to either the taxpayer or non-taxpayer group. Chapin then calculated the death rates per thousand in each group. The crude annual death rate of the latter (24.8 per 1,000 living) was more than double that of the taxpayers (10.8). As seen in Table 2, this disparity is found in all but the five- to nine-years age cohort, and is greatest in the productive years (30 to 49) and in the 70 and over cohort. Since the non-taxpayer group includes more than 80 per cent of the

TABLE 2. ANNUAL DEATH RATES, TAXPAYERS AND NON-TAXPAYERS, PROVIDENCE, RHODE ISLAND, 1865[23]

Ages	*Death Rates per 1,000*		*Ratio of Taxpayers' to Non-taxpayers' Rates**
	Taxpayers	*Non-taxpayers*	
All ages	10.8	24.8	230
Under 1	93.4	189.8	203
1 to 4	40.3	66.6	165
Under 5	50.5	94.0	186
5 to 9	15.9	15.7	99
10 to 19	3.0	8.2	273
20 to 29	6.0	11.8	197
30 to 39	4.5	15.5	344
40 to 49	1.4	14.5	1036
50 to 59	8.6	25.1	292
60 to 69	15.1	39.5	262
70 and over	32.9	138.5	421
Population size	10,515	44,080	
Number of deaths	114	1,097	

* Taxpayers' rates = 100.

population, had Chapin been able to make a finer class breakdown he presumably would have found even greater differences between the top and bottom strata.

Collins, in an early review of socioeconomic mortality data, cites an 1887 paper by Humphreys on mortality in Dublin in 1883–1885, which shows a higher mortality among the poor, but presents no data. The earliest data presented by Collins refer to Danish mortality rates from 1865 to 1874, the 1870 census having been used to obtain denominator information.[24] Individuals were assigned to high, middle or poor classes on the basis of the head of household's occupation. The top category includes capitalists, professionals, wholesale dealers and higher officers. The middle group contains master mechanics, petty officers, teachers, clerks and small shopkeepers. The poor class is made up of workmen, servants and those in almshouses. The age-adjusted mean annual death rates, by sex, of the population aged 20 and over in Cophenhagen and in other towns, is shown in Table 3. The data show that class differences are greater in Copenhagen than in provincial towns, and greater among males than among females. More significantly, although the rates show primarily an inverse class gradient, the

TABLE 3. MEAN ANNUAL DEATH RATES PER THOUSAND PERSONS, AGE 20 AND OVER, DENMARK, 1865–74, BY SEX AND RESIDENCE (AGE-ADJUSTED)[18]

Class	Copenhagen		Other Towns	
	Rate	Ratio	Rate	Ratio*
Males				
High	16.5	100	13.4	100
Middle	20.2	122	17.1	128
Poor	31.2	189	22.6	169
Females				
High	13.4	100	12.4	100
Middle	12.3	92	14.1	114
Poor	22.3	166	16.5	133

* High class rate in each group = 100.

TABLE 4. ANNUAL DEATH RATES PER 1,000 AND RATIOS, MALES, BY AGE AND MAJOR OCCUPATION GROUP, UNITED STATES, 1890 AND 1900[27]

Major Occupation Group	All Ages		15–24		25–44		45–64		65 and Over	
	Rate	Ratio**	Rate	Ratio	Rate	Ratio	Rate	Ratio	Rate	Ratio
1890										
Males in specified occupations*	13.8	100	5.6	100	9.3	100	18.4	100	70.1	100
Professionals	15.7	113	5.0	90	8.5	91	19.1	104	79.3	113
Mercantile and trading	12.2	88	3.5	63	7.4	80	17.1	93	73.6	105
Clerical, official	9.8	71	6.2	110	9.2	98	13.6	74	38.5	55
Manufacturing and mechanical industries	13.0	94	5.0	90	9.2	99	20.1	109	77.7	111
Laboring and servant	22.6	163	9.7	174	17.0	182	33.2	180	114.9	164
1900										
All occupations	15.0	100	5.1	100	8.8	100	19.9	100	98.4	100
Professionals	15.3	102	4.8	94	7.6	86	20.7	104	105.6	107
Mercantile and trading	12.1	81	2.6	51	6.7	76	19.9	100	93.8	95
Clerical, official	13.5	90	7.2	141	11.1	126	19.9	100	55.9	57
Manufacturing and mechanical industries	13.8	92	4.4	86	8.4	95	20.2	102	105.4	107
Laboring and servant	20.2	135	7.7	151	13.9	158	31.9	160	126.6	129

* Guralnick presents data for "all males" and for eight occupational categories. Only the five which can be reasonably ranked are selected here, though ratios are calculated on the basis of all eight categories.

** Rate for all occupations in each age category = 100.

differences between the high and middle classes are relatively small compared to the gap between them and the poor class. The rates are based on 21,000 deaths in Copenhagen and 22,000 deaths in the other towns.

The first of many ecological studies was Rowntree's well-known survey of York, England, in 1899.[25] Rowntree divided the wage-earner areas of the city of York into three levels. The overall death rates per thousand persons (not age-standardized) he reports for 1899 are: highest, 13.5; middle, 20.7; poorest, 27.8 (ratios of 100:153:206). In this case, unlike the earlier Danish data, the inverse gradient is quite regular.

In a paper focusing on later data, Britten calculates overall death rates for 1900 in the nine states and the District of Columbia, which then comprised the death registration area.[26] He compared white-collar rates to those for the "laboring and servant" class in three age groups. Taking the white-collar death rate as 100, the ratios for the lower class group were: for ages 15–24, 151; for ages 25–44, 165; and for ages 45–64, 159.

As a prologue to her analysis of 1950 death rates, Guralnick presents, without analysis, the full set of data upon which Britten evidently based his calculations, as well as similar data for 1890.[27] Table 4 presents the relevant data for mortality among roughly ranked occupational groups. For the employed male population as a whole, in both years, professionals have a somewhat higher mortality rate than do other white collar workers or those in industry, most of whom are presumably manual workers. Conceivably this may be explained by the fact that the rates are not age-standardized, and professionals might be an older group. The age-specific rates do show professionals as having a lower than average rate in the younger age groups and somewhat above average in the higher groups. The most striking fact about these data is the very sizable difference, at all ages, between the "laboring and servant" class and all other groups. In both 1890 and 1900, the ratio of this class is highest in ages 25–44 and 45–64, somewhat lower at ages 15–24, and lowest—though still relatively high—in the 65 and over category. An interesting pattern is shown by the clerical and

official group: in the youngest age category its ratio is quite high, in 1900 approaching that of the lowest class; in each successive age category its ratio goes down, so that in the 65 and over category it has by far the lowest mortality rate.

