THE INCREASING MORTALITY FROM CHRONIC RESPIRATORY DISEASES

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A declining death rate is generally assumed to be an almost inevitable concomitant of increased medical knowledge and improved public health and medical practices. If pressed, thoughtful persons may admit that man is not immortal and that the death rate must either cease to decrease or else decrease at an almost imperceptible rate at some future time; but probably few persons believe that this is, in fact, imminent.

Although reliable mortality statistics are not available for the entire period, the death rate among people of western European origin probably has been declining for at least two centuries. Apart from the acute communicable diseases primarily of early childhood and adolescence, diarrhea, enteritis, and dysentery, the group of diseases for which one of the largest relative declines in mortality has occurred are those of the respiratory system. This group includes such familiar disorders as tuberculosis, influenza, pneumonia, bronchitis, emphysema, cancer of the lung, and acute upper respiratory infections such as the common cold.

At the beginning of this century, 26 percent of the deaths in the United States were attributed to these diseases of the respiratory system. Three of them, influenza and pneumonia, and tuberculosis were the two leading causes of death. By 1940, the percentage of deaths attributed to this group of diseases had dropped to 11. In 1959, diseases of the respiratory system accounted for only 8 percent, or one out of every 12 deaths in the United States. The numbers of deaths reported as caused by specific diseases of the respiratory system during 1959 are shown in Table 1.

Table 1. Number of deaths attributed to diseases of the respiratory system, United States, 1959.

Diagnoses		Number of deaths
001-008	Tuberculosis	10,627
162,163	Cancer of lung	34,302
160,161,164	Other respiratory tract cancer	3,111
241	Asthma	4,984
470-475	Acute upper respiratory infections	971
480-483	Influenza	2,845
490-493	Pneumonia	52,194
500-502	Bronchitis	3,840
526	Bronchiectasis	2,263
527.1	Emphysema	7,728
525	Non-occupational chronic interstitial pneumonia	3,570
510-524, 527.0, 527.2	Others	6,220
Total		132,655

Source: Publications of the National Office of Vital Statistics.

Asthma has been included since some physicians may use this term for disorders diagnosed by others as emphysema, bronchitis, etc.

Pneumonia still is the leading cause of death among the diseases of the respiratory system, but tuberculosis which formerly ranked second has been displaced by cancer of the lung. Indeed tuberculosis now causes fewer deaths than a group of respiratory disorders which, for want of a better term, have been referred to as chronic nonspecific respiratory diseases. Included in this group are conditions diagnosed as bronchitis, bronchiectasis, chronic pulmonary fibrosis, chronic interstitial pneumonia, and emphysema. These diseases, which are assigned numbers 500-02, 525, 526, and 527 in the International Statistical Classification of the World Health Organization, caused 18,825 deaths during 1959. There are good reasons to include bronchial asthma in this group which would raise the number of deaths to 23,809. However throughout the remainder of this discussion I shall group together the conditions coded to numbers 500-02, 525, 526, 527 of the International Statistical Classification and shall refer to these rather loosely as chronic respiratory diseases.

In the past these diseases have not received much attention in medical literature in the United States. There seems to have been a feeling that these terms should be used as a diagnosis of last resort and applied to conditions for which a more precise and definite term is not appropriate. Whatever the reason, these disorders have never been recorded as important causes of death in the United States until the past decade, in contrast to Great Britain where bronchitis has been an important cause of morbidity and mortality for many years.

The rather slight medical importance attached to bronchitis and emphysema has been reflected in rules for classifying and tabulating death certificates on which these diseases were entered as primary or contributory causes of death. Prior to 1949, the principal or underlying cause of death shown in national mortality statistics was determined by an arbitrary hierarchy of diseases shown in the Manual of Joint Causes of Death. Bronchitis, emphysema, and similar diseases had a low priority in this hierarchy, so that when these were entered on a death certificate together with a more "important" disease the latter was selected as the underlying cause irrespective of the attending physician's statement.

Some information concerning the effect of these procedures on the number of deaths that were classified as caused by these diseases in official publications of mortality statistics can be obtained from special tabulations of contributory causes of death for 1925 and 1940. In 1925, the number of deaths for which chronic respiratory diseases were classified as a contributory cause of death was 74 percent greater than the number for which these were classified as the

primary or underlying cause.

