MORTALITY DIFFERENTIALS IN MICHIGAN

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Paul Michael Houser

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and Anthropology

Chas P Loomis

Major professor

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MORTALITY DIFFERENTIALS IN MICHIGAN

By

Paul Michael Houser

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A THESIS

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PREFACE

This dissertation is a systematic analysis of the general mortality characteristics of the population of Michigan, and is designed to supply background data for other health studies now underway in the State. Dr. C. P. Loomis originally called my attention to the need for such a study.

Mortality studies by their nature require many hours of tedious effort and involve many procedural technicalities. I am particularly indebted to Dr. John F. Thaden and to Dr. J. Allan Beegle, not only for the time which they have spent with me in consultation which has been a source of constant inspiration, but also for the additional service of reading the entire manuscript and making valuable suggestions for its improvement. To Dr. Duane L. Gibson and Robert T. Hyde, I am also indebted for reading certain chapters and for making many helpful comments. The writer appreciates suggestions and criticisms given by: Dr. Margaret Jarman Hagood, Dr. Robert D. Grove, Dr. John K. Ryan, Dr. Bernard G. Mulvaney, and Dr. C. J. Nuesse.

I wish to acknowledge the cooperation of the Michigan State Department of Health in supplying me with certain needed tabulations, and the valuable assistance of the Department of Sociology and Anthropology of Michigan State College which granted me the use of necessary equipment and aided in the drawing of several maps.

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Paul M. Houser
University of Maryland
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PART I

INTRODUCTION

CHAPTER I

INTRODUCTION

A. Importance of Health Studies

One of the challenging problems facing the United States today is that of providing adequate health education and health care for its citizens. Vance says, "High among the traits determining the cultural adequacy of any people must be listed their vitality."[1] Action programs in this field, however, presuppose considerable knowledge about the incidence of diseases, mortality rates, and the cost and availability of medical care. Although in the process of every day living a variety of data about these problems have been accumulated, our scientific information about morbidity and mortality data is too meager, without added research, to serve adequately as a base for any long-time program. As we realized this, more and more interest in research projects developed.

The people of Michigan were interested in health problems, even at a very early date. In 1852 Dr. Zina Pitcher of Detroit listed by months the forms of diseases most prevalent in his practice for that year.[2] These people

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1. Vance, Rupert B., and Danilevsky, Nadia, All These People, The University of North Carolina Press, Chapel Hill, North Carolina, 1945, p. 335.

2. Kleinschmidt, Earl E., "Prevailing Diseases and Hygienic Conditions in Early Michigan," Michigan History Magazine, Vol. 25, No. 1, 1941, p. 58.

had some cause for concern because, at that time, Michigan was considered one of the most unhealthful States in the Union.[1] Infectious and contagious diseases were taking a tremendous toll. Dr. Earl E. Kleinschmidt, who made a study of public health in Michigan has this to say, "Some diseases such as malarious fevers, dysentery, rheumatism, pneumonia, pleurisy, cholera infantum, and croup were present during most of the year. There was a constant and unvarying succession of inflammatory diseases in winter, and malarious fevers of varying severity during the remaining three seasons of the year which, with dysentery and infantile summer complaint, constituted most of the diseases."[2]

The environmental factors contributing to epidemics were carefully noted over a period of years. Swamps and swales were contributing much to the health hazards of early Michigan residents. As late as 1881, physicians estimated that malaria accounted for over fifty percent of all illness in the state. Thus Michigan came to be known as the home of malaria. As the drainage of the land for agricultural purposes progressed, conditions improved. In this regard, Dr. Kleinschmidt remarks, "No less an authority than Dr. H. F. Lyster of Detroit declared that, because of the drainage of land, all forms of malaria diminished fully seventy-five per cent in and around Detroit over a period of twenty years

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1. Kleinschmidt, Earl E., ibid., p. 57.
2. Kleinschmidt, Earl E., ibid., p. 59.

from 1854 to 1874."[1]

During the same period, sanitary conditions in cities throughout Michigan were contributing their share of casualties. The nature of these conditions was set forth clearly by the Rt. Rev. George D. Gillespie of Grand Rapids in a speech to the Sanitary Convention held in that city in 1881. He spoke as follows:

> "But when men got the cobwebs of ignorance out of their eyes when they began to look about and inquire into things what did they find?**** They found sewers, under prominent residence and business streets, where the amount of drainage they ought to carry off is immense, entirely filled up, so that even the slimy rats themselves could not get through them; for years had they been in that condition, and the filth, and slops, and disease-breeding refuse, from hundreds of houses and out-buildings had to be left on the surface of the ground to fester and poison the atmosphere. They found streets and alleys, in the very heart of the city, filled with rotting vegetables and animal debris. They found cesspools and privy vaults in all parts of the city fairly running over with rottenness. All these things they found and much more of a like sickening nature, and they no longer wondered that the death rate was almost up to that of New York and even London."[2]

While most physicians in this early period associated the occurrence of disease with environmental factors, many of their beliefs about causal relationships we now know to be erroneous. Dr. Kleinschmidt continues, "In the absence of scientific explanations for the spread of prevailing diseases, many theories were evolved to explain their cause.

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1. Kleinschmidt, Earl E., ibid., pp. 60-61.

2. Kleinschmidt, Earl E., ibid., p. 91, from An. Rep. S.B.H., XV, xvii. Rev. Gillespie was President of the Grand Rapids Sanitary Association.

In general, disease was ascribed to the presence of filth of one kind or another and to poisonous gases coming from such accumulations."[1] Out of such observations came the impetus for these early research efforts.

Although an examination of the public health history of Michigan shows that great inroads have been made on the control of communicable diseases, little more than a beginning has been made on the control of chronic illnesses. This seems to be true also for the nation.

This apathy toward the control of chronic diseases is partly a matter of attitude. Stieglitz, in his noteworthy collection of works on Geriatric Medicine, deplores the common attitudes of the medical fraternity, the public health officials, and lay leaders, which assume that the chronic diseases, which take such a large toll from the middle and upper age groups of our population, are of such a nature that little can be done to prevent or stay their course. He observes, "Biologists and physicians have been strangely content to take the phenomena of aging as a matter of course."[2] He continues, "It is impossible in our ignorance to say what aging is, what it does, or why and how it does it. Very little is known; much of what we think we know is merely suspicion. Some is more purely wishful thinking. But the consciousness of ignorance is

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1. Kleinschmidt, Earl E., ibid, p. 80.

2. Stieglitz, Edward, ed., Geriatric Medicine, W.B. Saunders Co., Philadelphia, Pennsylvania, 1944, p. 3.

distinctly encouraging."[1]

As a result of the observations of people interested in the problems of health, the demand for scientific knowledge is growing. Consequently, both public and private agencies today are encouraging research projects in this field.

Present Studies in Michigan. Michigan has been among the leading states in the field of health research for many years. There are a number of influences accounting for her present position of leadership. An important factor has been her membership among the ten original death registration States of 1900. Attempts of the State to record the number of deaths occurring within her borders began as early as 1868 but further emphasis was given to this work with the creation of a State Board of Health in 1873. Through the influence of this Board and the Honorable Jonas MacGowan, member of Congress from Michigan, the National Board of Health was authorized a few years later.[2] Because of the nature of early health problems in Michigan, it is not surprising that leaders in this field became aware not only of the importance of accurately recording deaths and the incidence of disease in the population, but also of the value of using such data as a basis for planning

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1. Stieglitz, Edward, ed., ibid., p. 5.

2. Kleinschmidt, Earl E., "Major Problems in Sanitation and Hygiene in Michigan, 1850-1900," Michigan History Magazine, Vol. 28, No. 3, 1944, pp. 443-444.

subsequent health programs. Consequently, many of the early annual reports of the State Board of Health contain extremely interesting statistics and keen analyses of health conditions.[1]

In addition, the prestige gained for the State by the University of Michigan Medical School established in 1850 and the now very active School of Public Health have been among the important factors operating to keep the State aware of its emerging health problems. Thus they have provided stimulation for continuous research and planning in the health field. Nor can one overlook the influence of two privately endowed foundations, in promoting and financing both research and action programs in child health and welfare, particularly in rural areas. These foundations are the Childrens' Fund of Michigan established in 1929, and the W.K. Kellogg Foundation established in 1930. And finally, the leaders of the 71 County Health Departments[2] operating in Michigan have also been a constant inspiration, encouraging adjustments and improvements based on facts derived from scientific reports, surveys, and studies. There is no doubt that the healthy social climate created by these forces was partially responsible for current studies

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1. See early volumes of the Annual Reports of the State Department of Health, available in the Michigan State Library, Lansing, Michigan.

2. In 1943, 69 counties having County Health Departments comprised 77.1 per cent of the rural population and 24.5 per cent of the urban population. Since that time Lenawee and Macomb counties have organized County Health Departments. See Seventy-first Annual Report of the Michigan Department of Health, 1943, footnote, p. 113.

completed or now in the process of completion. Such studies include:

1. A study of hospital resources and needs in Michigan conducted by the Michigan Hospital Survey Committee appointed by Governor Kelly. According to the Committee, they were to (a) study present health facilities and personnel in Michigan, (b) study related socio-economic factors bearing upon need for hospital service, and (c) determine hospital needs and draft a plan which would provide an adequate system of coordinating hospital and public health facilities in all parts of the State.[1]

2. A survey of the costs of medical care among recipients of Old Age Assistance, initiated by the State Department of Social Welfare in cooperation with the Bureau of Public Assistance of the Federal Security Agency. Their objectives were to study the adequacy, the availability, and the costs of medical care to these recipients of minimum income.[2]

3. A study of the incidence of disease in selected counties of Michigan, initiated by the Department of Sociology and Anthropology of Michigan State College and the United States Department of Agriculture. This study was a house to house survey of the incidence of disease in a sample of rural families of three counties, Shiawassee, Kent, and Cheboygan.[3] Under the supervision of a State Committee, a similar study is being made of Michigan.

4. A study of nursing education needs in Michigan which was prepared for the Michigan Council on

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1. Report of the Michigan Hospital Survey, Hospital Resources and Needs, W.K. Kellogg Foundation, Battle Creek, Michigan 1946.

2. Oosterhof, Willis W., "Medical Care Under Public Assistance, in Michigan," Michigan Welfare Review, Vol. 3, No. 4, 1946, pp. 1-4; Continued in Vol. 4, No. 4, 1947, pp. 1-21.

3. Hoffer, Charles R., "Health and Health Services for Michigan Farm Families," Department of Sociology and Anthropology, Michigan State College, East Lansing, Michigan, 1947 (Mimeographed). See Also, Hoffer, Charles R., "Medical Needs of the Rural Population in Michigan," Rural Sociology, Vol. 12, No. 2, June 1947, pp. 162-168.

Community Nursing. It was designed to supplement data on nursing needs and facilities collected by the Michigan Hospital Survey.[1]

B. Problems in Studying Vital Statistics

Mortality Data as Important Social Phenomena. Mortality data measure certain aspects of health. They represent the climax, or the culmination, of the incidence of morbidity. If mortality rates are high for a given disease in a particular area, one can assume a high incidence of the disease, a lack of control of the disease, or both. Such lack of control may result from inadequate knowledge of the nature and cause of disease, or from lack of medical personnel and health facilities, or from low standards of living.

If the death rate is low, however, the implications are not so obvious. Such a death rate may imply a decrease in incidence, an increase in preventive measures, or no change in incidence but an advance in treatment techniques. For example, our decreasing death rates from typhoid fever resulted largely from preventive measures which we initiated, but decreasing death rates from diabetes have resulted from an advance in treatment techniques. Obviously, then, while mortality data throw light on the health of a people, they should never be considered as a substitute for morbidity data. It is morbidity data plus mortality data that make the whole.

However, to date, morbidity data have been so limited

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1. Bixler, Genevieve Knight, "Nursing Resources and Needs in Michigan," Michigan Council on Community Nursing, Lansing, Michigan, 1946.

that it has been necessary to rely on mortality figures. Rupert Vance devotes two chapters in All These People to death rates as measures of health and vitality of the people. He laments the absence of figures on illness and the necessity of depending upon death rates to describe health. However, he seems positive that death rates can be used properly to measure certain aspects of health. He writes:

> "In the United States to a large extent we have been compelled to render our judgments on the state of the people's health not from figures of illness but from figures in death. This can be done only by relating rates of death to at least two conditions: (1) the age and sex make-up of the people, and (2) the cause of death. Thus death, which can be regarded as a biologically normal phenomenon at the end of the life span, must in the absence of morbidity statistics be related to the age curve of the population if it is to be accepted as a valuable index. Implicit in this procedure is the idea of the average incidence of death on a standard population under a given environmental complex. Over a period of time the changing incidence of death on a population gives a measure of the improvement in health conditions attendant upon improvement in environment and progress in medical knowledge and practice. To relate this to cause of death and thus to type of illness we need to determine standard ratios of the incidence and length of morbidity to death from each cause. Such figures, if obtained, however, would last but a few years before the progress of medical services rendered them obsolete. Surgeon General Thomas Parran well stated the situation when he said that the sickness and death rates of previous years are inadequate yardsticks for the present and are useless as goals for the future. To think otherwise is to regard medical science and public health as static rather than dynamic forces."[1]

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1. Vance, Rupert, and Danilevsky, Nadia; op. cit., p. 336.

Walter Willcox, one of the foremost demographers in the United States, claims that death rates are the best measure of the incidence of morbidity that we have at the present time. He assumes that morbidity is correlated with mortality, but that the correlation will decline as the death rate declines. His position is summed up in the following statement:

> "Since there is no direct and satisfactory measure of health or sickness, the problem can best be attacked by assuming that health is correlated with longevity and sickness with death, and measuring the death rate and length of life. Now that we have country-wide registration, the health of the people can be measured approximately by the amount of death. To be sure, a population might have no sickness and no premature death; everyone might remain healthy to the end of life and death come with no premonitory warning. This may be an unattainable ideal, but the prolongation of life and reduction of certain diseases suggest that the movement is in that direction; if so, the correlation between sickness and death is decreasing. But it has not yet disappeared; indeed it is still strong enough to make the statistics of death and their interpretation in various ways not only the best but almost the only way of measuring health."[1]

Newsholme writing in 1924 comments: " .... under present conditions deaths as a rule give more reliable statistical information than cases of sickness."[2]

Sydenstricker, discussing the necessity for relying on mortality statistics in analyzing health conditions, says: "Changes in the health of the population can be

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1. Willcox, Walter F., Studies in American Demography, Cornell University Press, Ithaca, New York, 1940, p. 222.

2. Newsholme, Arthur, The Elements of Vital Statistics, D. Appleton & Co., New York, 1924, p. 596.

measured in only one way because of the absence of suitable records. No data comparable from one period to another exist on the prevalence of physical and mental defects and impairment, and statistics of illness for representative population groups for any period of time are entirely lacking. We are perforce restricted to statistics of mortality."[1]

Sydenstricker continues with this caution: "Mortality statistics as an index of the trend in the health of a population possess serious limitations and should be used with caution .... The lower the death rate of a population becomes, the more nearly does it approach the rate that represents mortality at the end of the life span and the less sensitive it is as an index of ill health at earlier ages."[2]

In a study of health and mortality in Louisiana published by Louise Kemp in collaboration with T. Lynn Smith, the writers indicate that "The index to health and mortality used in this study is the death rate."[3]

Although Professor Smith based his study of health in Louisiana on mortality rates, in his book The Sociology of Rural Life, he points out that mortality data do not measure health in the same sense as do morbidity data. He separates his discussion of the two topics into different

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1. Sydenstricker, Edgar, Health and Environment, McGraw-Hill Book Co., Inc., New York, 1933, p. 147.

2. Sydenstricker, Edgar, ibid, p. 147.

3. Kemp, Louise, and Smith, T. Lynn, Health and Mortality in Louisiana, Agricultural Experiment Station, Louisiana State University, Bulletin 390, 1945, p. 9.

chapters. His true position is indicated by the following statement: "A widespread practice among writers on this subject (incidence of sickness) has been to substitute data on mortality for data on morbidity, although it has been pointed out repeatedly that the pictures resulting from the two types of data are by no means identical. Accordingly, data on mortality will be presented in another chapter, and this section will be devoted entirely to materials dealing with health itself."[1]

It should be pointed out, however, that Professor Smith finds it necessary to employ mortality data even in his chapter on incidence of sickness. The maps of tuberculosis death rates on page 115 of The Sociology of Rural Life are referred to as incidence rates on page 116.

Pearl never believed that mortality rates should be substituted for morbidity rates, but each should be employed to study the particular aspects of health which it measures. He says: "There is ever present in vital statistics, and from the beginning always has been, an attempt to make the incidence of mortality a measure or index of the incidence of morbidity, generally speaking. What actually is done is to weaken and impair the value of the statistics for the study of mortality in the hope to make them a little better indices of morbidity."[2]

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1. Smith, T. Lynn, The Sociology of Rural Life, Harper and Brothers, New York, Revised Edition 1947, p. 106.

2. Pearl, Raymond, Introduction to Medical Biometry and Statistics, W. B. Saunders Company, Philadelphia, Penn., 1941, p. 65.

Opinion of Authorities Regarding the Relative Merits of Certain Kinds of Rates in the Measurement of Mortality. According to Raymond Pearl, death rates, properly calculated, measure the force of mortality. Likewise, properly calculated rates of illness or sickness measure the force of morbidity. He defines the "force of mortality" as the proportion of those exposed to the risk of death who actually die. "Thus, if 100 persons are truly exposed to the risk of dying within a given year, and 3 die, the force of mortality within the time limit of that year is 3 per cent."[1]

The exposed cases must be at risk before the resulting rates can be called measures of the true force of mortality. Males obviously could not be exposed to the risk of death from puerperal causes, and neither could females who are not within reproduction ages. Thus death rates, when properly calculated, measure the force of mortality, or the probability that death will occur to a given class. Each different death rate states a different measure of probability of death. Pearl preferred to define the meaning of each rate and let it go at that, rather than to blanket the meanings of several rates under the concept of a general term such as "health." Such will be the position of the author in this study, because it seems reasonable to state the meaning of each mortality rate and proceed to employ the rates with those particular meanings as a

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1. Pearl, Raymond, ibid., p. 173.

measure of health.

Most authorities have expressed themselves regarding the relative value of certain rates as a measure of health and mortality. Pearl very clearly states those death rates which, in his opinion, most nearly approach "scientifically accurate records of natural phenomena:

1. Deaths from all causes (either for all ages together or for separate age groups, as for example, 'infant mortality' (deaths under one year of age).
2. Traumatism (Rubrics 169 to 198 inclusive).
3. Homicide (Rubrics 166 to 168 inclusive)."[1]

In an earlier edition of Medical Biometry and Statistics, Pearl had included suicide in the above list, but excluded it later because "suicide is sometimes concealed by surviving members of the family; how often no one knows."[2]

Many authorities believe that infant mortality and maternity death rates are the best measures of the health situation in so far as mortality rates are concerned. Newsholme views the following types of death rates as the best measures of public health work, that is, when considering only death rates:[3]

1. A statement for the current year and for a series of years of the death-rate under 1 year of age per 1,000 births.
2. A statement of the death-rate for the first

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1. Pearl, Raymond, ibid., pp. 65-66.
2. Pearl, Raymond, ibid., p. 66.
3. Newsholme, Arthur, op. cit., pp. 595-596.

week and for the first month after birth.

3. A statement of the death-rate per 1,000 births from diarrhea and enteritis of children under 2 years of age.

4. A statement of the number of deaths from septic and other diseases and accidents associated with child-bearing per 1,000 births, if possible for a series of years.

5. A statement of the death-rate from tuberculosis (All forms and Phthisis) for a series of years.

6. A statement of the death-rate from:

Typhoid fever
Diphtheria
Scarlet fever
Measles
Whooping cough
Malaria
Cerebro spinal fever
and of any other prevalent infectious disease.

He claims that the "value of these is increased when the rates for a series of years can be given."[1]

Professor Kumlien, in his study of health facilities in South Dakota, writes with respect to mortality rates: "Crude, maternal, and infant death rates are probably a fairly good index of general health conditions for any given area."[2]

Dr. Leland B. Tate, Rural Sociologist at the Virginia

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1. Newsholme, Arthur, ibid., p. 595.

2. Kumlien, W. F., Basic Trends of Social Change in South Dakota; Public Health Facilities, Agricultural Experiment Station, South Dakota State College, Bulletin 334, 1940, pp. 6-7.

Polytechnic Institute, lists the following rates as measures of the health status of a population: (1) the infant death rate, (2) the maternal death rate, and (3) the general death rate. Under "Reflectors of the Present Health Situation," he writes, "The health status of a people is reflected by a number of things, such as infant, maternal, and general death rates, and the prevalence of certain diseases, defects, and deficiencies."[1] He quotes Dr. George M. Lawson, Professor of Preventive Medicine and Bacteriology, University of Virginia School of Medicine, as saying that "the infant mortality of any area is the best single indicator of health."

Thus there seems to be consensus to the effect that crude death rates indicate the trouble spots in the health situation, while the infant and maternity death rates, and death rates from communicable diseases, particularly if taken over a period of years, seem to indicate the effectiveness of the public health program.

Mortality Differentials by Sex a Problem for Study. Students of demography and vital statistics have known for many years that males have higher death rates than females, but, to date, few studies have gone any further than to show that there are differences in the death rates by sex. The English statistician John Graunt (1620-1674) observed that males have a higher sex ratio at birth but that ultimately

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1. Tate, Leland B., The Health and Medical-Care Situation in Rural Virginia, Bulletin 363, Virginia Agricultural Experiment Station, Blacksburg, Virginia, 1944, p. 10.

females constitute about half of the population.[1]

Professor Willcox showed in 1933 that female death rates have improved more than male rates from 1900-1930. He pointed out that fact, and observed that "it is a point inviting analysis."[2] However, he offered no explanation. In another study, however, Willcox attributed most of the excess of male over female deaths to biological forces.[3]

Sydenstricker points out the increase in death rates from certain degenerative diseases, and then summarizing from Wiehl[4] he says, "Wiehl, after a careful study of the sex-age-specific rates for the principal causes of mortality among adults, made the interesting observation that the upward trend in these diseases (except diabetes) was more pronounced among males than females, especially in the ages 35 to 64 years, and pointed out that in the short period considered (1921-1927) the greatest relative increases were in heart diseases and accidents, especially among males."[5] Again Sydenstricker offered no explanation

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1. Graunt, John, Natural and Political Observations Made upon the Bills of Mortality, (edited by Walter F. Willcox) The John Hopkins Press, Baltimore, Md., 1939, p. 71. See Also Duncan, Otis Durant, Social Research on Health, Social Science Research Council, New York, 1946, p. 22.

2. Willcox, Walter F., Introduction to Vital Statistics of the United States 1900 to 1930, Bureau of the Census, Washington, D. C., 1933, p. 41.

3. Willcox, Walter F., Studies in American Demography, Cornell University Press, Ithaca, New York, 1940, p. 120.

4. Wiehl, Dorothy G., "Some Recent Changes in the Mortality Among Adults," Journal of Preventive Medicine, Vol. IV, No. 3, May, 1930.

5. Sydenstricker, Edgar, op. cit., p. 168.

of the sex differential.

Pearl presents data showing that ".... the age specific death-rates are normally lower for females than for males at all ages except possibly at the extreme ends of the life span, where certain difficulties prevent the accurate collection of the data necessary to establish specific rates with the highest degrees of reliability."[1]

Pearl found that not only were age-specific rates generally lower for females but also that from birth to age 20 and from age 50 up, the declines in death rates age-specific were relatively greater. He offers a biological explanation. He says, "Now it is seen that also the female death-rates, within the stated age limits, decline relatively more than the male in a secular period when mortality is generally improving. This is another indication of the innate biological or constitutional superiority of the female sex. For it is plain that public health efforts during the period were not directed more towards females than males. Furthermore, females were not less exposed to general environmental hazards in 1930 than in 1910."[2]

There is one outstanding exception to this trend. In diabetes mellitus, the males are the favored sex. Bortz points out that in 1938 in the United States, there were 9,987 male deaths from diabetes mellitus among those 50-89

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1. Pearl, Raymond, op. cit., p. 181.

2. Pearl, Raymond, ibid., p. 183.

years of age as compared with 20,740 female deaths.[1] He offers no explanation.

In the opinion of the writer, mortality-sex differentials are not adequately explained by the biological causation hypotheses of Pearl and Willcox.[2] There are too many variations in the differentials for which there are no satisfactory biological explanations, and for which socio-economic explanations are more convincing. (It is conceded that biological explanations are more acceptable for certain phenomena.) Many of the differentials by sex may be explained in terms of the social roles of the sexes and their relation to the total social structure. The testing of this socio-cultural hypothesis is outside the scope of this thesis but in Appendix IV, it is elaborated as a partial explanation of causes of death.

Significance of Racial Mortality Differences in Michigan. Research in racial differences to date has not revealed any inherited biological differences which might explain variations in mortality data among races. By and large, differences in mortality for racial groups do not exist because of inherent racial differences, but rather because of various hidden classifications, such as economic differences

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1. Stieglitz, Edward, ed., op. cit., pp. 227-228.

2. See Pearl, Raymond, op. cit., p. 183 and Willcox, Walter F., op. cit., p. 120.

among classes, within racial categories. Linder and Grove explains:

> "It is easy to overemphasize the value of a racial break-down for mortality and natality statistics. The mortality rate is obviously and necessarily a function of age. Very little evidence, however, exists to show that observed differences in mortality for various racial groups are due to inherent racial differences. Race is not independent of other factors, and the economic, social, and medical circumstances of one racial group may be quite different from those of another. When deaths are classified by race there is created also, for example, a hidden classification of economic status to the extent that economic status is correlated with race. An observed difference in mortality between races may in actuality be no more than a difference of mortality for different economic classes. This observation applies to the interpretation of data classified by any other characteristic, but it is particularly important in the case of racial classification."[1]

Since the non-white population in Michigan referred to as "all other races" numbered but 216,463 in 1940 and comprised only 4.1 per cent of the total population, race as a variable offers little by way of explaining the total mortality health situation in Michigan. However, one chapter is devoted to race mortality differentials in Michigan.[2]

Problems in the Treatment of Mortality Data. (a) Adjusting for Age and Sex. In most populations, differences in the age of the population group are so great as to make it necessary to adjust for this factor. As Linder and

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1. Linder, Forrest E. and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Bureau of Census, Washington, D. C., 1943, p. 12.

2. See Chapter V, "Race Mortality Differentials."

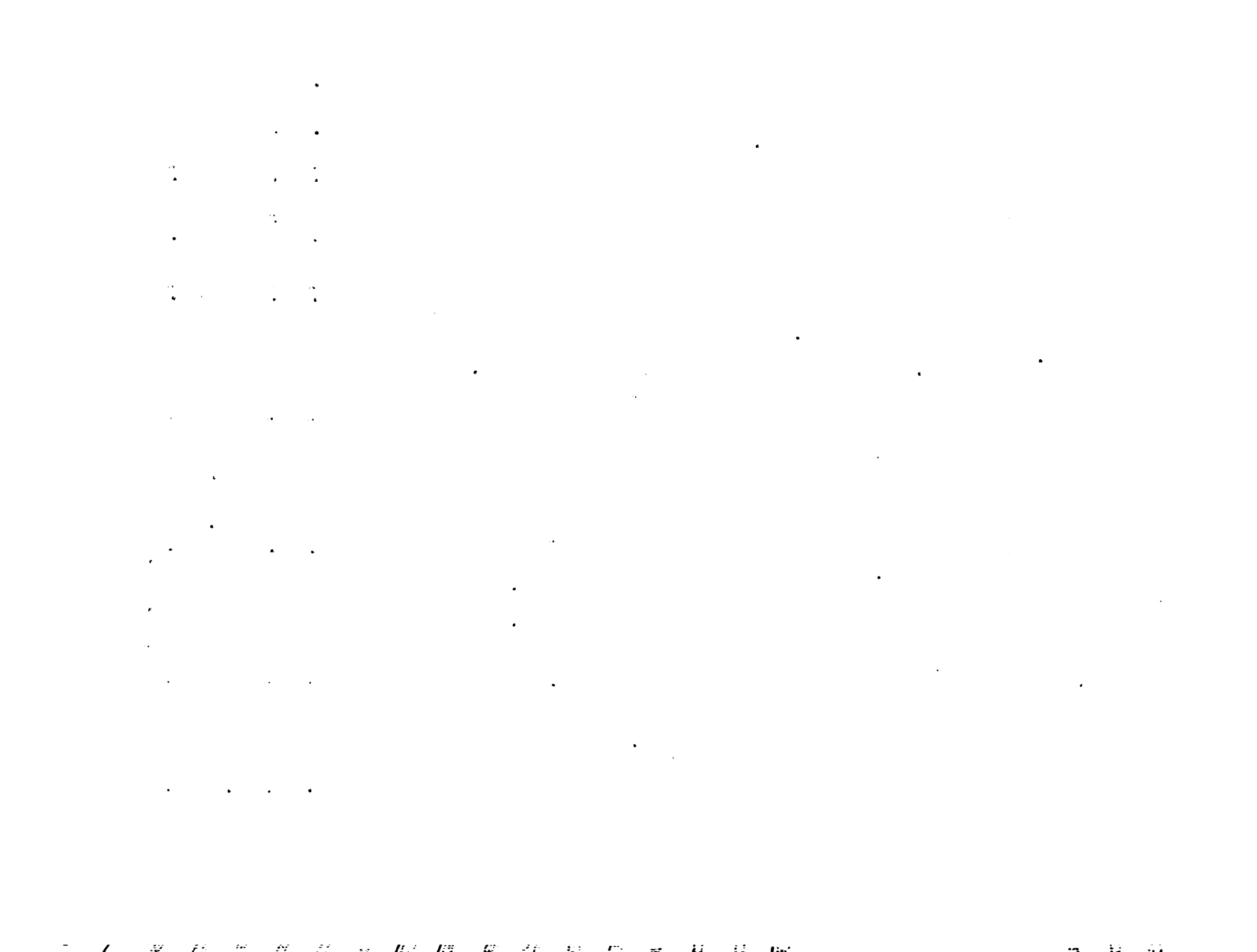
Grove[1] point out, it is usually also desirable to adjust for sex although it ordinarily makes little difference in the result.

(b) Treatment of Unknown Ages. One of the problems which confront investigators interested in mortality data is the number of cases which cannot be assigned to an age frequency because the age is unknown. In some states this number is very high. However, in handling Michigan data it is not a serious problem since the number of "unknown ages" is seldom over 25 in any one year. This small number can be disregarded without affecting the results. Linder and Grove[2] do not attempt to distribute unknown ages, but include them in their "all ages" class in each table. According to their figures, in 1940 there was only one state in which the percentage for unknown ages at death exceeded 1.00 per cent, and in all other states the figure was less than 0.40.[3]

(c) Use of Age Limited Rates. The Committee on Forms and Methods of Statistical Practice,[4] an authority on the use of "age limited rates," recommends limiting age

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1. Linder, Forrest E. and Grove, Robert D., op. cit., p. 68.
2. Linder, Forrest E. and Grove, Robert D., ibid., p. 11.
3. See discussion "Problems Relating to the Reporting of the Causes of Death," p. 29.
4. Linder, Forrest E. and Grove, Robert D., op. cit., Foot note, p. 85.



group populations for a specific disease to those age groups in which the deaths occur. Discussing "age limited rates" they state:

> "These are simply broad age-specific rates designed to measure the mortality from a single disease or group of related diseases. For example, instead of finding the death rate from communicable diseases of childhood based upon the total population, it is found specific for the population under 15 years of age. For heart disease a broad age group from the middle to the end of life may be used. This practice helps to reduce the distortion in cause-of-death rates that is due to varying age distribution."

The Development of Vital Statistics Reporting. Vital statistics have been defined as "the numerical study of groups of human beings politically organized,"[1] and in this sense the term is synonymous with demography. The founding of vital statistics is attributed to Captain John Graunt (1620-1674) by most writers. Graunt made an analytical study of the Bills of Mortality of London and in 1662 published his findings in a book entitled Natural and Political Observations Mentioned in a Following Index and Made upon the Bills of Mortality. Known Bills of Mortality, that is lists of burials, baptisms, and marriages date back as far as 1532, but not until Graunt did anyone attempt to analyze them statistically with the idea of deriving generalizations about the nature of vital statistics phenomena. He is credited with having demonstrated at least four important facts. These have been summarized by Pearl as follows:

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1. Willcox, Walter F., op. cit., p. 195.

> "First, he made clear the regularity of certain vital phenomena which appear to be merely the play of chance in their individual occurrence. Second, he pointed out the excess of male over female births, and the approximately equal numbers of the sexes in the population. Third, he demonstrated the relatively high rate of mortality in the earliest years of life, and finally he discovered that the urban is higher than the rural death-rate normally."[1]

No small contribution, also, was the interest that Graunt stimulated in others to examine vital statistics data.

Perhaps, the next most significant event in the growth of vital statistics was the preparation of the first life table based on what might be considered really sound principles. This work was done by the English astronomer Edmund Halley (1656-1742) and was published in essay form in 1693 under the title "An Estimate of the Degrees of Mortality of Mankind drawn from curious Tables of the Births and Funerals of the City of Breslaw."[2] In passing, one should also mention the work of Adolph Jacques Quetelet (1796-1874), who applied the skill of a trained mathematician to the task of developing a more adequate methodology for the analysis of vital statistics.

With the development of an adequate theoretical background for the analysis of vital phenomena, it remained for Dr. William Farr to insist that such theory be applied toward the solution of practical problems and the attainment of definite goals in the field of public health. Consequently, he adapted statistical procedure to practical ends.

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1. Pearl, Raymond, op. cit., pp. 24-25.

2. Dublin, Louis I. and Lotka, Alfred J., Length of Life, The Ronald Press Company, New York, 1936, pp. 42-43.

Pearl quotes from Greenwood as follows: "...But in the densest forest of symbols Farr never loses sight of, and never allows his companion to lose sight of, some definite and concrete end which he proposes to reach.

"... The greatest mathematical statisticians of the first half of the ninteenth century were not Englishmen; we have not to our credit any theoretical work of that date which will compare with the researches of Laplace and of Poisson in France or Gauss in Germany; but of no civilized country can a record of fatal disease be constructed with the precision which appertains to the medico-statistical history of England and Wales since 1840."[1]

In the new world, Lemuel Shattuck, born in 1793, became interested in the problems of public health, perhaps because of the loss of four members of his family from tuberculosis, and through this interest introduced several major reforms of a practical nature into vital statistics procedures. Although a layman, Shattuck is credited by Willcox with the following achievements:

> "Shattuck was the leader in founding the American Statistical Association.
>
> "He was the main agent in carrying to a successful conclusion the prolonged campaign for that effective system of registering births, marriages, and deaths in Massachuesetts, which has now expanded to include every state in the Union.
>
> "Through his influence and that of his Boston census of 1845 upon the Federal census of 1850, the

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1. Pearl, Raymond, op. cit., p. 32 from Greenwood, Major, Medical Statistics, Lancet, May 7, 1921.

census practice of the United States was modernized.[1]

> "Through his Plan for a Sanitary Survey of Massachusetts to be executed by a projected State Board of Health, he contributed more than any man of his generation, professional or lay, to the improvement of American public health and preventive medicine. Such a State Board of Health, was established in Massachusetts 20 years after his report recommended it and then imitated in State after State.
>
> "Through the 50 recommendations embodied in the Plan he anticipated nearly all the public health measures not based on bacteriology which were introduced in the following two generations."[2]

John Shaw Billings (1838-1913) while attached to the Bureau of Census was the first man to suggest machine tabulation of vital data. These machines were employed successfully for the first time in 1890 and greatly increased both the accuracy and volume of work.[3]

The Death Registration System. As first used the term vital statistics applied chiefly to mortality and morbidity data, and in the United States was identified with registration statistics rather than census figures. This separation was natural since the legal basis of the two reporting systems varied. The taking of decennial censuses was required in our Constitution and was under Federal control. The first Federal census in the United States was in 1790 but it was not until 1902 that the Bureau of Census was made a perma-

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1. One valuable innovation was the substitution of the individual for the family as a census unit.
2. Willcox, Walter F., op. cit., p. 479.
3. Willcox, Walter F., ibid., p. 488.

nent governmental body.[1]

Registration statistics, on the other hand, were the responsibility of the state and local governments and had a more spotty development. State figures were then pooled in a Federal report. The first states to report for a national total were Massachusetts, New Jersey, and Washington, D. C., in 1880.[2]

After the Bureau of Census became a permanent group in 1902, it sponsored a national registration system for both deaths and births. Perhaps because American citizens were more interested in the public health movement than in some other aspects, the registration of deaths progressed more rapidly than that of births. The first step was to collect all the laws, ordinances, and statistical forms pertaining to the registration of deaths in use by the states and local units from which a model form was drafted. The American Public Health Association pioneered in this work and later it was endorsed by the American Medical Association and similar bodies. This became the basis for a uniform Federal Reporting System.

A model state law was also drafted and submitted to Congress for approval with the recommendation that it be adopted by the states. Most of the states passed the model law or one similar to it. Michigan was among the ten states included in the original death-registration States of 1900.

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1. Pearl, Raymond, op. cit., pp. 22-24.

2. Linder, Forrest E. and Grove, Robert D., op. cit., p. 96.

By 1910 twenty states were in the death-registration system, in 1920 the number leaped to thirty-four, and finally in 1933, for the first time, all of them were admitted to both the birth-and death-registration systems.[1] The main features of the death-registration system provide:

1. A state law controlling the reporting system.
2. Provisions in the state law which prohibit the disposal of a corpse until a permit has been secured.
3. Provision that a permit cannot be given until a certificate of death has been completed on a standard form. This form includes a statistical description of the deceased and a professional statement of the cause of death.
4. Completion of the certificate of death by the undertaker with the necessary assistance of friends, physicians, etc.
5. Provision for a standard nomenclature and classification of causes of death excluding vague statements of cause. These have been revised periodically.
6. Provision that the local registrar file with the State registrar each month the certificates which he has received.
7. Provision for state supervision and follow-up by the State registrar.
8. Provision for the purchase of copies of the certificates from the state and local units by the Federal Government, to be turned over to the Bureau of Census for the preparation of data to be made available to the registration States.[2]

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1. Linder, Forrest E. and Grove, Robert D., op. cit., pp. 96-99.
2. Willcox, Walter F., op. cit., pp. 202-203.

Admittance to the national registration system is achieved (1) by demonstrating that at least 90 per cent of all deaths or births were registered, and (2) by passing a state law controlling registration.

It is believed by most authorities that death registrations are more complete than birth registrations although no Nation-wide test of death registration has ever been made. Some comparison may be made by observing the results of the Nation-wide test of the completeness of birth registration made by the Bureau of Census in 1940. According to this test, only 7 of the 48 states had a higher percentage return for birth registration than Michigan, which averaged 97.8 per cent. Returns from Michigan were more complete than from all other States in the East North Central Region.[1] Willcox[2] presents data to show that the nine states with the lowest death rates in 1935 averaged only about half as long a period in the death-registration area as the other forty states including the District of Columbia. It is evident that some of these States with death rates under 10 per 1,000 population, for example Arkansas, have low rates partly because of incomplete registration returns. It is estimated that only 75.9 per cent of the births in Arkansas were registered in 1940.

Willcox applied the same sort of analysis to death rates by rural and urban areas in 1930, and showed that

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1. Linder, Forrest E. and Grove, Robert D., op. cit., p. 99.
2. Willcox, Walter F., op. cit., p. 211.

rural rates were more equal to urban rates in those states where the registration system was initiated earliest. In the West South Central States, the rural death rate was only 8.3, and in the West North Central 9.1, while the urban death rates for these regions were 15.6 and 13.1 per 1,000 population respectively.[1] This seems to be acceptable evidence for Willcox's contention that death rates tend to be trustworthy only after a state has had ample time to perfect its registration system. However, it does not follow that the longer a state has been in the registration system the more complete will be its registration returns. Where there is reason to believe that the number of deaths are incomplete, death rates should be interpreted with great caution and where possible adjusted for under-registration. For example, there is reason to believe that Louisiana has a fairly high amount of under-registration of deaths because of its low percentage of birth registrations (86.1), much of which is likely to be in rural areas. Thus, the low death rates in this State for rural areas (8.7 per 1,000 in the rural areas for all causes as compared with 13.7 in the urban districts)[2] may be due to failure to report all deaths that occur.

Problems Relating to the Reporting of the Causes of Death. There are several sources of error which influence the original data on which specific-cause death rates are based,

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1. Willcox, Walter F., ibid, p. 213.

2. Kemp, Louise and Smith, T. Lynn, op. cit., p. 14.

especially when they are studied over a period of time. Some of the important ones are listed here and are followed by brief discussion.

1. Periodic revisions of the International List of Causes of Death.
2. Proportion of death certificates with only one cause of death given by the physician.
3. Variation in the accuracy of the diagnosis of causes of death by physicians among states, and in rural versus urban areas.
4. Number of deaths classified as "ill-defined and unknown causes."
5. Under-registration of deaths.

Early in the development of the statistics of mortality, it became obvious that if data were to be comparable from locality to locality a uniform system of classification was necessary. In 1853 the First Statistical Congress, held in Brussels, appointed William Farr and Marc d'Espine to draw up such a classification. Their system, subsequently prepared, was adopted in Paris in 1855. It was revised in 1864, 1874, 1880, and 1886. In 1893, arrangements were made for decennial revisions and the last one was completed in 1938.[1] Obviously data collected prior to 1938 must be adjusted for this factor before it can be considered comparable. Insofar as possible the Bureau of Census indicates comparable causes within specified dates.

Another factor complicating mortality data is the increasing number of death certificates being returned with

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1. Pearl, Raymond, op. cit., pp. 57-58.

more than one cause of death listed. Pearl makes this observation, "It is interesting to note that in the 20 years from 1917 to 1936 inclusive the percentage of such certificates in the United States Registration Area rose from about 35 to almost 60.... -- a reflection of a more widespread desire to report causes of death as accurately, intelligently, and honestly as possible."[1] In 1929 the Commission for Revision of the International List of Causes of Death requested the United States Government to study the problem, and Dr. Timothy F. Murphy, then Chief Statistician of the Division of Vital Statistics, United States Bureau of the Census, initiated the study. He compiled a set of 1032 cases containing from two to five causes of death and submitted them to the statistical offices of 18 countries. Seventeen countries replied. The largest consensus regarding the primary cause of death was for cancer and other tumors with an average of 77.4 per cent.[2] At present, the offices of vital statistics operate under a set of arbitrary rules. But, as the study mentioned above indicates, considerable work must be done in revising and interpreting these before international data can be presumed comparable.

Variation in the accuracy of the diagnosis of causes of death by the physician is another factor which introduces

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1. Pearl, Raymond, ibid., pp. 59-60.

2. Pearl, Raymond, ibid., pp. 60-61.

sources of error into mortality statistics. Pearl observes, "Some physicians all of the time and all physicians some of the time, will use their own terminology instead of that of the International Classification in reporting the cause of death on the original death certificate .... The only conceivable remedy is the slow and tedious one of education leading to ever closer and more precise cooperation ...."[1] Such errors tend to be greater in less advanced and isolated areas of the nation because they are largely dependent upon the efficiency and cooperation of physicians and administrators of the registration system.

Perhaps one of the major sources of error is the number of deaths classified as "ill-defined and unknown causes." There is great variation among the states in this respect. In 1940 New Mexico had more than 20 per cent of its total deaths so classified as compared with 0.01 per cent in Rhode Island. Obviously, a comparative study of the causes of mortality between the two States would have little value. In trend studies, it is important to note the proportion of deaths classified as "ill-defined and unknown causes" because the increase in some of the specific causes may result from a decrease in deaths assigned to ill-defined and unknown causes. In states and geographic areas where it is known that a high proportion of deaths are unreported or are classified as ill-defined and unknown causes,

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1. Pearl, Raymond, ibid, p. 59.

there is no really satisfactory way to adjust data for a study of causes of death. Obviously, mortality studies of causes in these areas should be interpreted with great caution.

Many physicians not only report inaccurately but in some instances fail to report at all. This results in under-registration of both births and deaths. For some localities, these omissions are quite large, if results of the Census Bureau Nation-wide test of birth registration completeness is any indication.

Thus, it appears that the best known indices of the influence of these various sources of error on mortality data are (1) the proportion of deaths classified as ill-defined and unknown causes, and (2) results of the Bureau of Census Nation-wide test of birth registration completeness. If the state ranks low in completeness of birth registration and high in ill-defined and unknown causes, then the inaccuracies resulting from all of the other sources of error listed above are likely to be present also.

In Michigan, according to the Nation-wide test, 97.8 per cent of all births were reported for the year 1940, while only 4.1 per cent of the deaths were classified as ill-defined and unknown causes. We are assuming, therefore, that Michigan is among those states having the more accurate mortality data. Specific-cause death rates are among those included in this study.

Twenty-five causes of death listed by the Bureau of Census as being comparable over a period of time are presented

for several classes of the population.[1] In an effort to obtain more accuracy, the change in the death rates from these causes is shown for the period 1910-1940. All rates are based on deaths allocated to place of residence unless otherwise indicated.

1. Linder, Forrest E. and Grove, Robert D., op. cit., pp. 104-106.

CHAPTER II

METHODS AND PROCEDURES

Importance of Mortality Studies

In Chapter I, the importance of health studies[1] was discussed briefly from a general view, but in this section a specific emphasis is placed upon the value of analyses of the incidence of death. The ability of individuals, or groups of individuals, to live long and to "stay the hand of death" has not been an object of scientific study until relatively recent years.[2] However, there has probably always been an interest in the subject. In the words of Dublin and Lotka, "From time immemorial, the

> length of the human life span has been a topic of the keenest interest. The poetic reference to it by the Psalmist is in the mind of every one. That this interest in longevity continues to date is seen in the frequent references in the daily news to the span of life, and to the gains which have been made in the average duration of life, especially within the last century."[3]

Aside from the curiosity and interest manifested by the ordinary citizen in such questions as, "How long will I live?" or "Who dies in my community?" systematic analyses of mortality rates in communities and States may be justified in part, at least, by the following:

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1. See pp. 1-5.
2. See pp. 22-25 for a brief discussion of the history of Vital Statistics.
3. Dublin, Louis I., and Lotka, Alfred J., op. cit., p. 111.

1. Mortality data are more completely and accurately recorded than morbidity, and for this reason they are more commonly employed in analyses of the health of a population. Reporting of deaths is enforced by law, and the rules and regulations of the death-registration system[1] are now in force in all of the States. Michigan was included in the original ten death-registration States of 1900, and with this long history of participation in the national registration system this State may be considered among those having the more accurate mortality data.

2. Hospital planning now under way in many States, makes use of the number of deaths taking place in the community in estimating facilities which should be provided. This is especially important because deaths occurring in hospitals are increasing. The Michigan Hospital Survey, for example, related the number of deaths in the hospitals of a community to the length of stay and computed an index which they used in determining the need for hospital beds.[2]

3. Health campaigns having financial and educational goals tend to lean heavily upon the arguments supplied by the increasing number and rate of deaths from pertinent causes. One needs only to mention such research and educa-

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1. See pp. 25-29 for a history of the death-registration system in the United States.

2. Report of the Michigan Hospital Survey, op. cit., Chapter VII, p. 101 for a discussion of the bed-death ratio and its use in estimating the number of hospital beds needed.

tional programs as those presented in behalf of cancer and heart diseases control.

Objectives

The general purpose of this study is to describe systematically the mortality characteristics of the population of Michigan. To achieve this end, the analysis will be centered around the following general questions:

A. What is the present mortality situation[1] in Michigan?

B. How does present mortality in Michigan compare with the Nation?

C. Are there great variations among the counties?

D. What are the principal changes in Michigan compared with the United States?

The specific items to be analyzed are listed as follows:

1. The principal causes of death and their relative rank in Michigan, for rural and urban areas.

2. Age, sex, and race mortality differentials in Michigan.

3. Mortality in Michigan compared with the Nation classified by age, sex, race, residence, and principal causes of death.

4. The principal causes of death in counties of Michigan by rural and urban residence.

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1. The present situation is defined as the year 1940 or averages centering around this year.