Szabady,[28] reporting the data (non-age-standardized) for the total population of pre-World War I Hungary, divides the non-agricultural population into non-manual and manual groups. For all persons, the death rates per thousand in 1900 were, respectively, 15.1 and 25.1; in 1910, the gap had narrowed, with both rates having fallen to 13.8 and 20.9. That differences in infant mortality contributed considerably to class differences in overall mortality is shown by considering only the rates of earners. In 1900, the non-manual death rate was 13.6, compared to 17.5 for manual earners. By 1910, the difference had nearly disappeared, the rates being 15.0 and 15.9 per thousand.

Huber[29] examined occupational mortality in France for 1907–1908, calculating death rates on the basis of the 1906 census. His figures are primarily for individual occupations, but he does give age-specific death rates for four broad groups, which are presented in Table 5. Managers and officials consistently show the lowest rates. Clerical workers have, at ages 25–34, the highest rates, but thereafter craftsmen and kindred workers have higher rates. The rates of these two groups are, throughout, closer to each other than to those of the managerial group. Class differentials are greatest at ages 45–54. Private household workers, presumably a low status group, have relatively low rates. Since the data refer only to males,

TABLE 5. AGE-SPECIFIC ANNUAL DEATH RATES PER 1,000 AND RATIOS, BY OCCUPATIONAL GROUPS, MALES, FRANCE, 1907–08[29]

	Managers, Officials		*Clerks*		*Craftsmen, Kindred Workers*		*Private Household Workers*	
Age Group	*Rate*	*Ratio**	*Rate*	*Ratio*	*Rate*	*Ratio*	*Rate*	*Ratio*
25–34	6.4	100	8.8	138	8.2	128	7.2	112
35–44	8.2	100	12.0	146	13.6	166	9.6	117
45–54	12.7	100	20.3	160	23.2	183	16.2	128
55–64	24.4	100	40.0	164	42.3	173	32.1	132

* Rate of managers, officials in each age group = 100.

who presumably served primarily in well-to-do households, such rates need not be inexplicable.

In another ecological study, Martin[31] calculated the correlations of the age-standardized mortality rates of the 28 boroughs of London in 1911–1912, with two measures of dwelling density: the percentage of population living in dwellings with two or more persons per room, and the average number of persons per room. The correlations were, respectively, 0.89 and 0.93. No change took place by the next decade (the correlations were 0.92 and 0.91). In 1920–1922, however, a third measure reflecting class was used—the percentage of the labor force in the Registrar General's classes IV and V—whose correlation with mortality was, though highly significant, much lower (0.69).

In a relatively early review of morbidity and mortality data, Sydenstricker, one of the pioneers in the field, cites Bruno's study of 22,600 deaths among 1.3 million wage-earners in 1915–1916, with life insurance in 12 American companies, showing a clear inverse occupational gradient.[32] The death rates per 1,000 policyholders were: professional and semiprofessionals, 3.3; skilled workmen, 3.7; semiskilled workmen, 4.5; unskilled workmen, 4.8. Using the rate of the professional class as 100, the ratios of the other three were 112, 136 and 145.

Dublin[33] reported the results of a similar series of studies of policyholders with the Metropolitan Life Insurance Company. He divided the population into those holding "industrial" policies and those with "ordinary" life insurance policies. Though the former are taken as representative of "the urban wage-earning population," an undue proportion of skilled and unionized workers are probably included. "Ordinary" policy-holders are "composed mainly of the clerical, professional, and commercial classes." In the first of these studies, covering 1911 to 1913, no comparative data are presented for the two populations, though the "industrial" death rates are compared to those of the total population in the death registration area of the time. The study covering 1922 to 1924 is based on 112,364 deaths among the 3.25 million "industrial" white male policyholders aged 15 or over. The ratio of age-standardized death

TABLE 6. RATIOS OF DEATH RATES OF INDUSTRIAL:ORDINARY POLICYHOLDERS OF THE METROPOLITAN LIFE INSURANCE COMPANY, WHITE MALES, AGE 20 AND OVER

Period	20 and Over (Age-Adjusted)	Age Group Ratios* 20–24	25–34	35–44	45–54	55–64	65 and Over
1922–24**	255	157	207	224	218	181	135
1922–24***	187	120	187	207	192	164	121
1937–39***	144	129	166	162	158	136	126

* Ratio = Industrial rate/Ordinary rate × 100.
** See reference 33 (Dublin and Vane, 1930, p. 7).
*** See reference 33 (Dublin and Vane, 1947, p. 1009).

rates of "industrial:ordinary" white male policyholders aged 20 and over are given differently in two of Dublin's publications. In the earlier report this ratio is given as 2.55:1, and in the later report as 1.87:1. The discrepancy results from elimination in the latter analysis of those "ordinary" policyholders who had obtained insurance between 1919 and 1923, thus largely eliminating the factor of better medical selection. Data shown in Table 6 on the death rate ratios by age groups show—whichever set of figures is taken—a rising ratio till age 35–44 and then a decline, the 65 and over group showing about the same or a lower ratio than the 20–24 group. Calculating the percentage differences between the two policyholder groups at different ages, for life expectation, Dublin shows roughly a 20 per cent difference between them, the advantage being that of the "ordinary" insured. This difference is somewhat smaller in the younger groups, rises to a peak between the ages 45 and 50, and declines after that age, being lowest after age 70.

In one of the first American studies of mortality rates, Coombs used all deaths in the city of Chicago between 1928 and 1932.[34] Each death was assigned to the census tract of residence at time of death. The tracts were grouped into five levels on the basis of the 1930 median monthly rental in the tract, using rounded cutting points (e.g., $30.00–44.99). Age-standardized data are presented separately by nativity, sex and race. Each of the four categories presented in Table 7 (whites only) shows a relatively smooth in-

TABLE 7. MEAN ANNUAL DEATH RATES PER THOUSAND PERSONS, CHICAGO, 1928–32, BY CENSUS TRACT RENTAL LEVELS, NATIVITY AND SEX (AGE-ADJUSTED)[34]

Median Tract Rental	*Native-born, White*		*Foreign-Born, White*	
	Rate	*Ratio**	*Rate*	*Ratio**
Males				
$75 and over	8.7	100	9.4	100
$60–74.99	9.2	106	9.8	104
$45–59.99	10.2	117	10.8	115
$30–44.99	11.6	133	11.9	126
Less than $30	15.1	174	14.8	157
Females				
$75 and over	6.8	100	7.1	100
$60–74.99	7.9	116	9.3	131
$45–59.99	9.1	134	9.6	135
$30–44.99	10.2	150	10.2	144
Less than $30	12.3	181	12.7	179

* Highest rental group rate in each group = 100.

verse gradient of mortality rates and median rental. Interestingly enough, the spread is greater among females than among males. Some indication of a minimum differential, among males, may be seen between the two highest rental levels, and, among all four groups, the greatest differential appears between the two lowest levels. Within these qualifications, class differentials show clearly all along the line.