In 1940, the number of death certificates with chronic respiratory diseases classified as contributory was 2.5 times the number for which these were considered primary. The principal diseases that took precedence over chronic respiratory diseases were cardiovascular diseases and other respiratory disease exclusive of tuberculosis. Corresponding tabulations for years subsequent to 1940 have not been published but there is no reason to believe that there has been an increase in the proportion of all death certificates with a diagnosis of one or more of these chronic respiratory diseases for which these diseases have been selected as the underlying cause of death. On the contrary, it is possible that this proportion may have decreased and that the number of deaths for which chronic respiratory diseases are considered to be a contributory cause of death may now be three or more times the number for which these are considered to be the primary cause.

An additional factor affecting the comparability of mortality statistics for this group of respiratory diseases over the past three decades is changes in their classification in the International List of Causes of Death and its recent revisions, The International Statistical Classification. The code numbers assigned to these diseases in recent years are as follows:

Diagnosis	7th Revision (1958-)	6th Revision (1949-1957)	5th Revision (1939-1948)	4th Revision (1930-1938)
Bronchitis	500-502	500-502	106	106
Chronic interstitial pneumonia	525	525	114	114
Bronchiectasis	526	526	106	106
Emphysema	527.1	527.1	113	113

In the Fourth and Fifth revisions of the International List, number 114 also included silicosis, pneumoconiosis, gangrene of lung, and abscess of lung which are assigned to Nos. 521, 523, and 524 of the Sixth and Seventh revisions. The number of deaths assigned to emphysema, No. 527.1, in the Sixth and Seventh revisions was not published by age, sex, and color for 1949 to 1957 inclusive so that No. 527 as a whole has been used unless otherwise specified. In addition to emphysema, No. 527 includes deaths assigned to atelectasis, hernia of lung, stenosis and ulcer of the bronchus, acute pulmonary edema, and mediastinitis. Nearly 85 percent of the total number of deaths assigned to this number are attributed to emphysema.

The number of deaths assigned to the following code numbers have been used to compute the death rates shown in this paper: Sixth and Seventh revisions, 500-502, 525, 526, 527; Fourth and Fifth revisions, 106, 113, 114. The death rates for 1930-32 and 1939-41 were multiplied by .774 and those for 1948 were multiplied by .810 to correct for the inclusion of diseases that were not assigned to Nos. 500-02, 525, 526, and 527 of the Sixth and Seventh revisions.

A major change in the method of coding and classifying causes of death was incorporated in the Sixth revision. Not only was the entire classification changed but the procedure for selecting the underlying cause of death also was changed. The Joint Cause Manual was discontinued and the selection of the underlying cause of death was based on the statement of the physician. No attempt has been made to adjust the mortality rates shown here for lack of comparability brought about by the changes in coding and classifying causes of death that followed the introduction of the Sixth revision. Instead, rates are shown for 1948, the last year during which the Fifth revision was used, and 1949-51, the first three years of use of the Sixth revision. Most of the difference in the magnitude of these two rates may be attributed to the change in procedures following the introduction of the Sixth revision.

Even though the Joint Cause Manual was abandoned at the end of 1948 as the principal basis for selecting the underlying cause when two or more diseases are entered on a death certificate, a number of joint cause coding rules have subsequently been adopted by the National Office of Vital Statistics for use when the sequence of diseases given by the certifying physician is considered to be implausible. The only basis for appraising the effect of these rules upon the number of deaths assigned to the respiratory diseases discussed in this paper is a special tabulation showing the number of deaths assigned to each code number from a 10 percent sample of deaths occurring in 1958 and which were coded by both the Sixth and Seventh revisions. There was no change in the classification numbers for these diseases in the two revisions so that the difference in the number of deaths assigned to each cause may be attributed to changes in rules for selecting the underlying cause of death.

The following numbers are the ratios of the number of deaths assigned to each cause following the rules for the Seventh revision to the corresponding number assigned following the rules of the Sixth revision. The ratios which are from unpublished data provided by the National Office of Vital Statistics are:

500-02	Bronchitis	106.7
525	Other chronic interstitial pneumonia	99.4
526	Bronchiectasis	114.7
527	Other diseases of lung and pleural cavity	85.1

For the group as a whole the ratio was 0.95.

