## SOME RECENT CHANGES IN MORTALITY AMONG ADULTS IN THE UNITED STATES

A summary of one<sup>1</sup> of a series of studies on diseases of adult life, made by the Division of Research of the Milbank Memorial Fund

NHAT the trend of general mortality in adult life and of mortality from such diseases as heart disease and cancer has not been favorable in recent years has been pointed out by various writers. The average expectancy of life after reaching maturity has declined during the past decade, according to figures published by the Metropolitan Life Insurance Company,<sup>2</sup> although some gain in the expectation of life at birth is indicated, as a result chiefly of the improvement in infant mortality. With the reduction in mortality in the early years of life and from the more serious infectious diseases, the constitutional and degenerative diseases of adult life have taken the leading position as causes of death. To combat these diseases, the cooperation of the individual is necessary, and numerous efforts are now being made by health and medical agencies to encourage people to have periodic examinations for the purpose of discovering any impairments or evidences of disease in their early stages.

Changes in conditions affecting the health of adults can be studied only through changes in mortality, since comparable data on the prevalence of disease and ill-health are not available over a period of years. A marked difference in the trend of mortality among men and women who had reached middle life is indicated for the years since 1920 and it is pur-

<sup>&</sup>lt;sup>1</sup>Complete study was published in the Journal of Preventive Medicine, May, 1930.

<sup>&</sup>lt;sup>2</sup>Statistical Bulletin, Metropolitan Life Insurance Company, February, 1929.

posed in this article to consider the changes in mortality for specific sex-age groups and in the death rates at specific ages for the major causes of adult mortality.

The best health years so far experienced in the United States are 1921 and 1927; in neither year was the death rate affected by any unusual prevalence of respiratory conditions nor by any other general epidemic or unfavorable situation. Accordingly, these years have been selected for a comparison of specific sex and age groups in order to reveal what differences in the mortality experience of the two years among adults at different ages occurred in spite of the similarity of the gross rates. The mortality data used throughout this paper refer to the original death registration area composed of the New England States, Indiana, Michigan, New Jersey, New York and the District of Columbia. For this area, the death rate among males was 12.5 both in 1921 and 1927<sup>3</sup>. For females the death rate showed some decline, being 11.8 in 1921 and 11.2 in 1927, and in both years the total rate for females of all ages was more favorable than the male death rate.

The death rates for males at specific ages in the two years are compared in the upper half of Fig. 1, and the same comparison for females is presented in the lower half of this figure. Comparing first the mortality among males, we find that the mortality up to age 35 was consistently lower in 1927 than in 1921, but after this point the mortality curve for 1927 crosses that for 1921 and continues higher for all the older age groups. The two curves showing mortality among females appear fairly similar to the age mortality curves for males except that the female curve for 1927 does not cross

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<sup>&</sup>lt;sup>3</sup>The figures for mortality by sex and age in 1927 were furnished in manuscript by the United States Bureau of the Census, as were also the data on deaths in 1921 and 1927 from specific causes by sex and age which are discussed later in this report. Other data are from the United States Mortality Statistics, published annually by the Bureau of the Census.

the 1921 curve until the age group 45-54 is reached and thereafter the curves stay rather closer together. Thus, for each sex, the mortality in early childhood in 1927 was very decidedly more favorable than in 1921, the improvement was less marked for the young adult ages, while in middle age and

old age the rates were less favorable in 1927, with the increase in middle age mortality starting at an earlier age for the males than for the females.

The actual differences between the rates in these two years for either sex and specific age groups are brought out strikingly by the bar graphs in Fig. 2. The saving in lives under 5 years of age is very marked for both males and females, amounting to eight and seven for each one thousand boys and girls respectively in the population. Under age ten

Fig. 1. Comparison of the death rates for 1921 and 1927, at specific ages, for males and females in the United States registration area of 1900.



the decrease in the death rates was slightly less for females than for males, but from age 10 to 34 the opposite is true, and



Fig. 2. Actual and percentage changes in the death rates between 1921 and 1927 for specific sex-age groups in the United States registration area of 1900.

the greater improvement for females becomes increasingly marked with age. The increase in the death rate for males aged 35 to 44 years is nearly one per thousand population and for each successive ten-year age group the excess mortality in 1927 over the 1921 rate gives an increasingly unfavorable picture until for the ages 65 and over the excess is more than ten per thousand population. The situation indicated for the

females of adult ages is in striking contrast to that for males; for ages 35 to 54 the mortality among females changed only slightly between 1921 and 1927, the increase in mortality for ages 55 to 64 was less than one-third the increase at this age for males, and for ages 65 and over the increase was approximately one-half that for males.