Whitney's study using 1930 data was the first large-scale American study following the pattern which had been set by the British Registrar General.[35] Death certificate data were obtained from ten states: Alabama, Connecticut, Illinois, Kansas, Massachusetts, Minnesota, New Jersey, New York, Ohio and Wisconsin. These states contained 39 per cent of the gainfully employed. The 1930 census was used to obtain denominator information. Analysis was limited to males aged 15 to 64, in an attempt to limit the unreliability introduced by retirement. Age-standardized data are presented within the social-economic classification developed by Edwards and used standardly by the United States Census.

As can be seen in Table 8, mortality rates vary inversely with class in the total age group of 15–64. Only the proprietor group is out of line. If retail dealers, whose rate is 8.4, are excluded from

this category, the rate would be 7.0, making a linear relationship. The curve, however, is not smooth, as can be seen clearly from the ratios presented in the table. The largest difference is found between unskilled and semiskilled workers, with a sizable difference between the latter and skilled workers. Beyond this level the differences, although existent, are relatively small.

The same general pattern appears in each of the three age-specific sets of data. The spread, however, is greatest in the 25–44 age group and least in the oldest group. In the latter, differences among the four occupational categories from skilled workers and up are almost nonexistent. This study indicates, then, that class is most intimately related to mortality rates among the unskilled and, secondarily among the semiskilled workers, and during middle age.[36]

Sheps and Watkins[37] sought to overcome the weakness of ecological studies by utilizing information obtained in careful sociological study which grouped areas in New Haven, Connecticut, into "natural areas." The boundary lines of these areas were such that information about census tracts could be used for purposes of setting denominators and standardizing for age. The seven resulting areas for which death rates for 1930 to 1934 were calculated con-

TABLE 8. ANNUAL DEATH RATES PER 1,000 GAINFULLY OCCUPIED MALES, AGED 15 TO 64 YEARS (AGE-STANDARDIZED) BY AGE GROUPS ACCORDING TO SOCIOECONOMIC CLASS, 1930[36]

	*Age Groups**							
	15–64		*15–24*		*25–44*		*45–64*	
Socioeconomic Class	*Rate*	*Ratio***	*Rate*	*Ratio*	*Rate*	*Ratio*	*Rate*	*Ratio*
All gainfully employed males	9.1	100	3.2	100	5.5	100	17.9	100
Professional men	6.7	74	2.3	72	3.5	64	16.2	90
Proprietors, managers and officials	7.9	87	3.1	97	4.2	76	15.8	88
Clerks and kindred workers	7.8	86	2.3	72	4.1	74	16.5	92
Skilled workers and foremen	8.3	91	3.0	94	4.9	89	17.1	96
Semiskilled workers	10.1	111	3.2	100	6.1	111	20.8	116
Unskilled workers	14.5	159	4.7	147	9.6	174	24.8	138

* The age-standardized figures for the age group 15–64 are based on the 53 occupational groups with 500 or more deaths (Whitney, Table 8, p. 32). These cover 79 per cent of the gainfully employed. This set of data was selected as more reliable than the figures for all deaths, given by Whitney in Table 1, p. 17. The trends in the two sets of data are very similar. The age-specific data are only available in Whitney's Table 1, and cover the entire surveyed population.

** Rate for all gainfully employed males = 100.

tained from 10,000 to 51,000 people. A total of 8,201 deaths were recorded during this period. The seven areas were ranked from best to worst, based on a composite of factors including rental, delinquency rates, social standing and financial dependency. All data were age-adjusted.

Taking the average annual death rate over the five-year period of the best area (8.0 per 1,000 persons) as 100, the ratios of the other six areas, going down the socioeconomic scale, were: 111, 110, 128, 136, 145, 148. Other than the fact that the rates for the second and third highest areas are almost identical, a clear inverse linear relationship is found. When the authors combined the seven areas into three, the range was substantially narrowed (100:114:134). The strongest relationship between mortality rates and economic level were found at ages 0–5 and 25–64.

Stocks[38] calculated the correlation of the 1934 mortality rates in the 83 county boroughs (cities of 50,000 or more, excluding London) of England and Wales, with the mean number of persons per room and a social class index, i.e., the percentages of males aged 14 and over in the labor force in the Registrar General's classes IV and V. He found a crude correlation coefficient of 0.77 between mortality and the housing measure, and 0.68 between mortality and the class measure. When both class and latitude are controlled, the partial coefficient for the housing measure is somewhat reduced to 0.51. Controlling for density and latitude, the partial coefficient for mortality and class is greatly reduced to 0.29. As noted earlier, Martin[39] used the same measures for the 28 London boroughs. The 1930 to 1932 age-standardized mortality rates correlated 0.80 with the mean number of persons per room and 0.62 with the percentage in classes IV and V. A somewhat higher correlation was found (0.87) with the percentage of persons living in dwelling units of two or more persons per room.

Szabady,[40] whose data for Hungary for earlier years showed almost no difference in the death rates between nonagricultural and manual and non-manual gainfully employed workers in 1910, also shows the same picture for 1930–1931. He then notes, however, that if corrections are made for the differential age-distribution, the

picture changes considerably. The standardized death rates for 1930–1931 were 14.7 per 1,000 persons for manual workers compared with 11.3 for non-manual workers. (130:100; earners only). Non-standardized rates for 1941 showed a reversed picture: 13.4 for non-manual as compared to 11.1 (83:100) for manual workers, for which Szabady offers no explanation.

In 1935, Rowntree returned to the city of York to make his second well-known study of poverty.[41] He notes that York differs little from England as a whole and from other large cities in its overall and infant mortality rates. His study was based on a house-to-house survey of 16,362 families, including 55,206 persons out of the total city population of 90,000. Since his concern was primarily with poverty, he included only wage-earners. Thus the study includes some on the lower white-collar level, and excludes a few high-income manual workers and domestics working in well-to-do areas. The mortality spread between the top and bottom groups, therefore, is probably less than what it would be had the total population been included.

The surveyed population was divided into five levels, two of which are considered to be below the poverty line. The age-standardized death rates per thousand persons for 1935–1936 were: for the two highest levels, 814; for the middle level, 11.2; and, for the two poverty levels, 13.5 (ratios of 100:133:161).

Dublin and Vane's analysis of life insurance policyholder data, referred to previously, presents data for 1937 to 1939, shown in Table 6.[42] The death rate ratios of "industrial" to "ordinary" policyholders are lowest at ages 20–24 and 65 and over (129 and 126) and highest at ages 25–34 and 35–44.