5. Changes in the principal causes of death in Michigan and the Nation, 1910-1940.

6. Changes in age-and sex-specific death rates of Michigan and the Nation, 1910-1940.

7. Changes in mortality differentials by race, Michigan and the Nation, 1910-1940.

Hypotheses

Although death rates tend to follow the same general patterns throughout the United States, there are sufficient variations in social, economic, and other environmental conditions to justify the testing of several widely accepted generalizations of mortality phenomena. Proven propositions based on social phenomena do not necessarily remain true from one period to another. Changes in mortality rates are in part reflections of variation in the population composition. Molyneaux probably expresses a rather widespread reaction when he writes concerning the generalization that the urban is higher than the rural death rate, "We have reached a time when it becomes necessary to qualify this proposition."[1]

As time progresses, some mortality differentials are becoming less and others greater, and further these changes are not likely to be identical in all local areas and in all

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1. Molyneaux, Lambert, Gilliam, Sara K., and Florant, L.C., "Differences in Virginia Death Rates by Color, Sex, Age, and Rural or Urban Residence," American Sociological Review, Vol. 12, No. 5, 1947, pp. 532-533.

parts of the country. If we know that, in general, non-whites do have higher death rates than the white population, this knowledge provokes equally important questions as to whether the magnitude of differences is greater in urban or in rural areas, or in one region as compared with another.

Thus, this dissertation will be concerned with such natural inquiries as: Do males have higher death rates than females? Is Michigan an exception? Do sex differentials vary among segments of the population? Does a particular racial, sex, or resident group have higher rates from a certain disease than another? Are the mortality characteristics of rural residents in highly urban counties the same as those living in predominantly rural counties? These, and many other questions considered in this dissertation are listed below as propositions and are considered the hypotheses of this study.

1. Urban death rates are higher than the rural.
2. Colored death rates are higher than the white.
3. Males have higher death rates than females.
4. Death rates have declined in all segments of the population.
5. Small cities have higher rates than large cities.
6. The Nation has higher death rates than Michigan.
7. Mortality change is greater for the Nation than for Michigan.
8. Sex-mortality differentials are increasing.
9. Mortality declines for younger ages are greater than for older ages.

10. Race-mortality differentials are decreasing.

11. Infant and maternal death rates are decreasing.

12. Mortality rates for chronic diseases are increasing.

13. Sex-mortality differentials are greater in urban than in rural areas.

14. Rural death rates tend to be high in counties where urban rates are high, and low where urban rates are low.

15. There is an inverse relationship between size of city and mortality rates.

The implications of a mortality generalization are usually matters of interpretation or deduction. However, inferences as to general health conditions may be more accurately indicated by certain rates than others. For example, infant death rates, tuberculosis, and mortality rates for other communicable or preventable diseases are frequently employed as measures of the health level of a population. Such implications, or possible explanations, are indicated frequently in this dissertation. However, no attempt is made to test hypotheses involving causes or explanations of high rates. A social-causation hypothesis of mortality differentials is briefly elaborated in Appendix IV.

Measures of Mortality Employed

The number of deaths per 1,000 or 100,000 population is the basic measure employed, although it is usually refined by (1) computing the rate for specific classes of the population, such as, age, sex, race, and residence; or (2) adjusting, or standardizing, the rate for age. These measures are

commonly referred to as crude death rates, specific death rates, and adjusted death rates.[1] In general, the more refined the rate, the more specific the meaning and thus the less chance there is of misinterpreting the rate.

With the exception of infant and maternal death rates, deaths are related to the population as enumerated by the Federal Census in April, 1940, rather than the estimated mid-year population as is customary. The population of Michigan was fluctuating and growing quite rapidly[2] during this period and it is believed that the conventional practice of employing estimated populations as of July 1 would result in an appreciable error. It is assumed, therefore, that the errors of mid-year population estimates for Michigan in 1940 are greater than those introduced into the rates by employing enumerated populations of a date only a few months from the mid-year.[3]

Procedures Used in Analyses of County Data

The mortality rates presented for the counties include

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1. See Appendix I for a list of all formulas used in this study. The direct method of adjusting death rates is used wherever possible, and the standard population used in most instances is the United States, 1940. This information is given in the tables where the adjusted rates are presented. The indirect method is employed for adjusting rates by principal causes in counties. Examples of these methods are given in Appendix I.

2. See Beegle, J. Allan, Michigan Population, Michigan State College, Agricultural Experiment Station, East Lansing, Michigan, Special Bulletin 342, p. 11 and 21.

3. See Linder, Forrest E., and Grove, Robert D., op. cit., p. 37 where such an assumption is recommended under stated conditions.

the following:

(1) Total crude and age-adjusted rates

(2) Crude rates by residence

(3) Ten principal causes and suicide

(4) Five principal causes by residence

(5) Infant death rates for total and rural and urban areas.

These data are given both in tables and maps. The major problem with which one is confronted in attempting to analyze death rates for counties is the small number of deaths on which some of the rates are based. This problem also occurs for some of the State data separated into racial groups. In order to provide a basis for evaluating death rates, it is necessary to indicate those rates which are based on small numbers of deaths. Therefore, following a procedure employed by the United States Bureau of the Census and the National Office of Vital Statistics,[1] all death rates which are based on less than 20 deaths are indicated by underscoring. Differences, and especially small ones, between two such rates should be interpreted with caution.[2]

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1. The Vital Statistics Division of the United States Bureau of Census was transferred to the United States Public Health Service in July 1946 and is now known as the National Office of Vital Statistics.

2. According to studies made by the U.S. Bureau of Census and reported by Linder and Grove, a death rate based on 20 deaths "...has a standard error of roughly 22 percent of the magnitude of the rate. Rates based on smaller frequencies have larger standard errors, and those based on larger frequencies have smaller standard errors. The standard errors of many of the rates based on frequencies greater than 20 should also be calculated before a conclusive interpretation of the differences between the rates is made."
(See Linder, Forrest E., and Grove, Robert D., op. cit. p. 94.)

In view of the foregoing consideration another technique was employed to increase the accuracy of rates in local areas. This method consisted of finding the total number of deaths in each county for ten years, 1935-1944, and relating the average deaths to the corresponding enumerated populations of 1940. This procedure produces a much more stable death rate than one for any single year.[1] Thus the county rates which are underscored indicate the number of deaths to be under 200 rather than 20. Oscoda, the smallest county in the State, a population of 2,543 in 1940, had 227 deaths during the ten years or an average of 22.7. All of the counties had more than 200 deaths and only four counties had less than 500 during the ten years. Although many of the rates for specific causes are based on less than 200 deaths, the stability introduced by the ten-year average appears to give them a relatively high degree of consistency. This consistency is indicated by the regular occurrence of counties either in high or low rate columns as expected.

Order of Presentation

Part I of this study presents in this and the foregoing chapter the introductory materials pertaining to the problems, methods, procedures, and objectives of mortality

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1. Michigan began allocating deaths to place of residence in 1935, and mortality data for rural and urban residents in counties are available in the Annual Reports of the Michigan Department of Health since that date. Prior to 1935 only deaths by place of occurrence are available.

studies and at appropriate places indicates their bearing on this particular analysis.

Part II portrays in four chapters the mortality--health situation in Michigan as of 1940, presenting data for the State as a whole covering rural-urban differentials, racial differences, and finally comparisons of Michigan with the United States.

Part III, a discussion of internal variation, consists of two chapters devoted to the analysis of county data.

Part IV, a section on trends, shows in one chapter some of the changes in mortality that have occurred during a thirty year period, 1910-1940, for Michigan in comparison with the United States.

Part V. Summary and Synthesis.

The pattern of presentation within each chapter is as follows: (A) Data, (B) Interpretation, (C) Summary. The tables and graphic materials are placed on the same page with the discussion when possible; otherwise they follow the page after which the reference is made.

Sources of Data

The primary sources required for an analysis such as the present one are the official tabulations published by the State and National Bureaus of Vital Statistics. The State data has been obtained from the following two sources:

Vital Statistics of the United States, 1940, Part II, Residence, United States Government Printing Office, Washington, D.C., 1943.

(Data in this volume covering the calendar year 1940 are compiled from transcripts of original death certificates received from registration officials of States, cities, and territory and possessions of the United States. Data are classified by geographic area, cause of death, age, sex, race, and institution. Tabulations were prepared under the immediate supervision of Dr. Robert D. Grove, Social Science Analyst, and Dr. Iwao M. Moriyama, Associate Biometrician. See page one.)

Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, United States Government Printing Office, Washington, D.C., 1943.
This volume contains detailed time-trend tables of mortality. (Death rates are based on official tabulations of deaths and include specific rates for cause of death, age, sex, race, and geographic area. No adjusted rates are included. The age-specific rates in this volume were employed in adjusting rates for the dissertation.)

The county data presented in Chapters VII and VIII are from the following source:

Annual Report of the Michigan Department of Health, Numbers 64 through 73, Michigan Department of Health, Lansing, Michigan, 1936-1945.

The bibliography at the end of the dissertation lists the complete reference to all publications cited. Citations also occur on the page where the reference is made.

Table and Figure Numbering System

Tables and Figures are numbered consecutively within each Chapter preceded by the chapter number as follows:

Chapter VII	Table 7.1	Figure 7.1
	Table 7.2	Figure 7.2
Chapter VIII	Table 8.1	Figure 8.1
	Table 8.2	Figure 8.2

The first table and the first figure in Chapter VII, for example, are referred to as "Table 7.1" and "Figure 7.1."

A text reference to the second table listed in Chapter VIII is referred to as "Table 8.2".

The Appendices

The appendices are given Roman numerals and tables in them are numbered consecutively by Arabic numerals within each Appendix. Several large tables are placed in Appendix II.

PART II

PRESENT HEALTH SITUATION IN MICHIGAN

CHAPTER III

MORTALITY AND HEALTH IN MICHIGAN: A GENERAL VIEW

Crude Resident and Age-Adjusted Death Rates

In 1940 the crude resident death rate[1] for all causes in Michigan was 9.9 per 1,000 of the total population. This includes deaths from unknown causes. This rate comprises all residents of Michigan whether they died in or out of Michigan.[1] When the period 1935-1944 is taken as representative of the present situation, the crude resident death rate[1] for Michigan is slightly higher, namely 10.1 per 1,000 population. This ten-year average, perhaps, more accurately measures the force of mortality[2] on the Michigan population. When the deaths on which the 1940 rate is based are adjusted to the age distribution of the population of the United States in 1940, the age-adjusted death rate[3] is approximately the same as the ten-year average rate, namely, 10.2 per 1,000

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1. For a statement of the method of computation, meaning as a measure of health, advantages and disadvantages of the crude resident death rate, see pp.309ff. All death rates employed in this study are based on deaths allocated to the place of residence of the person unless otherwise indicated. Deaths were allocated to place of residence in Michigan for the first time in 1935, and this practice had been continued in all subsequent Vital Statistics Reports. Mortality data prior to 1935 are not available for computing the crude resident death rate, and it is necessary to employ deaths by place of occurrence.

2. For a discussion of the force of mortality, see p. 13.

3. See Appendix I for method of computation, meaning, and uses of the adjusted death rate. Here the 1940 deaths were adjusted by both the direct and indirect methods and essentially the same result was obtained using the population of the United States in 1940 as a standard.

population. The crude resident death rate for the year 1945 was 9.9[1] per 1,000 population, or the same as for 1940; however, this does not mean necessarily that no changes occurred in any of the varying mortality risk groups composing the respective populations. Although Michigan's population fluctuated a great deal from 1930-1940 and since 1940 during the war years, it is likely that most of this change has been between the rural and urban areas within the State.[2] However, there has been a slow, steady flow of negro and white migrants from the Southern States to the industrial centers of Michigan, which probably has influenced the mortality patterns more than the rapid population movements in Michigan occurring during the war.

In view of the close similarity among the four rates presented, it is reasonable to assume that the relative standing of classes (specific mortality risk groups) in 1940 remained approximately the same in 1945. (The 1940 crude rate is 9.9, which is identical with the 1945 crude death rate; and the ten-year average crude death rate is 10.1 which is almost the same as the age-adjusted death rate for 1940, namely, 10.2.) Since 1940 is a more satisfactory year for a detailed analysis of data inasmuch as

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1. "Deaths and Death Rates for Selected Causes United States, Each Division and State, 1945," Vital Statistics--Special Reports, 1947, Volume 27, Number 3, Table2, p. 41.

2. See Commission on Hospital Care, "State Hospital Study Manual," Book IV, (maps and tables) pp. 10-12, (preliminary draft).

population estimates for some of the classes are not available for other years, the year 1940 will be used.

Age-Specific Death Rates

There are greater variations among the various age-group mortality rates than among any other classes of the population for the obvious reason that the risk of death is very much greater at certain ages than at others (see Table 3.1). The age-specific death rates[1] for a given population have a characteristic form. It is a picture of high death rates for those under age 1 year, the rates dropping to the lowest point at ages 5-14, and then rising steadily until the end of the life span.

Table 3.1

AGE-SPECIFIC DEATH RATES, MICHIGAN, 1940

Age Group	Rate per 1,000 Population
All Ages[1]	9.9
Under 1	48.1
1 - 4	2.2
5 - 14	1.0
15 - 24	1.7
25 - 34	2.5
35 - 44	4.6
45 - 54	9.6
55 - 64	21.2
65 - 74	48.2
75 - 84	113.6
85 Over	245.1

[1] Includes deaths of unknown ages.
Source: Computed from Vital Statistics of the United States, 1940, Volume II, Residence, Table 9, p. 190.

1. For a statement of the method of computation, advantages, and disadvantages of the age-specific death rates, see Appendix I.

In Table 3.1 are shown the age-specific death rates for Michigan and the rate for all ages. At least three similarities can be pointed out. (1) The age-specific death rate that most nearly approximates the crude resident death rate for the State is 9.6 for age group 45-54. This is interesting since it indicates that an individual living in Michigan is subject to approximately the same average chance of death as are the people living there who are of age 45-54. (2) The age-specific rate for persons under 1 year of age is approximately the same as it is for the old aged group, 65-74, the rates being 48.1 and 48.2 respectively,--though persons in these two classes die from quite different causes. (3) The chance of death occurring to people aged 1-4 is 2.2 per 1,000 population, which is quite close to the probability of death for the population aged 25-34, namely, 2.5.

The greatest difference between age-specific death rates occurs between age group 5-14 and those 85 years and over. The lowest rate is that of age group 5-14, 1.0 per 1,000 population; and the highest rate, 245.1, that of age group 85 years and over. All of the age groups 55 years of age and up have death rates ranging from 21.2 to 245.1, which are two or more times the rates of all other age groups except those under 1 year of age. The low death rate age groups are 1-4, 5-14, 15-24, 25-34, 35-44, and 45-54. Thus, the age groups from which a toll of more than 10 deaths per 1,000 population in each age group is taken

Table 3.2

NUMBER OF DEATHS PER 10,000 OF TOTAL DEATHS OF KNOWN AGE, MICHIGAN, BY AGE GROUPS, 1940

Age	Deaths of Known Age	
	Number	Per 10,000 Deaths
Under 1	4,032	773
1 - 4	760	146
5 - 14	860	165
15 - 24	1,631	313
25 - 34	2,105	404
35 - 44	3,505	672
45 - 54	6,289	1,206
55 - 64	8,677	1,664
65 - 74	11,084	2,125
75 - 84	9,974	1,913
85 Over	3,230	619
Total	52,147	10,000
Unknown age	36	

Source: Computed from Vital Statistics of the United States, 1940, Vol. II, Residence, Table 9, p. 190.

Table 3.3

NUMBER OF PEOPLE PER 10,000 TOTAL POPULATION, MICHIGAN, BY AGE, 1940 (Enumerated as of Apr. 1)

Age	Total Population of Known Age	
	Total Population	Per 10,000 Population
Under 1	83,807	159
1 - 4	347,577	661
5 - 14	882,772	1,680
15 - 24	935,371	1,780
25 - 34	848,848	1,615
35 - 44	763,633	1,453
45 - 54	654,347	1,245
55 - 64	408,897	778
65 - 74	229,842	437
75 - 84	87,831	167
85 Over	13,181	25
Total	5,256,106	10,000

Source: Computed from Linder, Forrest E. and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, U. S. Government Printing Office, Washington, D. C., 1943, Table II, p. 898.

are those under 1 year of age and all age groups above 55 years of age (see Table 3.1). In Tables 3.2 and 3.3 the proportions of deaths and of populations in each age group are given.

Age and Sex Differences

Sex mortality differentials by age groups are given in Table 3.4.

Table 3.4

AGE-SEX SPECIFIC DEATH RATES, MICHIGAN, 1940

Age Groups	Rates per 1,000 Population		
	Male	Female	Excess Male
All Ages[1]	11.0	8.9	2.1
Under 1	55.1	40.7	14.4
1 - 4	2.3	2.0	.3
5 - 14	1.1	.8	.3
15 - 24	2.1	1.5	.6
25 - 34	2.7	2.2	.5
35 - 44	5.0	4.1	.9
45 - 54	11.0	7.9	3.1
55 - 64	24.2	17.9	6.3
65 - 74	53.5	42.8	10.7
75 - 84	122.2	105.2	17.0
85 Over	249.0	241.7	7.3

[1] Includes deaths of unknown ages.
Source: Computed from Vital Statistics of the United States, 1940, Volume II, Residence, Table 9, p. 190.

These data may be summarized as follows: (1) Death rates for males are higher than rates for females in all age groups, although some of the differences are small. (2) The excess of death rates for males over death rates for females vary from .3 per 1,000 population for those aged 1-14 years to 17.0, the greatest excesses being for those under 1 year of

age and those over 45. In general, the excess of rates for males over the rates for females steadily increases from age group 5-14 through age group 75-84. (3) Certain pairs of age groups have approximately equal death rates for males, and also approximately equal rates for females. They are summarized below:

Pairs of Age Groups	Male Rate	Female Rate
(1) All Ages	11.0	8.9
45-54 Years	11.0	7.9
Difference	.0	1.0
(2) 1 - 4 Years	2.3	2.0
15-24 Years	2.1	1.5
Difference	.2	.5
(3) Under 1 Year	55.1	40.7
65-74 Years	53.5	42.8
Difference	1.6	2.1

Rural-Urban Mortality Differentials

The crude and age-adjusted death rates for rural and urban areas are presented in the table below:

Table 3.5

PERCENTAGE DISTRIBUTION OF POPULATION, CRUDE RESIDENT AND AGE-ADJUSTED DEATH RATES, RURAL AND URBAN AREAS OF MICHIGAN, 1940

Residence Area	Percent Population	Crude Death Rate Per 1,000 Pop.	Age-Adjusted[1] Death Rate Per 1,000 Pop.
State	100.0	9.9	10.2
Urban	65.7	9.4	10.4
Rural	34.3	11.0	10.2

[1] Adjusted by direct method using the population of the United States for 1940.

Source: Vital Statistics of the United States, 1940, Volume II, Residence, Table 9, p. 190.

Crude resident death rates reveal that each year approximately 11.0 persons per 1,000 population living in rural areas die from all causes in comparison with 9.4 in the cities and towns. These two death rates indicate that urban mortality data tend to determine the death rate for the State. The variation of the rural rate from that of the State is 1.1 while the urban rate varies from the State rate only .5. This is to be expected since 65.7 percent of the total population of the State is urban and only 34.3 percent is rural. Because the urban population is young in comparison with the rural population, urban deaths reduce the crude death rate for the State. This rate is 9.9 per 1,000 population. When the rural crude rate is adjusted to the age distribution of the United States, it is lowered from 11.0 to 10.2; and when the urban rate is adjusted in the same manner, it is raised from 9.4 to 10.4.

Racial Mortality Differences[1]

Although Michigan has relatively few colored people and many of their death rates are based on small numbers of deaths, it is considered desirable to present some of the mortality differentials by race. The colored population of Michigan has increased rapidly during the past three decades,[2] and especially since the war. In all probability,

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1. See Chapter V for a more detailed treatment of racial mortality differentials.

2. See Table 5.1 in Chapter V.

it will continue to increase for the next few years.

In 1940 there were 216,463 colored people in Michigan of whom 96.2 percent were negro. The remaining 3.8 percent were primarily Indians. These groups combined had a crude death rate for that year of 12.6 per 1,000 population as compared with 9.8 for the white race (see Table 3.6). Thus, colored persons in Michigan die at a rate almost 3 per 1,000 population greater than that at which white people die, the excess of the rate for the colored group over the white being 29 percent.

Table 3.6

CRUDE RESIDENT AND AGE-ADJUSTED DEATH RATES FOR THE WHITE RACE AND ALL OTHER RACES, MICHIGAN, 1940

Race	Rates Per 1,000 Population	
	Crude Death Rate	Age-Adjusted Death Rate[1]
White Race	9.8	10.0
All Other Races	12.6	15.8
Difference	2.8	5.8

[1] Adjusted to the age distribution of the population of the United States, 1940, by the direct method.

Source: Crude data from Linder, Forrest E. and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, United States Government Printing Office, Washington D. C., 1943, Table 10, p. 193.

In spite of the fact that the colored group has a younger age distribution than the white population in Michigan, the crude death rate of the non-white segment is 29 percent higher than that of the white. Furthermore, when these two death rates are adjusted to the age distribution of the population of the United States for 1940, the

differential becomes even greater. The actual difference between the age-adjusted death rates is 5.8, which means that if the two racial groups had the same age distribution the colored people would die at a rate 58 percent higher than that of the white group. Thus, the excess of the death rate of the colored population over that of the white population cannot be explained in terms of their age distribution because they do not have larger proportions of their number among the upper ages (45 years and over) where the chronic diseases take such a large toll of human lives. It is not the object of this chapter to explain such differences but rather to show that they exist as a characteristic of Michigan's population. Several explanations for the high mortality rate among the colored races are offered in Chapter V.

Twenty-five Selected Causes of Death[1]

To know that 52,183 persons died in Michigan in 1940 is of little value unless such information is supplemented by an adequate analysis of the causes of death. It is the constantly shifting emphasis among the causes of death that introduces much of the uncertainty into the planning of health programs. An inspection of Table 3.7 indicates that in 1900 the two chief causes of death were communicable diseases--namely, pneumonia (including influenza); and

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1. For a treatment of various types of errors in reporting causes of death and their influences on the cause-specific rates, see pp. 29-34.

diarrhea (including enteritis, etc.). By 1910 heart diseases occupied first place but pneumonia again took the lead in 1920 following the influenza epidemic. By 1940 both of these communicable diseases had been displaced by two degenerative ones--namely, heart diseases and cancer.

Table 3.7

CAUSE-SPECIFIC DEATH RATES,[1] BY PLACE OF OCCURRENCE, MICHIGAN, 1900-1940[2]

Cause	Year				
	1900	1910	1920	1930	1940
Pneumonia including influenza	126.7	109.7	232.9	82.4	52.8
Diarrhea including enteritis, etc.	124.1	103.0	58.1	20.6	4.6
Heart Diseases	119.3	167.0	176.2	260.1	293.6
Cancer	61.2	74.6	83.2	92.5	119.4

Source: Linder, Forrest E. and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, U. S. Government Printing Office, Washington D. C., 1943, Table 20, pp. 344-347.

Heart diseases, the chief cause of death in 1940, proved fatal to 15,602 persons, or about 297 of every 100,000 of the State's population. More than two and one-half times as many people died from heart diseases as from any other cause.

The second most fatal disease in Michigan in 1940 was cancer, which accounted for 12 percent of all deaths

1. The formula for computing cause-specific rates is given on p. 338.

2. Trends and changes in mortality rates are presented in detail in Part IV of this study, Chapter IX.

Table 3.8

MORTALITY RATES FROM THE COMMON CAUSES OF DEATH IN MICHIGAN, 1940, AND THE RELATIVE RANK OF EACH CAUSE[1]

Rank	Cause of Death	Rate Per 100,000 Population
	All causes	992.8
1	Diseases of the heart	296.8
2	Cancer and other malignant tumors	119.4
3	Intracranial lesions of vascular origin	89.5
4	Nephritis	56.5
5	Pneumonia and Influenza	52.8
6	Accidents other than motor vehicle	41.7
7	Tuberculosis	34.3
8	Motor-vehicle accidents	33.1
9	Diabetes	26.6
10	Premature births	24.0
11	Suicide	13.9
12	Congenital malformation	13.8
13	Syphilis	11.5
14	Appendicitis	9.5
15	Hernia and intestinal obstruction	9.3
16	Cirrhosis of the liver	9.2
17	Ulcer of the stomach	6.1
18	Diseases of the prostate	5.7
19	Puerperal causes	5.5
20	Exophthalmic goiter	3.6
21	Diarrhea, enteritis, ulceration of intestines[2]	3.3
22	Bronchitis	3.2
23	Homicide	3.0
24	Alcoholism	1.1
25	Whooping cough	1.1
26	Scarlet fever	.8
27	Diphtheria	.4
28	Measles	.3
29	Cerebrospinal meningitis	.3
	Ill defined causes	4.1
	All other causes	112.3

Source: Vital Statistics of the United States, 1940, Part II, Residence, Table 10, pp. 226-7.

1. Based on population enumerated as of April, 1940.
2. Includes only deaths from this cause under 2 years of age.

Note: Deaths of residents occurring outside of Michigan are included in this table.

for that year, or about 120 people out of 100,000 of the population. Ranking second among the ten principal causes of death, cancer took a toll of 6,275 lives, which is 30 per 100,000 population more than its next nearest competitor, intracranial lesions of vascular origin.

Intracranial lesions of vascular origin occupied third place among the ten principal causes of death and was responsible for 90 deaths per 100,000 of the population. These disorders caused 4,702 fatalities or 9 percent of the total number of deaths in 1940.

Nephritis, another degenerative disease, ranked fourth. This disease killed 2,971 people, or 57 out of every 100,000 of the State's population in 1940. Approximately 6 percent of all deaths for that year were due to nephritis.

The four most common causes of death in 1940 (heart disease, cancer, intracranial lesions of vascular origin, and nephritis) were degenerative in nature. These four causes were responsible for 56.7 percent of the total deaths in Michigan. Only one other degenerative disease, diabetes mellitus, was among the ten principal causes. The five degenerative disorders listed among the ten principal causes of death accounted for over half, or 59.4 percent, of all the deaths in the State in 1940.

Pneumonia and tuberculosis, two communicable diseases, ranked fifth and seventh respectively. Pneumonia proved fatal to 2,777 persons, with a rate of 52.8 per 100,000 popu-

lation, while tuberculosis took the lives of 1,803 or 34 per 100,000 people. Together these diseases were responsible for approximately 9 percent of all deaths in Michigan in 1940.

Accidental deaths other than motor vehicle accidents ranked sixth and resulted in the death of 450 individuals. This is 26 percent more fatalities than occurred from motor vehicle accidents. The rates were 33 and 42 per 100,000 population respectively. When the two types are combined, accidents from all causes ranked fourth in the list of principal causes of death in Michigan, killing 3,930 people or 75 out of every 100,000 of the State's population. Slightly over 7 percent of all deaths in 1940 were caused by accidents.

Ninth and tenth in rank on the list of common causes were diabetes mellitus and premature births. About 27 Michigan people per 100,000 population died from diabetes and 24 from premature births. Slightly over 5 percent of all deaths were due to these two causes. The foregoing ten leading causes of death in Michigan comprised 78 percent of the total number for the year. Each of them took an annual toll of 20 or more people out of every 100,000 of the State's population.

In addition, there were three principal causes in which each killed more than 10 per 100,000 people in Michigan. They were as follows: suicide (13.9), congenital malformation (13.8), and syphilis (11.5). Each of these

proved fatal to more than 600 people in 1940, and together accounted for almost 2,000 deaths that year.

In addition to the ten principal causes, there were some other diseases with rates so high as to merit the consideration of everyone concerned with health conditions in the State. Among these are appendicitis (9.5), cirrhosis of the liver (9.2), hernia (9.3), ulcer of the stomach (6.1), and diseases of the prostate (5.7). Each took an annual toll of from 300 to 500 lives, and combined, about 2,000 lives. One other classified cause, puerperal causes, had an annual death rate of more than 5 per 100,000 population. There were 287 deaths in 1940. Goiter and homicide were responsible for the death of from 100 to 200 people in 1940, or from 3 to 4 out of each 100,000 of the State's population. The rates for the remaining diseases in Table 3.8 indicate that few people died from infectious diseases in 1940 though they were common causes of death not many years ago.

Referring to Table 3.8, we find that degenerative diseases caused more deaths in Michigan in 1940 than communicable diseases. Among the ten principal causes of death for the year, the five degenerative diseases caused 59.4 percent of all the fatalities. At the bottom of the list fell many of the infectious diseases--such as, whooping cough, measles, and diphtheria. As will be shown later, Michigan has performed her task of combating these communicable diseases better than the rest of the United States.

But she has a growing problem in the control of such diseases as heart disease, cancer, and intracranial lesions of vascular origin.

Infant and Maternal Mortality Rates[1]

The rapid decline of the infant death rate during the last few decades perhaps has signaled the end of that historical phase of our public health programs which might be called the "Communicable Disease Period," and has initiated the new phase, the "Chronic Disease Period." Although the infant rate is not as sensitive an index of public health progress as has been claimed,[2] the rate is the best known and most widely accepted single measure of the success of the public health movement in the control of communicable

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1. See Appendix I, p. 339, for formulas of these death rates.

2. Pearl studied the decrease of infant death rates in 21 countries during a period of approximately 17 years and found that seven countries had larger decreases than the United States. The average annual decrease of the infant death rate in the United States was 2.19, while those countries with larger decreases than the United States were: England and Wales 2.26, Switzerland 2.56, Japan 2.87, Finland 3.01, Ceylon 3.05, Italy 3.89, and Germany 5.19. Pearl concludes: "Evidently this relatively huge, rapid, and consistent drop cannot have been wholly due to public health efforts directed to this end. One reason for believing that other causal factors were involved is that the health services of the 20 countries in the table differ widely in the extent and effectiveness of their efforts. Another is the position of particular countries in the table. Thus the United States stands 8th in the table. It would take a lot of proving to demonstrate that each and all of the seven countries above it have health services more active and efficient in the infant mortality field." (See Pearl, Raymond, Introduction to Medical Biometry and Statistics, W. B. Saunders Company, Philadelphia, Pennsylvania, 1941, pp. 191-192.)

diseases.[1] Although communicable diseases are no longer the predominant health problems as measured by mortality data, their prevention and control will remain, without question, an important public health problem for which the infant death rate will continue to be a useful index.

The infant death rate in Michigan was 40.7 in 1940 and is an acceptable index of the present situation. It is identical with the average rate computed for the years 1935-1944. A four-year average, 1938-1941, was slightly higher, 41.4, a difference of less than 1 from the other rates. In 1940 there were 4,032 deaths under 1 year of age. The causes from which these deaths occurred and their relative rank are given in Table 3.9.

Among the ten leading causes of infant deaths is premature births, which is also among the leading causes when related to the total population. Premature birth ranks first as a cause of infant deaths. The number of premature births per 100,000 live births for the period, 1938-1941, was 1,352.1. This is twice as high as the rate for congenital malformation (570.0) which ranks second. Infant death rates from pneumonia, injury at birth, other diseases peculiar to the first year, and diarrhea, were all higher than 225. Two other causes listed among the ten principal ones, mechanical suffocation and diseases of the thymus gland, took between 90 and 100 lives each, per 100,000 live

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1. See Introduction, pp. 13ff, for opinions of various authorities relative to the use of mortality rates as measures of health. The infant death rate is included by most of the authorities.

Table 3.9

INFANT MORTALITY RATES BY SELECTED CAUSES, MICHIGAN, 1938-1941

Selected Causes	Number of deaths under 1 year of age per 100,000 live births (3-yr. ave.)
All Causes	4,137.3
Premature birth	1,352.1
Congenital malformations	570.0
Pneumonia (all forms)	557.9
Injury at birth	401.8
Other diseases peculiar to first year	259.7
Diarrhea, enteritis, etc.	229.5
Mechanical suffocation & other accidents	98.1
Diseases of thymus gland	96.0
Congenital debility	72.7
Whooping cough	56.8
Other diseases of respiratory system	55.1
Influenza	48.3
Diseases of nervous system	39.7
Intestinal obstruction	35.4
Diseases of ear and mastoid process	22.9
Syphilis	19.4
Diseases of circulatory system	18.6
Ill-defined & Unknown causes	18.1
Dysentery	17.3
Diseases of genito-urinary system	14.3
Measles	12.8
All other causes	140.8

Source: Commission on Hospital Care, State Hospital Study Manual, Book IV, (Mimeographed), 1946, Table 13, p. 28. Data computed from Vital Statistics of the United States, 1938, Part I, Table 24; 1939, Part II, Table 13; 1940, Part II, Table 14; 1941, Part II, Table 19.

births. The last two among the ten leading causes are congenital debility (72.7) and whooping cough (56.8). All of the other causes listed had infant death rates of 55.1 or less per 100,000 live births.

The maternal mortality rate has declined to such a low point that one wonders if maternal deaths will not practically disappear in the future. It is another example of the success of health education, public health programs, and medical care and treatment by physicians. In 1940 only 2.9 mothers per 1,000 live births died in Michigan, and this figure had dropped to 2.1 by 1942.[1] The decreases in the maternal mortality rate over a period of years are presented in Chapter IX.

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1. Linder, Forrest E. and Grove, Robert D., op. cit., Table 36, p. 621.

CHAPTER IV

RURAL-URBAN MORTALITY DIFFERENTIALS

How does the mortality-health situation of Michigan's people living in cities and towns compare with that of those living in the country? To the degree that the health of a population is measured by the rate at which people fail to overcome sickness, this question may be examined by comparing: (1) crude resident and age-adjusted death rates for rural and urban areas, (2) age and sex mortality differentials for urban and rural groups, (3) selected cause-specific death rates, (4) race-specific rates, and (5) infant and maternal mortality rates.

Crude Resident and Age-Adjusted Death Rates[1]

Each year approximately 11 persons per 1,000 people living in the rural areas die in comparison with 9.4 in the cities and towns. (See Table 4.1.) A partial explanation of this difference was indicated in the previous chapter where it was pointed out that a large proportion of the rural population falls into the older age groups which have greater risks of death. The crude resident rate for rural areas is also higher than the rate for all of the various population size cities with the exception of those cities of 2,500 to 10,000 population.

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1. See Appendix I for method of computing crude resident and age-adjusted death rates.

When a more refined death rate is computed for the rural and urban areas, by which differences in the age distribution of the two areas are eliminated, the total rural death rate is lower than the total urban rate.[1] Further, the rural death rate is lower than the rate for various population-size urban places. (Table 4.1) Therefore, when an age-adjusted death rate is employed to measure health,

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1. This proposition has been demonstrated both in Europe and the United States. The writer could find no study or reference which claimed to have proven the reverse proposition that the rural death rate is higher than the urban. Willcox, Walter, op. cit., p. 213, gives data showing the States in the New England division of the United States had a crude death rate in 1930 which was higher for the rural than the urban population (11.7 compared with 12.0), but these rates adjusted for age would without doubt show the reverse for this area. Landis writes, "Rural communities have long had a lower death rate than urban communities." Thompson presents data showing that the rural districts of England and Wales have lower death rates than urban, and he writes "... urban life in the United States and in England and Wales is less favorable to a low death rate than rural life, in spite of the fact that a disproportionately large part of all expenditures for health, and particularly for public health, takes place in the cities." (See references for Landis and Thompson below.) For some of the recent studies which show the death rates of the urban to be higher than the rural area see: Warren S. Thompson and P. K. Whelpton, Population Trends in the United States, McGraw Hill Book Company, Inc., New York, 1933, p. 241; Warren S. Thompson, Population Problems, McGraw-Hill Book Company, Inc., New York, 1942, p. 229; Paul H. Landis, Population Problems, American Book Company, New York, 1943, p. 191; Bureau of the Census, "Age-Adjusted Death Rates in the United States, 1900-1940," Vital Statistics---Special Reports, Vol. XXIII, No. I, 1945, Table VII, p. 21; J. Lambert Molyneaux, "Differential Mortality in Texas," American Sociological Review, Vol. X, 1945, p. 17-25; J. Lambert Molyneaux, Sara K. Gilliam, and L. C. Florant, "Differences in Virginia Death Rates by Color, Sex, Age and Rural or Urban Residence," American Sociological Review, Vol. 12, No. 5, October 1947, p. 534; Louise Kemp and T. Lynn Smith, Health and Mortality in Louisiana, Louisiana Experiment Station, Bulletin 390, Baton Rouge, 1945, p. 14.

small cities tend to have the lowest level of health,[1] while rural areas occupy the most favorable level.

Table 4.1

DEATHS PER 1,000 POPULATION BY RESIDENCE, MICHIGAN, 1940
(by place of residence)

Residence	Deaths per 1,000 population	
	Crude Death Rate (1)	Age-Adjusted Death Rate (2)
Total	9.9	8.93
Urban Total	9.4	9.15
Cities of 100,000 and over	8.5	8.98
Cities of 10,000 to 100,000	10.1	9.21
Cities of 2,500 to 10,000	11.7	9.39
Rural Total	11.0	8.59

1. Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, 1943, Table 11, p. 202; Urban and rural total computed from Vital Statistics of the United States, 1940, Vol. II, Residence, Table 9, p. 190.
2. Adjusted to the age distribution of the U. S. population in 1940 by the direct method.

One might naturally expect patterns in death rates for the small American city and for rural areas to be more or less similar since such cities usually occupy the role

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1. Small cities also have the highest crude and age-adjusted death rates for the United States as shown in Chapter VI, Table 6.9. In Virginia, it is true for the white but not for the colored population, according to Molyneaux, et al, op. cit., pp. 533-34. Molyneaux and colleagues explain the high rates in small cities on the basis of low densities of population and lack of financial ability to purchase expensive sanitary devices and medical services. Molyneaux found the small cities of Texas also to have the highest death rates of various size cities. (Molyneaux, J. Lambert, "Differential Mortality in Texas," op. cit., pp. 17-25.) According to Kemp, Louise, and Smith, T. Lynn, small cities (2,500 to 10,000) also have the highest crude death rates in Louisiana, but no age-adjusted rates were given, op. cit., pp. 14-15.

of service and trade center for the surrounding rural territory. They are frequently the place where many rural-farm people retire after their active farming days are over. Molyneaux offered the explanation that small cities have a low density of population and are financially unable to purchase expensive sanitary equipment such as certain types of modern sewage disposal, water supply, and medical service.[1] The concentration of the aged in the small cities, however, seems to explain the high crude rates satisfactorily. For example, compare the crude rates of the small with the large size cities. Their differential is 3.2, compared with the differential of the corresponding age-adjusted rates of only .41. The above factors undoubtedly account for most of the excess of death rates in small cities compared with larger ones.

Because of the apparent relationship between small American cities and the rural areas, cities of 2,500 to 10,000 are frequently referred to as "rural cities"[2] in publications of the National Office of Vital Statistics. Prior to 1930 the Vital Statistics Reports of the Bureau of Census included all places of less than 10,000 population

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1. Molyneaux, J. Lambert, et al, "Differences in Virginia Death Rates by Color, Sex, Age, and Rural or Urban Residence," op. cit., p. 535.

2. See volumes of Vital Statistics of the United States, prior to 1930, published by the Bureau of Census. See Vital Statistics of the United States, 1940, Part II, Residence, p. 5, for special reference to "rural cities."

as "rural."[1] In 1930 for the first time, such "rural cities," that is, those with a population of 2,500 to 10,000, were reported separately from the rural population. For purposes of this study, "rural" refers only to all places and population outside of incorporated cities of less than 2,500 population, according to the last census.

Age and Sex Mortality Differentials

The age-and sex-specific mortality rates are presented in Table 4.2. This Table allows one to make at least four important comparisons of death rates: (1) the urban and rural population for specific age groups, (2) the males in urban with males in rural areas by age groups, (3) the females in urban with females in rural areas by age groups, (4) males with females in urban and rural areas by age groups. The facts obtained by these comparisons are summarized as follows:

(1) In rural areas the death rates are lower than those of urban areas in six of the eleven age groups, while

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1. From 1902 when the permanent Bureau of the Census was created until 1930, records of deaths were collected for "cities of 10,000 population or over" and "rural," which meant the remainder of the county. "Rural" for purposes of tabulating vital statistics referred to all places of less than 10,000 population. In 1930 incorporated places of 2,500 to 10,000 were reported separately, and the remainder of the class "under 10,000 population" was reported as "rural," which included deaths occurring in all places outside of incorporated places of 2,500 to 10,000 population. These classifications of deaths by size of city and rural were "de facto" in Michigan until 1935 when the reports were made for the first time on a "de jure" basis.

Table 4.2

SPECIFIC DEATH RATES BY AGE, SEX, and RESIDENCE, MICHIGAN, 1940
(Rates are per 1,000 pop., by place of residence)

Age Groups	Total State			Rural			Urban		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
All[1] ages	9.9	11.0	8.9	11.0	12.3	9.5	9.4	10.2	8.5
Under 1	48.1	55.1	40.7	45.1	50.9	39.0	49.9	57.6	41.8
1 - 4	2.2	2.3	2.0	2.2	2.4	2.0	2.2	2.3	2.1
5 - 14	1.0	1.1	.8	1.0	1.1	.8	1.0	1.1	.8
15 - 24	1.7	2.1	1.5	1.8	2.1	1.5	1.7	2.0	1.5
25 - 34	2.5	2.7	2.2	2.3	2.7	1.9	2.5	2.8	2.2
35 - 44	4.6	5.0	4.1	4.2	4.7	3.5	4.8	5.1	4.4
45 - 54	9.6	11.0	7.9	8.6	10.0	6.9	10.1	11.5	8.4
55 - 64	21.2	24.2	17.9	19.8	22.3	16.7	22.1	25.4	18.6
65 - 74	48.2	53.5	42.8	46.8	50.5	42.1	49.3	56.3	43.3
75 - 84	113.6	122.2	105.2	114.1	120.5	106.4	113.1	124.1	104.4
85 Over	245.1	249.0	241.7	253.0	257.5	248.7	238.2	240.2	236.8

[1] Includes deaths of unknown ages.

Source: Computed from Vital Statistics of the United States, 1940, Volume II, Residence, Table 9, p. 190.

urban residents have lower rates in only three of the age groups, 15-24, 75-84, and 85 and over (Table 4.2). In two age groups, 1-4 and 5-14, the death rates in the two areas are identical, namely, 2.2 and 1.0 per 1,000 population respectively. Urban death rates are noticeably lower than rural rates in the age group 85 years and over. The urban rate is 238.2 and the rural rate 253.0. While urban death rates are lower in age groups 75-84 and 15-24, they are only slightly so. The urban death rates are respectively 113.1 and 1.7, while rural rates for the corresponding age groups are 114.1 and 1.8.

Age Group	Rural Death Rate	Urban Death Rate	Difference
25-34	2.3	2.5	.2
35-44	4.2	4.8	.6
45-54	8.6	10.1	1.5
55-64	19.8	22.1	2.3

Source: Table 4.2.

During the ages 25-64, inclusive, as well as under the age of 1 year, urban people succumb to death at higher rates than do rural people, although some of these urban rates are only slightly higher than the rural rates. For example, the difference between the urban and rural rates at ages 25-34 is only .2, the two rates being respectively 2.5 and 2.3. At ages 55-64, however, there is a difference between rural and urban death rates of 2.3. The differences in the four age groups comprising those persons 25 to 64 years of age, increase steadily from the youngest to the

oldest age group as follows: .2, .6, 1.5, and 2.3.[1]

(2) Observation of the columns rural male and urban male in Table 4.2 reveals that death rates of males in urban areas exceed those of males in rural areas from age 25 to 84 and also those under 1 year of age. Death rates of males under 1 year of age in the city exceed those in rural regions by approximately 13 percent. There is an actual excess of the urban rate of 6.7 (See Table 4.3). The greatest difference between male rates in the two areas occurs in the age group 85 and over where the difference is 17.3. The second highest difference is 6.7, for the age group under 1 year of age. Ranking third and fourth are respectively age groups 65-74 with a difference of 5.8 and 75-84 with a difference of 3.6. The latter two age groups are particularly significant since they comprise the 20 years above 65 when most working men are retired and when chronic diseases originating in middle life increasingly

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1. This suggests to the writer that there may be selective social factors in urban life which operate disadvantageously in man's biological adaptation and which may characterize rural life but to a lesser degree. Assuming that death rates reflect the culminating effect of all these factors, an interesting hypothesis becomes apparent, namely, that these factors tend to increase progressively in intensity from age group 25-34 to the oldest age group in this series, 55-64. It is the opinion of the writer that differences among the social roles of the rural and urban environments and their influence on group mores and institutional controls are in part responsible for differences in death rates. It is outside the scope of this dissertation to attempt a defense of this hypothesis. However, it is formulated in greater detail in Appendix IV.

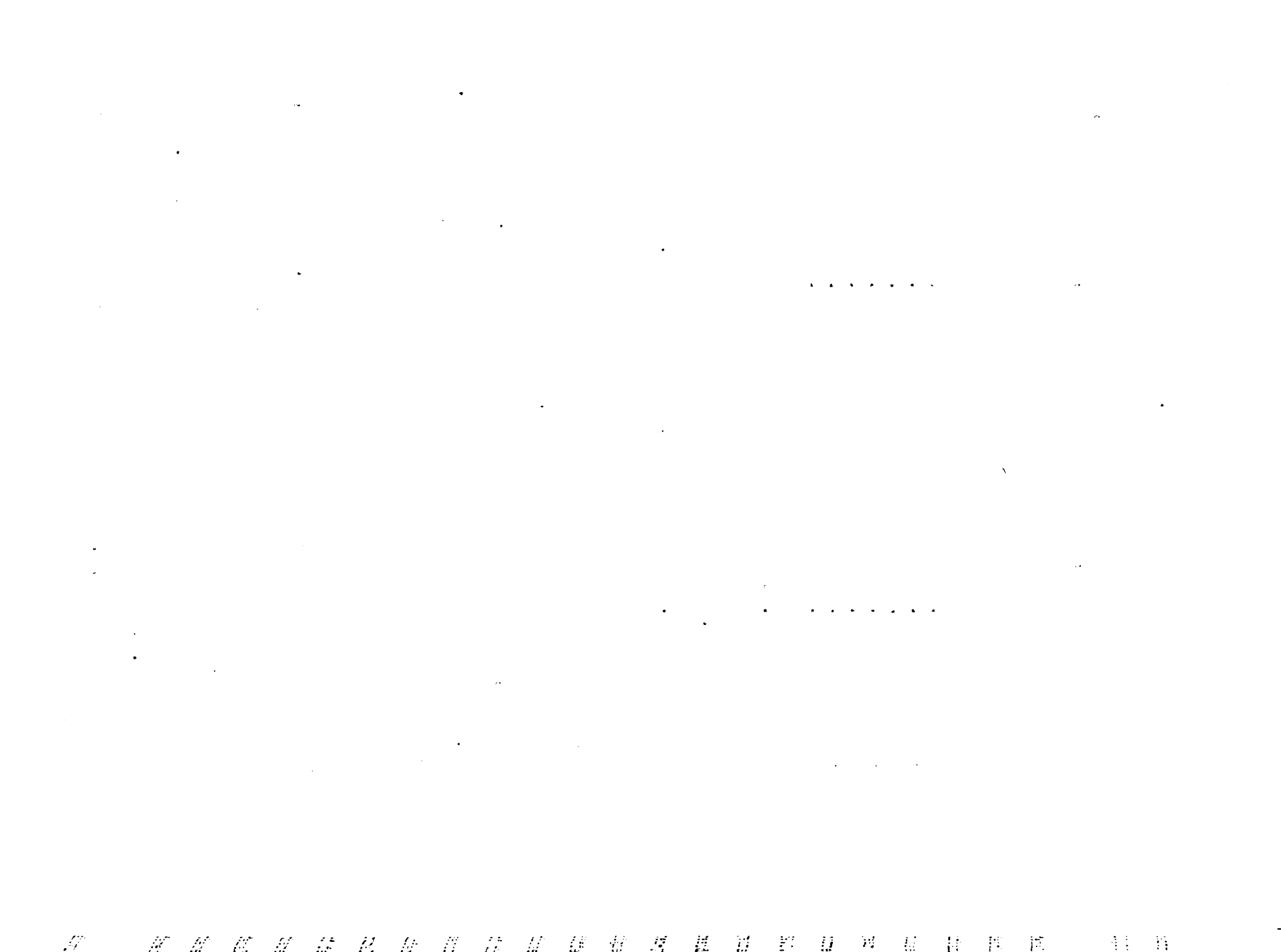
Table 4.3

DIFFERENCES BETWEEN DEATH RATES OF MALES AND DIFFERENCES BETWEEN DEATH RATES OF FEMALES IN RURAL AND URBAN AREAS, MICHIGAN, BY SELECTED AGE GROUPS, 1940

Age Group	Differences Male Rates Rural and Urban Areas	Differences Female Rates Rural and Urban Areas
Under 1	6.7 excess urban	2.8 excess urban
35 - 44	.4 excess urban	.9 excess urban
45 - 54	1.5 excess urban	1.5 excess urban
55 - 64	3.1 excess urban	1.9 excess urban
65 - 74	5.8 excess urban	1.2 excess urban
75 - 84	3.6 excess urban	2.0 excess rural
85 - Over	17.3 excess rural	11.9 excess rural

Source: Table 4.2.

take their toll. Urban rates for the age group 55-64 exceed rural rates by 3.1 deaths per 1,000 population. This is the last decade before old age retirement under the Social Security Act and again represents a period in life when chronic diseases begin to take their toll. In all of these three age groups, the urban male dies at the rate of 3.1 or more per 1,000 in excess of males of the same age in rural areas. It should be pointed out that in each of these age groups the urban population has a smaller proportion of its total number than does the rural population and hence the risk of death for the total urban population is less. For example, the three age groups combined amount to 1,245 population for each 10,000 of the total urban population, while the corresponding figure for the rural population is 1,645. (See Table 4.5.) The proportionate distribution of deaths is given in Table 4.4. Deaths at ages 55-74 are also con-



centrated more heavily for rural than urban, the number per 10,000 being 6,234 and 5,478 respectively.

