

Sex Differences in the Trend of Mortality From Certain Chronic Diseases

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Differences in the trends of mortality among men and women for cardiovascular-renal diseases, ulcer of the stomach or duodenum, diabetes mellitus, and hernia and intestinal obstruction are examined. A similarity between the pattern of trends for the various age-sex groups in ulcer death rates and in cardiovascular-renal death rates is noted, and the implications of this similarity are discussed.

IN ANALYZING the trend of mortality from the major cardiovascular-renal diseases during the period 1920 to 1947, Moriyama and Woolsey (1) found pronounced differences in the trends for men and women. There was a marked contrast in the direction of the trends for white men and women between ages 35 and 65. Death rates for the major cardiovascular-renal diseases increased considerably among white men in these ages, while the corresponding rates for women were declining.

Various hypotheses have been suggested to

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explain this phenomenon. Some of these are: differential effects of changing dietary habits upon the two sexes; differential effects of worry and personal tensions; differential effects of exercise or lack of exercise; changing patterns of urban and rural residence; and differing effects on the aging generation of men and women, which when young passed through the stress of World War I and the influenza pandemic of 1918-19.

While the explanation cannot be finally determined without a great deal of careful investigation, some light may be thrown on the subject by looking for other causes of death which exhibit a disparity in trend between the two sexes similar to that found for the cardiovascular-renal diseases. For this reason, death rates by age and sex for ulcer of the stomach or duodenum, diabetes mellitus, and hernia and intestinal obstruction are presented here for the two 6-year periods, 1921-26 and 1942-47.

The selection of 2 of these 3 causes of death for investigation was made because of the association which is known to exist between death rates for these diseases and 2 factors which may have something to do with the observed trends for cardiovascular-renal mortality. If one factor, tension and worry, played an

important part in the trends seen in mortality from chronic diseases of the heart, arteries, and kidneys, a similar pattern with respect to sex differentials might reasonably be expected to show up in the mortality for ulcers. On the other hand, diabetes death rates are known to be related to overweight. Consequently, finding trends of diabetes mortality which exhibited a disparity between the sexes like that seen for the cardiovascular-renal diseases would slightly strengthen the argument for overweight as an explanation of the latter. It was recognized, however, that diabetes was not an ideal selection from this standpoint. The introduction of insulin, which began to affect diabetes mortality in the middle of the 1920's, and, also, certain procedures in the assignment of primary cause of death may have modified the influence of changing proportions of overweight persons on the diabetes death rates.

Death rates for hernia and intestinal obstruction are probably not entirely independent of either of the two factors: tension and worry; and overweight (2). However, there is good reason to believe that their influence on mortality from this cause is very much less than on the two other causes of death. Hence, hernia and intestinal obstruction was chosen as a control for the other two, although "control" is not used here in the strict experimental sense.

Description of Method

The rates shown are for white men and women, ages 25-84, in the Death Registration States of the United States. (A time-series of death rates for the "registration States" refers to statistics which in a particular year are based on all States in the registration area in that year.)

The average number of deaths for each of the 4 causes of death in 3-year periods from 1921-23 through 1945-47 was first computed. This was done separately for each age and sex group shown in the table. Death rates were then computed on the basis of the estimated population for the middle year of each 3-year period. Because the trends for the entire 27-year span were observed to be essentially linear, it was concluded that a comparison of rates in two 6-year periods at the beginning and end of the inter-

val would serve adequately for studying the changes between 1921 and 1947.

The death rates specific for age and sex in the two 3-year periods 1921-23 and 1924-26 were therefore combined to obtain an estimated rate for the 6-year period, 1921-26. In a like manner, estimated rates for the period 1942-47 were computed. The age-specific rates for men and women in these two periods were then compared by means of ratios, the rate for the later period having been divided by the corresponding rate for the earlier one.