The increase in the number of deaths assigned to bronchiectasis was due primarily to the fact

that deaths attributed to both bronchitis and bronchiectasis, which had been assigned to bronchitis by the rules of the Sixth revision, were assigned to bronchiectasis by the rules of the Seventh revision. The net increase in the number of deaths assigned to bronchitis resulted from a change in coding rules whereby a combined diagnosis of asthma and bronchitis, which formerly had been assigned to asthma, was assigned to bronchitis. It is apparent that substantial changes in the number of deaths assigned to specific causes of death may be brought about by changes in coding rules even though the basic classification of disease remains unchanged.

Since it is believed that a clear distinction in usage of the terms, bronchitis, bronchiectasis, emphysema, pulmonary fibrosis, chronic interstitial pneumonia, etc., is not made by practicing physicians, and since changes in the coding rules and the system of classification used in computing mortality statistics have shifted the assignment of a significant number of deaths from one diagnosis to another at various times in the past, it is probable that the most valid presentation of the trend in the death rate is given by considering this group of diseases as a unit. Although death rates will be shown for certain specific diseases the main emphasis will be upon the trend in the death rate for the entire group of diseases coded to Nos. 500-02, 525, 526, 527 of the International Statistical Classification.

The trend in the age-adjusted death rates from the main diseases of the respiratory system is shown in Figures 1 and 2. The sharp

Fig. 1. United States White Males

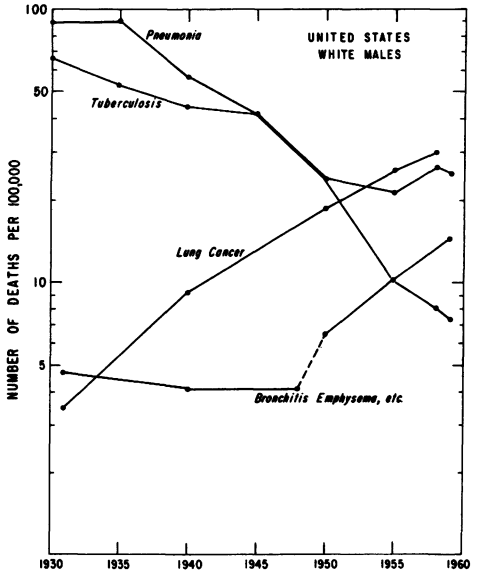
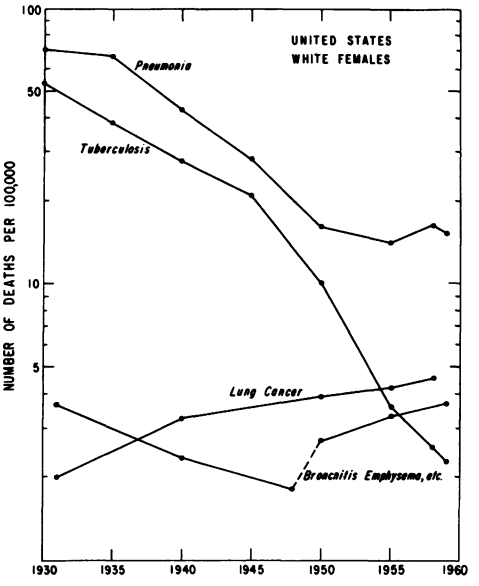


Fig. 2. United States White Females



decline in the death rate from pneumonia and tuberculosis is well-known. The controversy concerning the relationship of cigarette smoking to lung cancer has attracted widespread attention to the increase in the death rate from this disease. The recent increase in the death rate from chronic respiratory diseases including bronchitis and emphysema is not so well-known.

To what extent does the reported increase in the death rate from this group of diseases since 1950 reflect a real increase in incidence? This question cannot be answered accurately from existing information. It is obvious from the sharp increase in the death rate when the Sixth revision was introduced that procedures for the classification and coding of death certificates have greatly affected the reported trend in the death rate. The increase in the mortality rate for this group of diseases that has been recorded since 1949 almost certainly began before that date, but its beginning has been forever concealed by past methods of classifying official mortality statistics. It is plausible to suppose that the death rate from chronic respiratory disease as determined from death certificates has been increasing for as long as two or three decades but that the rate of increase may have accelerated during the past decade.