(3) In Table 4.2 the columns showing death rates of females in rural and urban areas demonstrate that rural death rates of females are lower than the corresponding urban rates from age 25 to 74 inclusive, and likewise for those under 1 year of age. The female death rate under 1 year of age in the city is only slightly higher than the corresponding rate in the country, or 41.8 as compared with 39.0. In those age groups comprising females from 1-24 years, the death rates are approximately equal in the two resident groups, while from age 25 to 74 inclusive, the ten-year age groups of females have death rates only slightly higher in urban places than in rural areas. The greatest difference between female rates in the two areas occurs for those 85 years and over, where the rural rate exceeds that of the urban by 11.9 deaths per 1,000 population. The second highest differential between these areas is for those under 1 year of age, where the urban death rate exceeds the rural by 2.8. The differences between urban and rural rates of females in all other age groups are 2.0 or less. Thus, there is not as much variation between the death rates of females at these important ages in rural and urban areas as there is between corresponding rates of males. These differences are summarized in Table 4.3.

(4) From an examination of the columns in Table 4.2 showing death rates of males and females in rural areas and

Table 4.4

NUMBER OF DEATHS PER 10,000 DEATHS OF KNOWN AGE, RURAL AND URBAN AREAS, MICHIGAN, BY AGE, 1940

Age	Deaths of Known Age: Rural Deaths	Urban Deaths	Per 10,000 Deaths: Rural	Urban
Under 1	1,422	2,610	720	805
1 - 4	302	458	153	141
5 - 14	328	532	166	165
15 - 24	562	1,069	285	330
25 - 34	598	1,507	303	465
35 - 44	916	2,589	464	799
45 - 54	1,764	4,525	893	1,396
55 - 64	3,109	5,568	1,575	1,718
65 - 74	4,665	6,419	2,363	1,981
75 - 84	4,534	5,440	2,296	1,679
85 Over	1,543	1,687	782	521
Total[1]	19,743	32,404	10,000	10,000

[1] Does not include deaths of unknown ages.

Source: Vital Statistics of the United States, 1940, Part II, Table 9, pp. 190-191.

Table 4.5

NUMBER OF PEOPLE PER 10,000 POPULATION, RURAL AND URBAN RESIDENCE, MICHIGAN, BY AGE, 1940 (Enumerated as of Apr. 1)

Age	Total Population of Known Age: Rural	Urban	Per 10,000 Pop.: Rural	Urban
Under 1	31,522	52,285	175	151
1 - 4	137,567	210,010	763	608
5 - 14	337,341	545,431	1,872	1,579
15 - 24	309,138	626,233	1,716	1,813
25 - 34	256,926	591,922	1,426	1,713
35 - 44	220,525	543,108	1,224	1,572
45 - 54	205,582	448,765	1,141	1,299
55 - 64	157,120	251,777	872	729
65 - 74	99,697	130,145	553	377
75 - 84	39,722	48,109	220	139
85 Over	6,099	7,082	38	20
Total	1,801,239	3,454,867	10,000	10,000

Source: Sixteenth Census of the United States, 1940, Population, Fourth Series, Michigan, Table 1, p. 5.



the corresponding rates in urban areas for the age groups specified, the generalization that death rates of males are higher than rates of females is true for every age group.[1] The magnitude of the differences between the death rates of males and females for each age group in the two areas is shown in the following table:

Table 4.6

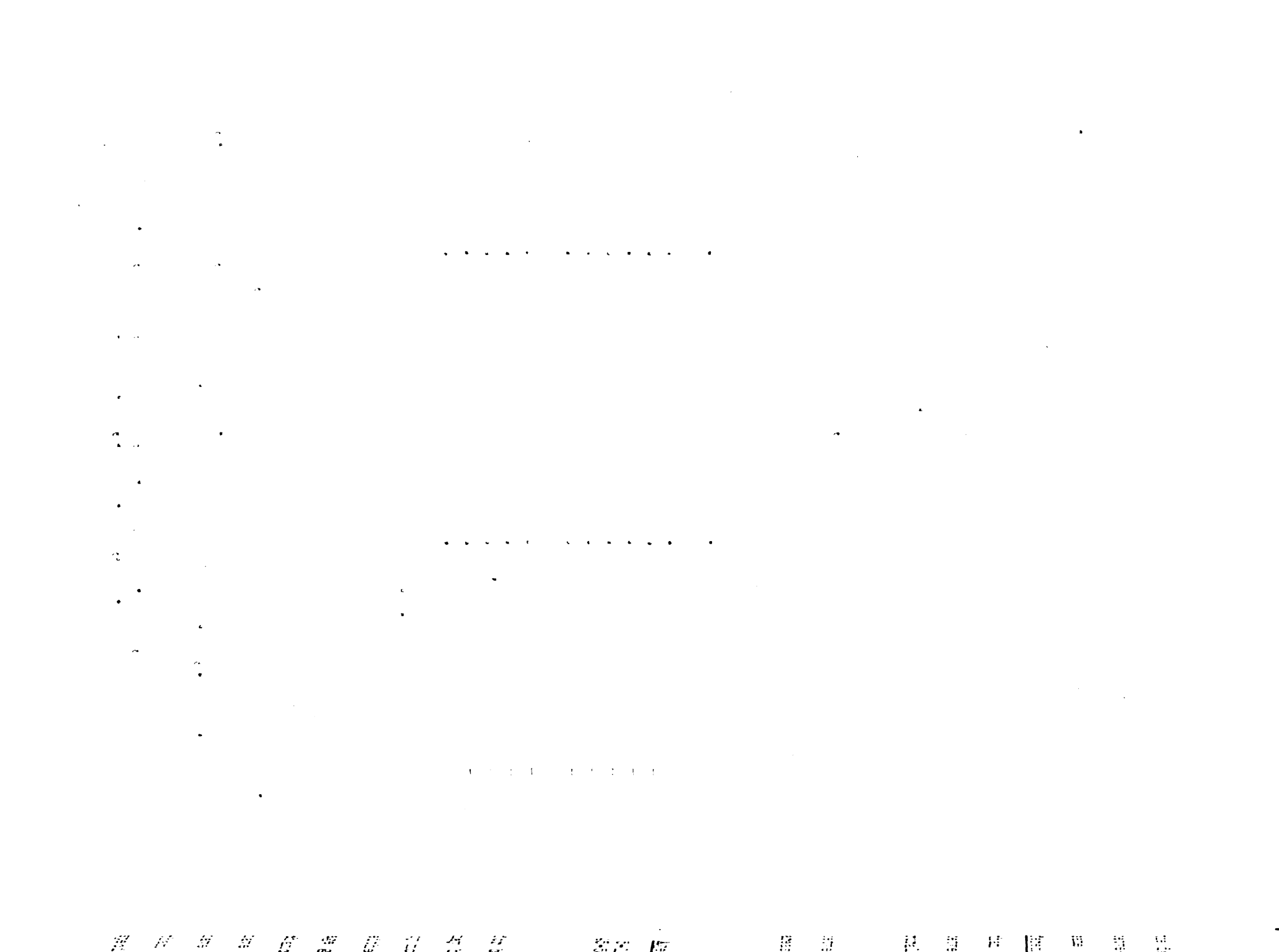
DIFFERENCES BETWEEN DEATH RATES OF MALES AND FEMALES IN RURAL COMPARED WITH DIFFERENCES IN URBAN AREAS, MICHIGAN, 1940

Age Group	Difference of Male and Female Death Rates	
	Rural	Urban
Total	2.8 excess male	1.7 excess male
Under 1	11.9 excess male	15.8 excess male
1 - 4	.4 excess male	.2 excess male
5 - 14	.3 excess male	.3 excess male
15 - 24	.6 excess male	.5 excess male
25 - 34	.8 excess male	.6 excess male
35 - 44	1.2 excess male	.7 excess male
45 - 54	3.1 excess male	3.1 excess male
55 - 64	5.6 excess male	6.8 excess male
65 - 74	8.4 excess male	13.0 excess male
75 - 84	14.1 excess male	19.7 excess male
85 Over	8.8 excess male	3.4 excess male

Source: Table 4.2.

Three interesting comparisons are presented based on

1. This generalization is well established, and exceptions to it are rare where death rates from all causes for total populations are given. See Willcox, Walter F., op. cit., p. 222; Yerushalmy, J., "The Age-Sex Composition of the Population Resulting from Natality and Mortality Conditions," The Milbank Memorial Fund Quarterly, Vol. XXI, No. 1, January, 1943, p. 37; Molyneaux, et. al, op. cit., p. 531. A few exceptions do occur when death rates are given by age and race; these are discussed in Chapter V of this study.



the data in Table 4.6: (a) Age groups in which differences between death rates of males and females are exactly the same in rural and urban areas, (b) age groups in which differences between male and female rates are higher in rural than in urban areas, (c) age groups in which differences between male and female rates are higher in urban than in rural areas.

(a) The age groups which have the same difference between death rates of males and females in rural and urban areas are as follows: (See Table 4.2 for rates)

Age	Difference (Male - Female) Rural	Urban	When death rate of male is 100, the rate of female is; Rural	Urban
5-14	.3	.3	73	73
45-54	3.1	3.1	69	73

Since age group 5-14 has the lowest death rates for both sexes in both the rural and urban segments, it may be considered the healthiest period of life as measured by mortality rates. Males have the same chance of dying in either location since the age-specific death rates for this age group are identical. Likewise, females have the same chance of dying in either of the segments, since they also have identical rates. However, males of this age group have a slightly higher chance of dying in either location than do females, since males have a slightly higher age-specific death rate for both urban and rural areas.

Although the age group 45-54 is characterized by

the same sex mortality differences in the two areas, one cannot conclude that the force of mortality on males as compared with females is identical in rural and urban areas because the two series of death rates on which they are based are not identical. The death rates for males and females in rural areas for age group 45-54 are 10.0 and 6.9 respectively; while the corresponding rates for the urban segment are 11.5 and 8.4 respectively. The female death rate in the urban segment for this age group is 73.0 percent as high as that of males, while in rural areas it is only 69.0 percent as high. In the urban population the death rate of females age 45-54 is closer to that of males of the same age than it is in rural population. Thus, we might conclude that there is a tendency for the force of mortality on males and females to be more nearly equal in urban than in rural areas for this age group.

(b) The age groups in which differences between the death rates of males and females are higher in rural than in urban areas are as follows: (See Table 4.2 for rates)

Age	Difference (Male - Female)		When death rate of male is 100, the rate of female is:	
	Rural	Urban	Rural	Urban
1- 4	.4	.2	83	91
15-24	.6	.5	71	75
25-34	.8	.6	70	79
35-44	1.2	.7	75	86
85 Over	8.8	3.4	97	99

The age groups comprised of persons 15 to 44 years old are significant ones because they include the greater part of

the working population in both areas and because death rates are normally low. In these age brackets, the differences between rates of males and females are greater in rural than in urban areas. Furthermore, as is indicated by the relative percentages given above, the death rates of both sexes for these age groups are more nearly equal in urban than in rural areas, and we may conclude that the relative force of mortality on them is more nearly identical in urban than in rural places.

(c) The age groups in which the differences between the death rates of males and females are greater in urban than in rural areas are as follows: (See Table 4.2 for rates)

Age	Difference (Male-Female) Rural	Urban	When death rate of male is 100, the rate of female is: Rural	Urban
0- 1	11.9	15.8	77	73
55-64	5.6	6.8	75	73
65-74	8.4	13.0	83	77
75-84	14.1	19.7	88	84

As the relative percentages show, the death rates of the sexes are more nearly equal in the rural than in the urban population. The higher these relative figures, the more nearly equal are the male and female death rates.[1]

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1. It is believed by the writer that these aspects of urban environment are primarily social in nature and are the combined effects of the tempo of city life and its resulting stresses and strains on sex roles as one passes from the younger to the older ages.

Mortality Differentials by Age in Various Size Cities and Rural Areas

The age-specific death rates for rural areas, and the small, medium, and large cities are presented in Table 4.7. Table 4.8 has been prepared to facilitate the observation of the death rates given in Table 4.7. The principal object is to show the relationship of the four population groupings to each other; namely, the rural population, and small (2500-10,000), medium (10,000-100,000), and large sized cities (100,000 and over), using the age-specific death rates of the rural population as a basis of comparison. Accordingly, three observations are presented: (a) an analysis of the respective age-specific death rates of the four population groups to determine which one has predominantly lower rates, (b) a comparison of the age-specific death rates of large cities with the corresponding rates of the rural population, (c) a comparison of age-specific death rates of small cities with corresponding rates of the rural population.

(a) Of the 33 age groups for all of the various size cities, there are only 9 which have death rates lower than those of the rural areas. The percentages presented in Table 4.8 exaggerate these differences and permit one to observe immediately those age groups in which death rates are higher in cities than in rural areas. The rural population has death rates which are lower than corresponding rates of all the cities for age groups under one year and for age groups 25-74 years.

Table 4.7 AGE-SPECIFIC DEATH RATES IN VARIOUS POPULATION-SIZE CITIES AND RURAL AREAS, MICHIGAN, 1940

Age Group	Death Rates per 1,000 Population: Cities 100,000 over	Cities 10,000 to 100,000	Cities 2,500 to 10,000	Rural Under 2,500
All Ages	8.5	10.1	11.7	11.0
Under 1	45.7	55.0	54.4	45.1
1 - 4	2.0	2.7	1.7	2.2
5 - 14	.8	1.1	1.1	1.0
15 - 24	1.7	1.6	2.2	1.8
25 - 34	2.6	2.4	2.8	2.3
35 - 44	4.8	4.4	5.5	4.2
45 - 54	10.2	9.8	9.9	8.6
55 - 64	22.4	21.9	21.6	19.8
65 - 74	49.2	49.7	48.7	46.8
75 - 84	113.3	114.3	113.8	114.8
85 Over	203.5	249.0	245.2	244.5

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 11, p. 202.

Table 4.8 PERCENTAGE DEVIATION OF AGE-SPECIFIC DEATH RATES IN VARIOUS POPULATION-SIZE CITIES FROM THE RURAL DEATH RATES, MICHIGAN, 1940

Age Groups	Percentage Deviation from rural death rates: Cities 100,000 or more	Cities 10,000 to 100,000	Cities 2,500 to 10,000	Rural Death Rates Per 1,000 Population
All Ages	-23	-8	∤6	11.0
Under 1	∤ 1	∤22	∤21	45.1
1 - 4	- 9	∤23	-23	2.2
5 - 14	-20	∤10	∤10	1.0
15 - 24	- 6	-11	∤11	1.8
25 - 34	∤13	∤ 4	∤22	2.3
35 - 44	∤14	∤ 5	∤31	4.2
45 - 54	∤19	∤14	∤15	8.6
55 - 64	∤13	∤11	∤ 9	19.8
65 - 74	∤ 5	∤ 6	∤ 4	46.8
75 - 84	- 1	-.4	- 1	114.8
85 Over	-17	∤.2	∤.3	244.5

Note: In this table the rural death rate for each age group equals 100.0. For death rates of cities on which percentage deviation from rural rates are based see Table 4.7. "Plus" indicates that the death rate is in excess of the rural rate, and "minus" that it is less than the rural death rate.

(b) In the large cities, those of 100,000 population and over, 5 of the 11 age groups have death rates lower than corresponding rates in the rural population. All of these age groups are among the young or the old, namely, 1-24, and 75 years and over. In two age groups, 45-54 and 55-64, these large cities have higher death rates than the rural areas, the medium, or the small size cities.

(c) In the small cities, 2,500-10,000, there are only two age groups which have lower death rates than the corresponding rates in rural areas. These age groups are 1-4 and 75-84. There are also only two age groups among the medium sized cities which have lower rates than those of rural areas, namely, 15-24 and 75-84.

Thus as measured by the age-specific death rates, rural areas have better health than any of the various sized cities.

Twenty-Five Principal Causes in Michigan, by Residence

Thus far in this Chapter it has been shown that the populations of the open country, with the exception of a few age groups, have lower death rates than the urban people. The question to be considered in this section is whether rural people maintain their favorable mortality position over urbanites when compared as to the manner in which they die.

Twenty-five of the most common causes of death in rural and urban areas are ranked according to the rural

crude rates in Table 4.9. Of these 25 causes, 14 have higher rates in rural areas, 9 are higher in urban areas, and 2 causes are nearly the same.[1] The rural and urban rates are approximately equal for diabetes mellitus and are identical for diphtheria. (See Table 4.10)

The four diseases which rank highest in number of deaths are heart diseases, cancer, intracranial lesions of vascular origin, and nephritis. These are the "big four" degenerative diseases in both urban and rural areas. As might be expected in view of the age distribution in the two areas, they take a greater proportionate toll of lives in rural than in urban areas (See Table 4.4). Of the total deaths from all causes in rural areas, 58.5 percent were from these four diseases, while the corresponding figure in urban areas was only 55.6 percent. Heart diseases account for 338.9 and 274.9 deaths per 100,000 population respectively in rural and urban areas. Furthermore, as indicated below, the rate from heart diseases is more than twice the rate

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1. Few studies of mortality by cause for 1940 have been made except those analyzing death rates for the United States or Regions. For comparison of mortality by cause in Michigan and the Nation see Chapter VI.
Kemp and Smith found that in Louisiana the crude death rates for most of the principal causes (19 out of 25 causes) had higher rates for urban than rural areas. This was true for the chronic diseases among both white and colored people in spite of the greater proportion of the rural population among the older age groups. No further explanation of this was given.
(Kemp, Louise and Smith, T. Lynn, op. cit., p. 14; the same data reported also in Hitt, Homer L., and Bertrand, Alvin L., Social Aspects of Hospital Planning, Louisiana Study Series No. I, Health and Hospital Division, Office of the Governor, Baton Rouge, Louisiana, 1947, p. 9)

Table 4.9 MORTALITY RATES FROM COMMON CAUSES OF DEATH IN MICHIGAN, 1940, BY RESIDENCE[1]

Cause of Death	Rates per 100,000 Population		
	Rural	Urban	Ratio: Rural/Urban
Diseases of the heart	338.9	274.9	1.23
Cancer	127.6	115.1	1.11
Intracranial lesions of vascular origin	110.6	78.4	1.41
Nephritis	63.3	53.0	1.19
Pneumonia and influenza	60.2	49.0	1.23
Accidents (non-vehicle	49.7	37.5	1.33
Accidents (motor-vehicle	38.5	30.3	1.27
Tuberculosis	30.0	36.3	.83
Diabetes mellitus	26.4	26.7	.99
Premature births	20.2	26.1	.77
Suicide	16.0	12.8	1.25
Syphilis	15.8	9.3	1.70
Congenital malformation	14.3	13.5	1.06
Hernia	9.8	9.1	1.08
Appendicitis	7.1	10.8	.66
Cirrhosis of the liver	7.0	10.3	.68
Ulcer of the stomach	5.8	6.2	.94
Puerperal causes	4.2	6.1	.69
Diarrhea, enteritis, etc.[2]	3.7	3.1	1.19
Exophthalmic goiter	2.8	4.0	.70
Whooping cough	1.6	.8	2.00
Homicide	1.5	3.8	.39
Scarlet fever	1.0	.7	1.43
Diphtheria	.4	.4	1.00
Cerebrospinal meningitis	.1	.4	.25
All Causes	1,097.0	938.4	1.17

1 Based on population enumerated as of April, 1940.

2 Includes only deaths under 2 years of age.

Source: Computed from Vital Statistics of the United States, 1940, Part II, Residence, Table 10, pp. 226-227.

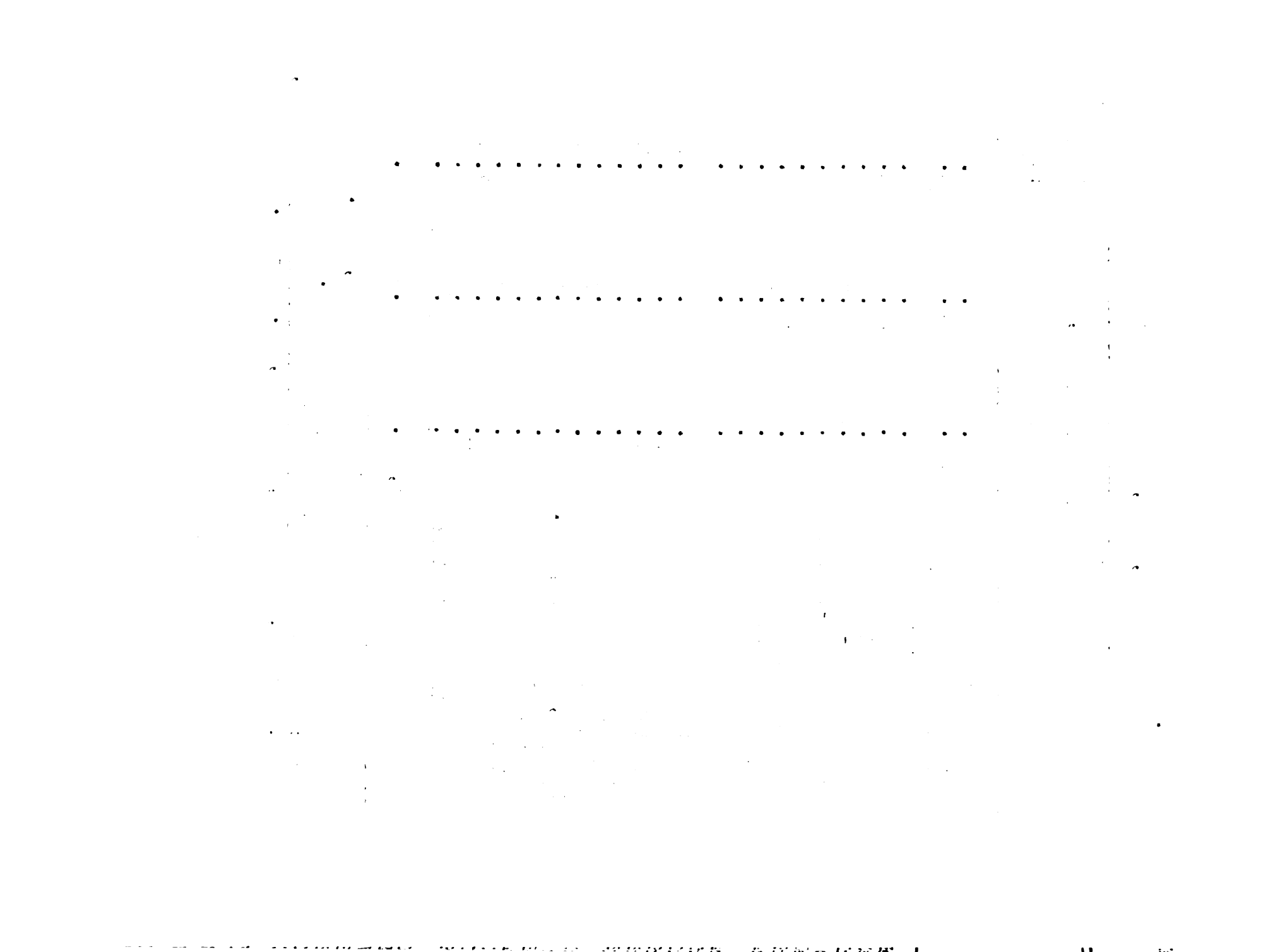


Table 4.10 DEATH RATES PER 100,000 POPULATION FROM COMMON CAUSES, BY RESIDENCE, PERCENTAGE DIFFERENCE, MICHIGAN, 1940[1]

Cause of Death	Death Rate		Percentage Difference Where	
	Rural	Urban	Urban Less Than Rural (Rural=100)	Rural Less Than Urban (Urban=100)
Heart diseases	338.9	274.9	18.9	----
Cancer	127.6	115.1	9.8	----
Intracranial lesions of vascular origin	110.6	78.4	29.1	----
Nephritis	63.3	53.0	16.3	----
Pneumonia & influenza	60.2	49.0	18.6	----
Accidents (non-vehicle	49.7	37.5	24.5	----
Accidents (vehicle)	38.5	30.3	21.3	----
Tuberculosis	30.0	36.3	----	17.4
Diabetes mellitus	26.4	26.7	----	1.1
Premature births	20.2	26.1	----	22.6
Suicide	16.0	12.8	20.0	----
Syphilis	15.8	9.3	41.1	----
Congenital malformation	14.3	13.5	5.6	----
Hernia[2]	9.8	9.1	7.1	----
Appendicitis	7.1	10.8	----	34.3
Cirrhosis of Liver	7.0	10.3	----	32.0
Ulcer of the stomach	5.8	6.2	----	6.5
Puerperal causes	4.2	6.1	----	31.1
Diarrhea, etc.[3]	3.7	3.1	16.2	----
Exophthalmic goiter	2.8	4.0	----	30.0
Whooping cough	1.6	.8	50.0	----
Homicide	1.5	3.8	----	60.5
Scarlet fever	1.0	.7	30.0	----
Diphtheria	.4	.4	----	----
Cerebrospinal meningitis	.1	.4	----	75.0

[1] Based on population enumerated April, 1940.

[2] Includes intestinal obstructions.

[3] Includes only deaths under 2 years of age.

Note: Rates based on less than 20 deaths are underscored.

Source: Computed from Vital Statistics of the United States, 1940, Part II, Residence, Table 10, pp. 226-227.

of the other three degenerative diseases. The rural rate exceeds the urban rate by 23 percent.

Cause of Death	Other Diseases Heart Disease Rural	Other Diseases Heart Disease Urban
Heart diseases	100.0	100.0
Cancer	37.7	41.9
Intracranial lesions of vascular origin	32.6	28.5
Nephritis	18.7	19.3

Source: Based on rates taken from Table 4.10.

The death rate from cancer in rural areas is only 11 percent in excess of the rate in urban places, 127.6 compared with 115.1. Intracranial lesions of vascular origin have a rate in rural areas almost twice the size of the urban rate, or 110.6 and 78.4 respectively. The next highest death rate in both areas is nephritis, which takes a toll of 63.3 per 100,000 in rural compared with 53.0 in urban places, an excess of 19 percent for the rural populace.

When the deaths from these four degenerative diseases are combined and related to the total population, the respective rates for rural and urban areas are 640.4 and 521.4, giving a difference in rates of 119.0 per 100,000 population, or a rural rate 23 percent in excess of the urban rate. When these same deaths are related to the population over 45 years of age, the rural rate is 2,269.8 and the urban rate is 2,033.4 per 100,000 with a difference of 236.4, or a rural rate only 12 percent higher than the urban rate. These "age-limited" death rates are influenced less by distortions due to varying age distributions of the rural and urban

populations,[1] and their relative differences tend to be less than those of the crude rates when expressed as ratios. This is indicated in the following table for the four degenerative diseases under discussion. (See Table 4.11)

Table 4.11

AGE-LIMITED AND CRUDE DEATH RATES PER 100,000 POPULATION FOR FOUR DEGENERATIVE DISEASES, MICHIGAN, 1940, BY RESIDENCE

Cause of Death	Crude Death Rate		Age-Limited (1) Death Rate		Ratio: Rural / Urban	
	Rural	Urban	Rural	Urban	Crude	Age-Limited
Heart disease	338.9	274.9	1201.3	1072.0	1.23	1.12
Cancer	127.6	115.1	452.2	448.9	1.11	1.01
Intracranial lesions of vascular origin	110.6	78.4	392.2	305.8	1.41	1.28
Nephritis	63.3	53.0	224.3	206.7	1.19	1.09
Total	640.4	521.4	2269.8	2033.4	1.23	1.12

(1) The total number of deaths in rural and urban areas from specific causes characteristic of the older population groups are related to the population over 45 years of age in each area. Deaths by age for specific causes are unavailable by rural and urban residence.

Source: Computed from Vital Statistics of the United States, 1940, Part II, Residence, Table 10, pp. 226-227.

Although both the crude and age-limited death rates for these four diseases are higher for the rural than for the urban areas, this is to be expected in view of the age distribution in the two populations. It will be shown later

1. See Chapter I, page 21ff. The Committee on Forms and Methods of Statistical Practice of the American Public Health Association recommends that death rates for these degenerative diseases be based on broad age groups from the middle to the end of life and for children's diseases on the population under 15 years of age, in order to eliminate partially the distortions due to differences in age of populations being compared.

that these rates are reversed in favor of the rural segment when more refined rates are computed in which allowance is made for age differences.

Specific causes of death may be classified in terms of their predominance in rural versus urban areas as follows:

Causes of Death Predominant in Rural	Causes of Death Predominant in Urban
1. Heart disease	1. Tuberculosis
2. Cancer	2. Premature births
3. Intracranial lesions of vascular origin	3. Appendicitis
4. Nephritis	4. Cirrhosis of the liver
5. Pneumonia and influenza	5. Ulcer of stomach
6. Accidents (non-vehicle)	6. Puerperal causes
7. Accidents (vehicle)	7. Goiter
8. Suicide	8. Homicide
9. Congenital malformation	9. Cerebrospinal meningitis
10. Hernia	
11. Syphilis	
12. Diarrhea	
13. Whooping cough	
14. Scarlet fever	

Among the causes of death which are classed as predominant in urban places are three which are often considered among the better measures of healthful environmental conditions in a population. These diseases with their rates are tuberculosis 36.3, premature births 26.1, and puerperal causes 6.1. The percentage excesses of these rates over corresponding rates for rural areas are respectively 17, 23, and 31. Tuberculosis, a transmissible disease, is usually associated with low economic and educational

conditions. Detroit tends to dominate the urban death rates of Michigan, and it has a high rate for tuberculosis.[1] On the assumption that the major portion of recent migrants to the industrial areas of Michigan came from the Southern States, particularly from Kentucky and Tennessee, a partial explanation of the high urban rate may be attributed to the fact that rates from tuberculosis have been high in these States.[2] However, if this is true, a more difficult thing to explain is the higher rate for non-whites in Detroit than exists in these Southern States.

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1. The death rate from tuberculosis in Detroit is 48.5 per 100,000 population. The urban rate for Michigan is 34.1, but minus Detroit it is only 25.5. For rural areas it is 30.0. Detroit has 73 percent of the State's urban non-white population. Since 91.4 percent of Michigan's colored population is classified as urban, it follows that most of them are located in Detroit. The tuberculosis rate for colored persons in Detroit is 181 whereas in urban areas outside of Detroit it is only 130.2. The next largest city in Michigan, Grand Rapids, has the lowest death rate from this cause of any city in the United States, namely 15.6. See Byrd, Oliver E., Health Instruction Yearbook, 1945, Stanford University Press, Stanford University, California, 1945, p. 138. About 1.1 percent of the population of Kent County (including Grand Rapids) is colored, while 8.1 percent of Wayne County (including Detroit) is colored. See Beegle, J. Allan, op. cit., Table 2, p. 79.

2. Palmer, Carroll E., Tuberculosis in the United States, Medical Research Committee, National Tuberculosis Association, New York, Volume 4, 1946, pp. 79, 63, and 159. According to this study, three-year average death rates from tuberculosis for the years 1939-1941 were as follows:

State	All Races	White	Non-white
Michigan	34.8	----	-----
Detroit	50.7	36.5	189.0
Kentucky	68.9	61.2	163.2
Tennessee	78.8	61.6	160.1

One explanation is this. It is quite possible that latent lesions are reactivated by the poor working and living conditions[1] which characterize the social environment of these migrants. J. Burns Amberson, Jr., Professor of Medicine, Columbia University, has this to say:[2] "If the infection (tuberculosis) is acquired in early childhood and the individual survives the immediate effects, the lesions usually remain latent until adolescence or adult life when reactivation is most likely to occur." He observes further, ".... Poorly fed and housed people have a higher incidence of the disease. .... It is known that laborious occupations under poor working conditions, exemplified by unskilled laborers, involves a death rate from tuberculosis which is five or ten times higher than that among professional classes. The factors of low wages and living conditions are of course interwoven. It is self-evident that the ultimate conquest of the disease must take into consideration these and other incidental causes as well as the factor of infection alone."

Premature births rank second and puerperal causes sixth on the list of predominant causes of death in urban

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1. Freedman found in his study of health differentials among rural-urban migrants that "in 1936 the health of recent rural-urban migrants who remained in the city was poorer than that of the general urban population." See Freedman, Ronald, "Health Differentials for Rural-Urban Migration," American Sociological Review, Volume 12, No. 5, 1947, p. 541.

2. Stieglitz, Edward J., ed., op. cit., pp. 336-338.

areas. One might have expected these rates to be lower in urban areas because medical care and health facilities are more accessible. However, over-activity on the part of the expectant mother, criminal abortions, and similar situations tend to increase the rates.[1] Therefore, it is probable that the stress and strain of urban life encourages habits and attitudes of living which are unfavorable to motherhood and this is reflected in the urban rates. In addition, the concentration in Michigan's industrial areas of Southern migrants whose levels of living are low[2] is offered as a further explanation of these rates.[3]

In rural areas, one might question the presence of high rates for motor vehicle accidents, suicides, and syphilis. They are 38.5, 16.0, 15.8 respectively. Rural residents die from both motor vehicle and all other acci-

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1. See Smiley, Dean Franklin, and Gould, Adrian Gordon, Community Hygiene, The MacMillan Company, New York, 1946, pp. 283-285. See also Dublin, Louis, et al, op. cit., p. 175.

2. Hagood, Margaret Jarman, Rural Level of Living Indexes for Counties of the United States, 1940, Bureau of Agricultural Economics, United States Department of Agriculture, Washington, D.C., 1943. The Rural Composite Index for Michigan was 114, for Kentucky 83, and for Tennessee 77. The higher the index the higher the level of living.

3. Burke found a statistically significant relationship between the diet of the mother during pregnancy and the condition of her baby at birth. In 216 cases studied all still-born premature and "functionally immature" infants were born to mothers whose diets were inadequate. Burke, Bertha S.,"Nutrition and Its Relationship to the Complications of Pregnancy and the Survival of the Infant," American Journal of Public Health, Vol. 35, No. 4, April 1945, pp. 334-339.

dents about 30 percent more than urban people. There are a number of factors contributing to this situation; the young and the old, both considered greater accident risks than the remaining population, are concentrated more heavily in rural areas,[1] speed laws are higher in the country and often not so well enforced, and occupational accidents in agriculture are numerous.

Suicide occurs more often in the country than in the city, the rates being 16.0 and 12.8 for 1940. This is contrary to the findings of Dublin (as reported by Gist) in his study of suicide in 180 cities in the United States for the years 1930-31.[2] He found that suicide rates were higher in urban than in rural areas and that they increased as the size of the city increased. Gist points out[3] that "one should exercise care in assuming that suicide is always associated with urbanism, or at least that urban rates necessarily exceed the rates for rural areas. Cavan found a greater difference between urban rates in different regions than exists between urban and rural rates for the country at large."[4]

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1. Beegle, J. Allan, Michigan Population, Special Bulletin 342, Michigan Agricultural College, Agricultural Experiment Station, East Lansing, Michigan, 1947, pp. 36-40.

2. Dublin, Louis I., To Be Or Not To Be.

3. Gist, Noel P. and Halbert, L.A., Urban Society, Thomas Y. Crowell Company, New York, 1945, p. 383.

4. Cavan, Ruth Shonle, Suicide, University of Chicago Press, Chicago, Illinois, 1928, pp. 46-54.

In 1940 the suicide rate in Michigan for rural males exceeded that for urban males by 33 percent, being 25.7 and 19.2 respectively. On the other hand, the rate for urban females followed the national pattern and exceeded that for rural females by 18 percent. The rates are 6.2 and 5.1 respectively. It is the author's opinion that several factors are operating to produce these high rural rates for suicide in Michigan. The rural population is preponderantly composed of older males who are frequently the victims of certain dread diseases, such as cancer, coronary thrombosis, or senile dementia. It has been found that ill health is a leading motive in 40 percent (whether successful or not) of all attempts at suicide by males; and that domestic difficulties account for another 30 percent.[1] Moreover, lumbering drew a large number of unattached men into Northern Michigan. The rapid decline of this industry and the State-wide depression of the thirties contributed further to the personal disorganization of males. (See Chapter VII for counties with high suicide rates.) And finally, it is probable that religious mores among males are weaker and hence do not operate as deterrents of suicide to the extent they do among females.

Only one negro in the rural areas of the State committed suicide and only 16 in the urban areas took their

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1. See Metropolitan Life Insurance Company, "Why Do People Kill Themselves?" Statistical Bulletin, 26; No. 2, February 1945, pp. 9-10.

lives. It would appear that suicide in Michigan is essentially a rural-white, male, behavior-pattern. Perhaps racial discrimination has built within the colored population a group consciousness which militates against suicidal tendencies among its members.

Homicide is largely an urban phenomenon in Michigan. The urban rate exceeds the rural rate by 39 percent. The rates are 3.8 per 100,000 population and 1.5 respectively. Moreover, it is essentially a non-white characteristic. Probably this is often an expression of repressed antagonism. In 1940 the rate per 100,000 population was 1.9 for whites and 28.6 for non-whites.[1] Undoubtedly, legislation controlling the use of firearms has done much to reduce this death rate.

Age-Adjusted Death Rates for Selected Causes

When the age distributions of rural and urban populations are taken into account, the death rates for the highest of the twenty-five principal causes discussed in this section present a somewhat different picture. Eight of the leading causes have been adjusted for age and are presented in Table 4.12.[2] This table shows the ratio of actual to expected deaths for each cause, "expected" being

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1. See Chapter V, p.127 for a detailed discussion.

2. Expected deaths are obtained in the same manner as in the indirect method of adjusting death rates. See Appendix I, pp. 321-325.

Table 4.12 AGE-ADJUSTED DEATH RATES FROM SPECIFIC CAUSES, MICHIGAN 1940, BY RESIDENCE[1]

Cause of Death	Observed Death Rates per 100,000 (1) Rural	(2) Urban	2x100/1	Ratio of Actual to Expected Deaths[2] (3) Rural	(4) Urban	4x100/3
Heart	338.9	274.9	81.1	97.2	104.1	107.1
Cancer	127.6	115.1	90.2	93.9	106.3	113.2
Intracranial lesions of vascular origin	110.6	78.4	70.9	102.1	98.7	96.7
Accidents (All)	88.3	67.7	76.7	114.9	97.3	84.7
Nephritis	63.3	53.0	83.7	94.8	103.4	109.1
Pneumonia	60.2	49.0	81.7	100.6	99.9	99.3
Tuberculosis	30.0	36.3	121.0	90.8	123.2	135.7
Diabetes mellitus	26.4	26.7	101.1	84.4	109.8	130.1
All causes	1097.0	938.4	85.5	96.8	102.6	106.0

[1] Urban includes all incorporated places with 2,500 inhabitants or more in April 1940. Rural embraces all the area outside of cities of 2,500 inhabitants or more in 1940

[2] The expected deaths are computed by applying the age-specific death rates in the total population of Michigan from each cause of death, to the corresponding age group of the urban and rural populations respectively, and summing for all ages. See Dublin, Louis I. and Lotka, Alfred J., Length of Life, p. 95, for an example of this method of adjusting cause-specific death rates for age in rural and urban areas. Age-specific rates for these eight causes are from Linder, Forrest E. and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, Table 23, pp. 476-477.

the number of deaths that would have occurred in each area if its death rate for each cause had been the same at each age as corresponding rates for the State of Michigan. Of the eight causes adjusted in this table, five have rates that are higher in urban than rural places. The crude heart disease rate in urban areas, for example, is 19 percent lower than the rural rate, but when the rates are adjusted for age, the urban rate is seven percent higher than the rural rate. The three diseases which have higher rates in rural than in urban areas are intracranial lesions of vascular origin, accidents, and pneumonia, the latter two rates being approximately equal.

Twenty-five Principal Causes of Death in Michigan by Race and Residence

The specific causes of death in rural and urban areas by race are presented in Table 4.13. Because there are relatively few colored people in Michigan,[1] an examination of the crude rates for white people reveal that race[2] has only a slight influence on the total rural and urban death rates in this state. The total rural rate for all causes is 11.0 per 1,000 population and the rural white rate is 10.8, a

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1. There are 216,463 colored people in Michigan of whom 91.4 percent are located in urban areas.

2. Comparisons of death rates of the colored and white population by cause should be made with reservation and caution when given for rural and urban areas of Michigan, since there are few colored in rural areas. Only seven of the twenty-five causes listed had frequencies of more than 20 deaths for rural colored people.

difference of only .2, while there is a difference of only .1 between the rates of total urban and urban whites. Thus, it appears that death rates for all causes in Michigan are not influenced very much by deaths occurring to the relatively few colored people in the population. However, the total urban death rates for a few causes do show an influence of the exceptionally high rates for colored people. These causes are listed below:

Urban total death rate by causes		Urban White	Difference
Pneumonia and influenza	49.0	46.8	2.2
Tuberculosis	36.3	28.2	8.1
Syphilis	9.3	7.6	1.7
Homicide	3.8	2.1	1.7

It is interesting to observe that rates of the colored population for these specific causes are particularly high, and it would be unusual if they did not exert an upward influence on the total rates in urban areas. However, the total urban death rate for cancer, 115.1, was influenced downward by the colored population. It is 2.7 less than the urban segment. This is probably best explained in terms of age. Colored people, among whom cancer takes a high toll, have relatively fewer of their number distributed among the older age groups than do white people.[1]

As might be expected, the rates of specific causes for the total rural population are influenced less by the colored group than the corresponding urban rates. The

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1. See also Beegle, J. Allan, op. cit., p. 41.

Table 4.13 MORTALITY RATES FROM COMMON CAUSES OF DEATH IN MICHIGAN, 1940, BY RACE AND RESIDENCE[1]

Cause of Death	Rates per 100,000 population					
	WHITE			OTHER		
	Rural	Urban	Ratio Rural/Urban	Rural	Urban	Ratio Rural/Urban
Diseases of the heart	337.9	274.0	1.23	438.3	388.7	1.13
Cancer	126.0	117.8	1.07	277.9	70.3	3.95
Intracranial lesions of vascular origin	111.0	79.3	1.40	176.4	63.7	2.73
Nephritis	63.3	51.4	1.23	58.8	79.4	.74
Pneumonia and influenza	59.0	46.8	1.26	176.4	85.0	2.07
Accidents (non-vehicle)	49.1	37.9	1.30	112.2	29.3	3.83
Accidents (motor-vehicle)	37.9	31.0	1.22	96.2	17.7	5.43
Tuberculosis	27.4	28.2	.97	272.6	170.4	1.60
Diabetes mellitus	26.1	27.0	.97	53.5	19.2	2.79
Premature births	20.0	25.0	.80	32.1	41.5	.77
Suicide	16.2	13.1	1.24	5.3	7.6	.70
Congenital malformation	14.4	13.9	1.04	5.3	6.6	.80
Syphilis	12.7	7.6	1.67	304.7	36.4	8.35
Hernia	9.8	8.8	1.11	5.3	12.6	.42
Appendicitis	7.1	10.4	.68	5.3	17.7	.30
Cirrhosis of the liver	7.1	10.5	.68	---	7.1	---
Ulcer of the stomach	5.7	6.2	.92	16.0	6.6	2.42
Puerperal causes	4.2	6.0	.70	10.7	7.6	1.40
Diarrhea, enteritis, etc.[2]	3.7	3.0	1.23	5.3	5.1	1.04
Exophthalmic goiter	2.9	4.1	.71	---	3.0	----
Whooping cough	1.5	.8	1.98	5.3	2.0	2.65
Homicide	1.4	2.1	.67	10.7	30.3	.35
Scarlet fever	1.0	.7	1.43	---	---	---
Diphtheria	.4	.4	1.00	---	.5	---
Cerebrospinal meningitis	.1	.4	.25	---	.5	---
All Causes	1082.2	926.0	1.17	2517.5	1143.3	2.20

[1] Based on population enumerated as of April, 1940.

[2] Includes only deaths under 2 years of age.

Note: Rates based on less than 20 deaths are underscored.
Source: Vital Statistics of the United States, 1940, Part II, Residence, Table 10, pp. 226-27.

causes for which rural death rates of white people are lower than the total death rate for corresponding causes in rural areas are listed below:

	Rural total death rate by cause	Rural White	Difference
Cancer	127.6	126.0	1.6
Tuberculosis	30.0	27.4	2.6
Syphilis	15.8	12.7	3.1

Thus, it appears that only certain cause-specific crude death rates for all races change materially when they are made specific for the white race. The urban rates are influenced slightly more than the rural rates, because the colored population is concentrated in the urban industrial areas of Michigan and have excessive death rates for these causes. Tuberculosis, syphilis, pneumonia, and homicide among the non-whites account for a portion of the high rate for these diseases among the rural and urban population. The remaining causes among the twenty-five listed have approximately the same rates for all races in the two resident areas as for the white race.[1]

Age-adjusted Death Rates for Selected Causes by Race and Residence

Table 4.14 enables one to compare age-adjusted rates from the leading causes by race and residence. Observation of these rates along with those of Table 4.12 reveals clearly that white people in rural and urban places dominate the total death rates in these areas for the causes listed.

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1. These crude cause-specific death rates are discussed more fully in Chapter V, Mortality Differentials by Race.

Table 4.14 AGE-ADJUSTED DEATH RATES FROM SPECIFIC CAUSES, MICHIGAN, 1940, BY RACE AND RESIDENCE

Cause of Death	Ratio of Actual to Expected Deaths[1]					
	White			Colored		
	(1) Rural[2]	(2) Urban[3]	$\frac{2}{1} \times 100$	(3) Rural	(4) Urban	$\frac{4}{3} \times 100$
Accidents (All)	108.2	95.3	88.1	243.8	75.0	30.8
Intracranial lesions of vascular origin	101.2	97.4	96.2	173.6	135.5	78.0
Pneumonia	98.5	94.3	95.7	300.0	207.4	69.1
Heart diseases	96.7	101.5	105.0	136.7	170.4	124.7
Nephritis	94.8	98.0	103.4	91.7	234.3	255.5
Cancer	92.7	104.7	112.9	216.7	89.1	41.1
Diabetes mellitus	83.5	109.3	130.9	200.0	111.8	55.9
Tuberculosis	83.0	83.0	100.0	850.0	503.0	59.2
All Causes	95.3	99.6	104.5	237.9	167.4	70.4

[1] The expected deaths are computed by applying the age-specific death rates in the total population of Michigan from each cause of death, to the corresponding age group of the urban and rural populations respectively, and summing for all ages. See Dublin, Louis I, and Lotka, Alfred J., Length of Life, p. 95 for an example of this method of adjusting cause-specific death rates for age in ruraland urban areas. It is essentially the principles employed in the Indirect Method of adjusting death rates for age, which are described and illustrated in Appendix I, p321ff.The age-specific rates employed as a standard for these eight causes are from Linder, Forrest E., and Grove, Robert D., op. cit., Table 23, pp. 446-477.