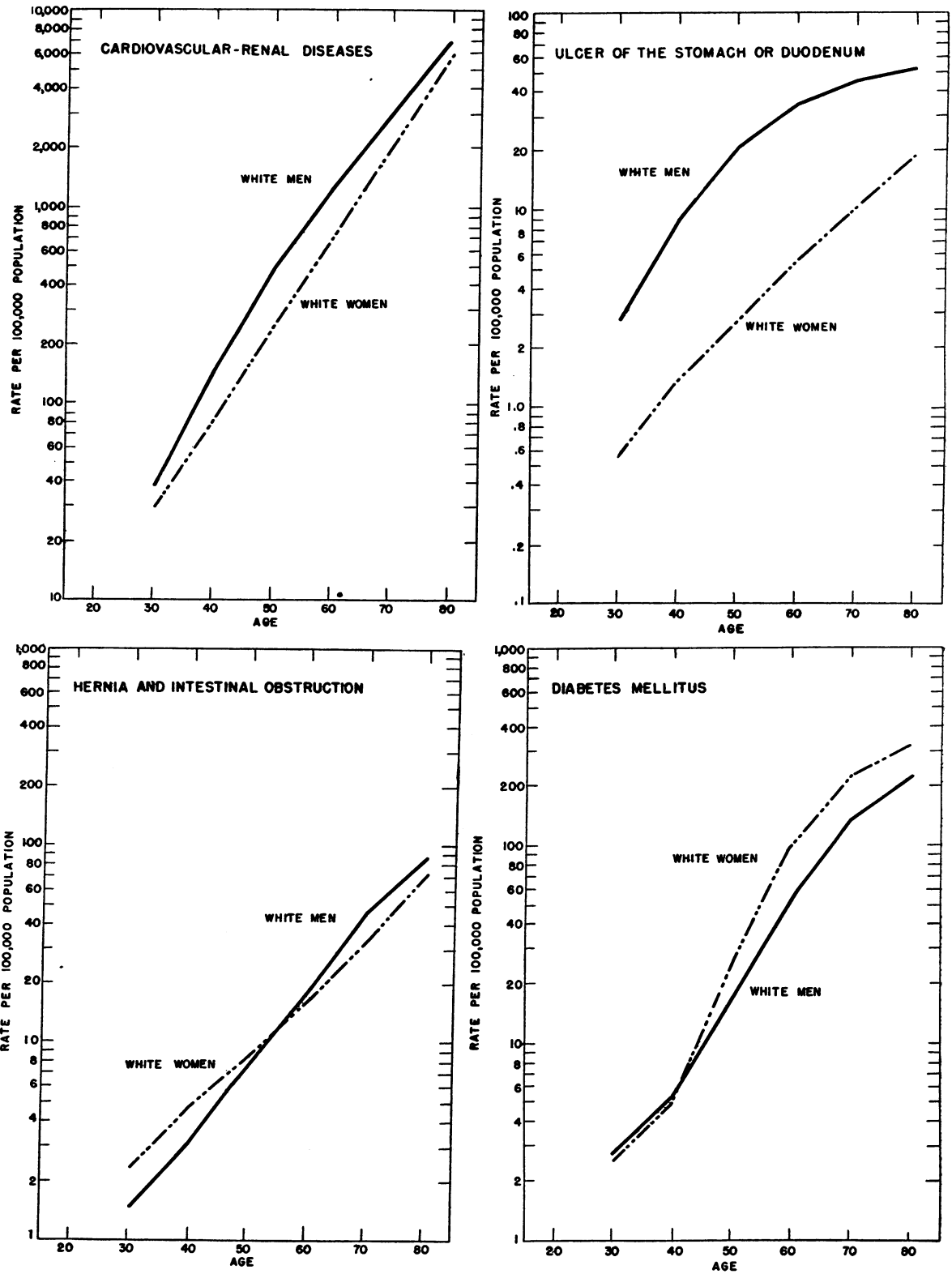
The study was restricted to the 27 years beginning with 1921 because the relative incompleteness of the death registration area prior to that time raises difficult questions concerning comparability of population groups. The death registration area did not actually cover the entire United States until 1933. However, by 1920 there were 34 States and the District of Columbia in the area which then contained 83.2 percent of the white population of the country. For a discussion of the effect of changes in the death registration area on trends of mortality for the cardiovascular-renal diseases, see reference 3.

Discussion

There are two disturbing influences that could alter the trends of mortality in the 27-year span, but neither one is believed to be capable of causing any serious distortion of the trends used in this study. One factor is the effect of changes in the number of States included in the death registration area. The other is the effect of periodic revisions of the International List of Causes of Death, which classifies mortality by cause. Increasing specificity in diagnosis and the improvement of medical knowledge of the nature of various diseases and their relationship to one another have made revision of the International List necessary.