A more comparable view of the changes in mortality which have occurred at different ages in this short period is given by the percentage decreases or increases shown by the death rates in 1927 for either sex at specific ages over the rates in

1921. These are presented graphically in the lower part of Fig. 2. At every age the proportionate change is more favorable for females than for males and this is particularly true for the ages of middle life. Very striking, indeed, is the comparison of the two sexes for the age group 35 to 44, at which age the death rate for males in 1927 showed an increase of 12.5 per cent over the 1921 mortality as against a decrease in the female death rate of 4 per cent. At ages 45 to 54, the increase for males was 13.5 per cent compared with an increase of 2.5 per cent for females.

Fig. 3. The trend of the death rates for males and females of adult ages in the United States registration area of 1900, during the period 1920-1927.



That these differences in the trend of mortality for the two sexes at various ages are characteristic of the period since

1920, is shown by the annual mortality rates from 1920 to 1927 inclusive for adult males and females of specific ages presented in Fig. 3. The annual rates have been plotted on a logarithmic scale and the curve or line for each sex-age group indicates the trend of the mortality. A greater slope upward or downward means a greater *relative* change in the mortality. The widening difference between the male and female mortality is quite marked, especially for the young adult groups. Even at ages 25 to 34, the more favorable course in the female death rate is seen; for the years 1920 to 1922 inclusive the female death rate was higher than the male, but in 1923, the curves crossed and the female rate has continued lower. For all age groups, the trend in the female mortality during this eight-year period has been more favorable than that exhibited by the male death rates, even when both have increased, as for ages above 55 years.

It is interesting to note that a similar unfavorable trend is not found in mortality in England and Wales. In Fig. 4, the trend of the death rates for specific sex-age groups in the original registration area of the United States is compared with that of the corresponding group in England and Wales<sup>4</sup> for the period 1920-1927. Contrary to the United States, an epidemic of influenza occurred in England in 1927 raising the rates for that year, while 1926, an epidemic year in the United States, was a non-epidemic year in England. The contrast in the trend of male mortality in the two countries for each of the decennial age groups from 25 to 64 years is very marked.

After age 35, for both males and females the deaths from eight causes make up 65 to 85 per cent of all the deaths. These are tuberculosis  $(31-37)^5$ , heart disease (87-90), cancer

 $^{5}\mbox{Numbers}$  in parenthesis refer to International List of Causes of Death, 1920 Revision.

<sup>&</sup>lt;sup>4</sup>Rates for England and Wales were taken from the Registrar-General's Statistical Review of England and Wales, for the year 1928, pp. 4-5.



Fig. 4. A comparison of the trend of mortality among adults in the United States registration area of 1900 with that in England and Wales for the period 1920–1927.

(43-49), diabetes (57), cerebral hemorrhage and apoplexy (74), pneumonia (100-101), nephritis (128-129), and accidents (175-196, 201-203). They vary as to relative importance at different ages but each exacts a heavy toll of adults every year.

In order to give the reader an idea of the relative importance of these diseases at different ages, Fig. 5 is presented. Obviously, heart disease is the most important cause of death for persons aged 45 years and over; the mortality from heart conditions rises very rapidly among adults and is more than double that from any of the other seven causes at ages 65 and over. Comparison of the age curve of mortality from tuberculosis with the curves for other important causes of death in adult life is particularly interesting. Among males, tuberculosis was the most important cause of death in 1927 at ages 25 to 44; among females it was the most important cause of death at ages 25 to 34, but it was exceeded by both cancer and heart disease at ages 35 to 44 years. The death rate from tuberculosis does not show the rise with age so characteristic of the other diseases included here.

Now, in order to compare the changes in the death rates from these causes between 1921 and 1927 among males and females at different ages, percentage increases or decreases have been computed and are shown in Fig. 6. The relatively favorable change in the mortality of females from each of these causes except diabetes, as compared with the change in the mortality among males, is very marked, especially for the ages from 35 to 64.