[2] Urban includes all incorporated places with 2,500 inhabitants or more in April 1940.

[3] Rural embraces all the area outside cities of 2,500 inhabitants or more in 1940.

Tuberculosis is the only disease that seems to have been greatly influenced by race. The tuberculosis rates for all races in rural and urban areas are respectively 90.8 and 123.2, the urban rate being 35.7 percent in excess of the rural (See Table 4.12). When the colored group is eliminated, the rates computed for whites only are 83.0 in both rural and urban areas. (Table 4.14) The rural-urban mortality differentials for all other causes for whites listed remain approximately the same as the ratios for total rural-urban areas given in Table 4.12. The rates for colored people are in excess of those of the white population for all specific causes presented in both rural and urban areas with the exception of accident (all) in urban areas.[1]

Infant Death Rates in Rural and Urban Areas

According to data for 1940 presented in Table 4.15, the rural people of Michigan living in places of less than 2,500 population have 42.1 infant deaths per 1,000 live births as compared with 39.3 for those living in urban places of 10,000 population or more. Large cities (100,000 or more population) lose fewer babies per 1,000 live births than any other population-size group. The rate for these cities is only 37.5. Small cities (2,500-10,000) have the highest infant death rate of all segments considered, name-

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1. This generalization eliminates nephritis and diabetes mellitus because these two causes are based on less than 20 deaths for non-whites in both areas.

ly, 45.0 deaths. Medium-sized cities (25,000-100,000) have the next highest infant death rate among both urban and rural groups. This rate is 43.2. It is evident from this data that infants living in urban places of 10,000 or more have slightly better chances of survival than rural infants or those living in small cities. However, this slight advantage almost disappears when the rate is averaged for the four years 1938-1941; the rate becomes 41.2 in urban areas and 41.8 in rural areas.

Table 4.15

INFANT MORTALITY RATES, MICHIGAN, BY POPULATION SIZE GROUPS, 1940 (By place of residence)

Population Size Group	Infant deaths under 1 year of age per 1,000 live births
Total Population	40.7
Total: 10,000 population or more	39.3
Cities of 100,000 population or more	37.5
Cities of 25,000 to 100,000 population	43.2
Cities of 10,000 to 25,000 population	39.2
Total: Cities under 10,000 population and rural	42.7
Cities of 2,500 to 10,000 population	45.0
Rural population	42.1

Source: Linder, Forrest E. and Grove, Robert D., op. cit., Table 28, p. 589.

Infant Death Rates by Selected Causes

According to data presented in Table 4.16, rural infant death rates are higher than urban rates for 11 out of 20 classified causes of infant deaths. Urban infants succumb from three of the six most common causes of infant

Table 4.16

INFANT MORTALITY RATES, MICHIGAN, 1938-1941
(By cause and residence)

Selected Causes	Deaths Per 100,000 live births		
	Total	Urban	Rural
All Causes	4,137.3	4,118.8	4,177.0
Premature births	1,352.1	1,442.5	1,158.2
Congenital malformations	570.0	565.3	579.9
Pneumonia (All forms)	557.9	507.1	666.9
Injury at birth	401.8	425.7	350.5
Other diseases peculiar to first year	259.7	265.7	246.8
Diarrhea, enteritis, etc.	229.5	216.3	257.9
Mechanical suffocation and other accidents	98.1	77.4	142.4
Diseases of thymus gland	96.0	86.6	116.3
Congenital debility	72.7	58.6	102.8
Whooping cough	56.8	46.4	79.1
Other diseases of respiratory system	55.1	51.2	63.3
Influenza	48.3	33.5	79.9
Diseases of the nervous system	39.7	44.2	30.1
Intestinal obstruction	35.4	36.5	33.2
Diseases of ear and mastoid process	22.9	25.4	17.4
Syphilis	19.4	20.3	17.4
Diseases of circulatory system	18.6	14.7	26.9
Ill-defined and unknown causes	18.1	12.2	30.9
Dysentery	17.3	16.2	19.8
Diseases of genito-urinary system	14.3	15.1	12.7
Measles	12.8	13.3	11.9
All other causes	140.8	144.6	132.7

Source: Vital Statistics of the United States, 1938, Part 1, Table 24, 1939, Part 11, Table 13; 1940 Part 11, Table 14; 1941 Part 11, Table. 19. Computed by Commission on Hospital Care, in State Hospital Study Manual, Book IV, (Mimeographed), Chicago 10, Illinois, Table 13.

death at higher rates than do rural, while rural infants have higher rates for the other three causes. These contrasts are emphasized below:

Infant diseases predominant in urban environment	Infant diseases predominant in rural environment	
Rates		
Premature births	14.4	11.6	
Injury at birth	4.3	3.5	
Other diseases peculiar to first year	2.7	2.5	
	5.7	5.8	Congenital malformation
	5.1	6.7	Pneumonia (all forms)
	2.2	2.6	Diarrhea, enteritis, etc.

These six causes comprised 83 percent of all infant deaths in 1940, and one of them, premature births, is among the ten principal causes of death when ranked according to incidence in the total population. When these six causes are combined, the rates for rural and urban areas in 1940 favor the rural places slightly. They are 32.8 and 34.2 respectively. However, the infant death rates from all causes in 1940 favors the urban over the rural population, the rates being 40.0 and 42.7 respectively. Infant death rates for 1940 adjusted for underregistration of births[1] present essentially the same relative ranks as the unadjusted infant rates. These rates for rural and urban places are 41.2 and 39.1 respectively. Thus it appears that on the basis of these data, urban infants have a slightly more favorable health level

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1. Corrections were made by applying the United States Bureau of Census estimate of 2.2 percent incompleteness of birth registration in Michigan to the total registered births. The unregistered births obtained were distributed to residence groups by allocating unregistered births at the same ratio as registered births to the State total in the two areas.

than rural infants.[1] However, it should be pointed out that earlier in the Chapter age-specific death rates for the age group under one year in these two areas definitely favored the rural areas.

Maternal Mortality Rates[2] in Rural and Urban Areas

Death occurs to mothers during child-birth at a higher rate in urban than in rural areas. Mothers living in places of less than 2,500 population die in child-birth at the rate of 2.3 per 1,000 live births as compared with a rate of 3.2 for mothers living in places with 2,500 or more population. When corrected for underregistration of births, these two maternal death rates are modified very little, the

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1. Thompson points out that reductions in infant death rates may be attributed to four major factors: "(a) the better care that children are receiving at home, that is, primarily, the improvement in the methods and sanitation of infant feeding; (b) the decline in the number of children born to a large portion of the mothers, thus enabling them to give their children better care both before and after birth, (c) the more expert medical care of children; and (d) the generally more comfortable circumstances in which a large part of the people in the more advanced nations now live." In the light of these factors one might point out that in Michigan because of the nature of health organization, the rural population has less opportunity for education in child and health care, less facilities available, and larger size families than the urban population. (Thompson, Warren S., op. cit., pp. 221-222)

2. Maternal deaths comprise all deaths of mothers that can be ascribed to childbirth (International List Numbers 140-150). When the number of maternal deaths is expressed in terms of per 1,000 live births it is referred to as "maternal mortality rate," but when the number of such deaths is related to the total population it is referred to as the death rate from "puerperal causes."

urban rate being 3.13 and the rural rate 2.26. Considering all cities of less than 10,000 and the open country population as "rural" and, on the other hand, all cities of 10,000 and over as "urban", the rural areas have lower maternal death rates than urban areas. These rates are respectively 2.5 and 3.2 deaths of mothers for each 1,000 live births. (See Table 4.17)

Table 4.17

MATERNAL MORTALITY RATES, MICHIGAN, 1940, BY POPULATION SIZE GROUPS[1] (By place of residence)

Population Size Groups	Deaths of Mothers Per 1,000 Live Births
	Total
Total Population	2.9
Total Urban: 2,500 population or more	3.2
Total: 10,000 population or more	3.2
Cities: 100,000 population or more	3.3
Cities: 25,000 to 100,000 population	3.3
Cities: of 10,000 to 25,000 population	2.5
Total: Cities under 10,000 population and rural	2.5
Cities: 2,500 to 10,000 population	3.4
Rural population	2.3

[1] Deaths are allocated to place of residence. Rates for frequencies of death of less than 20 are underscored. Total urban computed from Vital Statistics of the United States, 1940, Vol. II, Table 10, p. 227.

Source: Vital Statistics Rates in the United States 1900-1940, Bureau of the Census, Table 37, p. 632.

The rural population has lower maternal death rates than any other population-size group presented.[1] Small cities

1. This generalization ignores the maternal death rate of 2.5 for cities of 10,000 to 25,000 because it is based on less than 20 deaths.

of 2,500 to 10,000 have the highest rate, 3.4, and the next highest rate, 3.3, occurs in medium-size cities of 25,000 to 100,000 population. Dorn concluded in his study of maternal mortality rates that there is practically no difference between maternal mortality rates in urban and rural areas of the Nation, but that there is considerable variation among the States.[1]

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1. Dorn, Harold F., "Maternal Mortality in Rural and Urban Areas," Public Health Reports, Vol. 54, No. 17, April 28, 1939, pp. 684-690.

CHAPTER V

MORTALITY DIFFERENTIALS BY RACE

Of the 52,183 deaths which occurred in Michigan in 1940, five percent, or 2,732, were members of the colored races,[1] although this group constituted only 4.1 percent of the total population. Among the 216,463 persons classified as non-whites, 96.3 percent were Negroes, 2.9 percent were Indians, and .9 percent were Chinese and Japanese. Thus, with a population of 5,256,106 in 1940, the State had a relatively small number of colored people.[2] As Table 5.1 indicates, the non-whites have been increasing rapidly since 1910, and the Negro segment will probably continue to increase in the future. For this reason, among others, it is appropriate to include race mortality differentials among

Table 5.1

POPULATION OF MICHIGAN, BY RACE, PER CENT CHANGE OVER PRECEDING DECADE, 1900-1940

	Population (1)		Percent Change	
Year	White	Colored	White	Colored
1900	2,400,789	22,416		
1910	2,806,465	25,818	16.9	15.2
1920	3,651,242	71,998	30.1	178.9
1930	4,654,599	179,607	27.5	149.5
1940	5,039,643	216,463	8.3	20.5

1. Estimated as of July 1 for all years except 1940, which is enumerated as of April 1, 1940.

Source: Linder, Forrest E. and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, Table 1, p. 830 ff.

1. "Colored" includes Negroes, Indians, Chinese, and Japanese. Mexicans are included with the "White" group.

2. For a consideration of the problem of death rates based on a small number of deaths, see pp.42-43.

the important items of analysis in our description of the present mortality-health situation.

Race-Specific[1] Crude and Age-Adjusted Mortality Rates

Both the crude resident and the age-adjusted death rates are higher for the colored than for the white population.[2] In 1940 the crude death rate per 1,000 was 9.8 for the white segment, and 12.6 for the colored. The resulting differential between the two race-specific mortality rates assumes additional importance as a measure of health in Michigan when it is considered in relation to the age distribution of the colored races. Actually the age distribution of the non-whites favors a low mortality rate in this State, since proportionately there are more white than colored persons in the age frequencies above 45 years. It is from these age groups that the chronic diseases take their largest toll. Age-specific rates will be discussed in the following section.

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1. Computation of race-specific death rates are explained on p. 311ff.

2. Thompson states, "It has long been known that the Negroes have a higher death rate than the whites among whom they live." Thompson, Warren S., op. cit., p. 137. Thompson bases his statement on:
Dublin, Louis I, "Recent Changes in Negro Mortality," Metropolitan Life Insurance Company, New York, 1924;

Gover, Mary, and Sydenstricker, Edgar, "Mortality among Negroes in the United States," Public Health Bulletin 174, Government Printing Office, Washington D. C., June 1927;

Sydenstricker, Edgar, Health and Environment, McGraw-Hill Book Company, Inc., New York, 1933.

On the basis of race-specific death rates, there are approximately three deaths per 1,000 from the colored population in excess of the death rate for the white segment. This difference is greatly accentuated when the rates are adjusted for age differences. Using the age distribution of the population of the United States in 1940 as a standard, the resulting age-adjusted death rate for the whites is 10.0 per 1,000 population, whereas the rate for the non-whites is 15.8. This difference of 5.8 is more than twice that between the crude resident death rates, namely, 2.8.

Age-Specific Death Rates

In Table 5.2, the age-specific death rates for the white and non-white segments are presented.

Table 5.2

AGE-SPECIFIC DEATH RATES FROM ALL CAUSES PER 1,000 POPULATION, MICHIGAN, 1940, BY RACE (Allocated to place of residence.)

Age Group	Rates per 1,000 Population		Ratio: Colored / White	Excess: Colored / White
	White	Colored		
Total	9.8	12.6	1.3	2.8
Under 1	47.3	66.9	1.4	19.6
1 - 4	2.1	3.9	1.9	1.8
5 - 14	1.0	1.4	1.4	.4
15 - 24	1.6	5.0	3.1	3.4
25 - 34	2.3	6.8	3.0	4.5
35 - 44	4.2	11.2	2.7	7.0
45 - 54	9.1	21.8	2.4	12.7
55 - 64	20.8	35.8	1.7	15.0
65 - 74	48.0	57.1	1.2	9.1
75 - 84	114.1	121.7	1.1	7.6
85 Over	238.8	129.0	---	----

Source: Vital Statistics Rates of the United States 1900-1940, Table 11, p. 202.

These figures reveal that death rates are higher for the colored population than for the white in every age group but one--those 85 years and over. The lowest age-specific death rate among the series is 1.0 per 1,000 population for whites age 5-14 years, while the highest is 238.8, also for whites, but at age 85 and over. Some of the greater relative differences found between the two groups occur in age frequencies under 45 years. For example, at age 15-24 years the rate 5.0 for the colored segment is more than three times as high as that of the white population, namely 1.6. At age 25-34, the death rate for the colored groups is three times that of the white. Moreover, the number of infant deaths under 1 year of age per 1,000 population is 47.3 for whites and 66.9 for non-whites, the latter being approximately 40 percent higher than the former. Among the age groups 45 years and above, the highest relative difference is at age frequency 45-54, where the rate for the colored population is about two and a half times that of the white.

An understanding of the full significance of age-specific mortality rate differentials by race is more readily grasped if one observes the rates along with the population age distribution of the respective groups. These data are given in Table 5.3. The white population in Michigan has a much higher proportion of its number over 44 years of age than does the colored population. It is well to remember that the higher the proportion of the total population of a given class in the age groups above 44 years, in general, the

Table 5.3

POPULATION[1] OF MICHIGAN, BY AGE AND RACE, 1940

Age Groups	Population[1]		Per 10,000 Population	
	White	Colored	White	Colored
Total	5,039,643	216,463	10,000	10,000
Under 1	80,326	3,481	159	161
1 - 4	334,115	13,462	663	622
5 - 14	846,906	35,866	1,681	1,657
15 - 24	900,303	35,068	1,786	1,620
25 - 34	807,070	41,778	1,601	1,930
35 - 44	719,713	43,920	1,428	2,029
45 - 54	628,996	25,351	1,248	1,171
55 - 64	398,202	10,695	790	494
65 - 74	224,713	5,129	446	237
75 - 84	85,956	1,372	171	63
85 Over	13,343	341	27	16

1. Population enumerated as of April 1, 1940.
Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, Table 11, pp. 898-899.

higher is the risk of death, since it is at these ages that the chronic diseases take their toll. Yet, with this handicap, the white race has lower death rates in all age frequencies above 44 years except one--those persons 85 years and over.

On the other end of the life span, ages 1 through 24, the two groups have approximately equal proportions of their populations in each of the age frequencies. Yet in every instance, the mortality rates for the colored segment are considerably higher in these age groups than are those for whites. Ordinarily, a population with a relatively low proportion of its total number distributed among the older age groups, and with a relatively high proportion in younger age groups, has a low crude resident death rate. However,

this is not true of the colored segment in Michigan. Furthermore, for the age frequency 25-44, in which almost 4,000 out of every 10,000 colored persons fall, the age-specific rates are almost three times the death rates of the white population. This condition stems, in part, from the fact that a large proportion of the colored people in Michigan migrated from Southern States, where standards of living have been low,[1] and where opportunities for health education and medical treatment have been more restricted.

Sex-Mortality Differentials by Race

In Table 5.4, the sex-specific death rates are given for both the colored and the white populations.

Table 5.4

SEX-SPECIFIC DEATH RATES IN MICHIGAN BY RACE, 1940
(By place of occurrence)

		Rates per 1,000 Population			
		Male		Female[1]	
Race	Both Sexes	Crude	Adjusted	Crude	Adjusted
White	9.8	10.8	11.1	8.7	8.8
Colored	12.6	13.7	17.0	11.6	14.6

1. Adjusted to the age distribution of the United States population, 1940, by the direct method.
Source: Crude data from Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 10, p. 193.

Crude rates for both sexes are lower for whites than for non-whites. They are respectively 10.8 and 13.7 for males

1. See Footnote 2, p. 92.

and 8.7 and 11.6 for females--a difference of 2.9 between the racial groups for both females and males and a difference of 2.1 between the sexes for both whites and non-whites. Thus death rates for males are higher than for females in both racial groups in Michigan.[1]

It has been shown that the crude resident death rate of 12.6 for the colored races is higher than that of the white race, namely 9.8; and that the resulting differential becomes still greater when these rates are adjusted for age differences. The adjusted rates are 15.8 and 10.0 respectively. This situation persists in spite of the fact that both the age and sex population composition for the colored segment favors a lower crude rate for them than for the white group. The colored races have proportionately fewer males in their population, which tends to favor low rates since males generally have higher death rates than females. The sex-ratios are 105.3 for whites and 103.8 for non-whites.

Sex-specific death rates for the two population groups are also higher when they are adjusted for age differences (using the population of the United States for 1940 as a base). The rate for male whites increased .3, namely, from 10.8 to 11.1 per 1,000 population. On the other hand, the rate for male non-whites increased 3.3, or from 13.7 to 17.0.

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1. This generalization is true for each of the 48 States. Males have higher crude death rates than females for the United States and all of the 48 States for both white and colored racial groups in 1940. See: Linder, Forrest E., and Grove, Robert D., op. cit., Table, pp. 127-149.

The rate for female whites changed only slightly--from 8.7 to 8.8 but the rate for female non-whites increased from 11.6 to 14.6, a difference of 3.0. When the crude resident death rates for the two groups were adjusted for both age and sex, the death rate for the white population increased only slightly--from 9.8 to 9.9, whereas the death rate for the colored population increased from 12.6 to 15.8.

Sex-specific death rates by age group provides more detailed comparisons of race-mortality differentials. These figures are given in Table 5.5.

Table 5.5

AGE AND SEX-SPECIFIC DEATH RATES BY RACE, MICHIGAN, 1940
(By occurrence)

	Rates Per 1,000 Population			
	White		Colored	
Age Group	Male	Female	Male	Female
All Ages	10.8	8.7	13.7	11.6
Under 1	54.3	39.9	73.1	61.2
1 - 4	2.3	2.0	4.1	3.8
5 - 14	1.1	.8	1.4	1.4
15 - 24	1.9	1.3	4.5	5.6
25 - 34	2.5	2.0	7.3	6.5
35 - 44	4.6	3.7	10.8	11.3
45 - 54	10.4	7.5	23.9	19.3
55 - 64	23.8	17.5	36.6	35.2
65 - 74	53.1	42.7	66.7	48.8
75 - 84	122.2	106.7	141.3	105.0
85 Over	249.5	230.3	157.1	104.5

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 23, p. 476.

As might be expected, the death rates of the colored races are in excess of those of the white race at all ages and

for both sexes, except for rates of females at ages 75 and over and for males 85 years and over. In general, the differences pointed out in the section on age-specific rates by race are true for the sex-age-specific death rates. In addition, the following observations may be indicated: (1) For whites, the sex-age-specific death rates for males are higher than those for females. (2) Among non-whites, females have death rates in three age groups which are equal to or exceed those of the males. These age groups are 5-14, 15-24, and 35-44. (3) From ages 0-1 and 5-44 with the exception of age group 25-34, there tends to be less difference between death rates for males and females of the colored races than between male and female rates of the white race.

Table 5.6

DIFFERENCES IN AGE-SPECIFIC DEATH RATES, MICHIGAN, 1940, BY SEX AND RACE

Age Groups	Excess of Male Over Female		Excess of Colored Over White	
	White	Colored	Male	Female
All Ages	2.1	2.1	2.9	2.9
Under 1	14.4	11.9	18.8	21.3
1 - 4	.3	.3	1.8	1.8
5 - 14	.3	.0	.3	.6
15 - 24	.6	----	2.6	4.3
25 - 34	.5	.8	4.8	4.5
35 - 44	.9	----	6.2	7.6
45 - 54	2.9	4.6	13.5	11.8
55 - 64	6.3	1.4	12.8	17.7
65 - 74	10.4	17.9	13.6	6.1
75 - 84	15.5	36.3	19.1	----
85 - up	19.2	52.6	----	----

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, p. 476.

Note: In this table zero indicates no difference and dotted line indicates a minus difference.

The differences indicated in Table 5.6 which seem to invite explanation are those in which females among the colored population have equal or higher death rates than do males. It is likely that between the ages of 5-44 the colored female does not live as sheltered a life as does the white female, and therefore she is exposed to nearer the same risk of disease and death as is the colored male. The white female on the other hand occupies a more protected role than the colored female, and she is not subjected to as much physical labor and drudgery.

Rural-Urban Differentials

A comparison of the crude and age-adjusted death rates in Michigan, as indicated in Table 5.7, reveals several striking differences between the colored and white segments of the population in both rural and urban areas. One of the most outstanding mortality differentials among those presented, results from the crude death rates of whites and non-whites living in rural areas.

Table 5.7

CRUDE AND ADJUSTED DEATH RATES PER 1,000 POPULATION BY RACE AND RESIDENCE, MICHIGAN, 1940

	White		Colored		Difference	
Residence	Crude	Adjusted	Crude	Adjusted	Crude	Adjusted
Urban	9.2	10.2	11.4	14.7	2.2	4.5
Rural	10.8	9.7	25.2	24.6	14.4	14.9
Difference	1.6	.5	13.8	9.9		

Source: Taken from Table 5.9.

The colored population in rural areas dies at almost two times the rate of those in urban areas. The rates are respectively 25.2 and 11.4. This is contrary to the findings of Kemp and Smith in Louisiana and of Molyneaux in Virginia but is in keeping with the conclusions of Vance.[1] This high crude rate among colored groups in the rural areas of Michigan is difficult to explain, and it should be subjected to special study. Ordinarily a rate as high as 25.2 for a population group in an area as advanced in health care and sanitary education as is Michigan would be due to an aged population. However, this does not appear to be the explanation in this case. Such a conclusion is indicated by the only slightly lower age-adjusted rate of 24.6. It is probable, in the opinion of the writer, that the high rate is the result of a combination of factors. It is quite possible that there is a tendency for disabled non-whites to settle in the rural areas of Michigan. It has already been pointed out that Freedman[2] found the incidence of disease greater among migrants than among natives. Per-

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1. In Louisiana the rural colored crude death rate in 1940 was 11.4 and the urban 17.9, (Kemp, Louise, and Smith, T. Lynn, op. cit., Table II, p. 17). A similar differential characterizes the colored of Virginia (Molyneaux, Lambert, et al., op. cit., p. 534). Vance found the negro's highest death rate to be in the urban South and his lowest in the rural South. In the North the standardized rural rate is 18.2 while the urban rate is 17.1 (Vance, Rupert, op. cit., p. 347). Higher mortality rates for the rural colored population in the North than for the rural colored segments of the South may be partly due to incomplete registration of deaths in the South (See Willcox, Walter F., op. cit., p. 213).

2. Freedman, Ronald, op. cit., p. 541.

haps colored people who find it difficult to compete for a living in the industrial areas prefer to seek agricultural pursuits here rather than to return to the South. Moreover the economic and educational levels of rural Negroes as compared with urban may be such as to contribute to high death rates. Vance has this to say; "Excess Negro mortality is made of the elements that cause excess deaths everywhere. It is related to occupational factors found in rough, heavy, work, to poor housing, heating, and sanitation, to inadequate nutrition and poor medical care, and to that ignorance which condemns a people to both, when they might secure better."[1] Another contributing factor may be a high death rate among the Indians of Michigan living in rural areas.

A comparison of the crude death rates of the colored and white population living in rural areas reveals that rural whites have a crude death rate of only 10.8, compared with 25.2 for the rural colored racial groups. The difference between these two rates is 14.4. This indicates that colored persons in rural areas die at a rate more than twice as high as white people in the same areas. The colored races living in rural areas have an age distribution somewhat similar to an immigrant population in that they have a larger proportion of their number among the middle-aged groups than the white race, and smaller proportions among the younger and older age groups. These data are presented

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1. Vance, Rupert, op. cit., p. 349.

Table 5.8

POPULATION PER 10,000, MICHIGAN, 1940,
BY RACE, AGE, AND RESIDENCE

Age Groups	Number per 10,000			
	Rural		Urban	
	White	Colored	White	Colored
0 - 1	175	136	151	163
1 - 4	765	619	607	622
5 - 14	1,875	1,655	1,574	1,657
15 - 24	1,717	1,686	1,825	1,614
25 - 34	1,425	1,586	1,698	1,962
35 - 44	1,221	1,565	1,542	2,073
45 - 54	1,140	1,245	1,307	1,164
55 - 64	873	816	745	464
65 - 74	554	471	386	215
75 - up	255	221	165	66
Total	10,000	10,000	10,000	10,000
Actual Population	1,782,530	18,709	3,257,113	197,754

Source: Computed from Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table IV, p. 943.

in Table 5.8. In spite of this age distribution, which favors a low death rate, the colored segment in rural Michigan has much higher death rates than does the white segment. The age-adjusted death rate of rural whites is only 9.7 as compared with a rate of 24.6 for rural non-whites.

Apparently the industrial centers of Michigan select the healthier colored individuals, because the mortality differential of white and colored people living in urban areas is not nearly so great as that of these two racial groups in rural areas. The urban white population has a crude rate of 9.2 per 1,000, as compared with a rate of 11.4

for the urban colored population. Possibly, colored people in urban areas tend to adapt to proper health habits and to make greater use of medical facilities than do those in rural areas. Although the crude death rate of the urban white population is only slightly lower than that of the urban colored population, the death rate of non-whites, when adjusted for age, increases more than does the rate for whites. These age-adjusted rates are 14.7 for the colored and 10.2 for the whites. Since colored people in urban areas have lower proportions of their number in the older age groups and an excess in the middle-age groups, the colored population in urban areas should have a lower death rate than the white urbanites if the two groups are practicing the same health habits, obtaining the same amount of medical care, and have similar levels of living. Thus, we might contend that although urban colored people have an age distribution which favors a low death rate, they have higher death rates than white people in urban areas mainly for reasons that could be controlled with proper preventive measures.

In Table 5.9 death rates for the two racial segments of Michigan are classified by size of city. Death rates for the white population vary inversely with the size of the urban center, the large cities having the lowest rate. This relationship is also true among colored people for the crude rates but not for the age-adjusted rates. Small cities have the highest rate for the white population but for non-whites the rate is higher in the rural areas.

Table 5.9

DEATHS PER 1,000 POPULATION BY RESIDENCE AND RACE, MICHIGAN, 1940
(By place of residence)

Residence	Rates per 1,000 population			
	White		Colored	
	Crude[2]	Adjusted[1]	Crude[2]	Adjusted[1]
Total	9.8	9.97	12.6	15.77
Urban places	9.2	10.17	11.4	14.66
Cities of 100,000 and over	8.2	9.90	11.3	14.75
Cities of 10,000 to 100,000	10.1	10.42	11.8	14.16
Cities of 2,500 to 10,000	11.7	10.62	12.8	14.78
Rural	10.8	9.70	25.2	24.61

1. Adjusted to the age distribution of the population of the United States for 1940 by the direct method.
2. Source: Vital Statistics Rates in the United States, 1900-1940, Table 11, p. 202.

Specific Causes of Death by Race

Specific causes of death demonstrate consistently the superior health of the white over the colored population in Michigan. The non-whites have higher rates in 15 out of 25 important causes listed in Table 5.10. The two groups appear to be about equal with respect to degenerative diseases. The death rate from heart disease is 297 per 100,000 population for the white segment and 302 for the colored. Rural rates for heart disease vary more between whites and non-whites than do urban rates. The rural rate for the colored races is 438 and for the white 338, a difference of 100, whereas the urban rates are 289 and 274 respectively, a difference of 15.

The second most fatal degenerative disease, cancer,

Table 5.10 DEATH RATES FROM THE COMMON CAUSES OF DEATH IN MICHIGAN, 1940, BY RACE AND RESIDENCE

Cause of Death	Rates per 100,000 population								
	Total			Urban			Rural		
	White	Other	Ratio: Colored / White	White	Other	Ratio: Colored / White	White	Other	Ratio: Colored / White
Diseases of the heart	296.6	301.7	1.0	274.0	288.7	1.1	337.9	438.3	1.3
Cancer	120.7	88.2	.7	117.8	70.3	.6	126.0	277.9	2.2
Intracranial lesions	90.1	88.2	.8	79.3	63.7	.8	111.0	176.4	1.6
Nephritis	55.6	77.6	1.4	51.4	79.4	1.5	63.3	58.8	.9
Pneumonia & Influenza	51.1	92.9	1.8	46.8	85.0	1.8	59.0	176.4	3.0
Accidents Other than Vehic.	41.9	36.5	.9	37.9	29.3	.8	49.1	112.2	2.3
Tuberculosis	28.1	179.2	6.4	38.2	170.4	4.5	27.4	272.6	9.9
Motor-vehicle Accidents	33.5	24.5	.7	31.0	17.7	.6	37.9	96.2	2.5
Diabetes mellitus	26.7	22.2	.8	27.0	19.2	.7	26.1	53.5	2.0
Premature births	23.3	40.7	1.7	25.0	41.5	1.7	20.0	32.1	1.6
Suicide	14.2	7.4	.5	13.1	7.6	.6	16.2	5.3	.3
Congenital malformation	14.1	6.5	.4	13.9	6.6	.5	14.4	5.3	.4
Syphilis	9.4	59.6	6.3	7.6	36.4	4.8	12.7	304.7	24.0
Appendicitis	9.2	16.6	1.8	10.4	17.7	1.7	7.1	5.3	.7
Cirrhosis of the liver	9.3	6.5	.7	10.5	7.1	.7	7.1	---	---
Hernia & Intestinal obstruction	9.2	12.0	1.3	8.8	12.6	1.4	9.8	5.3	.5
Ulcer of the stomach	6.0	6.9	1.2	6.2	6.1	1.0	5.7	16.0	2.8
Puerperal causes	5.3	8.8	1.7	6.0	8.6	1.4	4.2	10.7	2.5
Diarrhea, enteritis, & ulceration of intestines	3.3	5.1	1.5	3.0	5.1	1.7	3.7	5.3	1.4
Exophthalmic goiter	3.7	2.8	.8	4.1	3.0	.7	2.9	---	---
Homicide	1.9	28.6	15.1	2.1	30.3	14.4	1.4	10.7	7.6
Whooping cough	1.0	2.3	2.3	.8	2.0	2.5	1.5	5.3	3.5
Scarlet fever	.8	---	---	.7	---	---	1.0	---	---
Cerebrospinal meningitis	.3	.5	1.7	.4	.5	1.2	.1	---	---
Diphtheria	.4	.5	1.2	.4	.5	1.2	.4	---	---
All Causes	981.2	1262.1	1.3	926.0	1143.3	1.2	1082.2	2517.5	2.3

Note: Rates based on less than 20 deaths are underscored.

Source: Vital Statistics of the United States, 1940, Part II, Table 10, pp. 226-7.

takes a much higher toll from the white population. The rate for the white segment is 120.7 and for the non-white segment 88.2. In other words, cancer proves fatal to about one-third more white persons than colored. The same trend is found between the two groups in the urban population, but in the rural population it is reversed, the rural rate for non-whites being 279 and for whites 126. This may be partially explained in economic and educational terms. Organized health education is lacking or inadequate, incomes are low, and facilities for treatment less available to colored people and particularly so in the rural areas.[1] Intracranial lesions follow approximately the same pattern as does cancer for the colored and white population and for both urban and rural places.

As might be expected, transmissible diseases take a greater toll from the colored segment in proportion to their numbers in the total population than from the white segment. For two important communicable diseases, tuberculosis and syphilis, this favorable position of the white group persists in both rural and urban areas. The death rate from tuberculosis for the colored races is 179 per 100,000 population, or more than 6 times that of the white race which is 28. The rate for this disease in urban areas is only 38 for white persons whereas colored people are dying almost four

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1. Vance also found cancer rates for the total colored population lower than for the total white. He did not give any breakdown by residence. (Vance, Rupert, op. cit., p.348.)

times as fast, or at a rate of 170. In the rural areas the rate is almost ten times as high for the colored as for whites, the rates being 273 and 27 respectively. Syphilis is outstanding as a cause of death among negroes and proves fatal to the rural colored population of Michigan 24 times as often as it does to the white race.[1] The rates are 12.7 and 304.7 respectively. The combined rate for three of the well-known transmissible diseases (tuberculosis, syphilis, and whooping cough) is 241 per 100,000 for the non-whites and only 39 for the whites. There seems to be some evidence pointing to the fact that both the educational and economic standards of migrants of the colored races are relatively lower than those of native residents, and much lower than those of native white residents. Further, it would not be unreasonable to suppose that these migrants have found competition for survival in urban areas ruthless, and have adjusted by moving into the rural areas of the State. Thus, they not only brought with them lower standards of economic and health care but have also tended to settle in areas where facilities are lacking to provide adequate health in-

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1. Kemp and Smith found that rural colored rates for syphilis were about 12 times as high as those for rural whites. Inasmuch as Michigan has done outstanding work in detecting and recording cases this is probably a part of the explanation of the differences in rates between the two States. See Kemp, Louise, and Smith, T. Lynn, op. cit., Table III, p. 21. Vance referring to the excessive rates for syphilis among the colored people makes this comment. "Among the causes of death which show a higher ratio of Negro to white races syphilis is outstanding. Against this must be placed the fact that syphilis is more likely to be recorded as a cause of death among Negroes." Vance, Rupert, op. cit., p. 348.

centives and health services.

White people are more likely to die from accidents (both non-vehicle and automobile) than the colored people. Because of our discrimination practices, these people are assigned tasks at hand labor out of proportion to their numbers and because of their low incomes do not have the money to purchase certain products and services which contribute to accidents in equal ratio with the whites, for example,--airplane rides, waxed hardwood floors, and automobiles.

Suicides in Michigan occur about 50 percent more often among whites than non-whites. The rates are 14.2 and 7.4 per 100,000 respectively. It is likely that superstition in some instances and the strength of the religious mores in other cases deters the negro from suicide. Furthermore racial discrimination has probably developed in-group feelings which are reflected in a kind of family solidarity that offers security to the individual.

On the other hand, homicide accounts for 15 times as many deaths among colored as white groups. It is debatable perhaps whether the colored people are less inhibited or whether repressed frustrations ultimately result in overt aggressions against their own people as well as others. Only 1.9 per 100,000 white people died by homicide in 1940 while 28.6 per 100,000 among the colored population died from this cause.

Mortality Rates of Infants and Mothers

The infant death rates of white and colored people living in various population-size groups are presented in Table 5.11.

Table 5.11

INFANT MORTALITY RATES BY RACE AND POPULATION-SIZE GROUPS, MICHIGAN, 1940
(By place of residence)

Population-Size Groups	Infant Deaths Per 1,000 Live Births			
	Total	White	Colored	Excess of Colored Over White Rate
Total	40.7	40.0	56.7	16.7
Cities of 10,000 and over	39.3	38.2	54.6	16.4
100,000 or more	37.5	36.0	52.4	16.4
25,000 to 100,000	43.2	42.7	63.7	21.0
10,000 to 25,000	39.2	38.2	72.1	33.9
Cities Under 10,000 and Rural	42.7	42.4	76.9	34.5
2,500 to 10,000	45.0	45.3	25.0	----
Rural	42.1	41.7	100.0	58.3

Note: Rates based on less than 20 infant deaths are underscored.

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 28, p. 589.

The infant death rates of non-whites are higher than those of whites in all[1] population-size groups. Column four in Table 5.11 shows the excess of death rates for the colored segment over rates for the white segment. It is interesting to note that this excess between the two death rates tends to

1. Cities of 2,500 to 10,000 are disregarded in this statement, since their rates are based on only 3 infant deaths among the colored population.

increase as the size of the population group decreases.[1] This pattern is set by the death rates for the colored population. The lowest rate among colored infants is 52.4 in cities of 100,000 and over, while the highest rate occurs in rural areas, namely, 100.0 per 1,000 live births.

However, among white infants there is no such steady increase of death rates by size of population group as is found among the colored population. While the lowest rate, 36.0, does occur in the largest size cities, the highest rate, 45.3, does not occur in the rural areas but rather in the smallest size cities, namely 2,500 to 10,000. White infants in rural areas have lower death rates than do infants in cities of 2,500 to 10,000, or in cities of 25,000 to 100,000 population. Another exception is that infants in cities of 10,000 to 25,000 have lower rates than the larger cities of 25,000 to 100,000 population.

The association of infant death rates among colored people with population-size groups is difficult to explain, since it does not resemble that of the rates of white infants in Michigan. The progressive increase of infant death rates among the colored population from large cities to rural areas is probably best explained, as suggested earlier, by the ecological forces which tend to distribute the colored population who migrate to Michigan from Southern States according to competitive abilities. The data above seems to

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1. Vance observes, "For the Nation as a whole, figures indicate that the larger the city, the lower the rate of infant deaths." (1940) Vance, Rupbert, op. cit., p. 377.

substantiate the explanation that the colored people who succeed in the industrial centers tend to raise their standard of living until they gradually approach the level of living of whites, and in this way provide better medical care for their infants than the colored who settle in rural areas after finding life in the big city too difficult. Further, cities provide more facilities than rural areas for medical care, and may be less discriminatory in opening them to colored people.

The number of mothers who die in childbirth per 1,000 live births in Michigan is presented in Table 5.12. This data is important only because it allows one to see how few mothers now die in childbirth. The rates are so low that they are almost meaningless for comparative purposes. For this reason, perhaps the actual number of deaths are more revealing. There were only 285 women who died from various puerperal causes[1] in the State in 1940. Of these 285 deaths, there were 266 among white women and only 19 among colored women. Two of the 19 deaths of the colored mothers occurred in rural areas and 17 in urban areas. When these deaths are expressed as rates, the rates among colored people are higher than those of white people in all of the various size cities and in rural areas. The reader is referred to Chapter 9 for trends in maternal mortality rates.

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1. Deaths from puerperal causes are International List Numbers 140-150.

Table 5.12

MATERNAL MORTALITY RATES BY RACE AND POPULATION-SIZE GROUPS, MICHIGAN, 1940
(By place of residence)

Population-Size Groups	Deaths of Mothers per 1,000 Live Births[1]		
	Total	White	Colored
Total	2.9	2.8	4.6
Cities of 10,000 and over	3.2	3.1	4.6
100,000 and over	3.3	3.2	4.2
25,000 to 100,000	3.3	3.3	5.3
10,000 to 25,000	2.5	2.3	9.6
Cities under 10,000 & rural	2.5	2.5	5.1
2,500 to 10,000	3.4	3.5	---
Rural	2.3	2.2	7.4

[1] Deaths from puerperal causes are International List Numbers 140-150.

Note: Rates based on less than 20 deaths are underscored.

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 37, p. 633.

CHAPTER VI

MORTALITY[1] DIFFERENTIALS IN MICHIGAN COMPARED WITH THE NATION[2]

A fruitful approach in the further analysis of differential mortality is to compare data in the United States with that of Michigan. Death does not usually occur to people in a given segment of the population at random. Some death rates are reflections of social, economic, and psychological conditions, and others are the results of a people grown old without replacement of children. In any event, the populations of the United States and Michigan have varying characteristics, and a systematic analysis of their similarities and differences may reveal aspects of health problems heretofore overlooked.

In 1940, there were 52,183 deaths in Michigan and 1,417,269 deaths in the United States. How are these deaths distributed in relation to sex, age, residence, race, and cause of death? On a strictly numerical basis, the United States is losing relatively more lives than Michigan, the crude rates per 1,000 population being 10.8 and 9.9 respectively, a difference of .9. Thus, approximately 118,502 people died in the United States who would have survived the year had the Nation's death rate been the same as that of

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1. All death rates for Michigan and the Nation in this Chapter are allocated to place of residence, except as indicated.

2. The "Nation" is defined as all of the States, outlying territory, and possessions of the United States.

Michigan. Differences in the crude death rate become more meaningful, however, when the deaths from which these rates are computed are related to such composition differences as age, sex, and race in the population of the two areas. One method for reducing the vital phenomena of two populations to more comparable units is to classify and analyze deaths in terms of segments of the population, such as comparing death rates of males in the United States with those of males in Michigan. Still another method is to relate data from two populations to a common standard so that the resulting rates are relative and hence comparable figures. Both methods will be used in analyzing the data in this Chapter.

Since age is so influential in determining the size of the death rate of any given segment of population, it is well to give some consideration to this problem before proceeding to an analysis of particular classes. If age as a variable is held constant by relating the death rates of Michigan and the United States to a standard population[1] the resulting age-adjusted death rates throw considerable light on the influence of age distribution on the death rates of the two areas. The crude and age-adjusted death rates are given below:

	Crude	Adjusted	Difference
United States	10.8	9.5	1.3
Michigan	9.9	8.9	1.0
Difference	.9	.6	

1. The standard million used here is the population of the United States for 1930.

Both adjusted rates were lower than their respective crude rates, which indicates that both populations in 1940 tended to be older than that used as a standard. Although the crude rate for the United States is reduced more than that for Michigan, the age-adjusted rate for the State is still slightly lower than that for the Nation. Thus, if the two population groups had indentical age distributions and the same age-specific rates as occurred in 1940, Michigan's death rate would remain lower than that of the Nation. For purposes of comparison the actual population and the deaths of known ages in Michigan and the United States are presented in Table 6.1. It shows the proportion of the total population and the total number of deaths in specific age groups expressed in ten thousands.

Mortality Differentials By Age

The total age-specific death rates for Michigan and the United States are presented in Table 6.2.

On the basis of the two series of death rates the following statements may be made:

(1) The age groups at which minimum and maximum death rates occur are the same for Michigan and the United States. They are 5-14, and 85 years and over respectively. The minimum death rates are identical in both populations, namely 1.0, but the maximum rate in Michigan is 245.1, an excess of 16.2 over the rate for the United States.

(2) Age groups from 55 years upward have death rates which are two or more times the rates of all other specific age

Table 6.1

DEATHS AND POPULATION OF MICHIGAN AND THE UNITED STATES PER 10,000 OF TOTAL DEATHS AND POPULATION, BY AGE GROUPS, 1940

Age	Number per 10,000			
	Michigan		United States	
	Deaths	Population	Deaths	Population
Under 1	773	159	784	153
1 - 4	146	661	174	647
5 - 14	165	1,680	164	1,704
15 - 24	313	1,780	346	1,817
25 - 34	404	1,615	461	1,621
35 - 44	672	1,453	674	1,392
45 - 54	1,206	1,245	1,162	1,178
55 - 64	1,664	778	1,663	803
65 - 74	2,125	437	2,162	484
75 - 84	1,913	167	1,803	172
85 Over	619	25	607	29
Total	10,000	10,000	10,000	10,000
Unknown age	36			1,702

Source: Computed from Vital Statistics of the United States, 1940, Volume II, Residence, Table 9, p. 178, Table 9, p. 190.

Table 6.2

AGE-SPECIFIC DEATH RATES PER 1,000 POPULATION, MICHIGAN AND THE UNITED STATES, 1940

Age	Rate per 1,000 Population			
	Michigan		United States	Difference
All ages[1]	9.9		10.8	excess .9
Under 1	48.1		54.9	excess 6.8
1 - 4	2.2		2.9	excess .7
5 - 14	1.0		1.0	--
15 - 24	1.7		2.0	excess .3
25 - 34	2.5		3.1	excess .6
35 - 44	4.6		5.2	excess .6
45 - 54	9.6		10.6	excess 1.0
55 - 64	21.2		22.3	excess 1.1
65 - 74	48.2	excess	48.0	.2
75 - 84	113.6	excess	112.6	1.0
85 Over	245.1	excess	228.9	16.2

[1] Includes deaths of unknown ages.
Source: Tables 4.2 and 6.3.

Table 6.3

SPECIFIC DEATH RATES PER 1,000 POPULATION BY AGE, SEX, AND RESIDENCE, UNITED STATES, 1940

Age	TOTAL			RURAL			URBAN		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
All Ages[1]	10.8	12.0	9.5	9.8	10.9	8.7	11.5	12.9	10.2
Under 1	54.9	61.9	47.7	52.7	59.5	45.8	57.3	64.4	49.8
1 - 4	2.9	3.1	2.7	2.9	3.2	2.8	2.8	3.0	2.5
5 - 14	1.0	1.2	1.0	1.0	1.1	.9	1.1	1.2	.9
15 - 24	2.0	2.3	1.8	2.1	2.4	1.9	2.0	2.2	1.8
25 - 34	3.1	3.3	2.7	3.1	3.3	2.8	3.1	3.4	2.7
35 - 44	5.2	5.9	4.5	4.7	5.1	4.3	5.5	6.4	4.7
45 - 54	10.6	12.5	8.6	8.9	10.1	7.5	11.7	14.1	9.2
55 - 64	22.3	26.2	18.1	18.6	21.1	15.8	24.8	30.2	19.6
65 - 74	48.0	54.2	41.9	42.7	46.5	38.2	52.1	61.2	44.3
75 - 84	112.6	121.5	104.5	107.7	113.7	100.9	116.5	129.0	106.9
85 Over	228.9	243.8	218.1	234.0	248.5	221.5	224.6	238.9	215.6

[1] Includes deaths of unknown ages.

Source: Computed from Vital Statistics of the United States, 1940, Volume II, Residence, Table 9, p. 178.

groups for both Michigan and the United States, except for the group under one year of age.

(3) The age groups which take a toll of less than 10 deaths per 1,000 population are 1-54 for Michigan and 1-44 for the United States.

(4) The United States has higher age-specific death rates than Michigan for all age groups except 5-14 and 65 and over.

Mortality Differentials by Sex

Death rates by sex for the United States are presented in Table 6.3 and for Michigan in Table 4.2. Both the crude and age-adjusted death rates of males and females given in Table 6.4 are higher for the United States than for Michigan. Age-adjusted rates are slightly lower, and their

Table 6.4

SEX-SPECIFIC DEATH RATES, PER 1,000 POPULATION, MICHIGAN AND THE UNITED STATES, 1940

Area	Male		Female		Difference (Male and Female)	
	Crude	Adj.[1]	Crude	Adj.[1]	Crude	Adj.[1]
United States	12.0	12.1	9.5	9.4	2.5	2.7
Michigan	11.0	11.0	8.9	9.0	2.1	2.0
Difference	1.0	1.1	.6	.4		

1 Adjusted to the age distribution of the United States population in 1940 by the direct method.

Source: Computed from Vital Statistics of the United States, 1940, Volume II, Residence, Table 9, pp. 178, 190.

differences are also slightly less. Differences, however, in both the crude and age-adjusted rates for both sexes never

exceed 1.1 in the two areas. This indicates a close similarity of age distribution within the sexes in the two population groups. Differences in crude rates between males and females in Michigan and those in the United States are 2.1 and 2.5 respectively. Females in both areas possess a noticeable survival advantage[1] over males. Moreover, this advantage is slightly greater for females in the United States than for those in Michigan.