However, the characteristics of the white population of the States in the death registration area from 1921 to 1933 differed only slightly from those of the entire country. Furthermore, the causes and groups of causes selected for examination were chosen because they were

Figure 1. Age-specific death rates for 4 diseases, 1942-47.



not seriously affected by the 1929 and 1938 revisions of the International List.

A more important consideration is the fact that the major emphasis here is on the comparison of trends for men and women. There is no reason to suppose that either of the above-mentioned factors would influence the trend for one sex in any way more or less than it would influence the trend for the other.

Age-specific death rates among white men and women for the major cardiovascular-renal diseases, ulcer of the stomach or duodenum, dia-

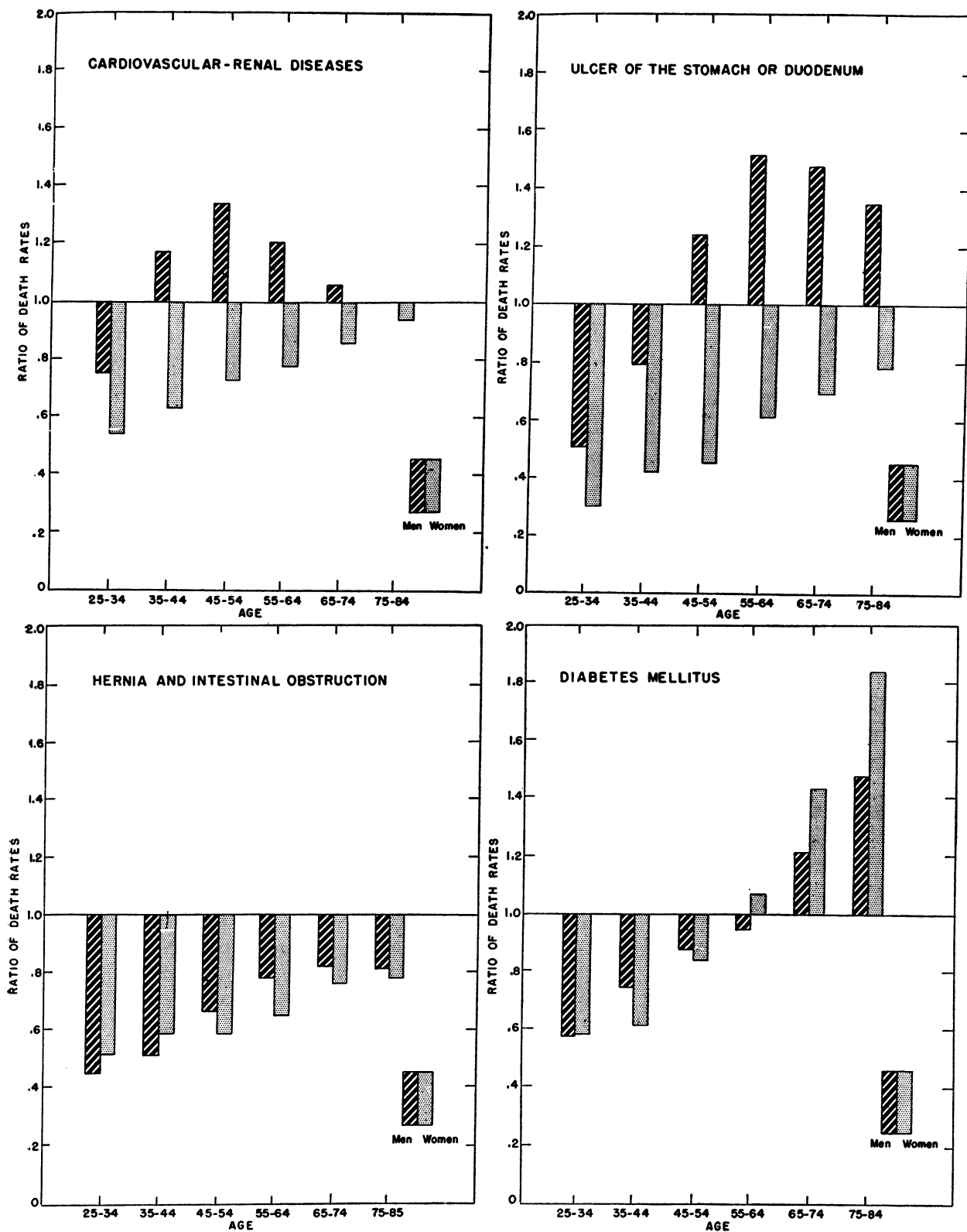
betes mellitus, and hernia and intestinal obstruction are shown in the table for the two 6-year periods, 1921-26 and 1942-47. The rates for the later period are also shown in figure 1 in which all four diseases are plotted on the same logarithmic scale to facilitate the comparison of relative differences between the sexes at the various ages. For each age and sex group, ratios of the 1942-47 rates to the corresponding 1921-26 rates are presented in the table and in figure 2. The same ratios are grouped by age in figure 3 so that the change in mortality for