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Altenderfer[48] divided the 92 United States cities with a population of 100,000 or more in 1940 into three equal-sized groups on the basis of per capita income. The mean incomes for the three groups of cities were $918, $789, and $668. The age-adjusted death rates per thousand people, using 1939–1940 data, were,

TABLE 9. AGE-STANDARDIZED ANNUAL DEATH RATES PER 1,000 PERSONS, AND RATIOS, BUFFALO, 1939–41, BY CENSUS TRACTS GROUPED ON BASIS OF MEDIAN RENTALS[44]

	Males		*Females*	
Rental Group	*Death Rate*	*Ratio**	*Death Rate*	*Ratio*
1 (highest)	9.4	100	7.2	100
2	9.9	105	8.1	112
3	11.4	121	9.0	125
4	12.2	130	10.0	139
5 (lowest)	14.9	158	12.4	172

* Highest rental group = 100.

respectively, 10.9, 11.0 and 12.1 (100:100:111). Thus, in what is probably the crudest kind of ecological comparison, in that the groupings are quite heterogeneous, the poorest third of the cities showed a higher death rate, though the magnitude of the difference hardly approaches that found in more detailed studies, while the other two thirds, as groups, do not differ from each other.

Following the model set by Coombs in her earlier study of Chicago, Yeracaris[44] divided the 72 census tracts in the city of Buffalo into five levels on the basis of the 1940 median rentals. Death rates were calculated for each of the five levels, using 1939–1941 data. As Table 9 shows, an inverse gradient is found for both sexes. Though female death rates are consistently below those for males, the actual spread between the tract groups is larger for females. With each successively lower step in the rental ladder, the differential between the tract groups increases, so that the largest gap appears between the lowest and next lowest groups, whereas a relatively small difference appears between the two top groups.

Yeracaris notes that, if the death rate of the highest tract group had prevailed throughout Buffalo, 19.1 per cent of the deaths would not have occurred. Had this rate prevailed in the second highest tract group, 6.8 per cent of its deaths would have been avoided. This percentage increases to 17.3 in the intermediate level, 24.5 in the fourth level and 38.5 in the lowest level.

Patno's analysis of Pittsburgh mortality data followed the same pattern.[45] The 1940 census tracts were ranked by using either the

median value of owner-occupied units or the median monthly rental. The tracts were then grouped into three levels, each containing about one-third of the city's white population. Data for 1950 were also employed, using median family income in each tract as a third criterion for classification.

With few exceptions, the data, shown in Table 10, indicate an inverse gradient of mortality with economic level of the tract grouping in the age-sex categories. This is true for both 1940 and 1950. The largest differentials are found in the 30 to 59 age group, particularly in the first of these decades. For females under ten, the gradient is direct, and in both sexes the 70 and over category shows no clear difference among the economic levels. No indication is given that economic differentials are any greater among males than among females.

Mortality rates in the Netherlands are among the lowest in the world. In this context, determination of social class differences be-

TABLE 10. MORTALITY RATIOS* AMONG WHITE RESIDENTS OF PITTSBURGH, BY CENSUS TRACTS, AGE AND SEX[45]

	Economic Level					
	1940			*1950*		
Sex and Age	*High*	*Middle*	*Low*	*High*	*Middle*	*Low*
Males						
All ages**	93	97	111	88	99	113
Under 10	84	98	114	73	105	119
10–29	102	86	113	90	116	95
30–39	73	88	143	64	83	148
40–49	67	114	117	85	85	131
50–59	93	89	123	75	104	123
60–69	98	97	108	92	98	108
70 and over	103	98	99	97	98	104
Females						
All ages**	93	100	114	91	105	106
Under 10	107	103	91	116	85	101
10–29	80	114	107	87	112	100
30–39	88	102	113	77	96	127
40–49	81	101	127	68	121	118
50–59	79	92	165	84	99	123
60–69	93	99	120	87	103	113
70 and over	100	100	103	95	109	97

* Rate in each age-sex category = 100.
** Age-standardized.

comes of particular interest. DeWolff and Meerdink[46] studied the mortality rates of gainfully employed males, aged 15–64 in Amsterdam in 1947–1952, using the 1947 census to provide denominator information. The population was divided into six occupational levels. The annual, average, age-adjusted death rates per thousand persons were: liberal professions, civil service, etc., 3.6; independent businessmen, 3.9; clerical workers, 5.1; managers, foremen, higher technical staff, 3.3; skilled workers, 4.2; unskilled labor, 4.2. The difference between the most favored group and the workers (117: 100) barely reaches statistical significance. In contrast to the findings of all other studies, unskilled workers do not differ from skilled workers. Only the clerical group is relatively high (though a death rate of 5.1 is, as such, quite low). The authors suggest two reasons for this rate. First, the clerical workers do not reach the standards of physical fitness required to obtain civil service employment, which would have placed them in the top level. Second, many are probably children of manual workers and are not sufficiently fit to work.

By the 1950's, the number of studies of socioeconomic mortality differentials had increased considerably. Szabady's review of the Hungarian data,[47] which had pointed to a higher rate among non-manual earners in 1941, shows a relatively small difference, though in the direction to be expected, for 1948–1949. Manual workers had a rate of 10.4 per thousand compared to 8.6 for non-manual workers (not age-adjusted). By 1959–1960 the difference had narrowed slightly, with rates of 10.5 and 9.0, respectively. Age-standardization reduces this gap somewhat, to 11.7 and 10.9 (107:100).

Tayback[48] divided Baltimore's 168 census tracts on the basis of the 1950 median tract rentals, grouping them into equal-sized population quintiles. The 1949–1951 death rates for the socioeconomic levels, excluding the nonwhite population, are shown in Table 11. In overall terms, a clear inverse class gradient is seen, the male slope being somewhat steeper than the female slope, with very few figures being out of line. The gap tends to be quite large in the younger age groups, where the death rate is low. Class differences in middle age (35–54) are very sizable. At this age, the major differences seem to be at the top and bottom, between the

TABLE II. ANNUAL DEATH RATES PER 1,000 WHITE POPULATION, BY AGE AND SEX, IN FIVE ECONOMIC LEVELS, BALTIMORE CITY, 1949–51[48]

	15–24		25–34		35–44		45–54		55–64		65–74		75+	
Economic Level	*Rate*	*Ratio**	*Rate*	*Ratio*	*Rate*	*Ratio*	*Rate*	*Ratio*	*Rate*	*Ratio*	*Rate*	*Ratio*	*Rate*	*Ratio*
White Males														
Highest	0.8	100	0.8	100	3.2	100	6.8	100	24.1	100	57.0	100	128.2	100
2	1.0	125	1.5	188	4.3	134	10.9	160	26.6	110	57.2	100	135.2	105
3	1.3	162	1.6	200	4.1	128	12.7	187	29.5	122	56.5	99	124.1	97
4	1.3	162	1.7	212	4.8	150	13.8	203	32.9	136	61.9	108	137.3	107
Lowest	1.4	175	2.2	275	6.4	200	17.6	259	40.5	168	72.8	128	142.3	111
White Females														
Highest	0.4	100	1.1	100	1.8	100	4.8	100	13.4	100	34.2	100	110.2	100
2	0.4	100	0.8	73	2.7	150	5.7	119	13.4	100	36.8	108	106.7	97
3	0.4	100	1.2	109	2.6	144	6.3	131	16.8	125	38.3	112	118.5	108
4	0.7	175	1.3	118	3.1	172	7.6	158	16.1	120	42.4	124	132.8	120
Lowest	0.8	200	2.1	191	3.4	189	7.9	164	21.9	163	42.8	125	123.8	112

* Highest economic level in each group = 100.

highest and next-highest and between the lowest and second-lowest economic levels. Differences remain considerable at ages 55–64, but tend to become much smaller thereafter.