Sex-mortality differentials by age are given in Tables 6.5 and 6.6. The salient conclusions are as follows:

1. Males have higher death rates than females at all ages for both populations, (Table 6.6, columns one and two). The differences, although small, are similar for both areas, the only exception being in age group 85 years and over where the rate of males exceeds that of females by 25.7 in the United States. Little weight can be given to this exception, since declarations of age for advanced age groups are subject to great error.[2]

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1. Thompson, in discussing the lower death rates among females, says, "Whatever the reason, they survive in greater numbers, and, as a result, a comparison of death rates of different populations without a knowledge of their sex constitution may, and often does, result in some misconception of their actual mortality conditions." (Thompson, Warren S. op. cit., p. 227) Elsewhere, Thompson suggests that the favorable female death rate is probably due to differences in occupational roles. (Thompson, Warren S., and Whelpton, P.K., op. cit., p. 181, 184) See, also, Landis, Paul H., op. cit., p. 214, and Appendix IV of this dissertation.

2. See Densen, Paul M. "Family Studies in the Eastern Health District: II The Accuracy of Statements of Age on Census Records," The American Journal of Hygiene, XXXII, No. 1 Sec. A, 1940, pp. 1-38.

Table 6.5

SPECIFIC DEATH RATES PER 1,000 POPULATION, MICHIGAN AND THE UNITED STATES, 1940, BY AGE AND SEX

Age Groups	Michigan		United States	
	Male	Female	Male	Female
All Ages[1]	11.0	8.9	12.0	9.5
Under 1	55.1	40.7	61.9	47.7
1 - 4	2.3	2.0	3.1	2.7
5 - 14	1.1	.8	1.2	1.0
15 - 24	2.1	1.5	2.3	1.8
25 - 34	2.7	2.2	3.3	2.7
35 - 44	5.0	4.1	5.9	4.5
45 - 54	11.0	7.9	12.5	8.6
55 - 64	24.2	17.9	26.2	18.1
65 - 74	53.5	42.8	54.2	41.9
75 - 84	122.2	105.2	121.5	104.5
85 Over	249.0	241.7	243.8	218.1

[1] Includes deaths of unknown ages.
Source: Tables 4.2 and 6.3.

Table 6.6

DIFFERENCES IN AGE-SPECIFIC DEATH RATES, MICHIGAN AND THE UNITED STATES, BY SEX, 1940

Age Groups	Differences					
	Male minus Female:		Male :		Female	
	Mich.	U.S.	Mich. and U.S.		Mich. and U.S.	
All Ages	2.1	2.5	1.0	U.S. excess	6.7	U.S. excess
Under 1	14.4	14.2	6.8	U.S. excess	7.0	U.S. excess
1 - 4	.3	.4	.8	U.S. excess	.7	U.S. excess
5 - 14	.3	.2	.1	U.S. excess	.2	U.S. excess
15 - 24	.6	.5	.2	U.S. excess	.3	U.S. excess
25 - 34	.5	.6	.6	U.S. excess	.5	U.S. excess
35 - 44	.9	1.4	.9	U.S. excess	.4	U.S. excess
45 - 54	3.1	3.9	1.5	U.S. excess	.7	U.S. excess
55 - 64	6.3	8.1	2.0	U.S. excess	.2	U.S. excess
65 - 74	10.7	12.3	.7	U.S. excess	.9	Mich. excess
75 - 84	17.0	17.0	.7	Mich. excess	.7	Mich. excess
85 Over	7.3	25.7	5.2	Mich. excess	23.6	Mich. excess

Source: Table 6.5.

2. The minimum age specific death rate for both sexes occurs in the age group 5-14 in both Michigan and the United States, and the maximum rates in both areas occur at ages 85 and over. The lowest rate in age group 5-14 is .8 for females in Michigan, and the highest rate is 1.2 for males in the United States.

3. In general the excess of male rates over those for females steadily increases from age group 5-14 in the United States and from age group 25-34 in Michigan through age group 75-84 in both populations.

4. Sex-specific death rates are higher for the United States than for Michigan in all age groups except 65 and over for females and age 75 and over for males.

Rural-Urban Mortality Differentials

Each year approximately 11 persons per 1,000 people living in rural areas of Michigan die in comparison with 9.8 in the rural areas of the Nation. (See Table 6.9) These crude death rates indicate that the toll of human lives exacted from Michigan's rural population is relatively greater than that of the rural population of the United States as a whole. Table 6.7 shows that Michigan's rural population has lower proportions of its total number in the ages from 1-34 than does the Nation and a marked excess over the rural segment of the United States from the age of 35 years upward.

It is also evident from Table 6.7 that proportionately more rural deaths occur at age 55 or over in Michigan than in

Table 6.7

DEATHS AND POPULATION PER 10,000 MICHIGAN AND THE UNITED STATES, 1940, BY AGE AND RESIDENCE

Age Groups	Deaths per 10,000[1]				Population per 10,000			
	Michigan		United States		Michigan		United States	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Under 1	720	805	974	659	175	151	181	132
1 - 4	153	141	242	130	763	608	786	541
5 - 14	166	165	205	138	1,872	1,579	2,007	1,470
15 - 24	285	330	404	308	1,716	1,813	1,864	1,780
25 - 34	303	465	454	466	1,426	1,713	1,455	1,749
35 - 44	464	799	578	736	1,224	1,572	1,212	1,531
45 - 54	893	1,396	947	1,302	1,141	1,299	1,046	1,280
55 - 64	1,575	1,718	1,444	1,807	872	729	760	836
65 - 74	2,363	1,981	2,104	2,200	553	377	483	485
75 - 84	2,296	1,679	1,932	1,719	220	139	176	169
85 Over	782	521	716	535	38	20	30	27
Total	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000

[1] Includes only deaths of known age.

Source: Vital Statistics of the United States, 1940, Part II, Residence, Table 9. Sixteenth Census of the United States, 1940, Population, Fourth Series, Michigan, Table. 1. Linder, Forrest E., and Grove, Robert D., Vital Statistic Rates of the United States, 1900-1940, Table IV, p. 936.

the United States, while larger proportions of rural deaths in the Nation occur under age 55. The rural age-adjusted death rate is higher in Michigan than in the Nation. Comparison of the age-specific rates provides one explanation (Tables 4.2 and 6.3). Inasmuch as rural Michigan has lower age-specific rates than the Nation for those under 54 years but higher rates for those over, it would appear that the excessive death rates from ages 55 upward partially account for the high rural rate in the State.

The ratios of male to female death rates for the age groups in rural and urban segments of Michigan and the United States are given in Table 6.8. These data show that sex-mortality differentials are greater in rural than in urban Mich-

Table 6.8

SEX-MORTALITY RATIOS, MICHIGAN AND THE UNITED STATES, 1940, BY AGE AND RESIDENCE

Age Groups	$\frac{\text{Male Death Rate}}{\text{Female Death Rate}} \times 100$			
	Michigan		United States	
	Rural	Urban	Rural	Urban
Total Crude	129	120	125	126
0 - 1	131	138	130	129
1 - 4	120	110	114	120
5 -14	138	138	122	133
15-24	140	133	126	122
25-34	142	127	118	126
35-44	134	116	119	136
45-54	145	137	135	153
55-64	134	137	134	154
65-74	120	130	122	138
75-84	113	119	113	121
85-up	104	101	112	111

Source: Based on death rates given in Tables 4.2 and 6.3.

igan for a majority of the age groups. In the United States the sex-mortality differential is greater in urban than in rural areas for all ages except those 85 years and over and those 15-24 years of age.[1]

In contrast to Michigan's urban population, the urban people of the United States have higher crude and age-adjusted death rates (Table 6.9). Their crude rates are 11.5 and 9.4, respectively, a difference of 2.1. The adjusted rates

Table 6.9

DEATHS PER 1,000 POPULATION, MICHIGAN AND THE UNITED STATES, 1940, BY RESIDENCE

Residence	Deaths per 1,000 Population			
	United States		Michigan	
	Crude	Adjusted[1]	Crude	Adjusted[1]
Urban Total	11.5	11.4	9.4	10.4
Cities: 100,000 over	11.3	11.4	8.5	10.3
Cities: 10,000-100,000	11.4	11.2	10.1	10.5
Cities: 2,500-10,000	12.4	11.8	11.7	10.8
Rural Total	9.8	9.8	11.0	10.2

1 Adjusted to the age distribution of the population of the United States in 1940 by the direct method.

Source: Crude rates except total urban are from Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, Table 11, pp. 198, 202.

for the same segments are respectively 11.4 and 10.4, a difference of only 1.0. Adjustments for age lowers the urban rate .1 in the United States but increases it 1.0 in Michigan. The two differences provide a rough measure of the influence of age on the crude rates, indicating that the urban crude

1. See also Appendix IV, Table 4.

rate in the United States is higher than the corresponding rate in Michigan because larger proportions of the population are in the older age groups (See Table 6.7).

The crude death rates of cities in both Michigan and the United States vary inversely with their size, the highest rates being found in small cities. As was indicated earlier this tendency for small cities to have high rates is becoming a matter of growing concern.[1] It is obviously not a pattern of certain isolated areas but is characteristic of the United States as a whole.

Various size cities have age-adjusted death rates slightly in excess of the rural areas in both Michigan and the United States. Large cities of 100,000 and over in Michigan have rates only .1 in excess of the rural rate, while in the United States the corresponding rate is 1.6 in excess of the adjusted rural rate. Small cities of 2,500-10,000 population have the highest adjusted rate in both the State and the Nation. The lowest rate in the United States is found in cities of 10,000-25,000, whereas in Michigan it is found in the large cities of 100,000 population or more.

The mortality data by residence given above may be summarized as follows: (1) The urban age-adjusted death rate

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1. Mangus points this out, also, when he says, "It is of considerable interest that the death rate was highest among rural residents and among residents of small towns and cities of less than 10,000 population. (Mangus, A. R., "Health and Human Resources in Rural Ohio," Mimeograph Bulletin No. 176, Department of Rural Economics and Rural Sociology, Ohio State University and Ohio Agricultural Experiment Station, Columbus, Ohio, 1944, p. 4. See, also, Footnote, p. 68, Chapter IV.

is lower for Michigan than for the United States, but the rural rate for the State is higher. (2) Both the crude and the adjusted death rates for various size cities are lower for Michigan than for the United States. (3) In both populations, crude death rates vary inversely with the size of the city. (4) The rural segment of Michigan's population has a higher crude death rate than the corresponding population group of the Nation, a reflection of the excess of older people among the rural population of Michigan.

Mortality Differentials by Race

According to data presented in Table 6.10, the crude death rates of the white and the colored segments of Michigan compare favorably with the corresponding classes of the United States. In Michigan 12.6 colored persons per 1,000 die annually, while the corresponding rate is 13.8 for the United States. This differential can be partially accounted for by the varying age distribution and partially by the high standard of living of Michigan's predominantly urban colored population.[1]

When the crude death rates for non-whites are adjusted for age, the rates are 16.2 for the United States and 15.8 for

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1. Michigan's colored population is relatively small, comprising only 216,463, of whom 91.4 percent are classed as urban compared with 47.9 percent so classed for the Nation as a whole. Less than 4 percent of the colored in Michigan are other than Negro. Of the State's total urban non-white population, 73 percent live in the city of Detroit. Thus, any comparison of the total colored in Michigan with those of the Nation is essentially a comparison of an urban group with one which is more than half rural.

Michigan, the difference being reduced two-thirds, or from 1.2 to .4.

Table 6.10

CRUDE AND AGE-ADJUSTED DEATH RATES PER 1,000 POPULATION, MICHIGAN AND THE UNITED STATES, 1940, BY RACE

Area	White		Colored	
	Crude	Adjusted(1)	Crude	Adjusted(1)
United States	10.4	10.2	13.8	16.2
Michigan	9.8	10.0	12.6	15.8
Difference	.6	.2	1.2	.4

(1) Adjusted to the United States population in 1940 by the direct method.

Source: Crude rates from Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 11, pp. 198,202.

Tables 6.11 and 5.3 show clearly that the colored population of the United States has relatively greater numbers than that of Michigan in the younger ages from 1-24 years and in the older ages from 55 to the end of the life span. In the latter age groups risks of mortality are great. On the other hand, Michigan's colored population has a larger proportion of its total number in the middle age groups from 25-55 where the risks of mortality are considerably less. It is to be expected, then, that the relative number of colored deaths in the United States and Michigan tend to be in excess at ages where the respective populations are concentrated. Hence colored deaths in the United States exceed those in Michigan from ages 1-24, and from age 55 upward.

Table 6.11

DEATHS AND POPULATION OF THE UNITED STATES PER 10,000 OF TOTAL DEATHS AND POPULATION, BY AGE AND RACE, 1940

Age	Number per 10,000			
	Deaths		Population	
	White	Colored	White	Colored
Under 1	727	1,163	150	180
1 - 4	158	280	630	795
5 - 14	155	228	1,665	2,043
15 - 24	292	707	1,802	1,945
25 - 34	387	953	1,617	1,656
35 - 44	585	1,261	1,392	1,398
45 - 54	1,095	1,601	1,202	966
55 - 64	1,690	1,482	833	542
65 - 74	2,288	1,325	499	354
75 - 84	1,975	663	181	94
85 - Up	648	337	29	27
Total	10,000	10,000	10,000	10,000

Source: Deaths computed from Vital Statistics of the United States, 1940, Volume II, Residence, Table 9, p. 178.

The white people in Michigan die at a slightly lower rate than those in the Nation. (Tables 6.11 and 6.12) The respective crude death rates are 9.8 and 10.4 per 1,000 population, a difference of .6. The age-adjusted rate for the United States is 10.2, while the rate for Michigan is 10.0, a difference of only .2. Thus, the white segments of the State and the Nation have approximately equal death rates, although the State rate is slightly lower than that of the Nation. An examination of Tables 6.11 and 5.3 reveals that the age distributions of the two white populations are quite similar. White people in Michigan, however, are more numerous in age groups under 15, and from ages 35-54, while white individuals in the United States are found more often in age groups 15-34, and in all groups from 55 years upward. Sex-specific crude death rates for the white and non-white populations are slightly lower in Michigan than in the United States (Table 6.13). This is more apparent when the age-sex-specific rates are examined (Compare Tables 5.2 and 6.14). Colored males in Michigan have lower rates, for example, at all ages except 75-84 than the corresponding group in the Nation. Differences between Michigan and the United States for white females classified by age are less pronounced. White females in both populations have identical age-adjusted death rates, namely, 8.8 per 1,000.

Among whites, male death rates exceed the female at all ages, and this is generally true for the colored group (Table 6.15). In Michigan, however, the rate for colored

Table 6.12

DEATHS PER 10,000 OF TOTAL DEATHS, MICHIGAN, 1940, BY AGE AND RACE

Age	White Deaths		Colored Deaths	
	Number	Per 10,000 of Known Age	Number	Per 10,000 of Known Age
Under 1	3,799	769	233	854
1 - 4	708	143	52	191
5 - 14	811	164	49	180
15 - 24	1,454	294	177	649
25 - 34	1,819	368	286	1,048
35 - 44	3,014	610	491	1,800
45 - 54	5,736	1,161	553	2,027
55 - 64	8,294	1,678	383	1,404
65 - 74	10,791	2,184	293	1,074
75 - 84	9,807	1,984	167	612
85 - Over	3,186	645	44	161
Total	49,419	10,000	2,728	10,000
Unknown	32		4	

Source: Deaths computed from Vital Statistics of the United States, 1940, Volume II, Residence, Table 9, p. 190.

Table 6.13

CRUDE AND AGE-ADJUSTED DEATH RATES PER 1,000 POPULATION, MICHIGAN AND THE UNITED STATES, 1940, BY RACE AND SEX
(By place of occurrence)

Area	White				Colored			
	Male		Female		Male		Female	
	Crude	(1) Adj.	Crude	(1) Adj.	Crude	(1) Adj.	Crude	(1) Adj.
United States	11.6	11.6	9.2	8.8	15.1	16.9	12.6	15.0
Michigan	10.8	11.1	8.7	8.8	13.7	17.0	11.6	14.6
Diff.	0.8	0.5	0.5	0.0	1.4	0.1	1.0	0.4

(1) Adjusted to the United States population in 1940 by the direct method.

Source: Crude rates are from Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 10, pp. 190, 193.

Table 6.14

AGE-SPECIFIC DEATH RATES PER 1,000 POPULATION, UNITED STATES, BY RACE AND SEX, 1940 (By place of occurrence)

Age Groups	White		Colored	
	Male	Female	Male	Female
All Ages	11.6	9.2	15.1	12.6
Under 1	56.7	43.6	101.2	77.4
1 - 4	2.8	2.4	5.3	4.4
5 - 14	1.1	.8	1.6	1.4
15 - 24	2.0	1.4	5.0	5.0
25 - 34	2.8	2.2	8.5	7.4
35 - 44	5.1	3.7	13.2	11.7
45 - 54	11.4	7.5	24.5	21.1
55 - 64	25.2	16.8	39.5	35.7
65 - 74	54.0	41.5	56.5	46.3
75 - 84	122.2	105.6	109.7	84.7
85 - Up	249.3	224.7	193.2	156.2

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, Table 23, p. 434.

Table 6.15

DIFFERENCES BETWEEN MALE AND FEMALE DEATH RATES, MICHIGAN AND THE UNITED STATES, 1940, BY AGE AND RACE

Age Groups	Excess of Male Over Female Death Rates			
	White		Colored	
	Michigan	United States	Michigan	United States
All Ages	2.1	2.4	2.1	2.5
Under 1	14.4	13.1	11.9	23.8
1 - 4	.3	.4	.3	.9
5 - 14	.3	.3	0(a)	.2
15 - 24	.6	.6	- 1.1(b)	.0(a)
25 - 34	.5	.6	.8	1.1
35 - 44	.9	1.4	- .5(b)	1.5
45 - 54	2.9	3.9	4.6	3.4
55 - 64	6.3	8.4	1.4	3.8
65 - 74	10.4	12.5	17.9	10.2
75 - 84	15.5	16.6	36.3	25.0
85 - Up	19.2	24.6	52.6	37.0

(a) Zero indicates no difference.
(b) Minus sign indicates excess of female rate.
Source: Based on death rates in Tables 5.5 and 6.14.

females exceeds that for males in two age groups, and in one, the rates are identical. Among non-whites in the United States, the sexes have equal rates, also, at age 15-24.

Is the sex-mortality differential greater for the colored or the white population? How do they compare in Michigan and the United States? If the age-adjusted death rate for each sex is expressed as a ratio of the male to the female rate, it is possible to answer these questions. The ratios are given below:

	White	Colored
United States	132	113
Michigan	126	116

Thus, the white sex-mortality differential is greater than the colored. Moreover, it is higher in the United States than in Michigan. However, the sex-mortality differential for non-whites is slightly in excess in Michigan.

Rural mortality differentials by race favor the United States, while urban differentials favor Michigan. The race-specific death rates by residence are given in Table 6.16. The significance of these data may be summarized as follows:

1. The crude and age-adjusted death rates of rural Michigan for both colored and white people are higher than corresponding rates for the Nation.[1]

2. Urban Michigan has lower crude and age-adjusted death rates than the United States for both white and colored

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1. See Chapter V, p. 119, Footnote 1.

groups.

3. Mortality differentials between the United States and Michigan by race and residence are greater for the colored in both rural and urban areas than for the corresponding white segments.

Table 6.16

CRUDE AND AGE-ADJUSTED DEATH RATES PER 1,000 POPULATION, MICHIGAN AND THE UNITED STATES, 1940, BY RACE AND RESIDENCE

Area	White				Colored			
	Rural		Urban		Rural		Urban	
	Crude	(1) Adj.	Crude	(1) Adj.	Crude	(1) Adj.	Crude	(1) Adj.
United States	9.5	9.2	11.9	10.8	12.2	14.4	15.6	18.3
Michigan	10.8	9.7	9.2	10.2	25.2	24.6	11.4	14.7
Difference	1.3	0.5	2.7	0.6	13.0	10.2	4.2	3.6

(1) Adjusted to the 1940 United States population by the direct method.

Source: Rural crude rates from Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 11, pp. 198,202; Urban crude rates computed from Vital Statistics of the United States, 1940, Volume II, Residence, Table 9, pp. 178, 190.

Principal Causes of Death

Mortality differentials tend to favor the people of Michigan when total death rates from classified causes are compared with those of the Nation. This comparison is presented in Table 6.17. The Table includes all of the specific causes re-classified into eighteen major groups of related causes. These are the 18 major subdivisions of the 1938

International List of Causes of Death.[1] Part I of the Table shows causes predominant in Michigan and Part II those predominant in the United States. All are ranked from high to low in terms of the death rate for Michigan. From the data in this Table, the following general observations may be made:

1. Michigan has lower death rates than the Nation for fourteen of the eighteen classified causes (Part II, Table 6.17).

2. Michigan has lower rates than the Nation for classified causes which take the lives of infants and children. They include the infectious and parasitic diseases, Michigan having a rate of 59.4 per 100,000 for this group compared with 91.0 for the Nation. It will be recalled that in the early history of Michigan, illness and death from infectious and parasitic diseases were major problems facing not only children but all residents. Crude death rates from diseases peculiar to the first year of life are only slightly less in Michigan than in the United States, 38.5 compared with 39.2.

3. Michigan has lower rates than the Nation for the preventable causes of death. These include violent or accidental deaths in addition to the infectious and parasitic diseases, and diseases of pregnancy and childbirth.

4. Causes of death which are predominant in Michigan tend to be those which are most difficult to control. In this

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1. See Appendix III for complete International List of titles included in each major subdivision.

Table 6.17

MORTALITY RATES PER 100,000 POPULATION FOR 18 CLASSIFIED CAUSES[1] OF DEATH IN MICHIGAN AND THE UNITED STATES, 1940
(By place of occurrence)

Causes	Rates per 100,000 Population		
Part I Causes Predominant in Michigan. (Ranked by Michigan Rate)	Michigan	United States	Excess of Michigan Rates
Diseases of circulatory system VII	315.8	314.4	1.4
Rheumatism, diseases of nutrition III	36.5	36.1	.4
Congenital malformations XIV	13.9	10.0	3.9
Diseases of blood and blood forming organs IV	8.5	7.4	1.1
Part II Causes Predominant in United States. (Ranked by Michigan Rates)	Michigan	United States	Excess of Michigan Rates
Cancer and tumors II	124.8	125.2	.4
Diseases of nervous system VI	101.3	103.6	2.3
Violent or accidental deaths XVII	91.8	94.3	2.5
Diseases of genito-urinary system X	70.1	95.4	25.3
Infectious and parasitic diseases, including tuberculosis I	59.4	91.0	31.6
Diseases of respiratory system VIII	58.8	66.1	7.3
Diseases of digestive system IX	53.3	59.2	5.9
Diseases peculiar to first year of life XV	38.5	39.2	.7
Senility XVI	6.4	7.7	1.3
Diseases of pregnancy, etc., XI	5.5	6.7	1.2
Ill-defined and unknown causes XVIII	4.1	16.0	11.9
Chronic poisoning and intoxication V	1.3	2.1	.8
Diseases of bones and organs of movement XIII	.7	.9	.2
Diseases of skin and cellular tissue XII	.5	1.1	.6

[1] The source cited gives the specific causes and the International List of rubrics included in each of the 18 classes of causes. See Appendix III for complete International List titles.

Note: Roman numerals refer to rubrics in the International List of 1938.

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, (U.S. Bureau

group, diseases of the circulatory system, which includes heart ailments, ranks first having a crude rate of 315.8 as compared with 314.4 for the Nation.

5. The three leading causes of death for Michigan and the United States are identical, namely, diseases of the circulatory system, cancer and tumors, and diseases of the nervous system. Michigan has lower rates than the Nation for the latter two of these.

Table 6.18 presents twenty-five specific causes of death by race and residence for Michigan and the United States. An inspection of this Table reveals that the urban segment of Michigan compares favorably with the Nation, while the rural segment compares unfavorably with the Nation. This is true, in general, for both white and colored people. Both racial segments of Michigan's urban population have lower death rates in twenty out of the twenty-five principal causes of death (Table 6.19). The exceptions for the two population groups are not identical, however. Urban death rates for whites exceed the Nation for motor vehicle accidents, congenital malformation, puerperal causes, exophthalmic goiter, and scarlet fever. Among the urban colored, the diseases which take a greater toll in Michigan than in the United States are tuberculosis,[1] suicide, appendicitis, exophthalmic goiter, and cerebrospinal meningitis. (Rates for

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1. See Chapter V, Footnote 1, p. 90, for a discussion of the high rate for tuberculosis among the urban colored of Michigan.

Table 6.18 MORTALITY RATES[1] FROM COMMON CAUSES OF DEATH, MICHIGAN AND THE UNITED STATES, 1940, BY RACE AND RESIDENCE (Deaths allocated to place of residence)

Cause of Death	Rates Per 100,000 Population							
	Rural				Urban			
	White		Colored		White		Colored	
	MichT	U.S.	Mich.	U.S.	Mich.	U.S.	Mich.	U.S.
Diseases of the heart	337.9	243.6	438.3	187.3	274.0	337.5	288.7	314.8
Cancer	126.0	97.7	277.9	53.9	117.8	145.2	70.3	105.0
Intracranial lesions of vascular origin	111.1	88.0	176.4	97.4	79.3	89.0	63.7	127.2
Nephritis	63.3	74.1	58.8	109.2	51.4	78.5	79.4	141.6
Pneumonia and influenza	59.0	70.0	176.4	117.6	46.8	59.5	85.0	133.8
Accidents (Non-vehicle)	49.1	46.0	112.2	51.6	37.9	47.2	29.3	55.4
Tuberculosis	27.4	34.0	272.6	93.7	38.2	38.5	170.4	116.5
Accidents (Motor vehicle)	37.9	26.4	96.2	12.1	31.0	26.6	17.7	26.5
Diabetes mellitus	26.1	20.5	53.5	11.1	27.0	32.8	19.2	25.3
Premature births	20.0	23.2	32.1	32.0	25.0	47.2	41.5	55.4
Suicide	16.2	13.3	5.3	3.0	13.1	17.1	7.6	6.4
Congenital malformation	14.4	10.2	5.3	5.5	13.9	10.5	6.6	6.8
Syphilis	12.7	8.8	304.7	45.6	7.6	10.7	36.4	63.7
Appendicitis	7.1	8.5	5.3	7.5	10.4	10.8	17.7	13.5
Cirrhosis of the liver	7.1	5.5	...	3.6	10.5	11.4	7.1	8.2
Hernia	9.8	7.6	5.3	8.2	8.8	9.6	12.6	14.0
Ulcer of the stomach	5.7	5.2	16.0	4.0	6.2	8.0	6.1	9.0
Puerperal causes	4.2	6.0	10.7	18.6	6.0	5.3	8.6	14.9
Diarrhea, enteritis, etc.[2]	3.7	8.4	5.3	19.7	3.0	5.4	5.1	12.2
Exophthalmic goiter	2.9	2.4	...	1.2	4.1	3.2	3.0	2.6
Homicide	1.4	3.3	10.7	23.1	2.1	3.1	30.3	44.4
Whooping cough	1.5	2.5	5.3	7.5	.8	1.1	2.0	4.1
Scarlet fever	1.0	.7	...	.1	.7	.4	...	.6
Cerebrospinal meningitis	.1	.6	...	.7	.4	.5	.5	.4
Diphtheria	.4	1.5	...	2.3	.4	.7	.5	1.2
All causes	1082.2	949.6	2517.5	1218.7	926.0	1109.4	1143.3	1561.0

1 Underscored rates are based on less than 20 deaths.
2 Under two years only.
Source: Vital Statistics of the United States, 1940, Part II, Table 10, pp. 210,226. Based on enumerated population, 1940.

the last four causes listed are computed on less than 20 deaths.) Two of these diseases, goiter and cerebrospinal meningitis, might almost be termed indigenous to Michigan. The control of these diseases, as well as appendicitis, depend on public enlightenment, reasonably adequate living standards, and available facilities. Under our present social structure, these control measures are not as available to the colored as to the white population. Perhaps the higher suicide rate among the urban colored in Michigan as compared with the corresponding segment of the Nation can be explained in terms of their rapid urbanization which has weakened the restraining influence of the religious mores while at the same time it has increased personal tension, conflict, and disorganization.

An examination of Table 6.19 indicates that rural-white death rates of fifteen of the twenty-five principal causes are higher in Michigan than in the United States, and that rates of twelve of these causes are higher for the rural colored. Both segments of the rural population are more likely to die from degenerative diseases in Michigan than in the United States. More rural people in Michigan, whether white or colored, die from accidents, both vehicle and non-vehicle, than in the United States. Suicide rates are higher in Michigan for both whites and non-whites. It is interesting to note, however, that rates for transmissible and infectious diseases, ailments for which modern science has developed means of control, are lower in rural Michigan

Table 6.19 PREDOMINANCE OF THE COMMON CAUSES OF DEATH IN URBAN MICHIGAN AND THE UNITED STATES, 1940, BY RACE
(Causes ranked by rates of the white population in rural Michigan)

Urban White Rates Predominant		Urban Colored Rates Predominant	
In Michigan	In United States	In Michigan	In United States
———	Heart	———	Heart
———	Cancer- tumors	———	Cancer- tumors
———	Intracranial lesions	———	Intracranial lesions
———	Nephritis	———	Nephritis
———	Pneumonia	———	Pneumonia
———	Accidents (Non Veh.)	———	Accidents (Non Veh.)
Accidents (Motor)	------	———	Accidents (Motor)
———	Tuberculosis	Tuberculosis	------
———	Diabetes mellitus	———	Diabetes mellitus
———	Premature births	———	Premature births
———	Suicide	Suicide	------
Congenital malform.	------	———	Congenital malform.
———	Syphilis	———	Syphilis
———	Appendicitis	Appendicitis	------
———	Cirrhosis of liver	———	Cirrhosis of liver
———	Hernia	———	Hernia
———	Ulcer of stomach	———	Ulcer of stomach
Puerperal causes	------	———	Puerperal causes
———	Diarrhea, entritis	———	Diarrhea, entritis
Exoph. goiter	------	Exoph. goiter	------
———	Homicide	———	Homicide
———	Whooping cough	———	Whooping cough
Scarlet fever	-------	1	Scarlet Fever
———	Cerebrospinal Men.	Cerebrospinal Men.	------
———	Diphtheria	———	Diphtheria

1 There were no deaths from this cause in this population.
Source: Table 6.18.

Table 6.19 PREDOMINANCE OF THE COMMON CAUSES OF DEATH IN RURAL MICHIGAN AND THE UNITED STATES, 1940, BY RACE
(Causes ranked by rates of the white population in rural Michigan)

Rural White Rates Predominant		Rural Colored Rates Predominant	
In Michigan	In United States	In Michigan	In United States
Heart	------	Heart	------
Cancer	------	Cancer	------
Intracranial lesions	------	Intracranial lesions	------
------	Nephritis	------	Nephritis
------	Pneumonia	Pneumonia	------
Accidents (Motor)	------	Accidents (Motor)	------
Accidents (Non Veh.)	------	Accidents (Non Veh.)	------
------	Tuberculosis	Tuberculosis	------
Diabetes mellitus	------	Diabetes mellitus	------
------	Premature births	Premature births	------
Suicide	------	Suicide	------
Congenital malform.	------	------	Congenital malform.
Syphilis	------	Syphilis	------
------	Appendicitis	------	Appendicitis
Cirrhosis of liver	------	1	Cirrhosis of liver
Hernia	------	------	Hernia
Ulcers of stomach	------	Ulcers of stomach	------
------	Puerperal causes	------	Puerperal causes
------	Diarrhea, entritis	------	Diarrhea, entritis
Exoph. goiter	------	1	Exoph. goiter
------	Homicide	------	Homicide
------	Whooping cough	------	Whooping cough
Scarlet fever	------	1	Scarlet fever
Cerebrospinal Men.	------	1	Cerebrospinal Men.
------	Diphtheria	1	Diphtheria

1 There were no deaths from this cause in this population.
Source: Table 6.18.

than in the Nation. Syphilis is the only important transmissible disease which makes a less favorable showing in this respect but in 1940 treatment methods were not as advanced as they are today. Furthermore, it is reasonable to assume that reporting was probably more accurate in Michigan since this State has been a leader in veneral disease control for a number of years. In the urban areas of Michigan where treatment facilities are more readily available and public health programs are operating with specific regard to this problem, syphilis rates are lower than for the Nation. They are 7.6 and 10.7 respectively for urban whites and 36.4 and 63.7 respectively for urban non-whites. The rural death rates from syphilis in Michigan are 12.7 for the white population and 304.7 for the colored, while for the United States they are 8.8 and 45.6 respectively. Among the rural colored people, syphilis is the second principal cause of death.

Rates from tuberculosis, pneumonia and influenza, and premature births are lower in rural Michigan than in the rural United States. These causes of death are frequently considered among the better indices of the healthful living conditions of a population. If this is true, Michigan's rural white people compare favorably in the healthfulness of their living conditions with the Nation. In the two areas the death rates from these causes for rural whites are as follows:

Area	Rural White Population		
	Pneumonia	Tuberculosis	Premature births
United States	70.0	34.0	23.2
Michigan	59.0	27.4	20.0
Difference	11.0	6.6	3.2

In Table 6.20 the age-adjusted death rates for eight leading causes of death are presented. Rural Michigan has rates lower than the Nation for three causes, namely, pneumonia, tuberculosis, and nephritis. Michigan's death rate for pneumonia is 26.6 percent less than that for the United States, and the rate for tuberculosis is 30 percent less. Two observations may be made from the age-adjusted rates in this Table: (1) In general, urban Michigan has lower death rates from specific causes than the United States. This is true for all causes in addition to specific causes, except for intracranial lesions of vascular origin. The urban rate from this cause in Michigan is in excess of that of the Nation 1.4 percent. (2) In most instances, rural Michigan has higher age-adjusted death rates from specific causes than the rural United States. This is true for five of the eight causes. Two communicable diseases, tuberculosis and pneumonia, are among the three causes for which death rates are lower in rural Michigan.

Infant Mortality Differentials

On the basis of data presented in Table 6.21, Michigan has lower infant mortality rates than the United States. This is true for the total, rural and urban areas, all sizes

Table 6.20

AGE-ADJUSTED DEATH RATES FROM SPECIFIC CAUSES, MICHIGAN AND THE UNITED STATES, 1940, BY RESIDENCE[1] (Causes ranked by ratios for rural Michigan)

Cause of Death	Ratio of actual to expected[2] deaths					
	Rural			Urban		
	Mich.	U.S.	$\frac{\text{Mich.}}{\text{U.S.}} \times 100$	Mich.	U.S.	$\frac{\text{Mich.}}{\text{U.S.}} \times 100$
Accident (all)	114.9	104.7	108.7	97.3	97.5	99.8
Intracranial lesions of vascular origin	102.1	96.0	116.8	98.7	97.3	101.4
Pneumonia	100.6	137.0	73.4	99.9	126.6	78.9
Heart diseases	97.2	78.6	123.7	104.1	108.0	96.4
Nephritis	94.8	135.0	70.2	103.4	140.1	73.8
Cancer	93.9	77.6	121.0	106.3	112.1	94.8
Tuberculosis	90.8	129.8	70.0	123.2	141.5	87.1
Diabetes Mellitus	84.4	70.8	119.2	109.8	113.3	96.9
All Causes	96.8	96.8	100.0	102.6	115.7	88.7

1 Urban includes all incorporated places with 2500 inhabitants or more in April 1940. Rural embraces all the area outside of cities of 2500 inhabitants or more in 1940.

2 The expected deaths are computed by applying the age-specific death rates in the total population of Michigan from each cause of death, to the corresponding age group of the urban and rural populations of Michigan and the United States, and summing for all ages. See Dublin, Louis I, and Lotka, Alfred J., Length of Life, op. cit., p. 95 for an example of this method of adjusting cause-specific death rates for age in rural and urban areas. It is essentially the principles employed in the Indirect Method of adjusting rates for age, which are described and illustrated in Appendix I. The age-specific rates used as a standard for these eight causes are from Linder, Forrest E., and Grove, Robert D., op. cit., Table 23, pp. 476-477.

Table 6.21

INFANT MORTALITY RATES, MICHIGAN AND THE UNITED STATES, 1940, BY RESIDENCE

Residence	Infant deaths under 1 year of age per 1,000 live births		
	United States	Michigan	Excess U.S.
Total Population	47.0	40.7	6.3
Urban Total	44.4	40.0	4.4
Cities: 100,000-over	39.3	37.5	1.8
Cities: 25,000-100,000	45.1	43.2	1.9
Cities: 10,000-25,000	48.4	39.2	9.2
Cities: 2,500-10,000	50.7	45.0	5.7
Rural Total	50.1	42.7	7.4

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 28, pp. 578 ff. Urban total computed from Vital Statistics of the United States 1940, Part II, Table 10, pp. 210,227.

of cities, and for the leading causes of death. The Nation's infant death rate exceeds that of Michigan by 6.3, the respective rates being 47.0 and 40.7 per 1,000 live births. The differential between the rates in rural segments of Michigan and the United States is 7.4, the rates for the respective areas being 42.7 and 50.1. In the urban areas of the two populations the rates are much closer together. Urban Michigan's infant death rate is 40.0, compared with 44.4 for the Nation.

Infant death rates for the United States decrease as the size of the city increases. The rate in the very large cities is 39.3, as compared with 50.7 in the very small

Table 6.22

INFANT MORTALITY RATES FOR SELECTED CAUSES, MICHIGAN AND THE UNITED STATES, 1940

	Number of deaths under 1 year of age per 100,000 live births		
	Michigan	United States	U.S. / Mich. x 100
All Causes	4071.9	4701.9	115.5
Premature births	1275.5	1370.4	107.4
Pneumonia (all)	600.9	630.4	104.9
Congenital malformation	594.8	467.5	78.6
Injury at birth	419.1	487.5	116.3
Diseases peculiar to first year of life	274.5	250.6	91.3
Diarrhea, enteritis, etc.	153.5	348.3	226.9
Accidental suffocation and other accidents	100.0	115.2	115.2
Diseases of thymus gland	99.0	44.5	44.9
Congenital debility	70.7	119.8	169.4
Diseases of respiratory system	69.7	53.4	76.6
Influenza	40.4	114.2	282.7
Whooping cough	33.3	85.4	256.5
Intestinal obstruction	29.3	31.5	107.5
Ill defined and unknown causes	22.2	240.8	1084.7
Diseases of genito-urinary system	20.2	14.0	69.3
Syphilis	16.2	53.0	327.2
Diseases of circulatory system	14.1	17.5	124.1
Diseases of ear and mastoid	11.1	21.0	189.2
Diseases of the nervous system	9.1	10.2	112.1
Dysentery	8.1	44.0	543.2
Measles	5.0	7.7	154.0

Note: Death rates based on less than 20 deaths are underscored.

Source: Computed from Vital Statistics of the United States, 1940, Part II, Residence, Table 2, pp. 69, 77. Table 14, pp. 325,329.

cities. This generalization is true, also, in Michigan with the exception of cities of 10,000-25,000. They have next to the lowest infant death rate in the State and next to the highest in the Nation.

Infant mortality rates by selected causes for Michigan and the United States are given in Table 6.22. Michigan has lower infant mortality rates for ten of the leading 15 causes on this list.[1] However, when these are presented by residence (Table 6.23) only the ten leading causes can be compared, because the remaining ones are based on a very small number of deaths. Of the ten leading causes, four have higher infant death rates in the United States in both rural and urban areas than in Michigan (Table 6.24). They include premature births, injury at birth, diarrhea, and congenital debility.

On the other hand, four of the ten leading causes have higher rates in both rural and urban Michigan than in corresponding segments of the United States. They include congenital malformation, other diseases peculiar to the first year of life, diseases of the thymus gland, and other diseases of the respiratory system.

The other two diseases are pneumonia and accidental suffocation. The rate for pneumonia in the urban segment of the United States is higher than for Michigan, but the

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1. Beginning with syphilis in Table 6.22, the rates for Michigan are based on less than 20 deaths, and are indicated by an underscore.

Table 6.23

INFANT MORTALITY RATES FOR SELECTED CAUSES, MICHIGAN AND THE UNITED STATES, BY RESIDENCE, 1940

Cause	Number of deaths under 1 year of age per 100,000 live births			
	Rural		Urban	
	Michigan	United States	Michigan	United States
All Causes	4,214.8	5,012.0	3,998.0	4,435.3
Premature births	1,075.9	1,272.2	1,378.6	1,454.8
Pneumonia (All)	761.8	711.9	517.7	560.4
Congenital malformation	592.8	425.6	595.8	503.6
Injury at birth	367.5	379.0	445.8	580.7
Other diseases peculiar to first year	249.0	225.4	288.0	272.1
Diarrhea, enteritis, etc.	163.0	402.9	148.6	301.5
Accidents, suffocation	148.2	135.8	75.1	97.5
Diseases thymus gland	133.4	38.5	81.2	49.7
Congenital debility	133.4	175.5	38.3	71.9
Other diseases of the respiratory system	83.0	59.9	62.8	47.8
Ill defined and unknown	35.6	430.8	15.3	77.4

Note: For complete titles of causes of death see source cited below.
Death rates based on less than 20 deaths are underscored.

Source: Computed from Vital Statistics of the United States, 1940, Part II, Table 2, pp. 69 and 77, Table 14, pp. 325 and 329.

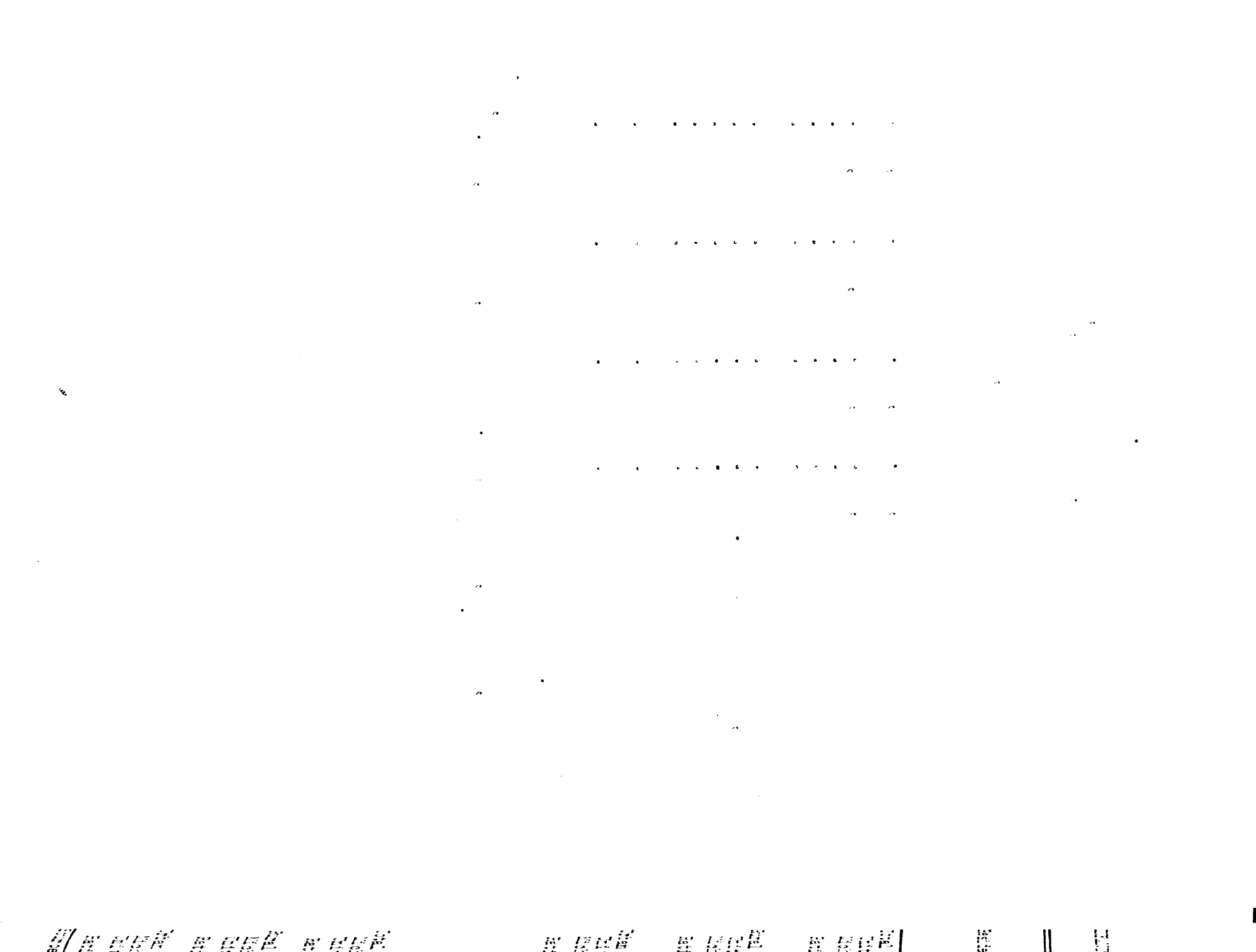


Table 6.24

INFANT DEATH RATES FROM SELECTED CAUSES, MICHIGAN AND THE UNITED STATES, 1940, BY RESIDENCE

Residence	Number of deaths under 1 year of age per 100,000 live births			
	Causes Predominant in the United States			
	Premature Births	Injury at Birth	Diarrhea, Enteritis	Congenital Debility
Total				
United States	1,370.4	487.5	348.3	119.8
Michigan	1,275.5	419.1	153.5	70.7
Ratio: $\frac{\text{U.S.}}{\text{Mich.}} \times 100$	115.5	116.3	226.9	169.4
Rural				
United States	1,272.2	379.0	402.9	175.5
Michigan	1,075.9	367.5	163.0	133.4
Ratio: $\frac{\text{U.S.}}{\text{Mich.}} \times 100$	119.2	103.1	247.2	131.6
Urban				
United States	1,454.8	580.7	301.5	71.9
Michigan	1,378.6	445.8	148.6	38.3
Ratio: $\frac{\text{U.S.}}{\text{Mich.}} \times 100$	105.5	130.3	202.9	187.7
	Causes Predominant in Michigan			
	Congenital Malformation	Other Diseases Peculiar to first year	Diseases of Thymus Gland	Diseases of Respiratory System
Total				
Michigan	594.8	274.5	99.0	69.7
United States	467.5	250.6	44.5	53.4
Ratio: $\frac{\text{Mich.}}{\text{U.S.}} \times 100$	127.2	109.5	222.5	130.5
Rural				
Michigan	592.8	249.0	133.4	83.0
United States	425.6	225.4	38.5	59.9
Ratio: $\frac{\text{Mich.}}{\text{U.S.}} \times 100$	139.3	110.5	346.5	138.6
Urban				
Michigan	595.8	288.0	81.2	62.8
United States	503.6	272.1	49.7	47.8
Ratio: $\frac{\text{Mich.}}{\text{U.S.}} \times 100$	118.3	105.8	163.4	131.4

Source: Computed from Vital Statistics of the United States, 1940, Part II, Residence, Table 2, pp. 69,77, Table 14, pp. 325,329.

rate for the rural segment of the Nation is lower than for the corresponding group in the State. Similarly, the rate for accidental suffocation and other accidental deaths in the United States is 15 percent higher than that of Michigan, but the State's rural rate is in excess of that for the rural segment of the Nation. Michigan's urban rate, 75.1, is lower for this cause of death than the corresponding rate, 97.5, for the United States, but rural Michigan's rate, 148.2, is higher than that of the Nation, 135.8. Thus, urban Michigan has lower rates than the urban part of the Nation for six of the ten leading causes of infant deaths, while rural Michigan has higher rates than the United States for six of the ten leading causes.