Age-specific death rates per 100,000 population for 4 diseases among whites, by sex, for 1921-26 and 1942-47, and the ratio of the rates: United States Death Registration States

Age groups	Death rates				Ratio of rates 1942-47 to 1921-26	
	1921-26		1942-47		Men ¹	Women
	Men	Women	Men ¹	Women		
Cardiovascular-renal diseases						
25-34.....	48.3	53.6	36.2 (41.4)	28.9	0.749 (0.857)	0.539
35-44.....	123.1	127.7	143.7	80.4	1.167	.630
45-54.....	368.4	340.0	495.2	248.9	1.344	.732
55-64.....	1,052.9	894.5	1,271.1	702.1	1.207	.785
65-74.....	2,855.0	2,512.5	3,033.1	2,167.4	1.062	.863
75-84.....	6,918.6	6,328.9	6,907.8	5,973.6	.998	.944
Ulcer of the stomach or duodenum						
25-34.....	5.43	1.88	2.73 (2.90)	0.56	0.503 (0.534)	0.298
35-44.....	11.26	3.22	8.90 (9.03)	1.35	.790 (.802)	.419
45-54.....	16.69	5.97	20.70	2.71	1.240	.454
55-64.....	22.67	8.88	34.45	5.43	1.520	.611
65-74.....	30.05	14.82	44.56	10.24	1.483	.691
75-84.....	38.20	24.07	51.58	18.81	1.350	.781
Hernia and intestinal obstruction						
25-34.....	3.23	4.46	1.45 (1.55)	2.30	0.449 (0.480)	0.516
35-44.....	6.06	8.05	3.11 (3.15)	4.72	.513 (.520)	.586
45-54.....	11.68	14.57	7.80	8.57	.668	.588
55-64.....	23.46	24.91	18.30	16.23	.780	.652
65-74.....	49.68	44.64	40.69	33.99	.819	.761
75-84.....	105.54	90.92	85.75	71.03	.812	.781
Diabetes mellitus						
25-34.....	4.73	4.25	2.72 (2.90)	2.47	0.575 (0.613)	0.581
35-44.....	7.00	7.95	5.20 (5.28)	4.87	.743 (.754)	.613
45-54.....	18.83	28.92	16.53	24.36	.878	.842
55-64.....	55.28	92.36	52.59	98.92	.951	1.071
65-74.....	109.25	159.67	132.81	229.15	1.216	1.435
75-84.....	147.67	170.14	218.69	313.64	1.481	1.843

¹ Rates and ratios in parentheses are based on populations that do not include Armed Forces overseas.

Figure 2. Ratio of age-specific death rates in 1942-47 to corresponding 1921-26 rates, by disease.



the four disease groups among white men and women of a given age may be compared more easily.

It can be seen in figure 1 that the greatest relative excess in the male rate over the female rate for the cardiovascular-renal mortality occurs at ages 45-54. For ulcer of the stomach or duodenum, this maximum discrepancy occurs in the same age group. The largest relative discrepancy between the sexes for diabetes mellitus occurs after age 55, with women exhibiting the higher rate. It is apparent that the relative sex difference in mortality is very much greater for ulcer of stomach or duodenum than it is for the other three disease categories.