Ellis conducted a very similar study in Houston.[49] The index used to rank census tracts was a modification of the index of social rank developed by Shevky and Williams, which utilizes measures of education, occupation and median family income. Tracts were grouped into quintiles, each of which contained 12 or 13 tracts. The 1949–1951 age-standardized, annual, average death rates per thousand persons for the white population of Houston by socioeconomic level are shown in Table 12. Although class differentials do appear, they differ from those in other studies. The range of differences is smaller, though still substantial. The two top groups of tracts, for males, and the three top, for females, are quite similar in their death rates. Most puzzling, perhaps, is the fact that males in the lowest tract level have a lower rate than do those in the adjacent level. Ellis suggests as a possible explanation the availability of free medical treatment for the lowest group. Group 4, not having such an advantage but having a limited income, may utilize funds for the females, who do have a lower rate than the females in group 5, whereas the males go on working and refrain from using such funds for themselves.

TABLE 12. AGE-STANDARDIZED AVERAGE, ANNUAL DEATH RATES PER 1,000 POPULATION FOR FIVE SOCIAL RANK AREAS, BY SEX, 1949–51, IN HOUSTON,[49] PROVIDENCE AND HARTFORD[50]

Socioeconomic Level	*Houston*		*Providence*		*Hartford*	
	Rate	*Ratio**	*Rate*	*Ratio*	*Rate*	*Ratio*
White Males						
1 (highest)	7.5	100	10.8	100	9.3	100
2	7.9	105	11.8	109	10.3	111
3	9.1	121	11.2	104	11.2	120
4	11.1	148	12.7	118	11.8	127
5 (lowest)	9.9	132	14.0	130	12.5	134
White Females						
1 (highest)	5.4	100	7.3	100	6.6	100
2	5.3	98	7.6	104	7.5	114
3	5.6	104	8.9	122	7.5	114
4	7.1	131	9.4	129	8.2	124
5 (lowest)	7.5	139	10.4	142	8.3	126

* Highest economic level in each group = 100.

Stockwell, whose concern was methodological as well as substantive, presents data exactly parallel to the above. These data also appear in Table 12. He also used a modified form of the Shevky-Williams index, studied deaths in 1949–1951, and included about one-fifth of the number of tracts in each socioeconomic level. Stockwell's data pertain to Providence and Hartford. The class differentials in these two cities are quite similar to those in Houston. In Providence, little difference is found among the top three levels of males or the top two levels of females. Hartford females do not differ among all five strata; levels 2 and 3 and levels 4 and 5 have almost identical rates.

Stockwell proceeded to compute rank order correlation coefficients between the census tracts in each city ranked by age-sex-standardized death rates and each of eight socioeconomic variables (occupation, two education variables, two income variables, two rent variables, crowding). In all cases, the correlation coefficients were significant.[50]

Since the British Registrar General system of social classification is the richest source of data on mortality differences over time among different socioeconomic levels, a number of attempts have been made to construct a comparable ranking in the United States. Breslow and Buell,[51] using the 1950 census for denominator data, classified all deaths of California males, aged 20–64, from 1949 to 1951, in one of five occupational classes. Class I includes professionals and kindred workers; class II is an intermediate group; class III includes sales, clerical and skilled workers; class IV includes semiskilled workers; and class V includes unskilled workers. Data for farmers and farm laborers are presented separately, differing from the British system, because the data on death certificates for these men were thought to be unreliable. All data are presented in terms of the standardized mortality ratio which is a ratio of the observed deaths in an occupation to the age-standardized expected number of deaths, as determined by the age-specific rates for men in all occupations. The standardized mortality ratio for all men is equal to 100. The California data are presented in Table 13.

For the entire age group, a rough inverse gradient is seen between class and mortality. To all intents and purposes, however, classes

I and II do not differ, nor do III and IV, though the latter two have a somewhat higher rate than the former. Class V has a strikingly higher rate. A smoother gradient appears at ages 20–34, and is most strikingly regular at ages 35–44, though in both cases class V is set off from the others by its high rate. Class differences begin to be attenuated at ages 45–54, with the exception of class V. This is even more true for the 55–59 group, and in the 60–64 group almost no class differences exist.

TABLE 13. MORTALITY RATIOS, CALIFORNIA MEN, AGES 20 TO 64, BY SOCIAL CLASS, 1949 TO 1951[51]

	Social Class				
Age Group	*I*	*II*	*III*	*IV*	*V*
20–64*	87	85	94	98	132
20–34*	62	66	77	91	183
35–44	69	76	86	105	171
45–54	90	81	94	102	141
55–59	99	88	99	99	115
60–64	95	96	101	91	107

* Age-standardized.

TABLE 14. ANNUAL DEATH RATES PER 1,000, AND RATIOS, MALES, BY AGE AND SOCIAL CLASS, UNITED STATES, 1950[52]

			*Social Class**		
Age Group		*All Occupations*	*I*	*II–IV*	*V***
20–64	Death rate	8.1	6.4	7.6	10.6
	Ratio***	100	79	94	131
20–24	Death rate	2.0	0.9	1.6	2.6
	Ratio	100	45	80	130
25–34	Death rate	2.2	1.1	1.8	3.2
	Ratio	100	50	82	145
35–44	Death rate	4.4	2.9	4.0	6.5
	Ratio	100	66	91	148
45–54	Death rate	10.9	9.3	10.5	14.2
	Ratio	100	85	96	130
55–64	Death rate	24.7	23.2	24.8	26.9
	Ratio	100	94	100	109

* See text for definition of class.
** White only.
*** Rate for all occupations in each age category = 100.