Granted that the number of death certificates with a diagnosis of bronchitis, emphysema and similar disorders has increased in recent years, is this simply a reflection of improved methods of diagnosis and a change in nomenclature and habits of diagnosis on the part of practicing

physicians combined with a decline in the death rate from tuberculosis and pneumonia, two major respiratory diseases whose presence may have masked bronchitis, emphysema, and allied conditions in the past? These factors undoubtedly account for part of the reported increase but any estimation of the relative magnitude of their effect can represent only an expression of personal opinion since objective data on this point are not available.

Raymond Pearl suggested that the respiratory system is more susceptible to disease than any other organ system. It is in continuous contact with the external environment and is not as well adapted to resist the action of harmful agents as is the skin which is similarly exposed. This diathesis may be expressed by the development of several specific diseases. If the lethal form of any one of these diseases is controlled, it will soon be replaced, in whole or in part, by an increase in the fatal form of some other respiratory disease.

The data in Figures 1 and 2 may be interpreted either as supporting or not supporting this hypothesis. There is no indication that the death rates from lung cancer and chronic respiratory diseases among white females, in the near future, will even reach the level of the death rates from pneumonia and tuberculosis recorded as recently as 1950. The contrary is true for white males. If the present rate of increase continues, the combined death rate from lung cancer and chronic respiratory diseases by about 1970 will reach the level of the combined death rate from tuberculosis and pneumonia in 1940.

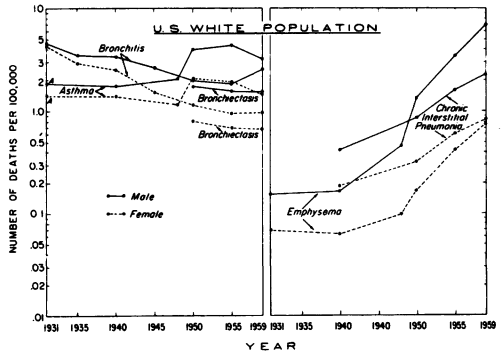
It seems fully as plausible, however, in the present state of knowledge to interpret the sex difference in the trend of mortality from these diseases as being not so much a manifestation of a constitutional susceptibility to disease as a response to specific exogenous agents.

The number of deaths from bronchitis, emphysema, and allied diseases currently reported in official vital statistics is a gross understatement of the number for which these diseases have contributed to the fatal outcome. The number of deaths for which these diseases are coded as the primary or underlying cause may be no more than one-third of the number for which they are listed as one of the causes of death. A tabulation of multiple causes of death is needed to provide more precise information on this.

The recent trend in the death rate from chronic respiratory diseases resembles that for cancer of the lung. The rate of increase is much greater for males than for females. The increase in the death rate among females is no greater than that which might reasonably be attributed to more accurate diagnosis and improved case finding. The amount and rate of increase for males in comparison to those for females are so great that a real increase in the incidence of these diseases is plausible even though the proportion of the increase that may be real cannot be stated with precision.

The trend of the death rate since 1930 for some of the specific diseases included in this group of chronic respiratory diseases is shown in Figure 3. A consistent increase has occurred

Fig. 3. U. S. White Population



only for emphysema and chronic interstitial pneumonia. The death rate for emphysema shown in Figure 3 is based on deaths assigned to No. 527.1 of the International Statistical Classification which is defined as emphysema without mention of bronchitis. If both emphysema and bronchitis are mentioned on a death certificate, this death is assigned to No. 502.0, bronchitis with emphysema, and is tabulated with other deaths assigned to chronic bronchitis. The number of death certificates with both emphysema and bronchitis is about 15 percent of the total number showing emphysema with or without mention of bronchitis.

The term, chronic interstitial pneumonia, includes diseases coded to No. 525 of the International Statistical Classification of which the principal ones are fibrosis of the lungs, chronic pneumonia, chronic inflammation of the lungs, cirrhosis of the lungs, and interstitial pneumonia. All of these are presumed to be non-occupational.