Age-Sex Patterns of Change

In both the cardiovascular-renal diseases and ulcers, the mortality among white women has been declining in the period studied, but the rate of this decline is consistently less with each succeeding age group from 25 to 85. Among men, there is a downward trend in mortality for both of these disease groups in the 25-34 age group. This downward trend changes to an upward trend in middle age, but beyond a certain age the rate of the increase declines. The greatest increase in the male cardiovascular-renal mortality is observed at ages 45-54, while at ages 75-84 there has been little or no change. In the ulcer mortality, however, the peak rate of increase among men is seen to be at ages 55-64. At later ages it decreases significantly, but the ratio of mortality in 1942-47 to that in 1921-26 does not drop back to 1.0 in the 75-84 age group as it does in the cardiovascular-renal group.

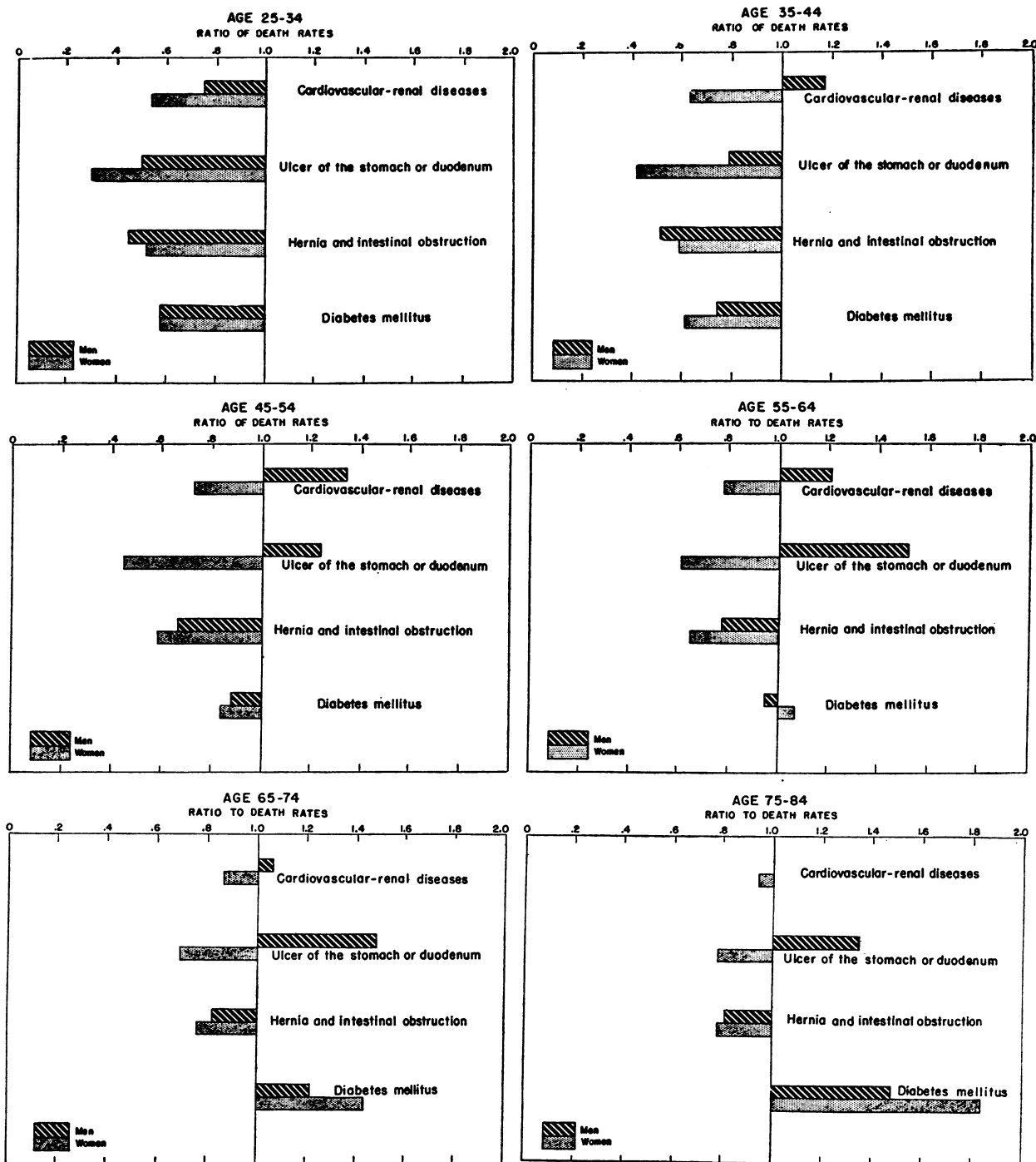
The pattern of change by sex and age for hernia and intestinal obstruction is quite different from that for the cardiovascular-renal diseases and ulcers. The pattern for diabetes is again different. Hernia mortality for both sexes has declined in all age groups although to a lesser extent in the older ages. With the exception of the first two age groups, 25-34 and 35-44, female mortality has decreased more rapidly than male mortality, but the difference between the trends for the sexes is very much less marked than in the cardiovascular-renal

diseases and in ulcers of the stomach or duodenum.