TABLE 15. ANNUAL DEATH RATES PER 1,000, AND RATIOS, WHITE MALES, BY AGE AND MAJOR OCCUPATION GROUP, UNITED STATES, 1950[54]

		Age Group													
	25–29	20–24		25–29		30–34		35–44		45–54		55–59		60–64	
Major Occupation Group	*SMR***	*X*	*Y**	*X*	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*	*X*	*Y*
All occupations	93	1.7	100	1.6	100	2.0	100	3.9	100	10.1	100	19.4	100	28.8	100
Professional, technical, kindred	82	1.2	73	1.2	70	1.5	76	3.2	81	9.4	93	18.9	98	29.2	101
Managers, officials, proprietors, nonfarm	85	1.5	86	1.3	79	1.5	76	3.3	85	9.5	94	18.9	98	28.9	100
Clerical, kindred	83	0.9	54	1.3	78	1.5	76	3.3	86	9.6	95	18.2	94	26.9	93
Sales	94	1.1	62	1.1	66	1.7	82	3.6	94	11.0	109	21.7	112	31.8	110
Craftsmen, foremen, kindred	94	1.8	103	1.6	97	2.0	99	4.0	102	10.1	100	20.8	107	32.1	111
Operatives, kindred	94	1.8	106	1.8	108	2.2	107	4.1	106	10.3	102	19.4	100	28.6	99
Service, except private household	116	1.2	72	1.6	98	2.4	117	5.1	133	13.8	136	22.4	116	29.2	101
Laborers, except farm and mine	131	2.6	149	2.8	171	3.6	178	6.5	167	14.5	144	23.8	123	34.9	121

* X = death rate per 1,000. Y = ratio, computed on the basis of rate for all occupations in each age category = 100.

** Standardized mortality ratios are computed on the basis of the entire population. Since non-white are excluded in this table, SMRs can fall below 100.

A more ambitious attempt along the same lines was conducted by Guralnick, who analyzed all male deaths in age group 20 to 64 in the United States in 1950.[52] In view of the fact that one primary purpose was to compare the United States data with the British, Guralnick collapsed classes II to IV to make this intermediate group comparable in the two countries. The data are presented in Table 14. For the entire age group, the picture is quite similar to that presented in the California study: a linear inverse gradient, with the intermediate occupational level being closer to class I, and the major gap occurring between class V and the intermediate group. Another publication by Guralnick,[53] in which standard mortality ratios are given separately for the five classes, presents figures almost identical with the California figures. The standardized mortality ratios for all United States males aged 20–64, in 1950, from class I to class V, are: 83, 84, 96, 97, 120. These ratios are for whites only, except for class I, which contains a few nonwhites. Once again classes I and II do not differ, nor do classes III and IV.

Examination of the age-specific rates in Table 14 shows the largest class gap to lie in the 25 to 44 age group, with classes II to IV being closer to class I than to class V. A considerable gap remains at ages 45–54, but it is substantially narrowed by ages 55–64.

Guralnick also analyzed the same 1950 data along more traditional American lines, using the occupational classification developed by Edwards for the United States Census.[54] This scheme seeks to rank occupations by socioeconomic levels. The standardized mortality ratios presented in Table 15, for white males aged 25–59, shows an inverse gradient, but one which does not distinguish among all of the eight occupational groups. The lowest ratios are found among the top three groups; they are followed closely by sales, skilled and semiskilled workers, whose ratios are identical. Service workers fare substantially poorer, and, finally, laborers have a considerably higher mortality ratio.

This pattern does not hold in all age groups. Prior to age 30, only the roughest gradient appears, though laborers fare markedly worst. A clear gradient appears in the 30–34 groups, which is maintained in the next ten year cohort. In both cases, the ratios of the top three

occupational groups are nearly identical. This pattern holds in ages 45–54 and 55–59 in part. Three mortality levels can be distinguished in these groups, which do not conform to the socioeconomic ranking: non-manual workers except sales workers; sales, skilled and semi-skilled workers; and service and unskilled workers. In the oldest age category, only laborers continue to differ from all other groups.

A state-wide ecological study merits mention in passing. Hamilton[55] analyzed the age-adjusted 1950 death rates in the 100 counties of North Carolina. Three of the eight variables used in the multiple correlation analysis may be regarded as socioeconomic measures: percentage of families owning own homes; percentage of homes with modern plumbing and not dilapidated; mean number of grades completed by adults. Only the first of these, with a correlation of –0.69 with mortality, makes a statistically significant contribution toward explaining the intercounty mortality variation. Home condition and education measures have almost a zero correlation with mortality rates. Of far greater importance are variables such as percentage of whites and ratio of hospital beds to the population.

Despite the tremendous shifts in the London population and the overall decline of about one million persons during the two decades following 1930, Martin's data for 1950–1952, correlating age-standardized death rates with percentage of two or more persons per room, average number of persons per room and percentage of employed in classes IV and V in the 28 London boroughs, continue to show highly significant correlations. For these three variables, the correlations were: 0.36, 0.80 and 0.90.[56]

Hansluwka's review of Austrian mortality data[57] begins with reference to a number of early studies which were based upon workers covered by social insurance, reflecting only a very small part of the population. He does, however, present data for the entire employed population for 1951–1953. Table 16 presents these rates for males in different age groups. For the very gross categories of "middle and upper class" and "working class" occupations, few sizable differences emerge, though the latter's rates are higher. At ages 14–17, the former's rate is appreciably higher. At ages 60–64, however, the working class has a much higher death rate. Hansluwka

TABLE 16. ANNUAL DEATH RATES PER 1,000 EMPLOYED MALES, BY AGE AND SOCIOECONOMIC CATEGORY, AUSTRIA, 1951–53[57]

Age Group	*Middle and Upper Class Occupations* (*1*)	*Working Class Occupations* (*2*)	*Ratio of* (*2*) *to* (*1*)*
14–17	2.0	1.3	68
18–29	1.7	1.8	110
30–49	3.4	3.8	112
50–59	12.6	13.4	106
60–64	15.8	24.4	154
65 and over	65.1	73.9	114

* Rate of (1) = 100.

also presents a bar chart showing mortality in Vienna in 1951–1953. The city's 23 districts were classified on the percentage of workers of the labor force in each district and grouped into four categories. The data, he concludes, show "a clearcut pattern of social grading of mortality."

A problem which has consistently bedevilled those who seek to seek to study socioeconomic differentials on mortality by use of death certificates and census records is the frequent noncomparability of data in the two sources, which leads to overestimation of the denominator in some occupations and underestimation in others, or difficulty in making any calculations. The nature of the problem has been explored, theoretically and empirically, by several writers.[58] Among these, Kitagawa and Hauser have sought to overcome the difficulties by individual matching of 340,000 death certificates from deaths occurring in the United States from May through August, 1960, with census information recorded for these individuals in the 1960 census. In addition, personal interviews were conducted with individuals knowledgeable about 94 per cent of a sample of 9,500 of the decendents.