Table 6.25

MATERNAL MORTALITY RATES, MICHIGAN AND THE UNITED STATES, 1940, BY RESIDENCE

Residence	Deaths of Mothers Per 1,000 Live Births		
	United States	Michigan	Excess U.S.
Total Population	3.8	2.9	.9
Urban Total	3.6	3.2	.4
Cities: 100,000 and over	3.1	3.3	--
Cities: 25,000 - 100,000	3.7	3.3	.4
Cities: 10,000 - 25,000	4.0	2.5	1.5
Cities: 2,500 - 10,000	4.3	3.4	.9
Rural Total	4.0	2.3	1.7

Note: Underscored rates are based on less than 20 deaths.

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 37, pp. 622, 632.

Maternal Mortality Differentials

The mothers of Michigan die from puerperal causes at lower rates than those of the Nation in both rural and urban areas, and for all population-size groups except large cities of 100,000 population and over (see Table 6.25 on the preceding page).

The maternal rates of the Nation and Michigan are 3.8 and 2.9 deaths per 1,000 live births, the excess of the Nation being 31 percent. Rural Michigan has the lowest maternal rate of any population-size group. Michigan's rural rate, furthermore, is exceeded by the corresponding rate of the Nation by 74 percent, or 1.7, this being the largest differential of the group. In contrast, the urban people of the United States and Michigan have maternal death rates of 3.6 and 3.2 respectively, the urban part of the Nation's rate being only 13 percent in excess of the rate for the State. The maternal rates for cities of the United States decrease as the size of the cities increase, but this is not true for the cities of Michigan. Small cities in the United States, those with 2,500 to 10,000 population, have a rate of 4.3, compared with 3.1 for the Nation's large cities of 100,000 population or more, a difference of 1.2. The maternal rates for cities of corresponding size in Michigan, however, are 3.4 and 3.2, respectively, a difference of only .2.

PART III

INTERNAL VARIATION

CHAPTER VII

MORTALITY DATA BY COUNTIES

The crude resident[1] death rates have value in locating the areas in which the incidence of death and fatal diseases are likely to occur most frequently. The importance of such data is well evaluated by the following statement from a publication of the United States Bureau of the Census written by Linder and Grove:[2] "Public health agencies are organized to deal with health problems by areas. The first question for them is how many people are dying and where are they dying. Important as it is, the question of why they are dying comes second."

Death is usually preceded by illness, and thus the need for health facilities is usually great where death occurs at high rates. It is recognized that the number of deaths which occur in a community is a very useful index of the need for hospital beds in that area.[3] The practical value of this data, analyzed for localities, will increase in importance as health programs begin to devote greater attention than at the present time to those diseases which are prevalent among the older aged population. Because of these uses of mortality incidence data and also the emerging interest of the general public,

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1. Deaths are allocated to place of residence.

2. Linder, Forrest E. and Grove, Robert D., op. cit., p. 13.

3. See Hospital Resources and Needs, Report of the Michigan Hospital Survey, W.K. Kellogg Foundation, Battle Creek, Michigan, 1946, Chapter VII, for a discussion of the bed-death ratio and its use in estimating the number of hospital beds needed in communities.

government, and health leaders in adequate care of the sick through hospital planning and extention of health facilities, it is considered desirable to present a detailed analysis of ten-year average crude resident death rates for the counties of Michigan.

To assist in the analysis of the distribution of deaths by county, several maps have been prepared. These maps show the number of deaths by county for either per 1,000 or per 10,000 population. In this Chapter, consideration is given to the distribution of deaths by county for all causes and for the principal causes, followed by an analysis of residential variation by county in Chapter VIII.

Crude and Age-Adjusted Death Rates: All Causes

Death rates from all causes are presented in Table 7.1 and Figure 7.1. Inspection of Figure 7.1 shows that the toll of deaths from all causes is highest along the southern border of the State and in the western half of the Lower Peninsula. The Upper Peninsula has only three counties where the crude resident death rate is more than 11.2 per 1,000 population. With the exception of three counties in the Thumb area (St. Clair, Sanilac, and Tuscola), and Ogemaw and Alcona, the eastern counties of the Lower Peninsula have lower death rates than those in the rest of the State.

The twelve lowest and the twelve highest crude resident death rates by county are listed below; the twelve lowest have death rates under 10.1 and the twelve highest are

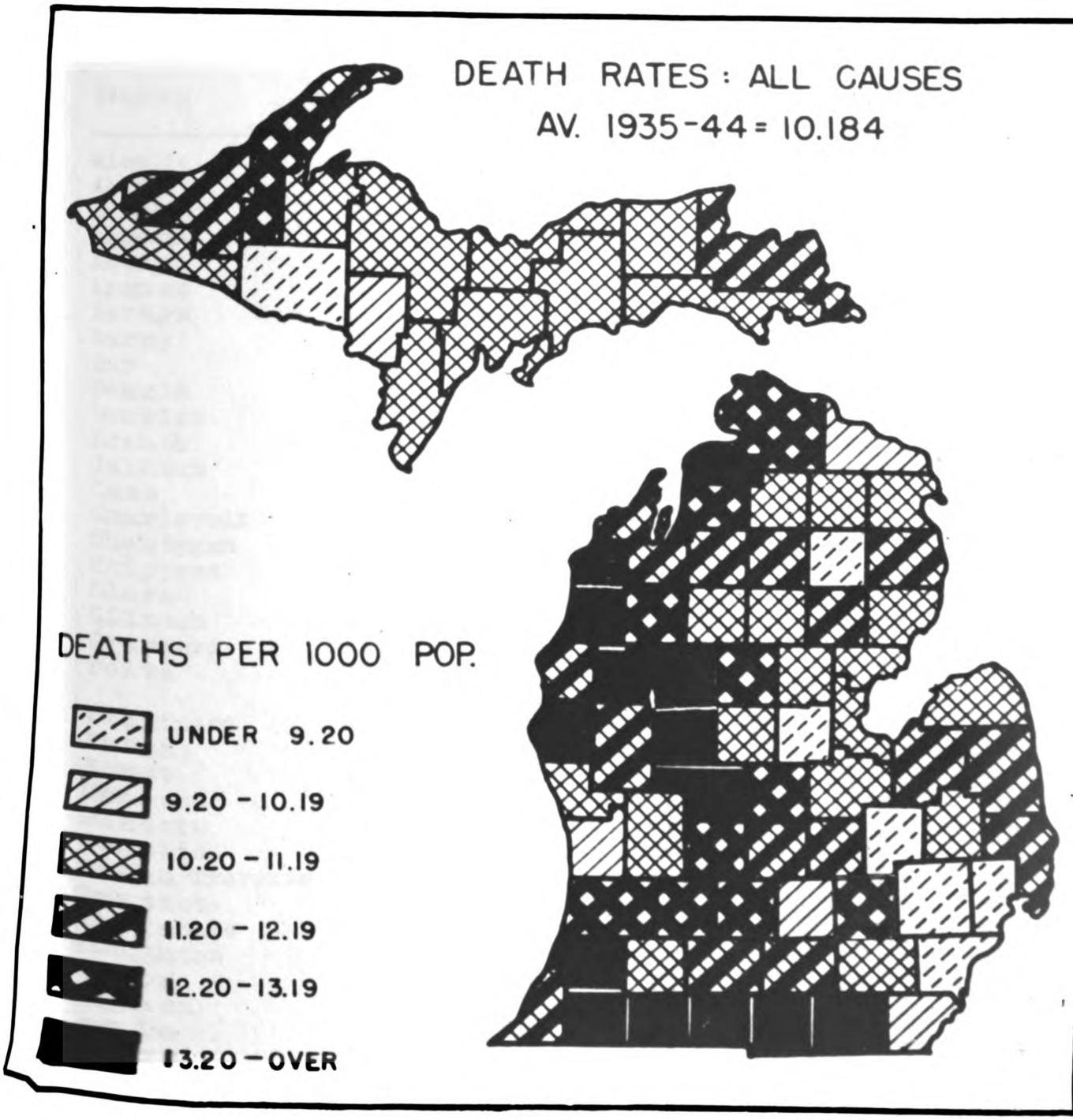


Figure 7.1 (Source: Table 7.1)

Table 7.1 AGE-ADJUSTED[1] AND CRUDE RESIDENT DEATH RATES FROM ALL CAUSES PER 1,000 POPULATION, COUNTIES OF MICHIGAN, AVERAGE 1935-1944 (Based on the 1940 population; by place of residence)

State and County	Death Rates		State and County	Death Rates	
	Adjusted	Crude		Adjusted	Crude
Alcona	9.7	11.6	Lake	10.3	13.3
Alger	12.1	11.2	Lapeer	10.0	11.1
Allegan	9.4	12.3	Leelanau	9.7	11.2
Alpena	9.8	10.4	Lenawee	10.1	13.2
Antrim	10.5	12.8	Livingston	9.9	12.9
Arenac	9.6	10.9	Luce	8.7	10.3
Baraga	11.5	11.1	Mackinac	10.9	11.0
Barry	9.4	13.2	Macomb	10.3	8.8
Bay	10.3	11.0	Manistee	10.3	13.4
Benzie	11.0	13.8	Marquette	10.9	11.0
Berrien	10.1	11.6	Mason	10.0	12.2
Branch	10.3	14.6	Mecosta	10.6	13.5
Calhoun	10.7	12.2	Menominee	10.1	11.0
Cass	10.3	14.8	Midland	9.0	8.3
Charlevoix	10.6	13.3	Missaukee	9.9	10.6
Cheboygan	10.4	12.2	Monroe	10.0	10.1
Chippewa	11.8	11.2	Montcalm	10.4	14.0
Clare	11.3	13.0	Montmorency	10.0	10.6
Clinton	9.4	11.6	Muskegon	10.7	10.2
Crawford	11.8	12.0	Newaygo	9.6	11.9
Delta	10.7	11.1	Oakland	9.7	8.2
Dickinson	10.1	9.5	Oceana	10.3	13.7
Eaton	9.7	12.9	Ogemaw	10.2	11.7
Emmet	11.7	13.2	Ontonagon	11.0	11.3
Genesee	10.1	8.5	Osceola	10.2	13.4
Gladwin	9.4	10.7	Oscoda	9.0	8.9
Gogebic	11.7	10.8	Otsego	10.0	11.1
Grand Traverse	8.6	11.5	Ottawa	8.7	9.7
Gratiot	10.4	13.2	Presque Isle	10.1	9.3
Hillsdale	9.6	13.7	Roscommon	9.2	10.2
Houghton	11.1	12.5	Saginaw	10.1	10.4
Huron	9.6	10.8	St. Clair	10.7	12.0
Ingham	9.8	9.7	St. Joseph	10.0	13.5
Ionia	9.6	12.5	Sanilac	9.6	11.9
Iosco	9.3	11.0	Schoolcraft	10.3	11.1
Iron	9.8	9.1	Shiawassee	10.0	12.2
Isabella	9.9	10.5	Tuscola	10.0	12.1
Jackson	10.2	11.3	Van Buren	10.0	14.6
Kalamazoo	9.7	10.8	Washtenaw	9.2	10.8
Kalkaska	9.8	11.3	Wayne	11.1	8.9
Kent	10.4	10.4	Wexford	10.3	12.6
Keweenaw	11.4	12.2	State	10.2	10.1

1. Based on the United States population, 1940, indirect method.

Source: Reports of the Michigan Department of Health, 1935-1944, Table 16.

13.3 or over per 1,000 population.

Twelve Lowest Crude Resident Death Rates		Twelve Highest Crude Resident Death Rates	
Oakland	8.2	Cass	14.8
Midland	8.3	Van Buren	14.6
Genesee	8.5	Branch	14.6
Macomb	8.8	Montcalm	14.0
Oscoda	8.9	Benzie	13.8
Wayne	8.9	Oceana	13.7
Iron	9.1	Hillsdale	13.7
Presque Isle	9.3	St. Joseph	13.5
Dickinson	9.5	Mecosta	13.5
Ottawa	9.7	Manistee	13.4
Ingham	9.7	Osceola	13.4
Monroe	10.1	Lake	13.3

Oakland county with the lowest death rate (8.2) and Cass county with the highest death rate (14.8) are both located in the southern part of the State. However, Oakland is an industrial county whereas Cass is predominantly rural.

Five of the high death rate counties are in the extreme southern part of the State, grouped fairly close together. These are Cass, Van Buren, Branch, Hillsdale, and St. Joseph counties. Of the remaining twelve, Benzie, Manistee, and Oceana are on the western coastline of the upper part of the Lower Peninsula; and Lake, Osceola, and Mecosta are in the heart of the Lower Peninsula. No Upper Peninsula county is included in this group. Hence, we may assume on the basis of the ten-year averages that the toll of death is greater among those living in the western half of the State.

Six of the counties with low death rates are located in the southeastern part of the State. They are the industrial or semi-industrial counties of Oakland, Genesee,

Macomb, Wayne, Monroe, and Ingham. One county, Ottawa, lies in the western part of the State; three counties, Midland, Oscoda, and Presque Isle are in the northeastern part of the Lower Peninsula; and two, Dickinson and Iron, are in the Upper Peninsula. It is interesting to note that counties of the Upper Peninsula are not found usually in either the lower or the higher death rate brackets. It is likely that the population is too young to place it in the higher brackets, while its communicable disease rate is too high to place it in the lower brackets.

Age-adjusted death rates are also given in Table 7.1 and are shown graphically in Figure 7.2. They are more comparable than crude rates, for they are not influenced unduely by differing age distributions among the counties. Rather, variations between such death rates are usually considered to be a result of conditions which may be improved, such as poor sanitation, lack of health facilities, lack of income with which to purchase medical care, or poor health habits and practices of the people.

For the most part, the high age-adjusted death rates fall in the Upper Peninsula, while low rate counties are found in the Lower Peninsula. The counties with the twelve highest and the twelve lowest age-adjusted death rates are listed below:

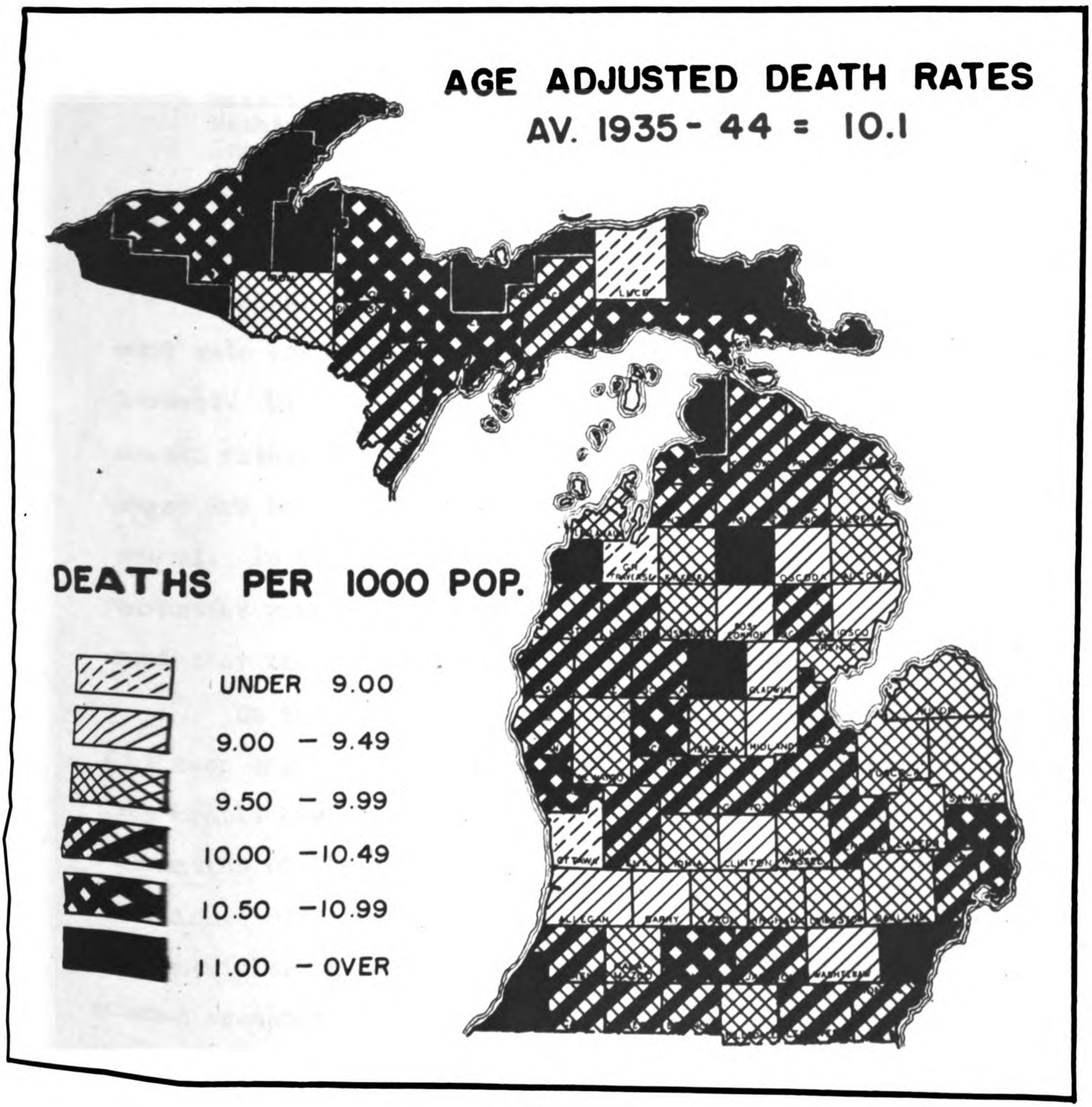


Figure 7.2 (Source; Table 7.1)

Twelve Lowest Age-adjusted Death Rates		Twelve Highest Age-adjusted Death Rates	
Grand Traverse	8.6	Alger	12.1
Luce	8.7	Chippewa	11.8
Ottawa	8.7	Crawford	11.8
Midland	9.0	Emmet	11.7
Oscoda	9.0	Gogebic	11.7
Roscommon	9.2	Baraga	11.5
Washtenaw	9.2	Keweenaw	11.4
Iosco	9.3	Clare	11.3
Allegan	9.4	Houghton	11.1
Barry	9.4	Wayne	11.1
Clinton	9.4	Ontonagon	11.0
Gladwin	9.4	Benzie	11.0

Alger county in the Upper Peninsula has the highest rate and Grand Traverse in northern Michigan has the lowest. Of the twelve counties with low age-adjusted death rates, one, Luce, is in the Upper Peninsula and the rest are below the Straits. They are for the most part rural. In contrast to this distribution, seven of the counties with high death rates are in the Upper Peninsula and they include both rural and urban counties.

On the basis of these data, the people in the fifteen counties of the Upper Peninsula occupy a less favorable health position than those in most of the counties of the State, and one naturally seeks an explanation. Dorn found that in Ohio the death rates in poor economic areas were greater than corresponding rates in good economic areas.[1] If this conclusion is tested for the twelve lowest and twelve highest age-adjusted death

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1. Dorn, Harold F., "Mortality Rates and Economic Status in Rural Areas," Public Health Reports, Vol. 55, No. 1, January 5, 1940, pp. 3-12, (Reprint No. 2126, p. 3).

rate counties of Michigan by employing standard of living measures[1] as criteria of economic status, there is indirect evidence to support the generalization. For the twelve low mortality counties the mean death rate is 9.1 and the mean standard of living index 101, whereas for the twelve high mortality counties the mean death rate is 11.5 and the mean standard of living index is 96.[2] Death rates in the high mortality counties are about 26 percent greater than in the low mortality counties. Moreover the standard of living measure is about 4 percent greater in the twelve areas with lowest death rates. This information also suggests an inverse relationship between mortality and standards of living which is in keeping with the findings of Dorn and

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1. The standard of living measures employed here are those given in Hospital Resources and Needs, Michigan Hospital Survey, op. cit., Table 13, p. 66. The standard of living measure is an average of ten characteristics after expressing each item in standard deviation units. The items included in the average follow: percentage of homes with radio, mechanical refrigeration, central heating, electric lighting, running water, occupied by owner, needing major repairs, less than 1.01 persons per room, average value of homes, and percentage of persons 25 and over having completed more than 6 years of school.

2. The standard of living measures for the counties with the twelve lowest age-adjusted death rates are as follows: Grand Traverse 104, Luce 85, Ottawa 114, Midland 103, Oscoda 87, Roscommon 94, Washtenaw 115, Iosco 97, Allegan 106, Barry 107, Clinton 108, and Gladwin 91. Those for the counties with the twelve highest age-adjusted death rates are: Alger 91, Chippewa 96, Crawford 92, Emmet 99, Gogebic 98, Baraga 88, Keweenaw 89, Clare 94, Houghton 98, Wayne 112, Ontonagon 90, and Benzie 102. Arithmetical means given in this chapter for the 12 high and 12 low death rates or their corresponding standard of living measures prevent counties with large populations from determining the size of the figure.

others.[1]

Wayne county, with approximately one-half of the State's population, ranks eleventh among the counties with the twelve highest death rates, while Berrien county, with around 80,000 population, ranks sixth highest. These two counties are populated predominantly by people neither very young nor very old, and many conditions resulting in high death rates are largely preventable.

The Principal Causes of Death: Cause-Specific Death Rates

The predominant causes of death to be discussed by county are given below with their relative rank for the State.

Rank	Rate per 1,000 population (Ten-year averages)
Heart Diseases	2.85
Cancer	1.16
Apoplexy	.88
Accidents (all)	.76
Pneumonia	.57
Nephritis	.55
Tuberculosis	.36
Premature births	.27
Diabetes mellitus	.26
Arteriosclerosis	.19
Suicide	.12

Ten-year average crude resident death rates were computed

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1. See: Coombs, L.C., "Economic Differentials in Causes of Death," Medical Care, Vol. I, July 1941, pp. 246-255; Mott, Frederick D. (M.D.), and Roemer, Milton I. (M.D.), Rural Health and Medical Care, McGraw-Hill Book Company, New York, 1948, p. 71-73; Registrar General, The Registrar General's Decennial Supplement; England and Wales, H.M. Stationery Office, London, England, 1936, Vol. II, p. 211, and pp. 191-210; Thompson, Warren S., op. cit., pp. 234-239.

because they provide a more stable measure of the occurrence of deaths. This is particularly important in small counties where a variation of a few deaths would affect the size of the rate materially.[1] These causes comprise approximately 80 percent of all deaths occurring to residents of the State during the ten year period 1935-1944. It is the object of this section to show how the incidence of death from these causes are distributed among the counties of the State. To aid in the presentation of the data, maps have been prepared showing the average number of deaths per 1,000 population in each county for each of the causes listed except arteriosclerosis and suicide.

1. Heart Diseases (All Forms). Heart diseases take a greater toll than any other cause of death in all of the counties of the State (See Appendix II, Table I for rank).

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1. Death rates should be interpreted with caution when based on a small number of deaths. According to Linder and Grove (op. cit., p. 93), a death rate based on 20 deaths "has a standard error of roughly 22 percent of the magnitude of the rate." Many of the death rates by causes for the counties are based on fewer than 20 deaths per year and this is indicated by underscoring the rates. It might be pointed out that the number of deaths that occur in a county is not a sample but a complete enumeration. Since Michigan's registration system is among the more efficient ones of the Nation, incomplete registrations being less than 2 per cent, inaccuracies from this source have been reduced. To counterbalance county variation in the number of deaths due to seasonal and unusual occurrences, the deaths in each county for ten years (1935-1944) have been averaged and related to the population of 1940. It is believed that these death rates present a fairly accurate estimate of mortality among counties. (See Linder, Forrest E. and Grove, Robert D., op. cit., pp. 93-94 for a discussion of the problem of death rates based on small numbers of deaths; See also this thesis, pp.42-43.)

The ten-year average death rate from heart diseases for the State is 2.9 per 1,000 population (Table 7.2). Observation of the map, Figure 7.3, reveals, as might be expected, that the high death rate counties follow closely the pattern of death rates for all causes. With the exception of Muskegon and Ottawa counties, rates are at or above the State average for the entire western half of the Lower Peninsula. There is also a group of high rate counties running along the Eastern Shore line from St. Clair as far north as Alpena county. Counties of the Upper Peninsula have low rates from these causes. Only four of the fifteen counties, namely, Chippewa, Luce, Schoolcraft, and Houghton have rates as high as 3.2 per 1,000 population or higher. The belt of low death rates from heart diseases in counties running up the eastern half of Michigan from Wayne to Presque Isle is a mortality condition caused primarily by younger aged populations in these counties.[1]

Twelve Lowest Death Rates from Heart Disease		Twelve Highest Death Rates from Heart Disease	
Midland	2.02	Van Buren	4.63
Oakland	2.03	Manistee	4.46
Genesee	2.16	Branch	4.45
Macomb	2.22	Emmet	4.35
Presque Isle	2.30	Livingston	4.15
Baraga	2.32	Charlevoix	4.04
Iron	2.36	Eaton	4.02
Wayne	2.41	Montcalm	3.99
Oscoda	2.44	Mecosta	3.97
Alger	2.57	Benzie	3.96
Gogebic	2.58	Wexford	3.93
Ingham	2.62	Cass	3.90

1. See Beegle, J. Allan, op. cit., pp. 49-51.

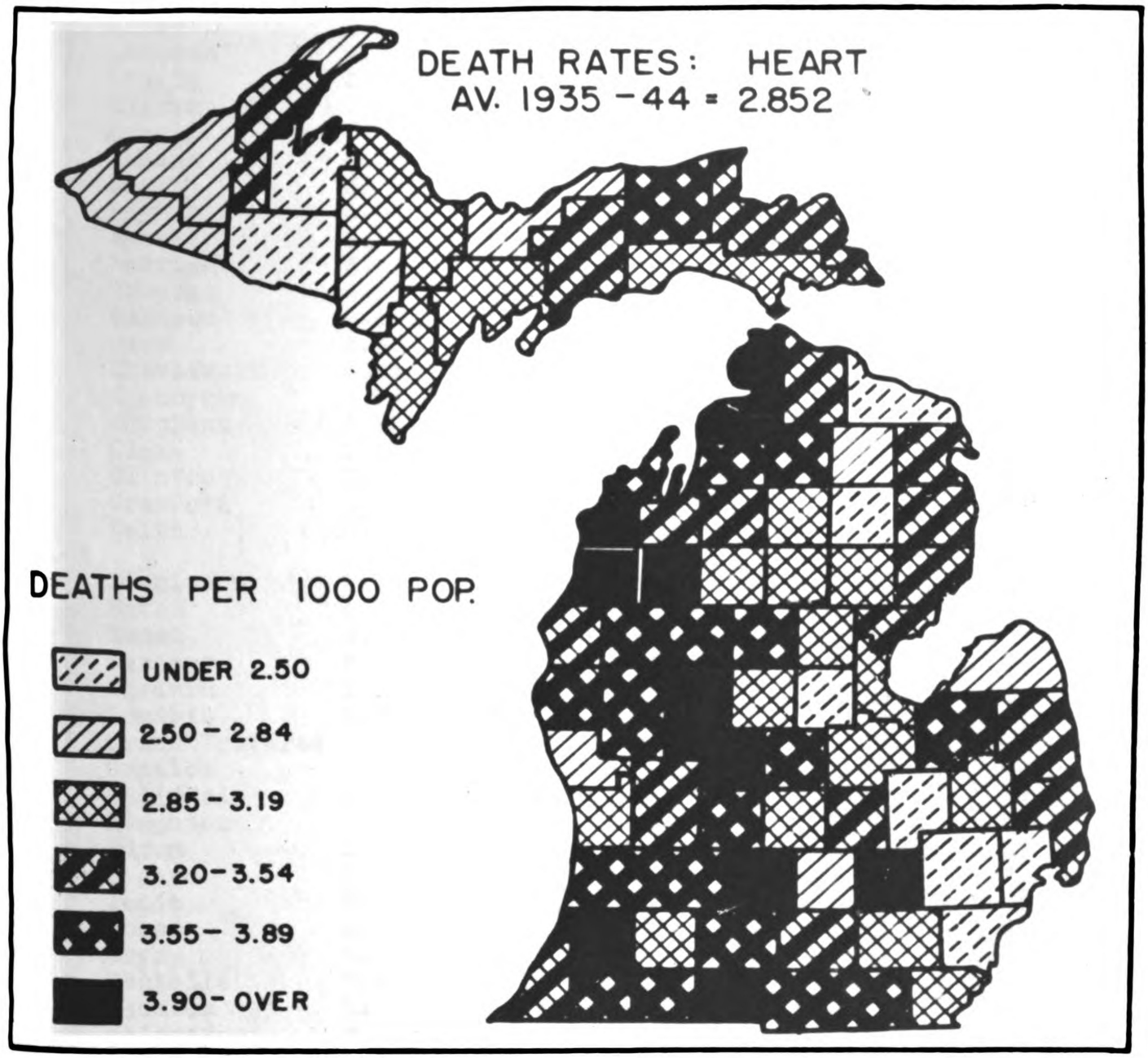


Figure 7.3 (Source: Table 7.2)

Table 7.2 CRUDE DEATH RATES FROM HEART DISEASES AND CANCER PER 1,000 POPULATION, BY COUNTY, MICHIGAN, AVERAGE 1935-1944 (Based on the 1940 population; by place of residence)

County	Heart Diseases (90-95)	Cancer (45-55)[1]	County	Heart Diseases (90-95)	Cancer (45-55)[1]
Alcona	3.51	1.12	Lake	3.79	1.38
Alger	2.57	.98	Lapeer	3.10	1.19
Allegan	3.85	1.37	Leelanau	3.77	1.23
Alpena	3.34	1.01	Lenawee	3.62	1.38
Antrim	3.73	1.41	Livingston	4.15	1.44
Arenac	3.30	1.05	Luce	3.85	.69
Baraga	2.32	.91	Mackinac	2.96	1.03
Barry	3.78	1.39	Macomb	2.22	1.00
Bay	3.04	1.31	Manistee	4.46	1.65
Benzie	3.96	1.27	Marquette	2.97	1.27
Berrien	3.43	1.30	Mason	3.49	1.32
Branch	4.45	1.47	Mecosta	3.97	1.25
Calhoun	3.66	1.27	Menominee	3.08	1.36
Cass	3.90	1.71	Midland	2.02	.88
Charlevoix	4.04	1.57	Missaukee	3.07	.85
Cheboygan	3.54	1.44	Monroe	2.95	1.14
Chippewa	3.36	.99	Montcalm	3.99	1.41
Clare	3.87	1.19	Montmorency	2.71	1.20
Clinton	3.06	1.17	Muskegon	2.72	1.06
Crawford	3.08	1.51	Newaygo	3.76	1.23
Delta	2.93	1.30	Oakland	2.03	.92
Dickinson	2.71	1.10	Oceana	3.64	1.47
Eaton	4.02	1.54	Ogemaw	3.19	.96
Emmet	4.35	1.41	Ontonagon	2.73	1.11
Genesee	2.16	.90	Osceola	3.89	1.49
Gladwin	2.95	1.16	Oscoda	2.44	1.10
Gogebic	2.58	1.14	Otsego	3.55	1.15
Grand Traverse	3.47	1.16	Ottawa	2.93	1.34
Gratiot	3.57	1.34	Presque Isle	2.30	1.04
Hillsdale	3.85	1.55	Roscommon	3.05	1.09
Houghton	3.46	1.59	Saginaw	2.95	1.14
Huron	2.81	1.26	St. Clair	3.35	1.38
Ingham	2.62	1.14	St. Joseph	3.78	1.51
Ionia	3.70	1.41	Sanilac	3.35	1.21
Iosco	3.36	1.44	Schoolcraft	3.22	1.31
Iron	2.36	1.18	Shiawassee	3.20	1.49
Isabella	2.96	1.13	Tuscola	3.75	1.37
Jackson	3.37	1.29	Van Buren	4.63	1.78
Kalamazoo	3.04	1.22	Washtenaw	3.14	1.32
Kalkaska	3.41	1.10	Wayne	2.41	1.05
Kent	3.41	1.34	Wexford	3.93	1.17
Keweenaw	2.85	1.22	State	2.85	1.16

1. International List number, 1938.

Note: Rates based on less than 200 deaths during ten years are underscored.

Source: Annual Report, Michigan Department of Health, 1935-1944, Numbers 64-74, Table 16.

The counties with the twelve lowest and the twelve highest death rates from heart diseases are given on the preceding page.

In general, the counties with the twelve lowest death rates from heart diseases have heavy concentrations of urban people, while the counties with the twelve highest rates from these causes are essentially rural. The highest rate (4.63) is in Van Buren county and the lowest rate is in Midland,--2.02 per 1,000 population.

2. Cancer. The death rates for cancer are given in Table 7.2 and are presented graphically in Figure 7.4. The rate for the State is 1.2 per 1,000 population. It is the second highest of the principal causes of death in Michigan, and is second highest for a majority of the counties. In 53 of the 83 counties (64 percent) cancer is the second highest cause of death while in 26 counties (31 percent) it ranks third.

The incidence of death from cancer follows closely that of heart diseases. The higher rates occur in the tier of counties along the southern border, in the central, and in the western areas of the Lower Peninsula. In general, the Upper Peninsula counties have lower death rates than those of lower Michigan.

The counties with the twelve lowest and those with the twelve highest death rates from cancer are listed below:

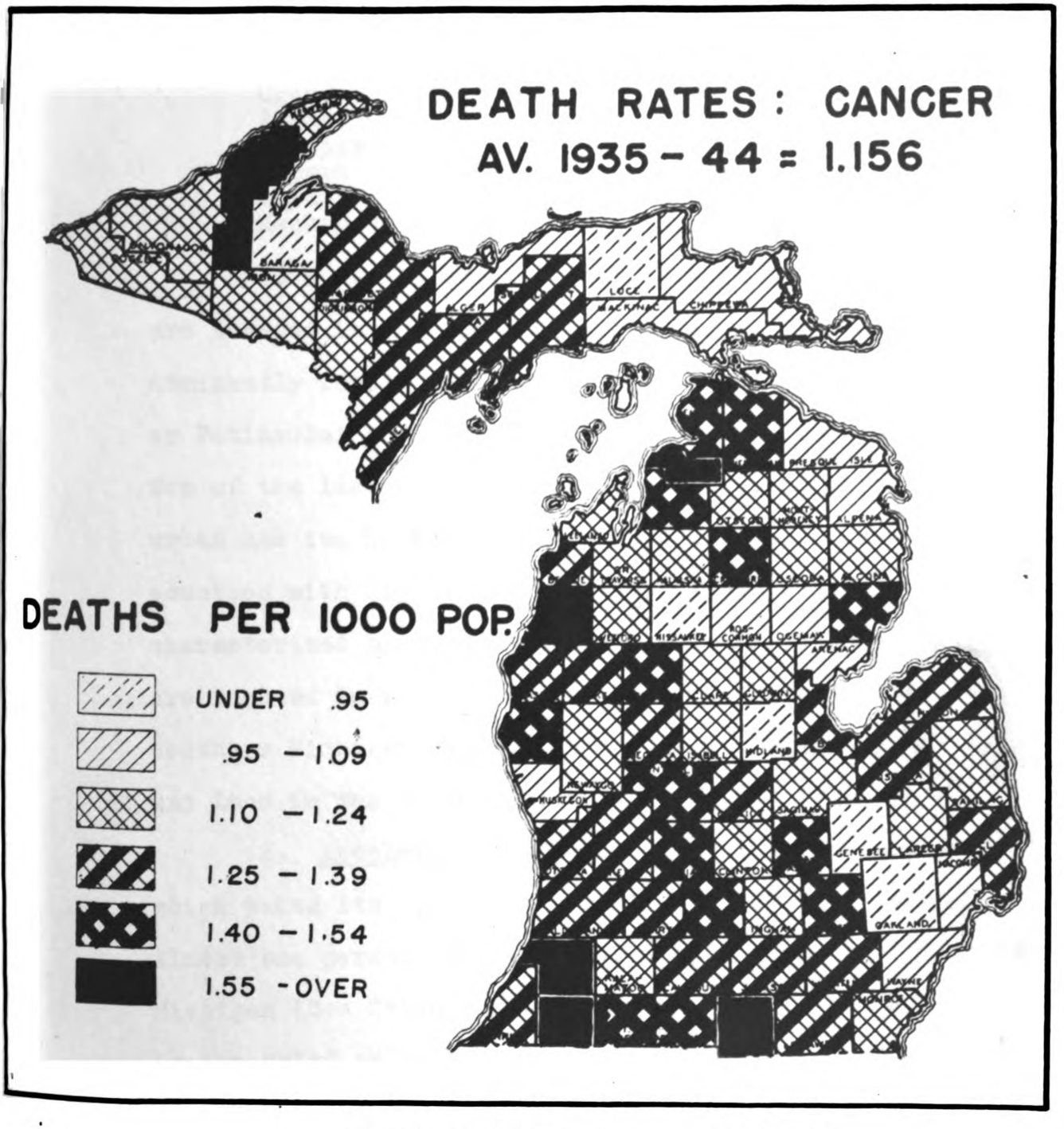


Figure 7.4 (Source: Table 7.2)

Twelve Lowest Death Rates from Cancer		Twelve Highest Death Rates from Cancer	
Luce	.69	Van Buren	1.78
Missaukee	.85	Cass	1.71
Midland	.88	Manistee	1.65
Genesee	.90	Houghton	1.59
Baraga	.91	Charlevoix	1.57
Oakland	.92	Hillsdale	1.55
Ogemaw	.96	Eaton	1.54
Alger	.98	Crawford	1.51
Chippewa	.99	St. Joseph	1.51
Macomb	1.00	Osceola	1.49
Alpena	1.01	Shiawassee	1.49
Mackinac	1.03	Branch	1.47

Five of the twelve counties with low rates for cancer are located in the Upper Peninsula and most of them are predominantly rural; three are in the northern part of the Lower Peninsula; and four are located in southern Michigan. Two of the last four counties mentioned are predominantly urban and two have large urban populations. Seven of the 12 counties with high death rates are essentially rural and are characterized by large numbers among the older ages. They are located in southern Michigan. Van Buren county in southern Michigan has the highest death rate, namely 1.78, and Luce in the Upper Peninsula has the lowest, .69.

3. Apoplexy.[1] Apoplexy is another chronic disease which takes its toll from among the older aged persons. Almost one person per 1,000 (.88) dies from this cause in Michigan (See Table 7.3 and Figure 7.5). Although apoplexy is the third principal cause of death for the State, it occupies this position in slightly less than 50 percent (48.2)

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1. Includes Cerebral hemorrhage (83a) and Cerebral embolism and thrombosis (83b).

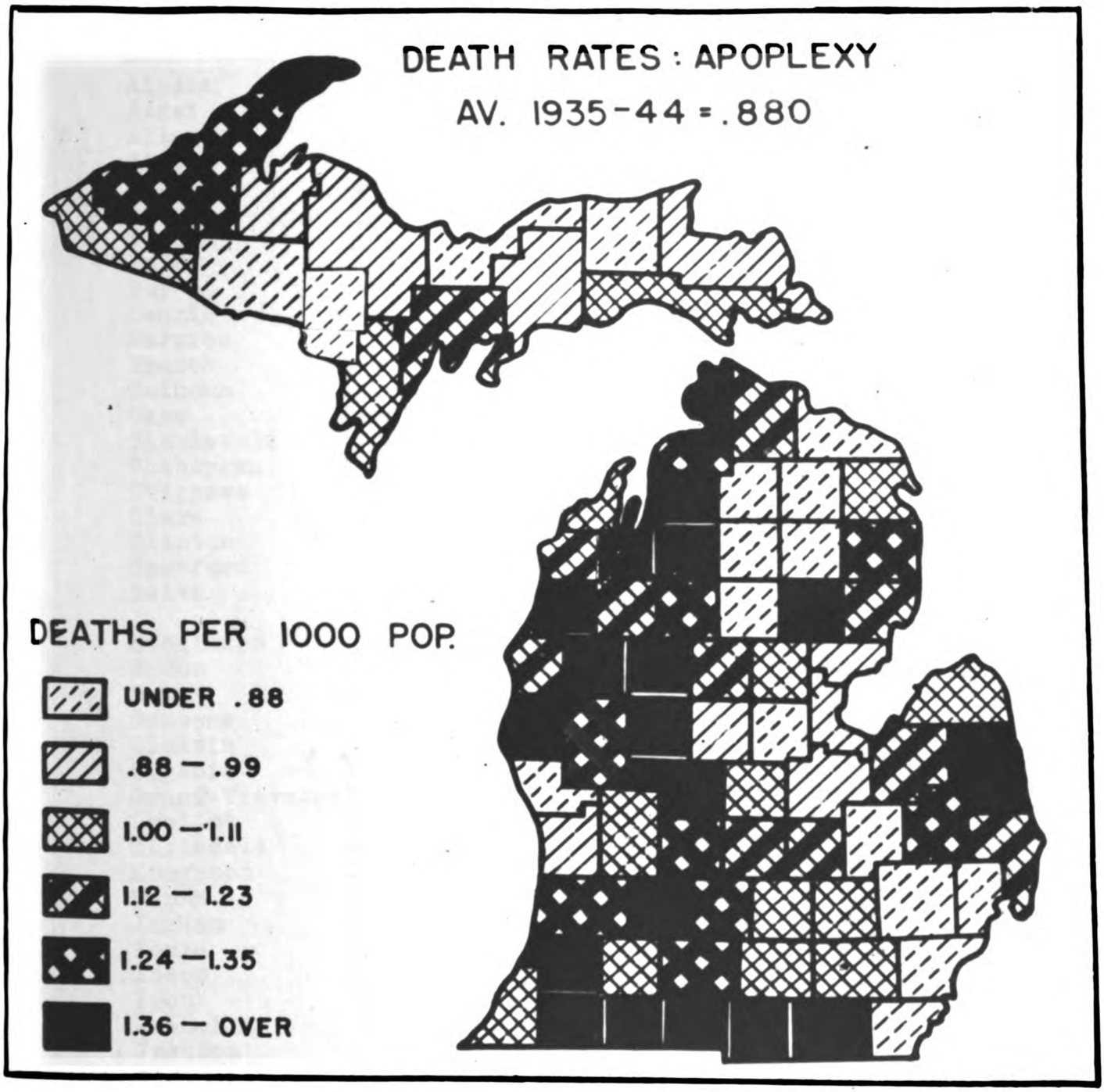


Figure 7.5 (Source: Table 7.3)

Table 7.3 CRUDE DEATH RATES FROM APOPLEXY AND ACCIDENTS PER 1,000 POPULATION, BY COUNTY, MICHIGAN, AVERAGE 1935-1944 (Based on the 1940 population; by place of residence)

County	Apoplexy (83ab)	Accidents: (169-195):	County	Apoplexy (83ab)	Accidents (169-195)
Alcona	1.28	1.08	Lake	1.52	1.21
Alger	.64	1.36	Lapeer	1.31	.93
Allegan	1.33	1.02	Leelanau	1.09	.79
Alpena	1.05	.81	Lenawee	1.42	1.07
Antrim	1.47	.76	Livingston	1.11	1.13
Arenac	.99	1.12	Luce	.62	1.06
Baraga	.92	1.35	Mackinac	1.06	1.21
Barry	1.69	1.04	Macomb	.86	.80
Bay	.92	.86	Manistee	1.59	.86
Benzie	1.18	1.24	Marquette	.93	.83
Berrien	1.05	.98	Mason	1.18	.96
Branch	1.68	1.10	Mecosta	1.47	.96
Calhoun	1.32	.90	Menominee	1.05	.78
Cass	1.64	1.29	Midland	.51	.73
Charlevoix	1.34	1.03	Missaukee	1.27	.72
Cheboygan	1.23	1.01	Monroe	.86	1.04
Chippewa	.89	.97	Montcalm	1.53	1.18
Clare	1.15	1.41	Montmorency	.60	1.15
Clinton	1.14	.85	Muskegon	.85	.70
Crawford	.66	1.14	Newaygo	1.31	.79
Delta	1.15	1.03	Oakland	.67	.73
Dickinson	.80	.83	Oceana	1.59	1.11
Eaton	1.30	1.04	Ogemaw	1.72	1.09
Emmet	1.41	.98	Ontonagon	1.33	1.08
Genesee	.65	.70	Osceola	1.59	1.09
Gladwin	1.10	.98	Oscoda	.71	.79
Gogebic	1.04	1.06	Otsego	.72	1.00
Grand Traverse	1.41	.86	Ottawa	.99	.63
Gratiot	1.08	.91	Presque Isle	.57	.71
Hillsdale	1.62	1.04	Roscommon	.76	.98
Houghton	1.28	.85	Saginaw	.90	.81
Huron	1.02	.95	St. Clair	1.17	1.05
Ingham	1.04	.79	St. Joseph	1.52	.96
Ionia	1.31	.85	Sanilac	1.49	.91
Iosco	1.18	.91	Schoolcraft	.97	1.01
Iron	.69	.95	Shiawassee	1.17	.96
Isabella	.99	.91	Tuscola	1.23	.96
Jackson	1.08	.87	Van Buren	1.64	1.17
Kalamazoo	1.09	.88	Washtenaw	1.08	.85
Kalkaska	1.42	.78	Wayne	.56	.58
Kent	1.01	.73	Wexford	1.16	.89
Keweenaw	1.57	.85	State	.88	.76

1. International List number, 1939.

Note: Rates based on less than 200 deaths during ten years are underscored.

Source: Annual Report, Michigan Department of Health, 1935-1944, Numbers 64-74, Table 16.

of the counties. The distribution of counties by rank are as follows:

Rank	Number of Counties	Percent
2	20	24
3	40	48
4	16	19
5	5	6
6	1	1

In one county, Emmet, apoplexy and cancer have the same death rate, namely 1.41. As might be expected, the incidence of death is high in the southern tier of counties and in the western part of the State. The counties with the twelve lowest and the twelve highest rates are given below:

Twelve Lowest Death Rates from Apoplexy		Twelve Highest Death Rates from Apoplexy	
Midland	.51	Ogemaw	1.72
Wayne	.56	Barry	1.69
Presque Isle	.57	Branch	1.68
Montmorency	.60	Cass	1.64
Luce	.62	Van Buren	1.64
Alger	.64	Hillsdale	1.62
Genesee	.65	Oceana	1.59
Crawford	.66	Osceola	1.59
Oakland	.67	Manistee	1.59
Iron	.69	Keweenaw	1.57
Oscoda	.71	Montcalm	1.53
Otsego	.72	St. Joseph	1.52

Four of the highest twelve rates are for counties in the southern tier, and two are in the adjoining tiers. These counties are Barry, Branch, Cass, Van Buren, Hillsdale, and St. Joseph. Only one of the high rate counties, Keweenaw, is located in the Upper Peninsula. The low rate counties are distributed throughout the State; three are in the Upper Peninsula, six including Midland are in the northern part of the Lower Peninsula, and three are the

industrial counties, Wayne, Oakland, and Genesee, in southeastern Michigan. The highest rate for apoplexy is 1.72 in Ogemaw and the lowest is .51 in Midland.

4. Accidental Deaths. The distribution of deaths from accidents of all kinds is shown in Table 7.3 and Figure 7.6. It is the fourth principal cause of death in the State, the rate being .76. In 55 counties, or 66 percent, it is likewise the fourth principal cause of death, but in 22 counties, or 27 percent, it occupies second or third place.