The greatest relative increases are found in the mortality from heart disease and accidents. Among males 35 to 44 years of age, the mortality from heart disease in 1927 was about 40 per cent in excess of that in 1921, but an excess of only 10 per cent among females of that age is manifested. From 45 to 74 years of age, the 1927 death rate from heart disease among males varied from nearly 30 to 37 per cent higher than the 1921 rate, as contrasted with the corresponding change in the death rates for females which was from 14 to 23 per cent higher. For ages 75 and over, the death rate from heart diseases was about 25 per cent higher for both sexes than in 1921. In the case of accidents the maximum increase for males is shown at ages 55 to 74, with an increase of about 40 per cent in 1927 over 1921, but for the younger adult males, aged 35 to 54 years, an increase of 30 to 34 per cent is indicated. The increase in accident mortality for females aged 35 to 54 was only slightly less than for males of

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Fig. 5. The death rates in 1927 from eight important causes of death for specific sex-age groups in the United States registration area of 1900.

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Fig. 6. Percentage increase or decrease in the death rates for 1927, as compared with the rates for 1921 from eight important causes of death for specific sex-age groups in the United States registration area of 1900.

that age, but at older ages, the percentage increase in the female mortality is 10 to 15 per cent less than that for males of corresponding ages.

Although the percentage increase in cancer mortality is less than for heart disease or accidents, it is far from negligible and the greater increase for males is very striking. The younger adult males also had a very definitely higher mor-

tality from pneumonia in 1927 than in 1921, which was not true of the females at any age. For nephritis, acute and chronic, the increase in the male rate for ages 35 to 64 years was only 6 to 12 per cent, but exceeded the increase in the female death rate for this cause. Mortality rates from cerebral hemorrhage and apoplexy and from tuberculosis showed a decrease at nearly all adult ages for both males and females, but the decrease was greater in the female rates. Only for diabetes was the change less favorable for females; the mortality from this disease has shown marked improvement for both sexes up to age 35 and for males up to age 45, but in the older age groups deaths from diabetes have increased for both sexes.

What these increases mean in actual numbers of persons dying in 1927 from these causes, who would not have died if the rate had continued the same as in 1921, can be seen in Fig. 7. For example, out of every 100,000 men aged 35 to 54 years in the population 43 *more* died from heart diseases alone in 1927 than died in 1921; 30 *more* died from accidents; 21 *more* died from pneumonia; and 9 *more* died from cancer; making a total of 103 *more* deaths in each 100,000 population from these four causes alone. A saving of 25 per 100,000 resulted from the decline in tuberculosis mortality but there remains a net loss of about 120 males aged 35 to 54 years out of every 100,000 in the population above the loss by deaths in 1921.

No such increase in deaths from these causes occurred among women aged 35 to 54 years. There were 16 more deaths from heart diseases; 6 more from accidents; 5 more from cancer; and 2 more from nephritis for each 100,000 women; but these increases were wholly offset by decreased mortality from other causes and the net effect was a saving of about 3 per 100,000 in the mortality for this age group.



Fig. 7. Actual difference between the death rates for eight important causes in 1921 and 1927 among males and females at ages 35 to 54 years and 55 to 74 years in the United States registration area of 1900.

For males aged 55 to 74 years, a striking increased loss of life is shown, with a total *net* increase of about 600 per each 100,000. From heart disease, 319 *more* out of every 100,000 men of this age died in 1927 than in 1921; 90 *more* died from cancer; 61 *more* died from accidents; 42 *more* died from acute

or chronic nephritis; 33 more died from pneumonia; and 17 more died from diabetes.

For women in the age group 55 to 74 years, there was an increase of 182 deaths from heart diseases; 73 from cancer; 30 from nephritis; 30 from diabetes; and 21 from accidents for every 100,000. The net change from all causes was an increase in mortality of about 280 per 100,000 population which, though less than half the net increase for males at this age, is substantial.

A comparison of the changes in mortality in several areas within the original registration states selected for broad differences in urbanization and density of population showed some interesting and suggestive differences. The three states of northern New England (Maine, New Hampshire, and Vermont) were taken as a predominantly rural area, Massachusetts as an urban area, and New York City as a definitely metropolitan area, and the percentage changes between 1921 and 1927 in the death rates of specific sex-age groups in these three areas were compared. Among males, the changes in this period at different adult ages were not very different in Massachusetts and in the three rural states, and an increase in mortality is not manifested below age 55. For New York City, however, the male death rate for each ten-year group above 25 years of age increased between 1921 and 1927; the change was very much more unfavorable than in either of the other areas, especially in the younger adult ages. Changes in the mortality among females in these selected areas, with a single very minor exception, for each adult age group were more favorable than among males in the same area. But, as for males, the change in New York City was less favorable at each age than in the other areas. These comparisons suggest that the explanation for a considerable part of the unfavorable trend in mortality among adults is to be sought in conditions associated with our larger metropolitan districts.