A preliminary analysis of the data using education and family income for white persons has been reported, though not yet published.[59] Consideration of the education variable, which is broken down into four levels of completed education by persons 25 and older, shows an inverse gradient of mortality rates by amount of education for both sexes in ages 25 to 64. Interestingly enough, this

gradient disappears for males 65 and over, but remains quite strong for females of this age.

The latest mortality study available is Tsuchiya's presentation of standardized mortality ratios for an occupational-industrial categorization of Japanese males, age 15 and over, in 1962.[60] No clear occupational gradient emerges from the data. The ratios, ranked from low to high, are: "management," 58; "clerks," 67; "mechanics and simple," 88; "sales," 89; "professional and technical," 92; "transporting and communicating," 135.

CLASS MORTALITY DIFFERENTIALS IN ENGLAND AND WALES

Since William Farr initiated the systematic study of occupational mortality statistics in 1851, the decennial reports of the British Registrar General for England and Wales have served as the outstanding source of information on the relationship of social class and mortality. For many years, the focus was on differential mortality risks of specific occupations. In the analysis of the 1910–1912 data, the various occupations were, for the first time, grouped together into five social classes, which excluded textile workers, miners and agricultural laborers, for whom separate statistics were presented. This classification was, in large part, industrial. Substantial changes were introduced in the following decade, making the classification more properly occupational.

In 1930–1932 a further step was taken in moving from a concern with occupational hazards toward one with comparison of mortality risks of people sharing a given social environment: the mortality of married women classified according to husband's occupation was introduced as a systematic part of the data analysis. Since this time, despite reclassification of various occupations, the five-class scheme of the Registrar General has been maintained. During the war years, no census was taken. Morever, a number of technical difficulties have arisen in the analysis of the data based on the 1961 census, hence nothing has yet been published for the latest period.

The Registrar General identifies 586 occupational unit groups to which every occupation in the country is assigned. Each of these

groups is assigned as a whole to one of five social classes, on the basis of the predominant characteristics of the majority of persons in the unit group. "The basic common factor of all groups is the kind of work done and the nature of the operation performed. . . . The occupations included in each category [of the five social classes] have been selected so as to secure that, so far as is possible in practice, the category is homogeneous in relation to the basic criterion of *the general* standing within the community of the occupations concerned."[61]

The five social classes are described as follows (the proportion of occupied and retired men aged 15 and over in 1951 is given in brackets);

Class I. Higher administrative and professional occupations and business directorships (3.3 per cent).

Class II. Other administrative, professional and managerial, and shopkeepers: persons responsible for initiating policy and others without this responsibility, but with some responsibility over others (15 per cent).

Class III. Clerical workers, shop assistants, personal service, foremen, skilled workers: skilled workers with a special name, special responsibility and adaptability (52.7 per cent).

Class IV. Semiskilled workers: persons who are doing manual work which needs no great skill or training but who are doing it habitually and in association with a particular industry (16.2 per cent).

Class V. Unskilled workers: laborers, cleaners and other lowly occupations (12.8 per cent).

Farmers and farm managers are included in class II and agricultural workers in class IV. Also, class III, which includes more than half the population, is composed of both manual and non-manual workers.

From the great amount and variety of data available in the reports of the Registrar General and papers based on these reports, those that seem to be the most important have been selected for present purposes. These are presented in Table 17. Collins' analysis

of the 1910–1912 data for occupied and retired males aged 15 and over, which refers to classes I, III and V and excludes textile workers, miners and agricultural laborers, shows a regular inverse gradient, with the largest gap being between class III and class V.[62] Stevenson's figures for the same period,[63] which also exclude the same three occupational categories, but refer to males aged 25–64 in the five social classes, show a similar gradient. The ratios for classes II, III and IV, however, are nearly identical, and not very much higher than for class I. Stevenson argued that about ten per cent of the

TABLE 17. STANDARDIZED DEATH RATES PER 1,000 AND STANDARDIZED MORTALITY RATIOS, ENGLAND AND WALES, FOR SELECTED AGE-SEX GROUPS AND TIME PERIODS, BY SOCIAL CLASS

Time Period	*I*	*II*	*III*	*IV*	*V*	*Population Group*
1910–12						
Death rate per 1,000	12.0	—	13.6	—	18.7	Occupied and retired males, age 15+, excludes textile workers, miners, agricultural laborers.[18]
Ratio (I = 100)	100	—	114	—	156	
Standardized mortality ratio	88	94	96	93	142	Males, age 25–64, excludes textile, miners, agricultural laborers.[63]
Standardized mortality ratio	88	94	96	107	128	As immediately above, modified by Stevenson.[63]
1921–23						
Death rate per 1,000	7.4	8.6	8.7	9.2	11.5	Males[64]
Ratio (I = 100)	100	116	117	124	155	
Standardized mortality ratio	82	94	95	101	125	Males, 20–64*
1930–32						
Standardized mortality	90	94	97	102	111	Males, 20–64*
ratio	81	89	99	103	113	Married women, 20–64*
1949–53						
Standardized mortality	98	86	101	94	118	Males, 20–64*
ratio	96	88	101	104	110	Married women, 20–64*
	100	90	101	104	118	Occupied males, 20–64, adjusted to control for occupational changes since 1930–32.
Death rate per 1,000	6.6		6.4		9.5	Males, 20–64, excludes agricultural workers.[65]
Ratio (I = 100)	100		97		144	

* See reference 61 (Registrar General, page 20). Logan (ref. 61, p. 204) gives only figures for 1950.

laborers on the census are misclassified as class IV rather than class V, which tends to lower the rates for the former and increase those for the latter. Changing the denominators to this extent would, he notes, produce a smoother gradient, as shown in Table 17. Collins also took the 1900–1902 and 1890–1892 data for 100 specific occupations and classified them as they had been classified in 1910, adjusting the death rates for age. "The results," he comments, "need not be presented here since they merely confirm the findings for 1910–1912." Collins proceeded to analyze the age-specific rates, which show that class differentials were largest in the 25–54 age groups. This is supported by Stevenson's analysis.

A similar picture emerges from the data for 1921–1923, despite the significant changes in classification. The gap between classes I and II is somewhat greater than in the previous decade. Classes II and III have near-identical ratios and class IV a somewhat higher ratio, while class V is still widely distinct from the others. Britten's analysis[64] of the age-specific rates compares class I to class III and class III to class V. For the former comparison, the greatest gap is at ages 16–19, and declines with regularity at each succeeding age. The pattern of the class V:III ratio, however, is different. Here the greatest gap is at ages 35–44 and, though a bit less so, at 45–54.