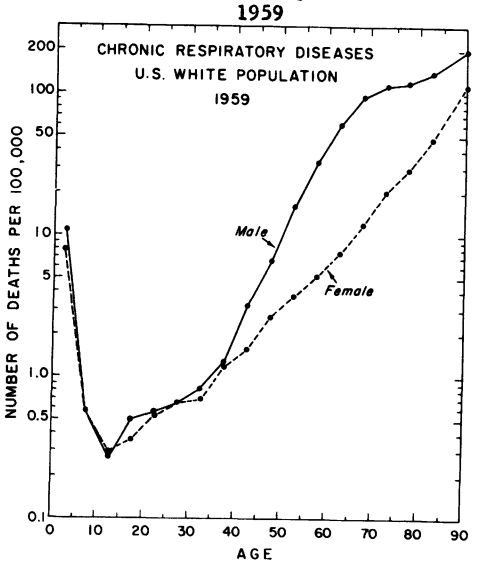
It is evident from Figure 3 that emphysema and chronic interstitial pneumonia are rapidly becoming the most frequently reported diagnoses among this group of diseases. In spite of the fact that current coding practices generally give preference in the selection of the underlying cause of death to other diseases the combined number of deaths assigned to these two diseases now is greater than the number assigned to respiratory tuberculosis.

Until nomenclature and usage become more uniform, the most valid representation of the trend in mortality from chronic respiratory diseases will be given by combining the diseases now coded to Nos. 500-502, 525-527 of the International Statistical Classification. However information concerning the number of deaths

assigned to each of the diseases coded to these members as well as the number of deaths for which these diseases are coded as a contributory cause of death should be published in order to provide data for judging the effect of coding practices and variations in diagnostic terminology upon the trend in the death rate.

Mortality from this group of diseases is relatively low until about 40 years of age (Figure 4). The death rate for children less than 10

Fig. 4. Chronic Respiratory Diseases
U. S. White Population
1959



years of age is considerably greater than that during adolescence but this is due to acute bronchitis which is not the same as the disorders diagnosed as chronic bronchitis, emphysema, etc., of late adult life.

After age 40 the death rate increases rapidly especially for white males for whom the rate at ages 65-69 is nearly 100 times that at ages 35-39. Prior to age 40 there is very little difference in the death rate for males and females, but after this age, the rate increases much more rapidly for males. The largest relative difference in the death rate for the sexes occurs between 60 and 70 years of age when the rate for males is 8 times that of females.

Summary

1. The death rate from diseases of the respiratory system has declined sharply since 1900. In 1900 twenty-six percent of all deaths were attributed to these diseases; in 1959 only 8 percent were attributed to these diseases.

2. During recent years, the death rate for certain respiratory diseases that formerly were unimportant as causes of death has been increasing rapidly. The first of these diseases for which an increase was observed was cancer of the lung which now causes more deaths than any other respiratory disease except pneumonia.

3. During the past decade, the death rate has increased significantly for a group of chronic respiratory diseases including bronchitis, bronchiectasis, pulmonary fibrosis, chronic interstitial pneumonia, and emphysema.

4. Due to lack of uniformity in the use of these diagnoses and to changes in the classification and coding rules used in the preparation of mortality statistics, the length of time that the death rate for these chronic respiratory diseases has been increasing as well as the level it has reached cannot be accurately ascertained.

5. The number of deaths attributed to these diseases in 1959 was nearly twice the number attributed to tuberculosis. Even so, this number possibly represents only about one-third of the total number of deaths for which this group of diseases contributes to the fatal outcome.

6. Most of the increase in the death rate is due to an increase in the number of deaths attributed to emphysema and chronic interstitial pneumonia.

7. The death rate for this group of chronic respiratory diseases is low prior to age 40, but it increases nearly 100-fold between the age groups 35-39 and 65-69 for white males. The death rate for males greatly exceeds that for females after age 40.

Legends to Figures

Figure 1. Age-adjusted death rate per 100,000 white male population from pneumonia (490-493), tuberculosis (001-019), lung cancer (162,163), and chronic respiratory diseases (500-502, 525-527) United States, 1930-32 to 1959.

Figure 2. Age-adjusted death rate per 100,000 white female population from pneumonia (490-493), tuberculosis (001-019), lung cancer (162, 163), and chronic respiratory diseases (500-502, 525-527), United States, 1930-32 to 1959.

Figure 3. Age-adjusted death rate per 100,000 white population by sex from asthma (241), bronchitis (500-502), chronic interstitial pneumonia (525), bronchiectasis (526), and emphysema (527.1), United States, 1930-31 to 1959.

Figure 4. Number of deaths per 100,000 white population by age and sex from chronic respiratory diseases (500-502, 525-527), United States, 1959.