Diabetes mortality dropped about 40 percent in the 25-34-year age group during the 27-year span, but the picture with each succeeding age group appears less favorable. The mortality among the aged from diabetes is known to be heavily weighted with deaths of persons succumbing with the disease rather than from it. Although there has been an increase in the number of deaths from diabetes, the death rate of diabetic patients has definitely improved. As Dublin and Lotka point out (4), the probability of diabetes being diagnosed has greatly increased, and consequently, it is not at all surprising that the number of death certificates on which diabetes is mentioned has increased. Hence, the apparently unfavorable trend beyond age 65 is probably the result of the increasing life expectancy of diabetic patients. It is the sex differential in trend, rather than the trend itself with which this study is concerned, and here it is seen that after age 55 the trend for women is less favorable than that for men. Below age 55 the trend for men has been less favorable in 2 of the 3 age groups.

The pattern of change by age and sex for hernia and intestinal obstruction or for diabetes is not at all similar to that for the major cardiovascular-renal diseases. However, the similarity in the pattern of change for cardiovascular-renal and ulcer of the stomach or duodenum death rates is striking. This resemblance may be purely coincidental in the sense that the factors responsible for the changes in cardiovascular-renal mortality may be quite different from those producing the changes in the ulcer death rates. It is also possible that the same factors are responsible in both trends but that these factors have nothing to do with the etiology of the diseases. For example, there might have been an increasing opportunity for men to obtain a diagnosis of an ulcer or a heart condition—an opportunity which, for some reason or other, women were not getting. The evidence presented here by no means constitutes proof, nor does it even create a strong likelihood that tension and worry are the cause of the relatively unfavorable mortality among men of the later working ages.

Figure 3. Ratio of age-specific death rates in 1942-47 to corresponding 1921-26 rates, by age group.



However, this evidence should be taken into account in choosing the hypothesis for further investigation. More specifically, the similarity between the trends for cardiovascular-renal and ulcer mortality makes the investigation of the relationship between psychosomatic factors and

the cardiovascular-renal diseases a particularly promising possibility.

It must be emphasized once more that the differences between the rate of change in mortality for the sexes is of concern here rather than the magnitude of the rate of change itself.

Owing to the procedure employed until 1949 in assigning the primary cause of death for statistical purposes (5), the death rate did not always measure accurately the trend in the inherent risk of death from a given disease. This was particularly true of diabetes, since the former procedure for the selection of primary cause resulted in the assignment of many deaths to diabetes in cases in which this disease was listed by the physician as merely a contributory cause. An investigation conducted by the Metropolitan Life Insurance Co. in 1935 indicated that "53 percent of 3,519 deceased diabetic policyholders, for whom the facts were known, died from degenerative conditions of the heart, kidney, or arteries, 13 percent from infectious diseases, 4 percent from cancer, and 4 percent from tuberculosis" (4, p. 339). Yet, if diabetes had been mentioned on the death certificate in these cases, the death would have been classified as a "diabetes" death in the official death statistics for at least half of the cases. However, there is no obvious reason for supposing that

this factor would tend to operate differentially on the mortality for either sex.

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Closing of Two PHS Hospitals

Two Public Health Service hospitals—one at Cleveland and one at Fort Stanton, N. Mex.—are in the process of closing.

Closure of the Fort Stanton facility, a tuberculosis sanatorium, will be completed when its patients are transferred to other Service hospitals. Curtailment of operating funds for Service hospitals was the reason for the decision.

At Cleveland, the 190-bed general hospital has discontinued admissions. When its present patients, mostly veterans, have been discharged or transferred, an outpatient clinic will be established in downtown Cleveland. Emergency hospitalization for Service beneficiaries will be provided by contract arrangement at local hospitals.