By 1930, class differentials, though now presenting a regular inverse gradient, had narrowed, with standardized mortality ratios of 90 for class I and 111 for class V, for males, aged 20–64. The innovation introduced in the data analysis for these years shows that general socioeconomic differences rather than specific occupational hazards were crucial in the relationship between class and mortality. This is seen in the data for married women classified by husband's occupation, in which the gradient is somewhat more steep than for the males.

The latest available data, for 1949–1953, show a rather different picture than that of previous decades. Class V still has a substantially higher ratio than the other classes; for the males, it is even higher than in 1930. Class II, however, now has the lowest ratio, followed by classes IV, I and III, in that order. For married women, the in-

verse gradient persists, except that here too, as among the males, class II has a lower ratio than class I. The relatively low ratio of class IV may well be an artifact of classificational changes from one social class to another. Adjustment of the data for occupied males to take account of these changes "has had the important effect of raising the SMR of Social Class IV from 94, where it was second lowest, to 104, where it occupies the second highest position, as it did in 1921–1923 and 1930–1932."[65] Guralnick's analysis of the British data,[66] excluding all gainfully employed in agriculture, and collapsing classes II–IV, shows that this latter group had a very slightly lower death rate than class I, while class V remains very much higher.

Moriyama and Guralnick,[67] in their attempt to compare data for males from the United States and England and Wales, present age-specific ratios for the latter combining the three middle classes and excluding all engaged in agriculture, for 1950 only. For most age groups, little difference is seen between class I and classes II–IV; this is particularly true from age 45 upwards. Class V has consistently higher rates; but whereas this is the case to a moderate degree at ages 20–24, the differential increases thereafter, reaching a peak at ages 35–44, after which it declines again and nearly disappears at ages 60–64. (The respective ratios of the three class groups I, II–IV and V, taking the rate of all occupations as 100, are: at ages 20–24, 102, 94, 122; at ages 25–34, 90, 95, 138; at ages 35–44, 83, 96, 143; at ages 45–54, 98, 97, 129; at ages 55–59, 99, 99, 115; and at ages 60–64, 100, 101, 106.)

Viewing the data for England and Wales in overall terms, class differentials in mortality in the twentieth century both have and have not declined. On the one hand, the differentials between the middle levels (among whom mortality rates differed little even in the earlier years) and class I have more or less disappeared. On the other hand, class V is still strikingly worse off than the rest of the population. Though indications are that its relative position improved in the earlier decades of the century, this does not seem to be the case between 1930 and 1950.

CONCLUSIONS

This statistical examination clearly provides no basis to reject the inference drawn from the figures of the Titanic disaster. Despite the multiplicity of methods and indices used in the 30-odd studies cited, and despite the variegated populations surveyed, the inescapable conclusion is that class influences one's chance of staying alive. Almost without exception, the evidence shows that classes differ on mortality rates. Only three such exceptions were found, indicating no or almost no class difference. Altenderfer, comparing 1939–1940 mortality rates of 92 United States cities classified into three mean income groups, shows a relatively small difference among them. Szabady, comparing nonagricultural manual and non-manual workers in Hungary in 1959–1960, shows the same. In both cases, the classification is so gross as to minimize differences which a finer analysis might reveal. Only DeWolff and Meerdink's study in Amsterdam in 1947–1952 can legitimately be regarded as strongly contradictory of the link between class and mortality. Their data, however, must be seen in the context of a population which has just about the lowest death rate ever recorded. This is not to dismiss the importance of their findings. On the contrary, it suggests the extremely important hypothesis that as the overall death rate of a population is lowered, class differentials may similarly decline.

This hypothesis finds support in an overall trend reflected in the studies reported. In the earlier studies, the differential between the mortality rates of extreme class groups is about a 2:1 ratio, but later studies show a narrowing of this differential, so that by the 1940's, a 1.4:1 or 1.3:1 ratio is much more typical. As can be seen from studying the death rates, these years witnessed a progressive decline in the overall death rate. At the same time, a cautionary note must be exercised. Despite an undoubted overall decline in mortality in the past three decades, the trend in the earlier decades of the century toward the closing of the class gap has been checked, if not halted.

This indication focuses on the differences between mortality rates of the lowest class and other classes. A more accurate picture of the

overall pattern would be to suggest that what has happened is a blurring, if not a disappearance, of a clear class gradient, while class differences remain. On the basis of the existent data—using, for the sake of convenience, a five-fold class distinction, this being the most popular—it is difficult to conclude whether classes I to IV now no longer differ in their mortality rates, or whether classes I and II have the lowest rates, and II and IV have higher rates, though not necessarily substantially so. What seems to be beyond question is that, whatever the index used and whatever the number of classes considered, almost always a lowest class appears with substantially higher mortality rates. Moreover, the differential between it and other classes evidently has not diminished over recent decades.

At this point discussion of the complex question of explanations for such patterns would not be appropriate. A possibility could be suggested, however. The truly magnificent triumphs over infectious diseases have been crucial in both narrowing the overall class differentials and in nearly eliminating differentials among all but the lowest class. In recent decades, however, access to good medical care, preventive medical action, health knowledge, and limitation of delay in seeking treatment have become increasingly important in combating mortality, as chronic diseases have become the chief health enemy in the developed world. In these areas, lower class people may well be at a disadvantage. As such factors become more and more important, as the historical supposition presented in the first pages of this paper suggests, increasing class differentiation may occur. This approach does not necessarily preclude consideration of genetic selection and what has commonly come to be called "the drift hypothesis."

The data reviewed lead to a further conclusion. With amazing consistency, the class differentials are largest in the middle years of life. This is no less true in the latest than in the earliest studies. Over and over again, the greatest gap is found in young and middle adulthood. The predominant pattern characterizing class differentials by age is that in which class differences are moderately high in the younger ages, rise to a peak at ages 30 to 44, begin to decline at that point and tend to disappear beyond age 65. Where a given

set of data varies from this pattern, it is in one of two directions: in the former cases, class differentials are lowest in the younger and older groups; in the latter, the decline in class differentials only begins in late middle age.

This pattern of greatest class differences in middle adulthood may be linked to the two historical suppositions which have heretofore been presented. To hypothesize in more general terms, when mortality rates are extremely high or extremely low, class differences will tend to be small. In other words, when men are quite helpless before the threat of death, or when men have made great achievements in dealing with this threat, life chances will tend to be equitably distributed. On the other hand, when moderate progress is being made in dealing with this threat, differential consequences are to be expected. The crucial idea that may be involved here is that of preventable deaths, at any given level of knowledge, technique and social organization. Where and/or when such deaths are concentrated, class differentials will be greatest, unless appropriate social action is taken. This differential is not inevitable.

Much more, of course, could be said in summary, with reference to both substantive and methodological issues. Needless to say, consideration of patterns of class differences by cause of death is essential for a full understanding of this relationship. But this would have extended the paper into a book.

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