The counties with the twelve lowest and the twelve highest death rates follow:

Twelve Lowest Death Rates from Accidents		Twelve Highest Death Rates from Accidents	
Wayne	.58	Clare	1.41
Ottawa	.63	Alger	1.36
Muskegon	.70	Baraga	1.35
Genesee	.70	Cass	1.29
Presque Isle	.71	Benzie	1.24
Missaukee	.72	Lake	1.21
Oakland	.73	Mackinac	1.21
Midland	.73	Montcalm	1.18
Kent	.73	Van Buren	1.17
Antrim	.76	Montmorency	1.15
Menominee	.78	Crawford	1.14
Kalkaska	.78	Livingston	1.13

Among the low mortality counties Wayne, Genesee, Oakland, Kent, and Muskegon are predominantly urban, while Midland, Ottawa, and Menominee have large urban populations. In contrast, the high mortality counties are all predominantly rural, three being in the Upper Peninsula, five in northern Michigan, and four in the southern part of the State. There are probably several factors contributing to this



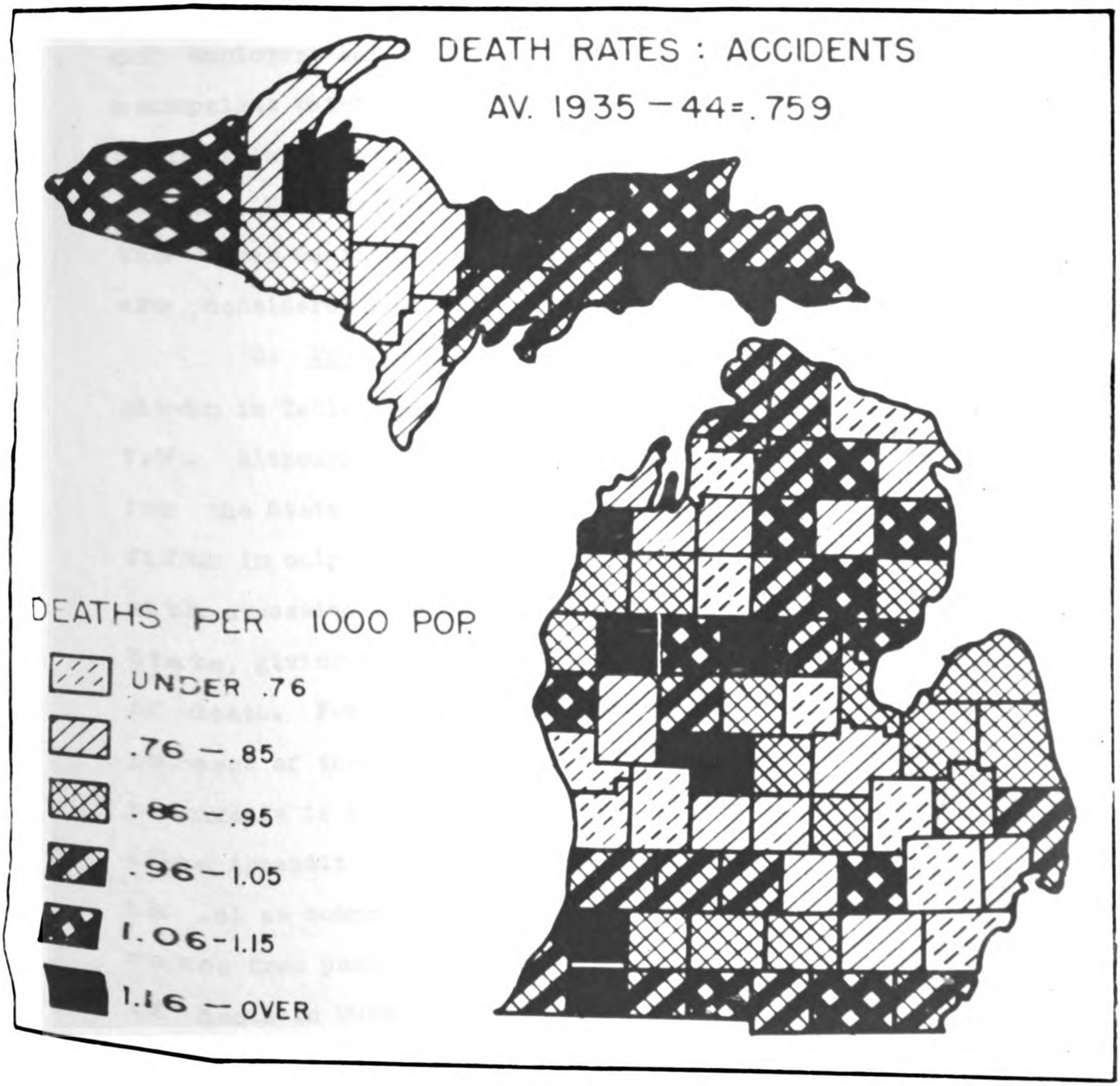


Figure 7.6 (Source: Table 7.3)

distribution. Supervision of motor vehicle traffic is more detailed and speed laws are lower in the city than in the country. It is also probable that the insurance liability of employers has resulted in improved safety devices and campaigns which have materially reduced accident hazards in industrial plants. Similar incentives are lacking in rural areas. Mining and lumbering, the two chief industries of the Upper Peninsula, are de-centralized occupations which are considered hazardous to life.

5. Pneumonia. The death rates from pneumonia are given in Table 7.4 and are presented graphically in Figure 7.7. Although it is the fifth principal cause of death for the State, it ranks sixth in 42 of the counties and fifth in only 31 of them. A few highly populated counties with excessive death rates determine the high rate for the State, giving it fifth rather than sixth place as a cause of death. For example, in Wayne County, which has 38.3 percent of the State's population, the death rate from pneumonia is exceeded only by heart diseases and cancer (See Appendix II Table 1). The death rate in Wayne county is .61 as compared with .57 for Michigan. Moreover, death rates from pneumonia constitute the fourth principal cause of death in Muskegon, Kalkaska, and Alger counties, their respective rates being markedly higher than that of Michigan. They are .71, .83, and .76 respectively.

The twelve counties with the highest and those with the lowest death rates are listed below:

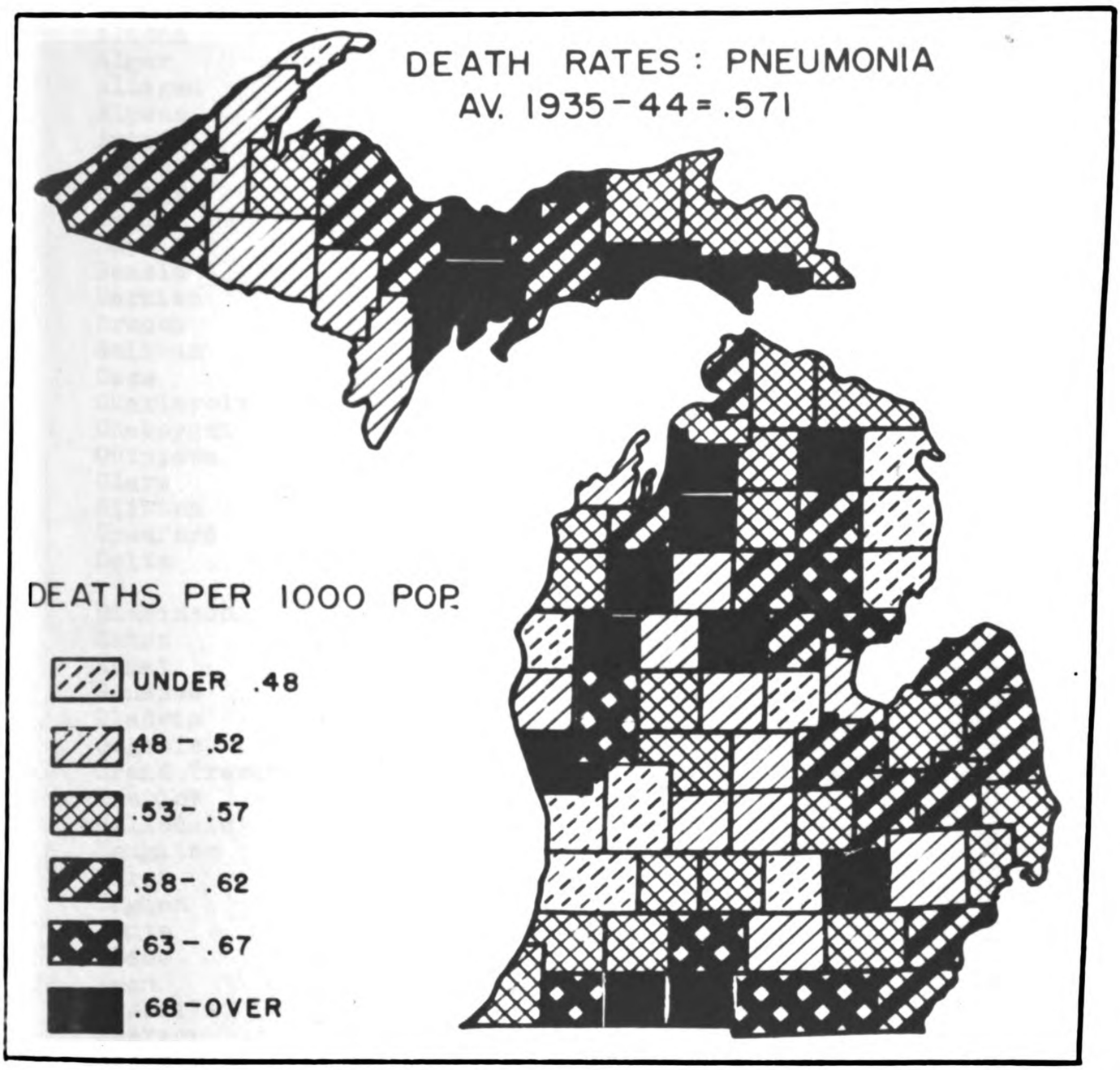


Figure 7.7 (Source: Table 7.4)

Table 7.4 CRUDE DEATH RATES FROM PNEUMONIA AND NEPHRITIS PER 1,000 POPULATION, BY COUNTY, MICHIGAN, AVERAGE 1935-1944 (Based on the 1940 population; by place of residence)

County	Pneumonia (107-109)	Nephritis (130-132)[1]	County	Pneumonia (107-109)	Nephritis (130-132)[1]
Alcona	.48	.84	Lake	.83	.69
Alger	.76	.57	Lapeer	.59	.62
Allegan	.47	.64	Leelanau	.49	.70
Alpena	.45	.53	Lenawee	.66	.77
Antrim	.71	.81	Livingston	.74	.50
Arenac	.64	.58	Luce	.54	.47
Baraga	.58	.36	Mackinac	.77	.50
Barry	.56	.92	Macomb	.55	.53
Bay	.53	.79	Manistee	.56	.47
Benzie	.54	.85	Marquette	.58	.53
Berrien	.57	.76	Mason	.44	.64
Branch	.72	.88	Mecosta	.58	.99
Calhoun	.65	.60	Menominee	.49	.49
Cass	.66	1.31	Midland	.44	1.09
Charlevoix	.55	.75	Missaukee	.51	.44
Cheboygan	.56	.47	Monroe	.58	.42
Chippewa	.56	.50	Montcalm	.54	.81
Clare	.91	.82	Montmorency	.83	.89
Clinton	.52	1.29	Muskegon	.71	.52
Crawford	.53	.85	Newaygo	.64	.68
Delta	.68	.53	Oakland	.48	.40
Dickinson	.48	.32	Oceana	.50	.54
Eaton	.53	.81	Ogemaw	.64	.49
Emmet	.59	.54	Ontonagon	.63	.55
Genesee	.62	.46	Osceola	.49	.74
Gladwin	.63	.74	Oscoda	.63	.83
Gogebic	.60	.58	Otsego	.57	.86
Grand Traverse	.61	.50	Ottawa	.29	.56
Gratiot	.50	.75	Presque Isle	.53	.42
Hillsdale	.66	.75	Roscommon	.60	.65
Houghton	.51	.63	Saginaw	.60	.59
Huron	.63	.60	St. Clair	.58	.84
Ingham	.42	.59	St. Joseph	.73	1.02
Ionia	.52	.62	Sanilac	.58	.63
Iosco	.42	.67	Schoolcraft	.61	.60
Iron	.52	.61	Shiawassee	.56	.84
Isabella	.51	.45	Tuscola	.58	.70
Jackson	.48	.66	Van Buren	.56	.90
Kalamazoo	.53	.72	Washtenaw	.53	.47
Kalkaska	.83	.48	Wayne	.61	.44
Kent	.41	.52	Wexford	.71	.75
Keweenaw	.42	.82	State	.57	.55

1. International List number, 1939.

Note: Rates based on less than 200 deaths during ten years are underscored.

Source: Annual Report, Michigan Department of Health, 1935-1944, Numbers 64-74, Table 16.

Twelve Lowest Death Rates from Pneumonia		Twelve Highest Death Rates from Pneumonia	
Ottawa	.29	Clare	.91
Kent	.41	Lake	.83
Keweenaw	.42	Kalkaska	.83
Iosco	.42	Montmorency	.83
Ingham	.42	Mackinac	.77
Mason	.44	Alger	.76
Midland	.44	Livingston	.74
Alpena	.45	St. Joseph	.73
Allegan	.47	Branch	.72
Jackson	.48	Muskegon	.71
Dickinson	.48	Wexford	.71
Alcona	.48	Antrim	.71

Coastal counties predominate among the low death rate group. They include Iosco, Alpena, and Alcona on the east coast; Allegan, Ottawa, and Mason on the west coast; and Keweenaw and Dickinson in the Upper Peninsula. Six of the twelve counties with high rates are in northern Michigan, two are in the Upper Peninsula, and four are in southern Michigan. The highest death rate from pneumonia is .91 in Clare and the lowest is .29 in Ottawa county.

6. Nephritis. The sixth principal cause of death in Michigan is nephritis, the rate being .55 per 1,000 population. This disease is a common cause of death in later life, and it tends to have high rates in counties where other chronic diseases take a large toll. (See Table 7.4 and Figure 7.8) Wayne county's low death rate of .44 forces the rate for the State downward. In Wayne and five other counties, nephritis ranks seventh as the principal cause of death, but in 44 of the counties it ranks fifth or above. Because of Wayne county's low rate nephritis ranks sixth rather than fifth in the State. As might be expected

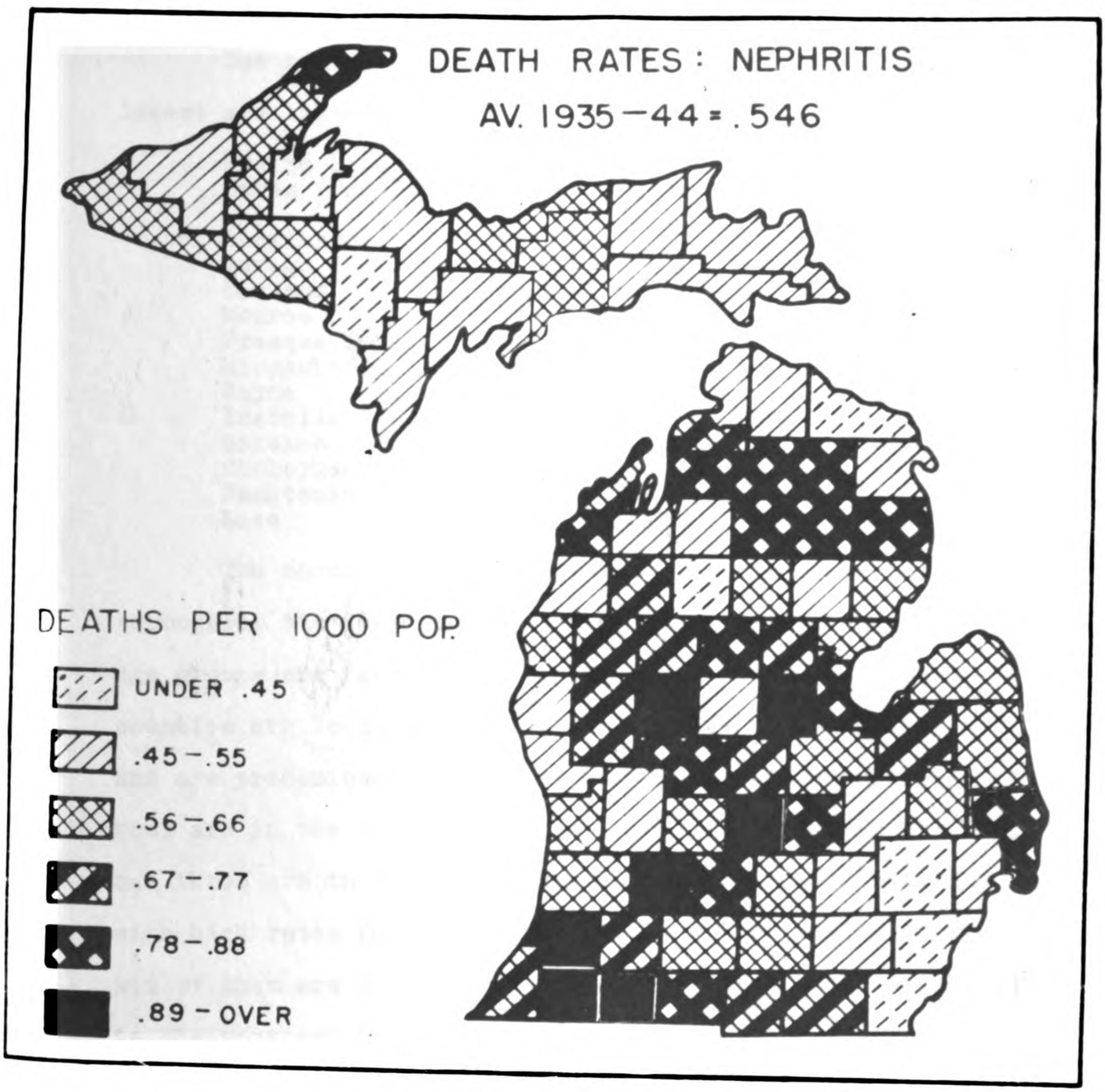


Figure 7.8 (Source: Table 7.4)

from their population composition, counties of the Upper Peninsula have low rates from nephritis. This is indicated by the light cross hatching in Figure 7.7.

The twelve highest death rate counties and the twelve lowest are listed below:

Twelve Lowest Death Rates from Nephritis		Twelve Highest Death Rates from Nephritis	
Dickinson	.32	Cass	1.31
Baraga	.36	Clinton	1.29
Oakland	.40	Midland	1.09
Monroe	.42	St. Joseph	1.02
Presque Isle	.42	Mecosta	.99
Missaukee	.44	Barry	.92
Wayne	.44	Van Buren	.90
Isabella	.45	Montmorency	.89
Genesee	.46	Branch	.88
Cheboygan	.47	Otsego	.86
Washtenaw	.47	Crawford	.85
Luce	.47	Benzie	.85

The counties with low death rates are distributed throughout the State in localities in which the younger age groups are fairly well represented. Five of these counties are located in the southern part of the State and are predominantly urban or have large urban populations; four are in the northern part of Michigan below the Straits; and three are in the Upper Peninsula. The twelve counties with high rates for nephritis are all predominantly rural. Six of them are in the southern part of Michigan and six are in the northern part. No county of the Upper Peninsula is in this group. Midland appears to be exceptional. In this county nephritis ranks second as the principal cause of death, although for other chronic diseases it has low death rates.

7. Tuberculosis. Death rates from tuberculosis are given in Table 7.5 and in Figure 7.9. It is the seventh principal cause of death in Michigan, the rate being .36 per 1,000 population. Without Wayne county, it would rank as the ninth principal cause of death in the State, the rate, less Wayne county, being 25.3. Since it is the sixth principal cause of death in Wayne county, this influences the State rate unfavorably. When counties are ranked from high to low according to death rates from this cause, Wayne occupies eighth position.

The twelve highest and the twelve lowest death rates by county are presented below:

Twelve Lowest Death Rates from Tuberculosis		Twelve Highest Death Rates from Tuberculosis	
Midland	.12	Gogebic	.73
Barry	.12	Houghton	.69
Missaukee	.14	Ontonagon	.59
Gladwin	.14	Keweenaw	.57
Ingham	.15	Dickinson	.57
Hillsdale	.15	Baraga	.56
Eaton	.15	Alger	.55
Oscoda	.16	Wayne	.53
Clinton	.16	Menominee	.52
Ionia	.16	Delta	.47
Ottawa	.16	Marquette	.45
Alcona	.16	Iron	.44

The low rate counties are concentrated in southern Michigan. In contrast, all of the high rate counties are in the Upper Peninsula except Wayne. The highest rate is .73 in Gogebic and the lowest is .12 in Midland. Since tuberculosis is considered a preventable disease, these excessive rates in a particular area must reflect inadequate

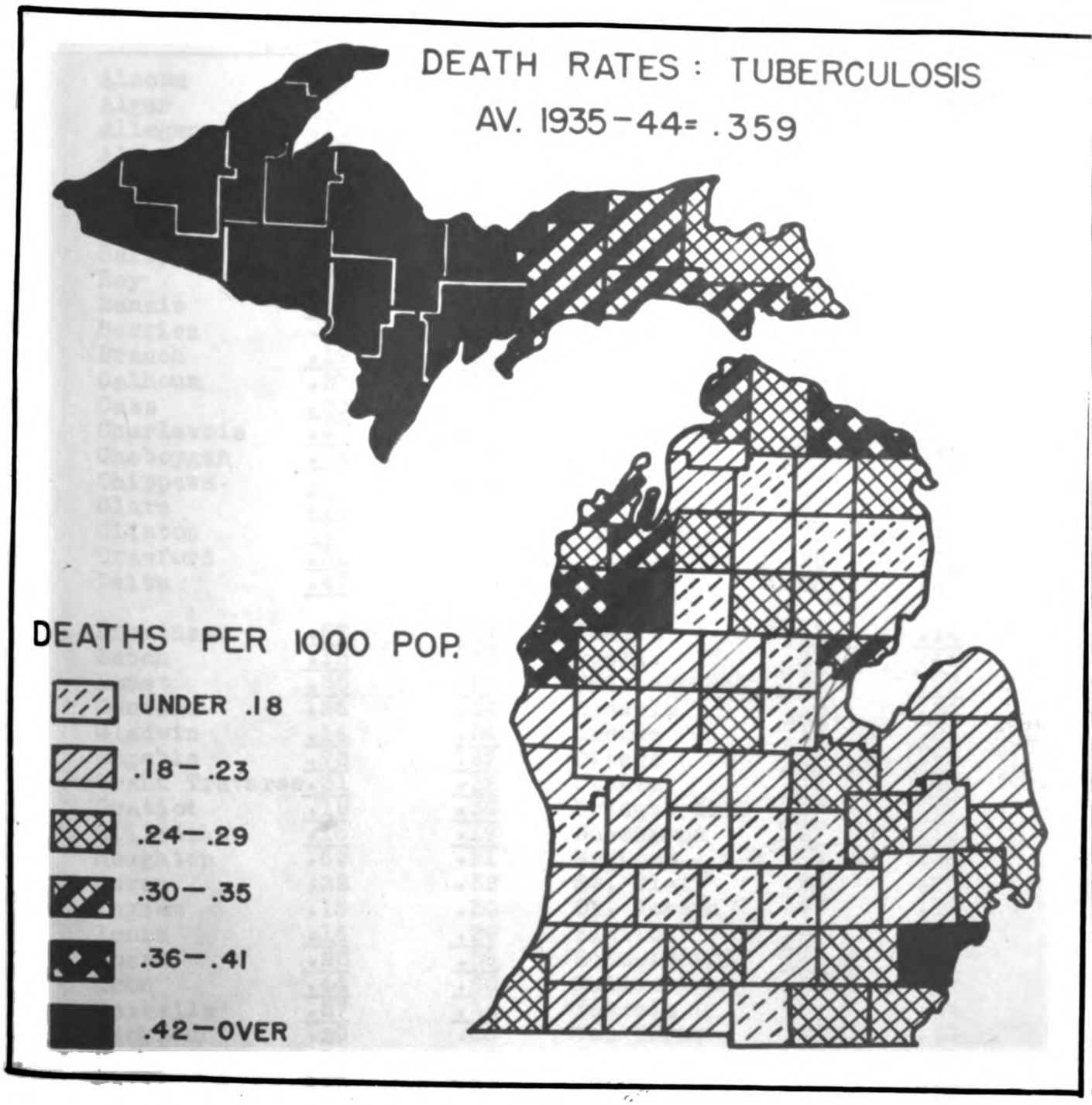


Figure 7.9 (Source: Table 7.5)

Table 7.5 CRUDE DEATH RATES FROM TUBERCULOSIS AND PREMATURE BIRTHS PER 1,000 POPULATION, BY COUNTY, MICHIGAN, AVERAGE 1935-1944 (Based on the 1940 population; by place of residence)

County	Tuberculosis (13-22)	Premature Births (159)[1]	County	Tuberculosis (13-22)	Premature Births (159)[1]
Alcona	.16	.35	Lake	.29	.10
Alger	.55	.41	Lapeer	.21	.16
Allegan	.19	.22	Leelanau	.34	.28
Alpena	.26	.27	Lenawee	.25	.31
Antrim	.20	.23	Livingston	.19	.30
Arenac	.32	.29	Luce	.31	.40
Baraga	.56	.29	Mackinac	.33	.39
Barry	.12	.24	Macomb	.25	.25
Bay	.21	.35	Manistee	.39	.31
Benzie	.28	.32	Marquette	.45	.29
Berrien	.29	.32	Mason	.40	.19
Branch	.19	.29	Mecosta	.20	.27
Calhoun	.27	.35	Menominee	.52	.35
Cass	.23	.23	Midland	.12	.28
Charlevois	.23	.38	Missaukee	.14	.45
Cheboygan	.24	.39	Monroe	.25	.30
Chippewa	.28	.37	Montcalm	.20	.30
Clare	.22	.31	Montmorency	.23	.36
Clinton	.16	.26	Muskegon	.23	.41
Crawford	.21	.37	Newaygo	.18	.28
Delta	.47	.31	Oakland	.20	.31
Dickinson	.57	.27	Oceana	.18	.14
Eaton	.15	.22	Ogemaw	.24	.44
Emmet	.35	.32	Ontonagon	.59	.32
Genesee	.26	.34	Osceola	.19	.24
Gladwin	.14	.28	Oscoda	.16	.24
Gogebic	.73	.27	Otsego	.17	.22
Grand Traverse	.31	.32	Ottawa	.16	.20
Gratiot	.18	.30	Presque Isle	.37	.27
Hillsdale	.15	.19	Roscommon	.27	.14
Houghton	.69	.21	Saginaw	.29	.30
Huron	.22	.32	St. Clair	.25	.27
Ingham	.15	.30	St. Joseph	.22	.20
Ionia	.16	.20	Sanilac	.23	.22
Iosco	.23	.30	Schoolcraft	.35	.29
Iron	.44	.23	Shiawassee	.17	.31
Isabella	.27	.30	Tuscola	.22	.24
Jackson	.20	.26	Van Buren	.23	.23
Kalamazoo	.19	.23	Washtenaw	.26	.25
Kalkaska	.25	.31	Wayne	.53	.25
Kent	.21	.21	Wexford	.43	.36
Keweenaw	.57	.22	State	.36	.27

1. International List number, 1939.

Note: Rates based on less than 200 deaths during ten years are underscored.

Source: Annual Report, Michigan Department of Health, 1935-1944, Numbers 64-74, Table 16.

social planning in the field of health. Franklin Roosevelt in discussing public health conditions in New York while Governor of that State said, "...there is no reason for tuberculosis to be twice as prevalent in some counties as in others;..."[1] Vance associates high rates for tuberculosis with areas in which standards of living are low. He says, "Preventable diseases of youth and middle age, like tuberculosis, influenza, and diseases of infancy are highest in regions of low living standards."[2] If a mean standard of living measure[3] is computed for the twelve counties with the lowest death rates and for those with the highest, those counties with the highest rates have the lowest standard of living index. The mean index was 102 for counties with low rates and 96 for counties with high rates.[4] Thus, these data tend to substantiate the conclusion that there is an inverse relationship between size of death rate from tuberculosis and the standard of living of the area.

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1. Roosevelt, Franklin D., The Governor's Foreword, from Public Health in New York State, Department of Health, Albany, New York, 1932, p. 7.

2. Vance, Rupert B., op. cit., p. 341.

3. The standard of living measures employed here are those used in Hospital Resources and Needs, Michigan Hospital Survey, op. cit., Table 13, p. 66.

4. The standard of living measures for the counties with the twelve lowest rates for tuberculosis are: Midland 103, Barry 107, Missaukee 91, Gladwin 91, Ingham 116, Hillsdale 104, Eaton 108, Oscoda 87, Clinton 108, Ionia 107, Ottawa 114, and Alcona 90. Those for the counties with the twelve highest rates are: Gogebic 98, Houghton 98, Ontonagon 90, Keweenaw 89, Dickinson 101, Baraga 88, Alger 91, Wayne 112, Menominee 97, Delta 98, Marquette 98, and Iron 94.

8. Premature Births. Table 7.5 gives the ten-year average annual number of deaths from premature births per 1,000 population for each county and in Figure 7.10 they are presented graphically. Premature birth is the eighth principal cause of death for the State, and for 25 of the 83 counties. The death rate for the State is .27. In 23 counties, this is the seventh principal cause of death while in one county, Missaukee (which has the highest death rate in Michigan from premature births), it ranks sixth. It is interesting to observe that in the belt of counties running from Genesee to Presque Isle in which death rates from chronic diseases are ordinarily low, rates from premature births are higher than the State average. This is shown by the cross hatching in Figure 7.10.

The counties that have the twelve lowest and those that have the twelve highest rates are as follows:

Twelve Lowest Death Rates from Premature Births		Twelve Highest Death Rates from Premature Births	
Lake	.10	Missaukee	.45
Roscommon	.14	Ogemaw	.44
Oceana	.14	Muskegon	.41
Lapeer	.16	Alger	.41
Mason	.19	Luce	.40
Hillsdale	.19	Mackinac	.39
Ionia	.20	Cheboygan	.39
Ottawa	.20	Charlevoix	.38
St. Joseph	.20	Chippewa	.37
Houghton	.21	Crawford	.37
Kent	.21	Montmorency	.36
Sanilac	.22	Wexford	.36

In general, the high rates from premature births are found in the northern part of lower Michigan and in the eastern part of the Upper Peninsula. Muskegon is the only

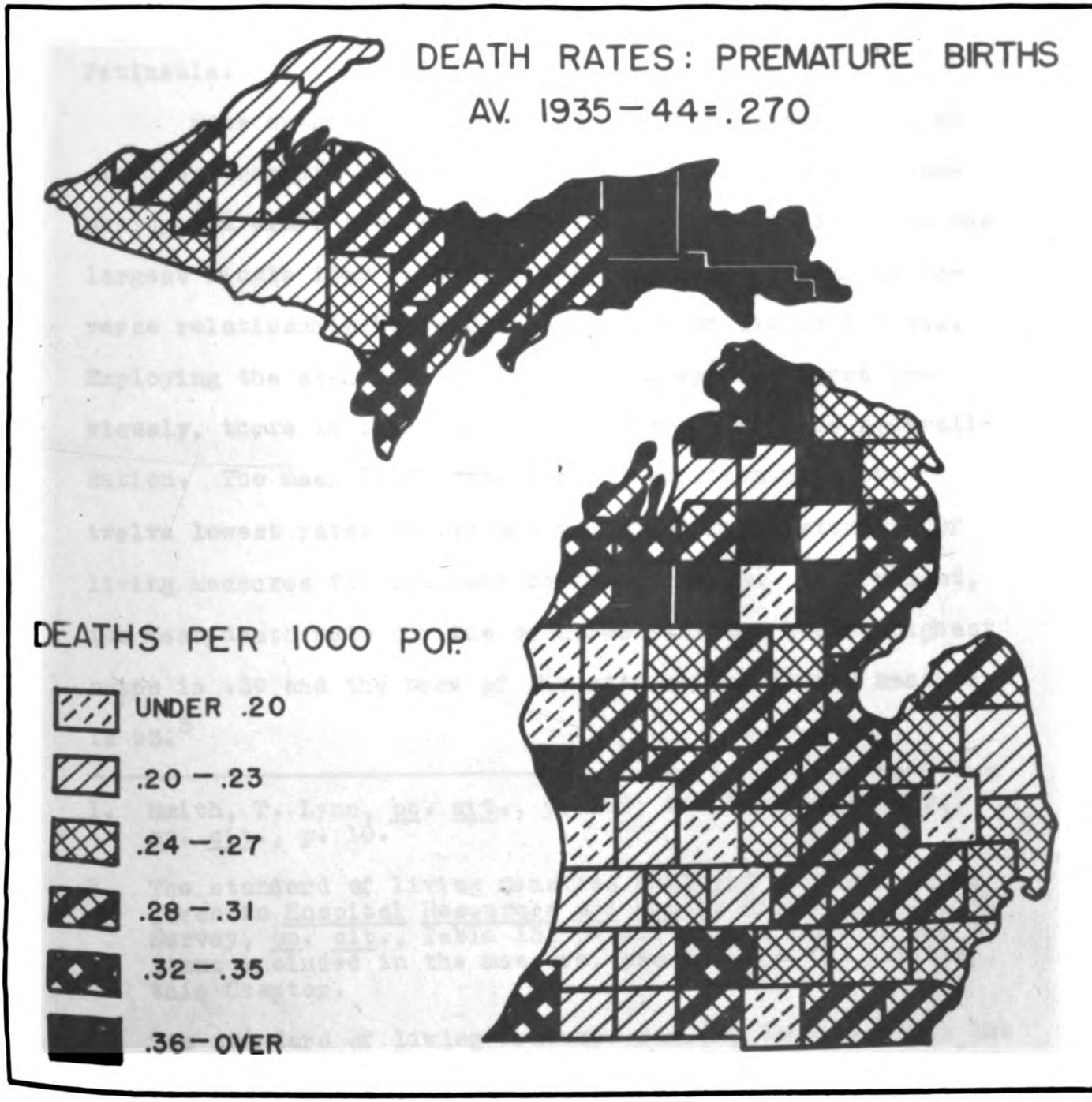


Figure 7.10 (Source: Table 7.5)

county in the southern half of the State listed in this group. On the other hand, seven of the counties with the twelve lowest death rates are located in the southern part of the State and only one, Houghton, is found in the Upper Peninsula.

Some authorities[1] consider the infant death rate an excellent measure of the general level of living of a community and since the death rate from premature births is the largest single item in this group, one might assume an inverse relationship between it and level of living indices. Employing the standard of living measures[2] mentioned previously, there is some evidence in support of this generalization. The mean death rate for the counties with the twelve lowest rates is .18 and the mean of the standard of living measures for the same counties is 102. In contrast, the mean death rate for the counties with the twelve highest rates is .39 and the mean of the standard of living measures is 93.[3]

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1. Smith, T. Lynn, op. cit., p. 168; and Tate, Leland B., op. cit., p. 10.

2. The standard of living measures employed here are those given in Hospital Resources and Needs, Michigan Hospital Survey, op. cit., Table 13, p. 66. For a list of the items included in the measure, see Footnote 1, p.177of this Chapter.

3. The standard of living measures for the counties with the twelve lowest death rates from premature births are: Lake 86, Roscommon 94, Oceana 95, Lapeer 102, Mason 103, Hillsdale 104, Ionia 107, Ottawa 114, St. Joseph 108, Houghton 98, Kent 114, and Sanilac 99. Those for counties with the twelve highest rates from premature births are: Missaukee 91, Ogemaw 86, Muskegon 108, Alger 91, Luce 85, Mackinac 87, Cheboygan 94, Charlevoix 99, Chippewa 96, Crawford 92, Montmorency 83, and Wexford 101.

9. Diabetes mellitus. The distribution of death rates from diabetes mellitus is shown in Table 7.6 and in Figure 7.11. The death rate for the State from this cause is .26. There are 20 counties in which diabetes ranks seventh rather than ninth as a principal cause of death. Some of these counties such as Branch, Cass, and Allegan, have large proportions of their numbers above 65 years of age, but others, for example those in the Upper Peninsula, do not have old aged populations. Diabetes, however, is not considered primarily a disease of old age, but may be expected in any age group. Dr. Bortz states, "Diabetes is most likely to appear between the ages of fifty and sixty. Following sixty, statistics show that there is a decrease in the chances for developing diabetes." But he also makes the following observation, "In the decade past, the mortality rate from diabetes in the group under forty-five years of age has gradually decreased, while it has steadily increased in the age group of sixty-five years or more."[1]

Twelve Lowest Death Rates from Diabetes Mellitus		Twelve Highest Death Rates from Diabetes Mellitus	
Otsego	.10	Keweenaw	.45
Kalkaska	.12	Mecosta	.44
Luce	.13	Manistee	.40
Baraga	.15	Houghton	.40
Oscoda	.16	Crawford	.40
Iosco	.18	St. Joseph	.38
Genesee	.18	St. Clair	.38
Midland	.18	Lake	.38
Oakland	.19	Oceana	.37
Ontonagon	.20	Menominee	.37
Presque Isle	.20	Shiawassee	.36
Gladwin	.21	Wexford	.36

1. Bortz, Edward L., "Diabetes Mellitus," from Stieglitz, Edward J., op. cit., pp. 226-227.

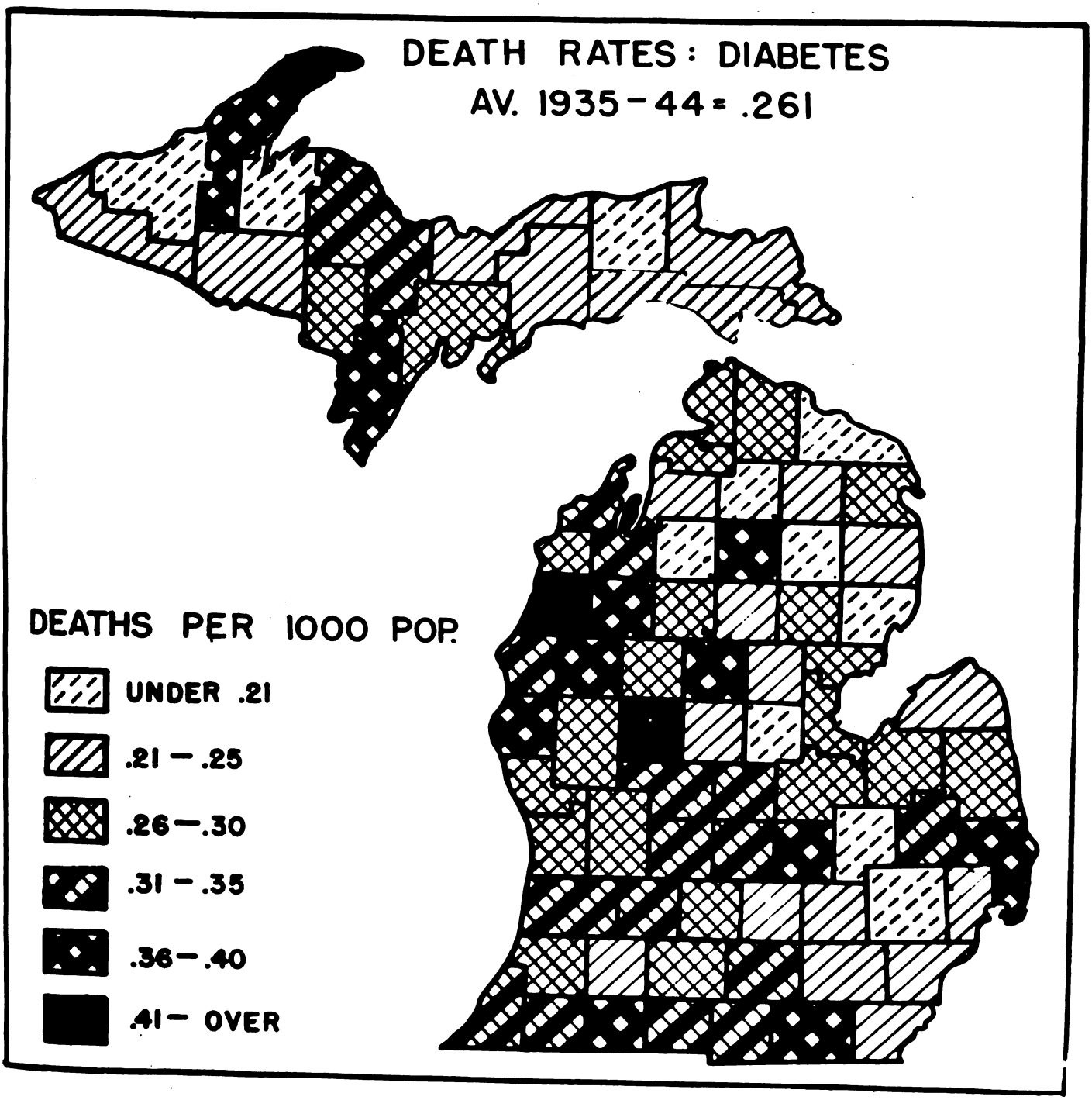


Figure 7.11 (Source: Table 7.6)

Table 7.6 CRUDE DEATH RATES FROM DIABETES MELLITUS AND ARTERIOSCLEROSIS PER 1,000 POPULATION, BY COUNTY, MICHIGAN, AVERAGE 1935-1944 (Based on the 1940 population; by place of residence)

County	Diabetes (61)	Arterio-sclerosis (97)[1]	County	Diabetes (61)	Arterio-sclerosis (97)[1]
Alcona	.22	.18	Lake	.38	.08
Alger	.25	.13	Lapeer	.34	.25
Allegan	.34	.30	Leelanau	.33	.12
Alpena	.30	.29	Lenawee	.36	.41
Antrim	.23	.29	Livingston	.24	.54
Arenac	.27	.11	Luce	.13	.07
Baraga	.15	.14	Mackinac	.24	.15
Barry	.31	.39	Macomb	.25	.09
Bay	.31	.14	Manistee	.40	.41
Benzie	.31	.53	Marquette	.33	.16
Berrien	.32	.20	Mason	.32	.37
Branch	.36	.29	Mecosta	.44	.57
Calhoun	.27	.25	Menominee	.37	.19
Cass	.35	.27	Midland	.18	.10
Charlevoix	.28	.20	Missaukee	.30	.07
Cheboygan	.26	.37	Monroe	.23	.17
Chippewa	.24	.21	Montcalm	.31	.47
Clare	.36	.28	Montmorency	.23	.13
Clinton	.32	.42	Muskegon	.28	.16
Crawford	.40	.21	Newaygo	.30	.26
Delta	.30	.16	Oakland	.19	.16
Dickinson	.30	.20	Oceana	.37	.57
Eaton	.29	.39	Ogemaw	.26	.16
Emmet	.28	.28	Ontonagon	.20	.11
Genesee	.18	.22	Osceola	.31	.32
Gladwin	.21	.13	Oscoda	.16	.16
Gogebic	.25	.14	Otsego	.10	.12
Grand Traverse	.32	.16	Ottawa	.29	.24
Gratiot	.35	.39	Presque Isle	.20	.10
Hillsdale	.32	.60	Roscommon	.22	.16
Houghton	.40	.15	Saginaw	.28	.24
Huron	.24	.30	St. Clair	.38	.24
Ingham	.25	.16	St. Joseph	.38	.52
Ionia	.32	.49	Sanilac	.27	.19
Iosco	.18	.37	Schoolcraft	.22	.07
Iron	.26	.06	Shiawassee	.36	.42
Isabella	.23	.42	Tuscola	.29	.19
Jackson	.31	.33	Van Buren	.29	.30
Kalamazoo	.25	.25	Washtenaw	.24	.41
Kalkaska	.12	.35	Wayne	.23	.09
Kent	.29	.28	Wexford	.36	.15
Keweenaw	.45	.30	State	.26	.19

1. International List number, 1939.

Note: Rates based on less than 200 deaths during ten years are underscored.

Source: Annual Report, Michigan Department of Health, 1935-1944, Numbers 64-74, Table 16.

The counties with the twelve lowest and the twelve highest death rates are given on the preceding page.

Three Upper Peninsula counties are among those with low rates, but three other counties in the same area are also listed among those with high rates. Six of the high mortality counties, namely Oceana, Keweenaw, Manistee, Houghton, St. Clair, and Menominee are on the coast. The highest rate is .45 in Keweenaw and the lowest is .10 in Otsego county.

10. Arteriosclerosis. Death rates from this cause are given in Table 7.6. The rate for the State is only .19 per 1,000 population. Since some of the county rates are small, they are given per 10,000 population. The counties with the twelve lowest rates and those with the twelve highest are as follows:

Twelve Lowest Death Rates from Arteriosclerosis per 10,000 population		Twelve Highest Death Rates from Arteriosclerosis per 10,000 population	
Iron	.64	Hillsdale	5.98
Luce	.67	Mecosta	5.74
Schoolcraft	.74	Oceana	5.67
Missaukee	.75	Livingston	5.42
Lake	.83	Benzie	5.26
Wayne	.86	St. Joseph	5.20
Macomb	.91	Ionia	4.87
Presque Isle	.98	Montcalm	4.65
Midland	1.00	Clinton	4.24
Arenac	1.08	Shiawassee	4.22
Ontonagon	1.14	Isabella	4.16
Leelanau	1.19	Manistee	4.12

Seven of the counties with high rates are in southern Michigan, and the remainder are in the northern half of lower Michigan. No Upper Peninsula county is among the high rate group. In contrast, four of the low mortality counties are in the Upper Peninsula, namely, Iron, Luce, Schoolcraft, and

Ontonagon. Six of the remaining counties are in northern Michigan, and two are the industrial or semi-industrial counties of Wayne and Macomb. The highest rate is 5.98 in Hillsdale county and the lowest is .64 in Iron.

11. Suicide. The incidence of death from suicide is given per 10,000 population in Table 7.7. The average annual rate for the State is 1.2. In five counties, Baraga, Lake, Otsego, Hillsdale, and Oceana, suicide death rates exceed those of some of the ten principal causes, although for the State suicide ranks much lower. Counties in which suicide ranks ninth or tenth also have high accident death rates as indicated by the following: (See Appendix II, Table 1)

	Rank of Accident
Baraga	2
Hillsdale	4
Lake	4
Luce	2
Alger	2
Arenac	2

The twelve highest and the twelve lowest death rates from suicide, by county, are given below:

Twelve Lowest Death Rates from Suicide	per 10,000	Twelve Highest Death Rates from Suicide	per 10,000
Kalkaska	.19	Baraga	2.67
Manistee	.87	Keweenaw	2.50
Osceola	.90	Cass	2.24
Presque Isle	.90	Ontonagon	2.20
Antrim	.91	Alcona	2.20
Luce	.94	Sanilac	2.11
Emmet	.95	Lenawee	2.11
Ottawa	.96	Lake	2.08
Kent	.97	Eaton	2.08
Muskegon	.98	Van Buren	2.08
Midland	1.00	Hillsdale	2.06
Missaukee	1.00	Calhoun	1.93

Table 7.7 CRUDE DEATH RATES FROM SUICIDE PER 1,000 POPULATION, BY COUNTY, MICHIGAN, AVERAGE 1935-1944 (Based on the 1940 population; by place of residence)

County	Suicide (163-164)[1]	County	Suicide (163-164)[1]
Alcona	.22	Lake	.21
Alger	.14	Lapeer	.11
Allegan	.13	Leelanau	.12
Alpena	.12	Lenawee	.21
Antrim	.09	Livingston	.19
Arenac	.13	Luce	.09
Baraga	.27	Mackinac	.13
Barry	.19	Macomb	.13
Bay	.11	Manistee	.09
Benzie	.12	Marquette	.17
Berrien	.18	Mason	.15
Branch	.19	Mecosta	.18
Calhoun	.19	Menominee	.11
Cass	.22	Midland	.10
Charlevois	.17	Missaukee	.10
Cheboygan	.11	Monroe	.14
Chippewa	.15	Montcalm	.10
Clare	.13	Montmorency	.13
Clinton	.16	Muskegon	.10
Crawford	.19	Newaygo	.15
Delta	.13	Oakland	.11
Dickinson	.13	Oceana	.18
Eaton	.21	Ogemaw	.11
Emmet	.09	Ontonagon	.22
Genesee	.11	Osceola	.09
Gladwin	.14	Oscoda	.12
Gogebic	.18	Otsego	.12
Grand Traverse	.13	Ottawa	.10
Gratiot	.14	Presque Isle	.09
Hillsdale	.21	Roscommon	.16
Houghton	.17	Saginaw	.10
Huron	.17	St. Clair	.17
Ingham	.12	St. Joseph	.12
Ionia	.15	Sanilac	.21
Iosco	.12	Schoolcraft	.12
Iron	.19	Shiawassee	.13
Isabella	.10	Tuscola	.13
Jackson	.15	Van Buren	.21
Kalamazoo	.14	Washtenaw	.16
Kalkaska	.02	Wayne	.11
Kent	.10	Wexford	.14
Keweenaw	.25	State	.12

1. International List number, 1939.

Note: Rates based on less than 200 deaths during ten years are underscored.

Source: Annual Report, Michigan Department of Health, 1935-1944, Numbers 64-74, Table 16.

Of the twelve low rate counties, eight, Kalkaska, Manistee, Osceola, Presque Isle, Antrim, Emmet, Midland, and Missaukee are in northern Michigan; one is in the Upper Peninsula, namely, Luce; and the remaining three are Ottawa, Muskegon, and Kent in southwestern Michigan. The lowest death rate from suicide is .19 in Kalkaska county and the highest rate is 2.67 in Baraga. Seven of the twelve counties with high rates from suicide are rural counties in southern Michigan. These counties are characterized also by high death rates from chronic diseases. These data support the findings of the Metropolitan Life Insurance Company reported by Byrd. They found that "among males ill health ranked as the leading motive, accounting for nearly 40 percent of all attempts at suicide, whether successful or not."[1] It will be recalled that suicide in Michigan is essentially a male white behavior pattern.[2] Under these circumstances one would expect a high incidence of suicide in these rural counties.

Infant Mortality Rates

The infant death rates are given in Table 7.8 and Figure 7.12. In this Table, the average (1935-1944) annual number of deaths under one year for each county is related to the annual number of live births. Ten-year average

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1. Byrd, Oliver E., op. cit., p. 197, from Metropolitan Life Insurance Company, "Why Do People Kill Themselves?" Statistical Bulletin, 26, No. 2, February 1945, pp. 9-10.

2. See Chapter V, p. 127 of this dissertation.

INFANT MORTALITY RATES
(by place of residence)
MICHIGAN, TEN YEAR AVE, 1935-1944 = 42.0

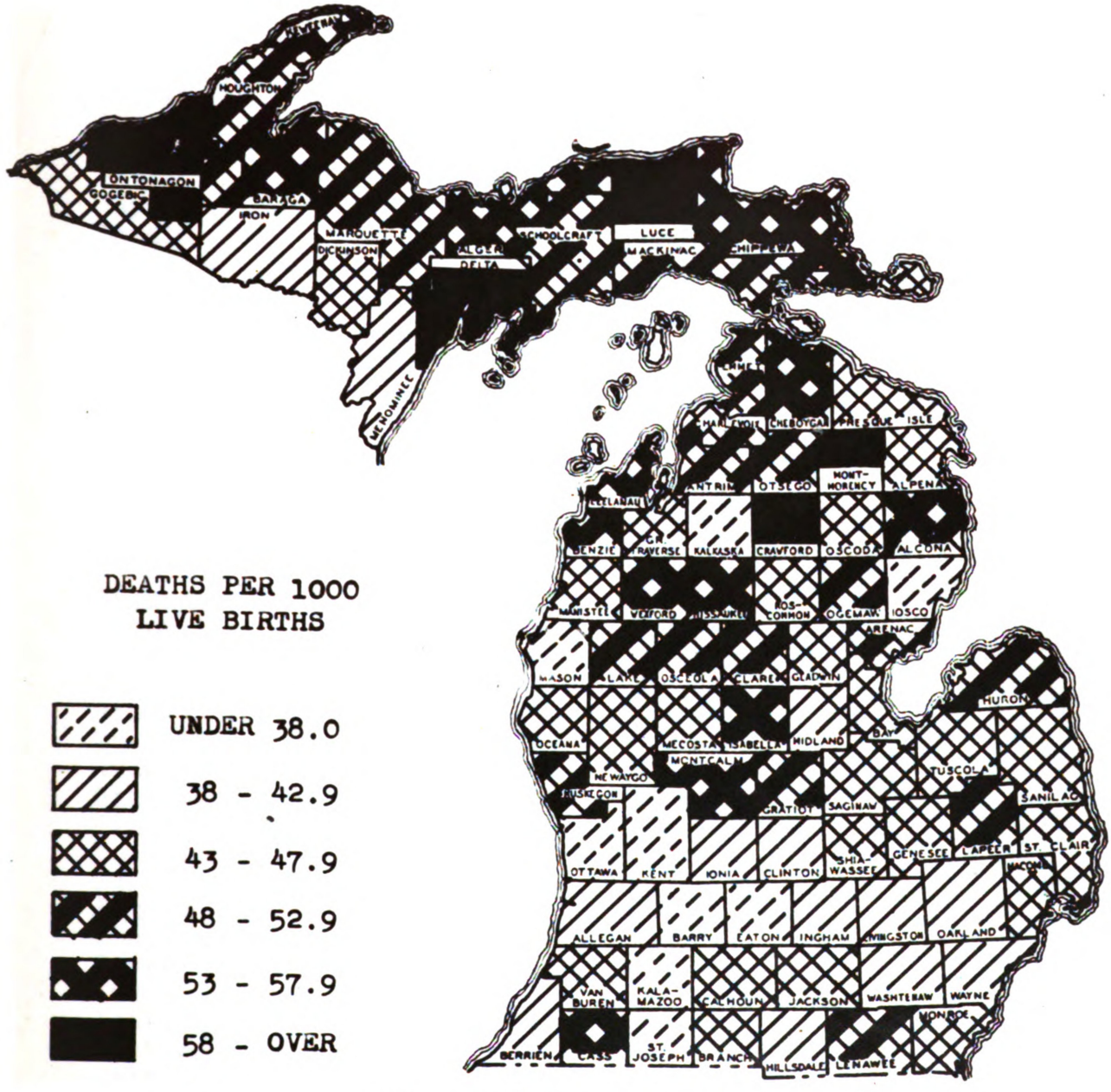


Figure 7.12 (Source: Table 7.8)

Table 7.8 INFANT MORTALITY RATES PER 1,000 LIVE BIRTHS IN COUNTIES OF MICHIGAN, TEN YEAR AVERAGES, 1935-1944[1] (Exclusive of stillbirths. By place of residence)

State and County	Rate	State and County	Rate
Alcona	54.56	Lake	49.57
Alger	57.14	Lapeer	48.45
Allegan	41.33	Leelanau	56.89
Alpena	44.16	Lenawee	48.67
Antrim	48.67	Livingston	42.54
Arenac	48.50	Luce	67.06
Baraga	56.01	Mackinac	52.48
Barry	35.26	Macomb	43.14
Bay	47.07	Manistee	46.71
Benzie	55.86	Marquette	49.17
Berrien	41.53	Mason	37.91
Branch	43.03	Mecosta	45.69
Calhoun	47.20	Menominee	40.55
Cass	53.66	Midland	42.06
Charlevoix	52.91	Missaukee	55.91
Cheboygan	53.62	Monroe	44.66
Chippewa	53.91	Montcalm	53.52
Clare	49.33	Montmorency	60.76
Clinton	39.38	Muskegon	52.86
Crawford	68.24	Newaygo	47.13
Delta	59.60	Oakland	40.50
Dickinson	45.37	Oceana	47.48
Eaton	37.33	Ogemaw	51.65
Emmet	48.97	Ontonagon	59.55
Genesee	43.54	Osceola	49.62
Gladwin	46.90	Oscoda	46.24
Gogebic	45.96	Otsego	49.12
Grand Traverse	46.23	Ottawa	30.37
Gratiot	51.20	Presque Isle	44.33
Hillsdale	39.90	Roscommon	46.02
Houghton	51.87	Saginaw	44.56
Huron	51.22	St. Clair	47.74
Ingham	41.11	St. Joseph	32.61
Ionia	42.66	Sanilac	45.80
Iosco	31.61	Schoolcraft	52.21
Iron	39.18	Shiawassee	47.99
Isabella	54.44	Tuscola	46.37
Jackson	45.77	Van Buren	44.68
Kalamazoo	34.06	Washtenaw	39.93
Kalkaska	37.49	Wayne	38.45
Kent	35.02	Wexford	53.98
Keweenaw	56.91	State	42.02

1. Ten year average births and deaths.
Source: Computed from the Reports of the Michigan Department of Health, 1935-1944, Table 8.
Note: Rates based on less than 200 deaths during ten years are underscored.

infant death rates are not as liable to be influenced unduely by unusual conditions in a county as are annual rates. This is important in small counties where infant death rates are based on a small number of deaths. For example in Oscoda county, only 24 deaths occurred during the ten year period. Observation of Figure 7.12 shows that below the Bay-Muskegon line, only six counties have infant death rates in the upper three frequencies, 48 and above, while above the line there are 18 counties with rates in this range.

The twelve counties with the highest and the twelve with the lowest infant death rates are given below:

Twelve Lowest Death Rates from Infant Deaths		Twelve Highest Death Rates from Infant Deaths	
Ottawa	30.37	Crawford	68.24
Iosco	31.61	Luce	67.06
St. Joseph	32.61	Montmorency	60.76
Kalamazoo	34.06	Delta	59.60
Kent	35.02	Ontonagon	59.55
Barry	35.26	Alger	57.14
Eaton	37.33	Keweenaw	56.91
Kalkaska	37.49	Leelanau	56.89
Mason	37.91	Baraga	56.01
Wayne	38.45	Missaukee	55.91
Iron	39.18	Benzie	55.86
Clinton	39.38	Alcona	54.56

Among the high rate counties six are in the Upper Peninsula, and the remaining six are in the upper part of the Lower Peninsula.

Seven of the twelve counties with low death rates for infants, namely Ottawa, Kent, St. Joseph, Kalamazoo, Barry, Eaton, and Clinton, are concentrated in the southwestern part of Michigan. The remaining counties in this group include three counties in the northern part of the Lower

Peninsula, Iron in the Upper Peninsula, and Wayne county. The lowest infant death rate is 30.37 in Ottawa and the highest is 68.24 in Crawford county.

As was true for tuberculosis and premature births, variations in the infant death rate tend to be associated with levels of living. In the twelve counties with low rates the mean of the standard of living measures[1] is 108 whereas the mean for counties with high rates is 91.

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1. The standard of living measures for the counties with low death rates are: Ottawa 114, Iosco 97, St. Joseph 108, Kalamazoo 113, Kent 114, Barry 107, Eaton 108, Kalkaska 82, Mason 103, Wayne 112, Iron 94, Clinton 108. Those for counties with high death rates are: Crawford 92, Luce 85, Montmorency 83, Delta 98, Ontonagon 90, Alger 91, Keweenaw 89, Leelanau 96, Baraga 88, Missaukee 91, Benzie 102, and Alcona 90. See Hospital Resources and Needs, Michigan Hospital Survey, Table 13,p.66.

CHAPTER VIII

MORTALITY DATA BY COUNTY: (CONTINUED)
RESIDENTIAL VARIATION[1]

Crude Resident Death Rates

The ten-year average crude death rates[2] in rural and urban areas[3] of the State are respectively 10.48 and 9.88, their difference being .60 per 1,000 population. The difference between the crude death rates in the same areas for the year 1940 is 1.6, the rural and urban rates being 11.0 and 9.4 respectively. Similarly, in the counties, corresponding differences between ten-year averages

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1. The term "residence" refers to the rural and urban classes of population as defined by the United States Bureau of the Census. "Rural" includes the population living outside of incorporated places of less than 2,500, while "urban" designates all population living within incorporated places of 2,500 population or more.

2. These are crude resident death rates based on deaths which have been allocated to place of residence. Deaths classified by place of occurrence are usually referred to as "recorded", but these are not employed in this analysis. In Michigan, deaths have been allocated to place of residence since 1935.

3. In some of the counties of Michigan, there are towns whose populations increased to 2,500 prior to 1940 which have been granted [redacted] incorporation charters; these were accordingly classified as urban places by the United States Bureau of the Census in April 1940. The 1940 Annual Report of the Michigan State Department of Health classified the deaths occurring in these particular counties during the calendar year of 1940 as rural or urban according to the United States Census of 1930, because 1940 census figures were not available when the report was issued. The death rates of counties by residence in this chapter, being ten-year averages 1935-1944, also define the rural and urban population of each county according to the United States Census of 1930. Counties which have urban places in 1940 which were not so classified in 1930 are indicated.

are likely to be less than for a single year. An accident taking the lives of five or six people, an epidemic, or an infection in the maternity ward of a single hospital resulting in several deaths, may materially influence the total annual death rate or those for specific causes in a given area, particularly, where the number of deaths under normal circumstances is small. The ten-year average death rate tends to smooth out such variations, and it is used throughout this chapter.

Rural Mortality Rates. The death rate for the rural segment of each county is presented in Table 8.1 and is shown graphically in Figure 8.1. Over half, or 56 percent of the 83 counties, have death rates above 11.00. These counties, for the most part, lie in the western half of the State or along the southern border. Less than half of the counties in the Upper Peninsula have rates as high as 11.0 and in no case do they exceed 11.9.

There is a belt of low rates, 9.9 or below, in the eastern part of the State running from Monroe county to Gladwin, and a similar pocket of low rates in the western part of the State comprising Muskegon, Ottawa, and Kent. These are, for the most part, predominantly urban counties.

The twelve highest and the twelve lowest death rates are given immediately below:

RURAL DEATH RATES : ALL CAUSES
MICHIGAN AV., 1935-1944 = 10.5

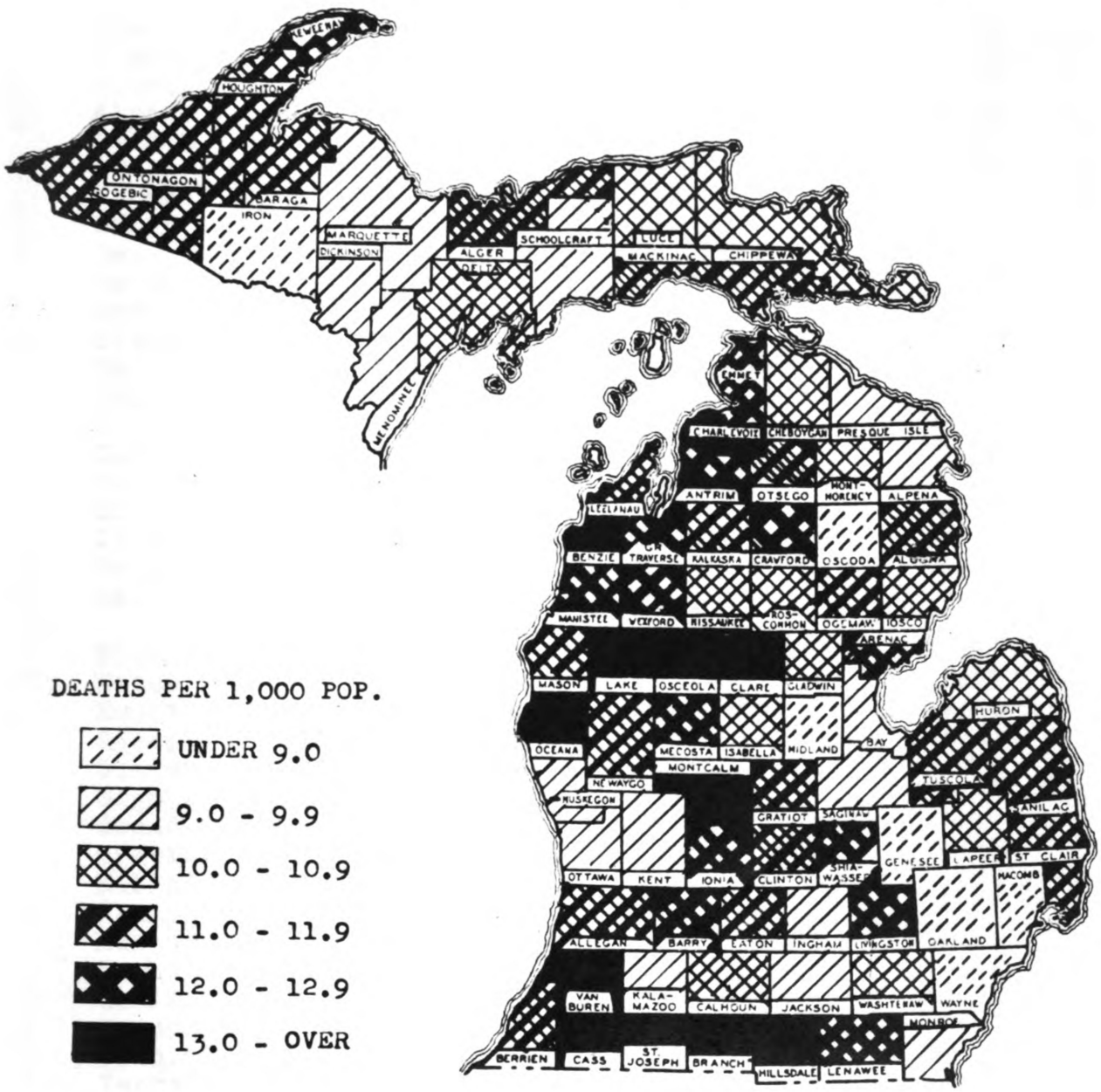


Figure 8.1 (Source: Table 8.1)

Table 8.1 RURAL MORTALITY RATES FROM ALL CAUSES OF DEATH PER 1,000 POPULATION, MICHIGAN COUNTIES, 1935-1944. (All rates are ten-year averages; based on the 1940 population; by place of residence)

State and County	Rural Death Rate	State and County	Rural Death Rate
Alcona	11.64	Lake	13.34
Alger	11.31	Lapeer	10.95
Allegan	11.93	Leelanau	11.25
Alpena	9.05	Lenawee[1]	12.98
Antrim	12.78	Livingston	12.07
Arenac	12.90	Luce[1]	10.25
Baraga[1]	11.07	Mackinac[1]	11.03
Barry	12.64	Macomb[1]	8.76
Bay	9.35	Manistee	12.80
Benzie	13.78	Marquette	9.99
Berrien	11.11	Mason	11.41
Branch	13.57	Mecosta	12.79
Calhoun	10.02	Menominee	9.27
Cass	13.96	Midland	8.37
Charlevoix	13.39	Missaukee	10.57
Cheboygan	10.79	Monroe	9.70
Chippewa	10.87	Montcalm	13.99
Clare	13.02	Montmorency	10.63
Clinton	11.05	Muskegon	9.84
Crawford	12.01	Newaygo[1]	11.87
Delta	10.66	Oakland	8.26
Dickinson	9.30	Oceana	13.67
Eaton	11.66	Ogemaw	11.65
Emmet	12.57	Ontonagon	11.34
Genesee	8.08	Osceola	13.35
Gladwin	10.66	Oscoda	8.93
Gogebic	11.96	Otsego	11.09
Grand Traverse	12.70	Ottawa	9.41
Gratiot[1]	11.99	Presque Isle	9.46
Hillsdale	13.63	Roscommon	10.22
Houghton	11.90	Saginaw	9.36
Huron[1]	10.82	St. Clair	11.17
Ingham	9.63	St. Joseph	14.61
Ionia	12.00	Sanilac	11.92
Iosco	10.97	Schoolcraft	9.62
Iron	8.11	Shiawassee	12.08
Isabella	10.52	Tuscola	11.48
Jackson	9.33	Van Buren	14.39
Kalamazoo	9.31	Washtenaw	10.38
Kalkaska	11.34	Wayne[1]	6.21
Kent	9.27	Wexford	12.87
Keweenaw	12.19	State	10.48

1. Residence according to the 1930 population.
Source: Annual Reports, Michigan Department of Health, 1935-1944, Table 16.

Twelve Lowest Death Rates Rural: All Causes		Twelve Highest Death Rates Rural: All Causes	
Wayne	6.21	St. Joseph	14.61
Genesee	8.08	Van Buren	14.39
Iron	8.11	Montcalm	13.99
Oakland	8.26	Cass	13.96
Midland	8.37	Benzie	13.78
Macomb	8.76	Oceana	13.67
Oscoda	8.95	Hillsdale	13.63
Alpena	9.05	Branch	13.57
Kent	9.27	Charlevoix	13.39
Menominee	9.27	Osceola	13.35
Dickinson	9.30	Lake	13.34
Kalamazoo	9.31	Clare	13.02

From the above data, it may be concluded that the lowest rural death rates are found chiefly in the highly urbanized counties, while the highest rural rates are, by and large, in the wholly or predominantly rural counties of the State.[1]

Urban Mortality Rates. The urban death rates are given in Table 8.2 and are presented graphically in Figure 8.2. These rates are generally higher than the rural rates, 75 percent of the 56 counties with urban populations having rates above 11.0. The highest urban rates are concentrated in southern Michigan and include the best agricultural counties, whereas the lowest urban rates are for the most part in the industrial areas. Rates for the Upper Peninsula

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1. Insofar as crude rates are concerned, this corroborates the findings reported by Loomis who says, "According to the Michigan State College surveys, the more rural the county or area the higher the death rate..." (See Loomis, Charles P., "Measuring Rural Medical Needs," First Annual Michigan Rural Health Conference, Michigan State College, East Lansing, Michigan, 1947, p. 20. If rates are adjusted for age, however the picture may be different. See Chapter IV, Table4.1 p. 68 for State crude and age-adjusted rates by residence.



URBAN DEATH RATES : ALL CAUSES
MICHIGAN AV., 1935-1944 = 9.9

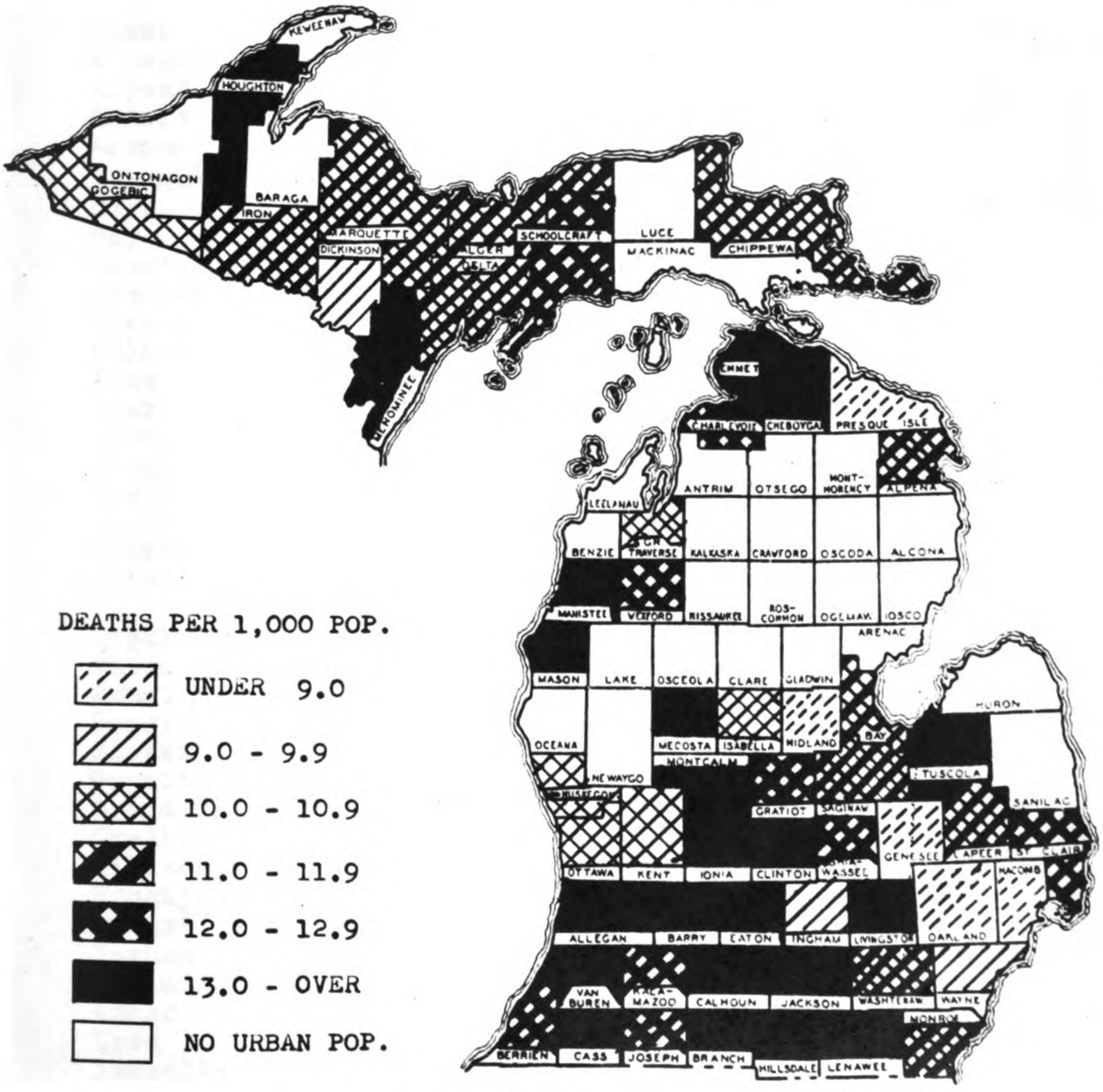


Figure 8.2 (Source: Table 8.2)

Table 8.2 URBAN MORTALITY RATES FROM ALL CAUSES OF DEATH PER 1,000 POPULATION, MICHIGAN COUNTIES, 1935-1944. (All rates are ten-year averages; based on the 1940 population; by place of residence)

State and County	Urban Death Rate	State and County	Urban Death Rate
Alcona	---	Lake	---
Alger	11.05	Lapeer	11.89
Allegan	13.80	Leelanau	---
Alpena	11.24	Lenawee[1]	13.89
Antrim	---	Livingston	16.40
Arenac	---	Luce[1]	---
Baraga[1]	---	Mackinac[1]	---
Barry	15.00	Macomb[1]	8.88
Bay	11.88	Manistee	14.00
Benzie	---	Marquette	11.46
Berrien	12.12	Mason	13.08
Branch	17.13	Mecosta	15.34
Calhoun	13.58	Menominee	13.58
Cass	17.68	Midland	8.30
Charlevoix	12.88	Missaukee	---
Cheboygan	14.21	Monroe	11.10
Chippewa	11.46	Montcalm	13.93
Clare	---	Montmorency	---
Clinton	14.52	Muskegon	10.39
Crawford	---	Newaygo[1]	---
Delta	11.42	Oakland	8.09
Dickinson	9.56	Oceana	---
Eaton	15.13	Ogemaw	---
Emmet	14.19	Ontonagon	---
Genesee	8.67	Osceola	---
Gladwin	---	Oscoda	---
Gogebic	10.16	Otsego	---
Grand Traverse	10.80	Ottawa	10.01
Gratiot[1]	12.83	Presque Isle	8.82
Hillsdale	14.14	Roscommon	---
Houghton	14.01	Saginaw	11.01
Huron[1]	---	St. Clair	12.80
Ingham	9.78	St. Joseph	12.04
Ionia	13.82	Sanilac	---
Iosco	---	Schoolcraft	12.17
Iron	11.01	Shiawassee	12.26
Isabella	10.57	Tuscola	18.66
Jackson	13.07	Van Buren	15.95
Kalamazoo	12.07	Washtenaw	11.26
Kalkaska	---	Wayne[1]	9.01
Kent	10.94	Wexford	12.20
Keweenaw	---	State	9.88

1. Residence according to the 1930 population.
Source: Annual Reports, Michigan Department of Health, 1935-1944, Table 16.

counties fall in the middle ranges, except for Houghton and Menominee where they are high.

The distribution of urban death rates at both extremes are given immediately below:

Twelve Lowest Death Rates Urban: All Causes		Twelve Highest Death Rates Urban: All Causes	
Oakland	8.09	Tuscola	18.66
Midland	8.30	Cass	17.68
Genesee	8.67	Branch	17.13
Presque Isle	8.82	Livingston	16.40
Macomb	8.88	Van Buren	15.95
Wayne	9.01	Mecosta	15.34
Dickinson	9.56	Eaton	15.13
Ingham	9.78	Barry	15.00
Muskegon	10.39	Clinton	14.52
Isabella	10.57	Cheboygan	14.21
Grand Traverse	10.80	Emmet	14.19
Kent	10.94	Hillsdale	14.14

Of the twelve counties with low rates, nine have large urban centers and three, Isabella, Midland, and Presque Isle, are rural counties with small urban populations. On the other hand, all of the twelve counties with high rates are predominantly rural, having small rather than large cities.

Causes of Death in Rural Areas: Non-communicable

Although one might expect the mortality rates from heart diseases, cancer, apoplexy, and nephritis to follow rather uniformly the age characteristics of the counties, there are interesting variations from this expected pattern. From the data given in Table 8.3 and presented graphically in Figures 8.3 to 8.7, the rural mortality from the five leading causes[1] are summarized in the following paragraphs.

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1. Pneumonia is not discussed in Chapter VIII, although its rate is slightly higher than that of nephritis. This appears to be justified in view of the conclusion in previous chapters, namely, that chronic diseases are the major health problems of the State.

RURAL DEATH RATES : HEART
MICHIGAN AV., 1935-1944 : 29.9

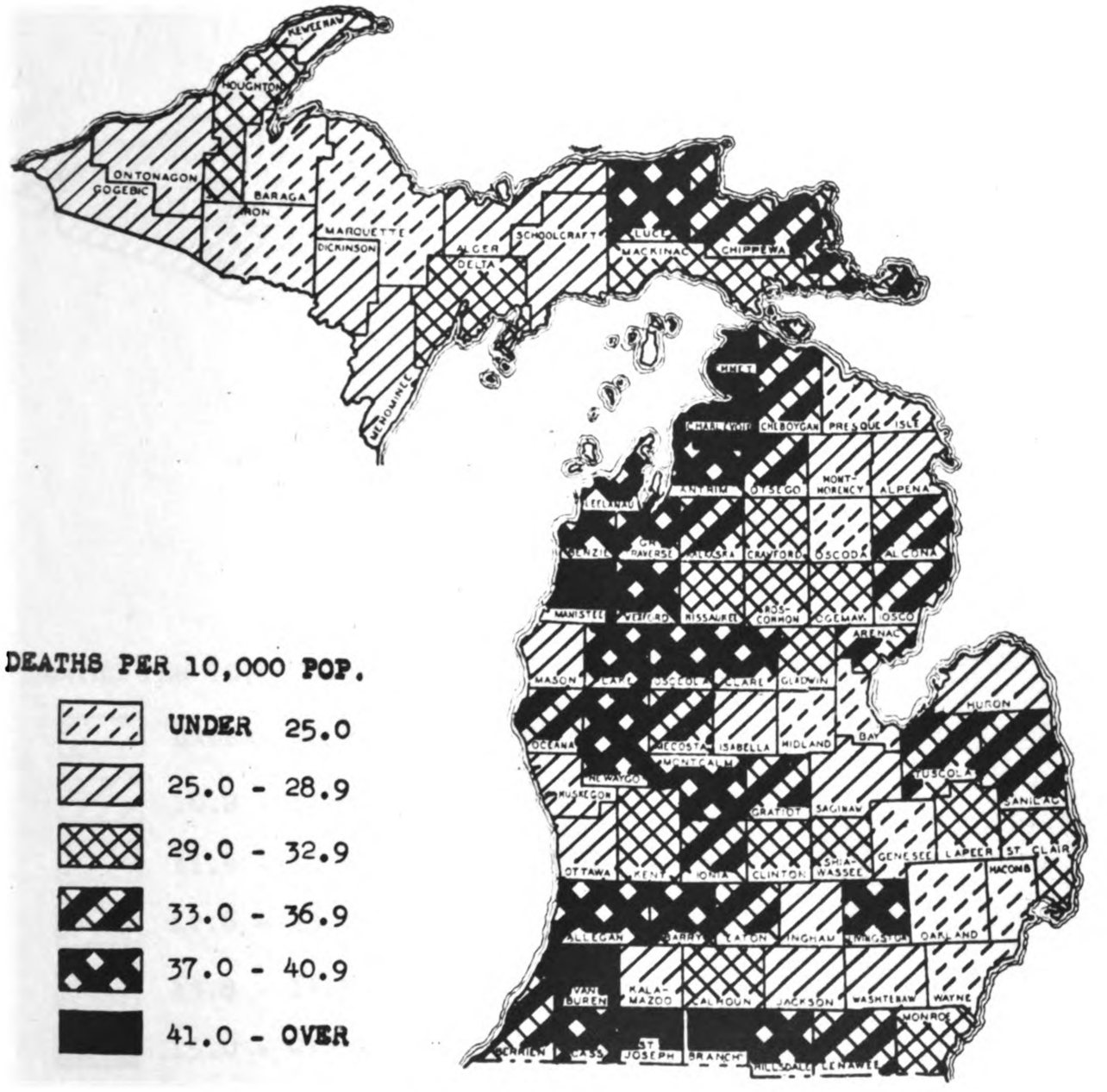


Figure 8.3 (Source: Table 8.3)

RURAL DEATH RATES : CANCER
MICHIGAN AV., 1935 - 1944 = 11.4

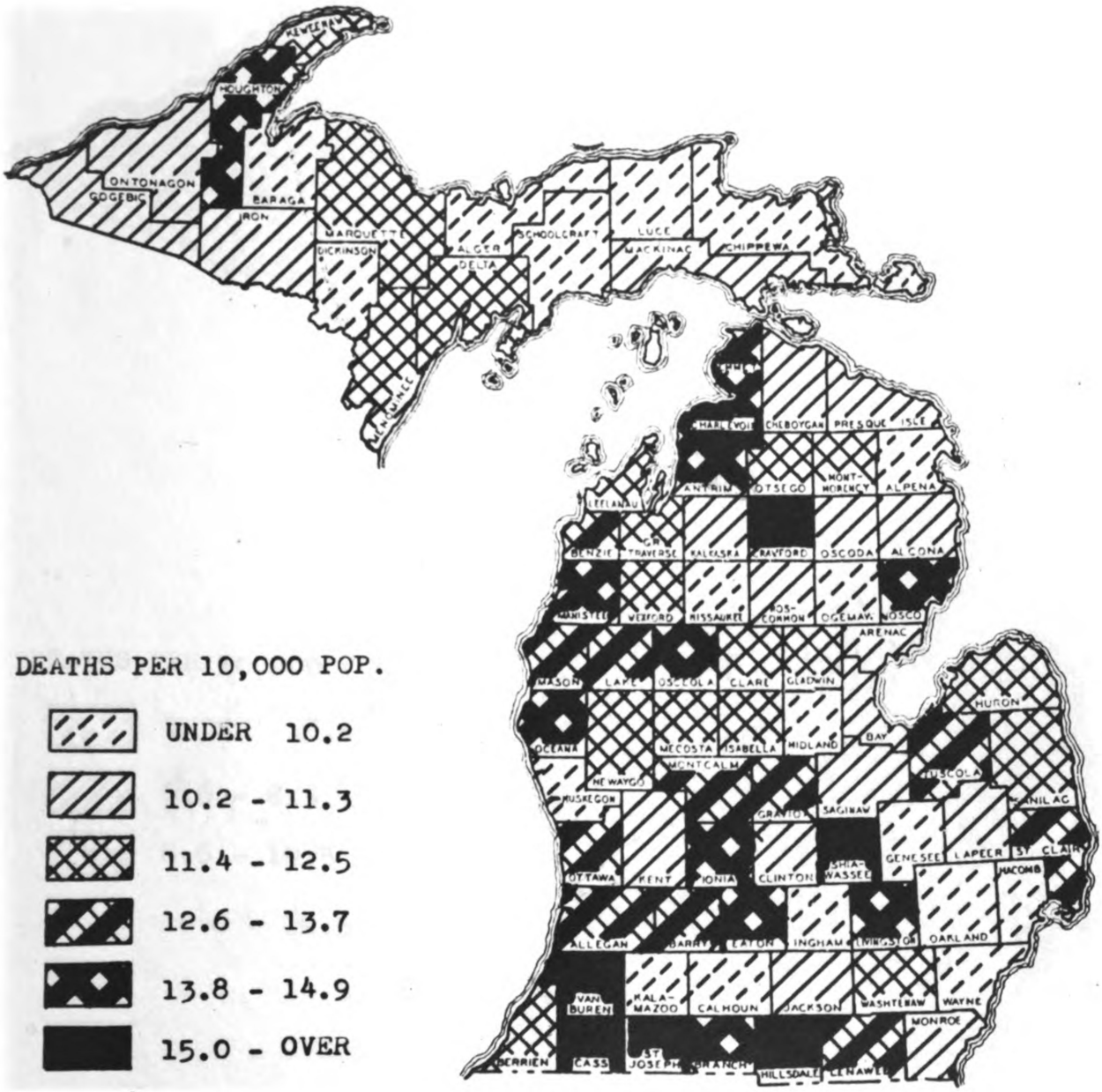


Figure 8.4 (Source: Table 8.3)

RURAL DEATH RATES : APOPLEXY
MICHIGAN AV., 1935-1944 = 10.5

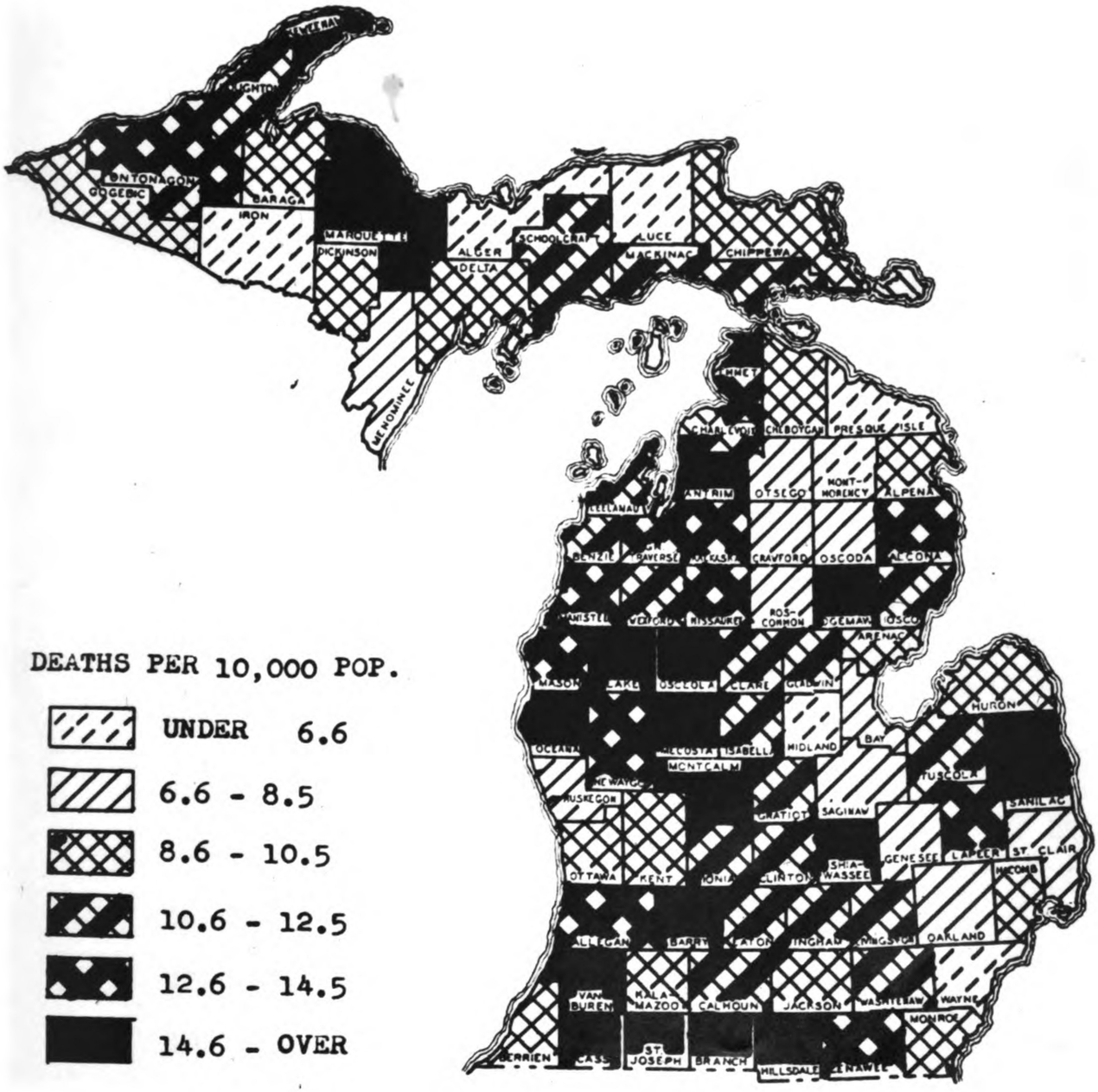


Figure 8.5 (Source: Table 8.3)

RURAL DEATH RATES : ACCIDENTS
MICHIGAN AV., 1935-1944 = 9.0

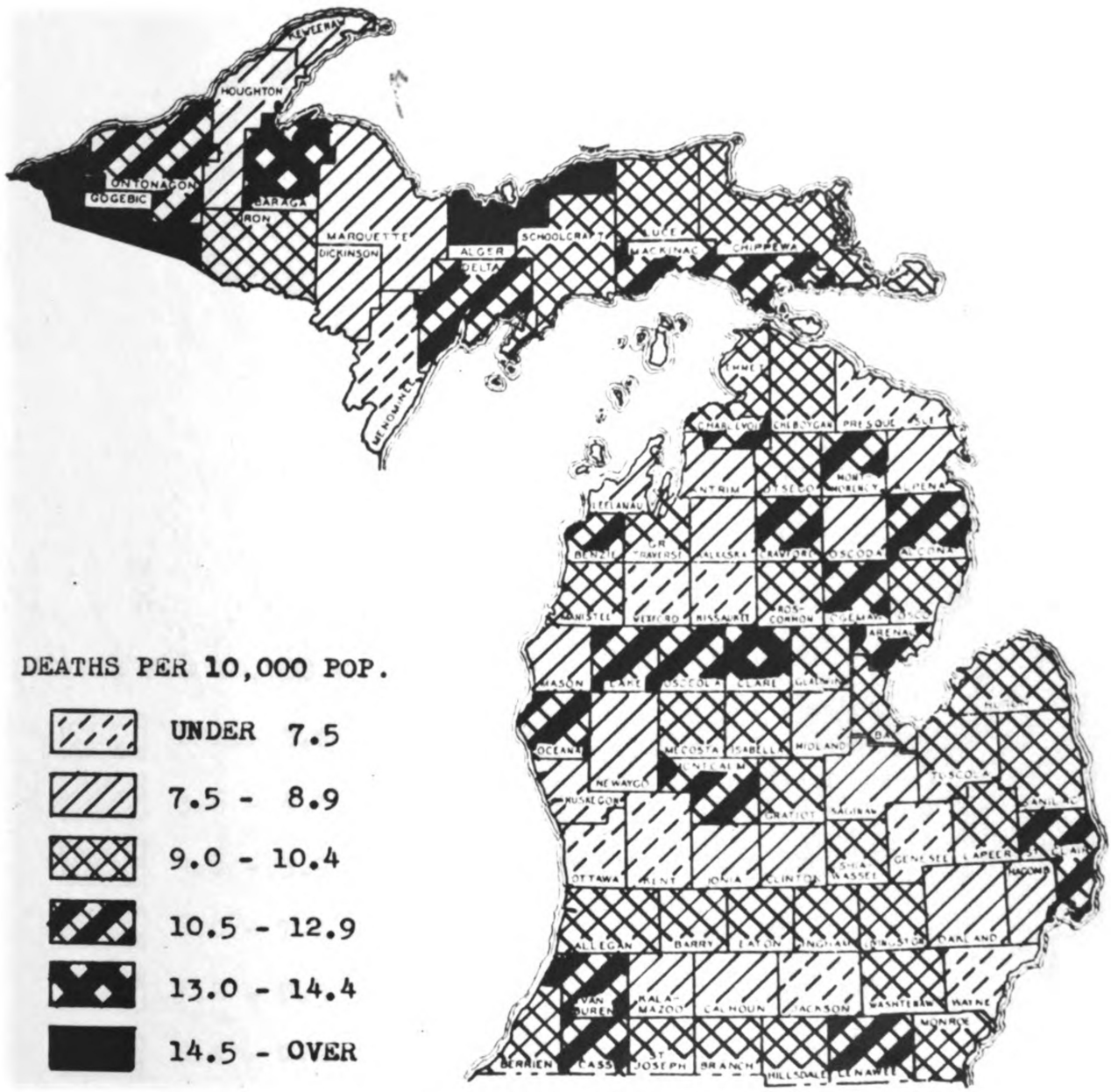


Figure 8.6 (Source: Table 8.3)

RURAL DEATH RATES : NEPHRITIS
MICHIGAN AV., 1935-1944 = 5.9

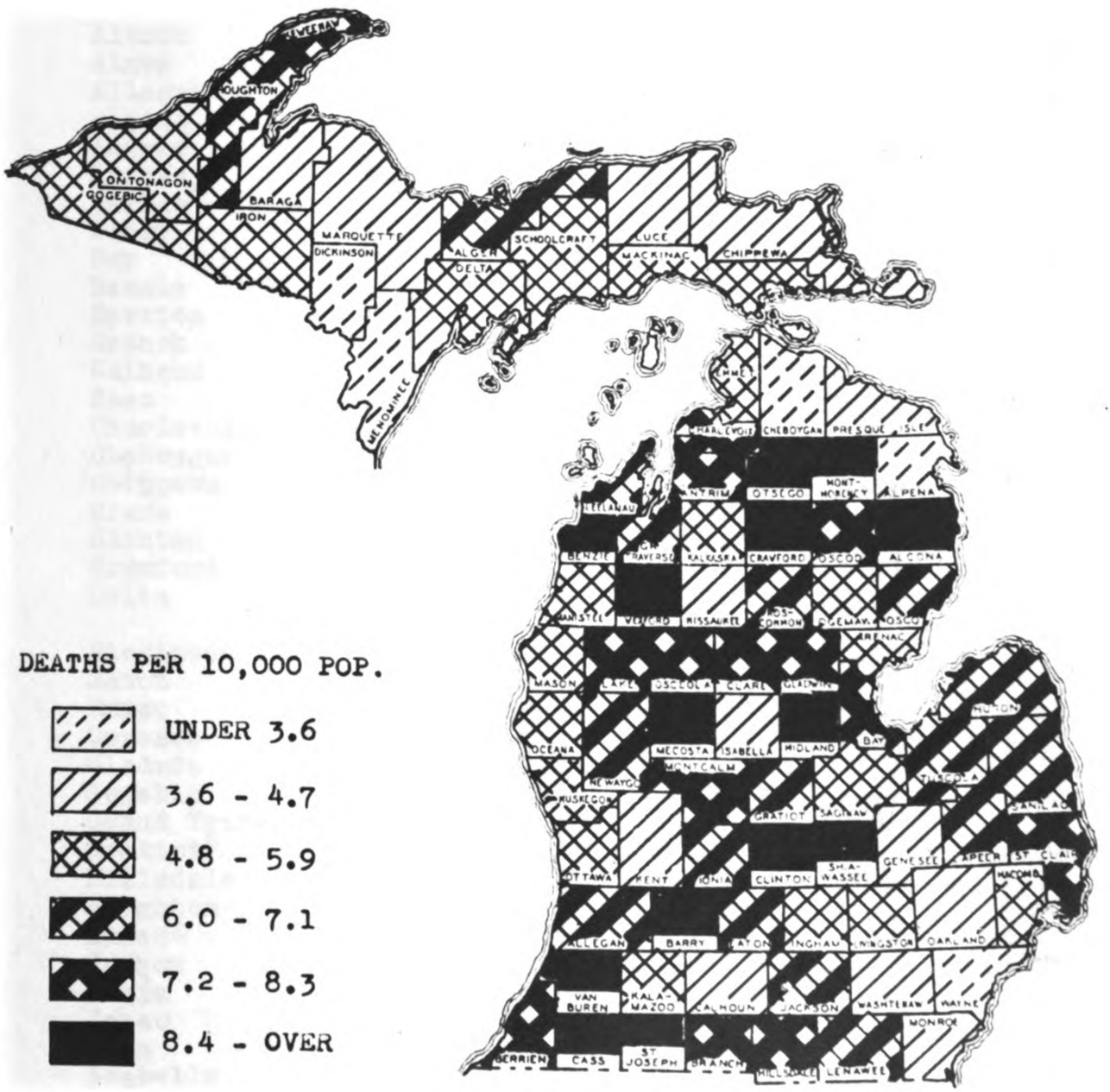


Figure 8.7 (Source: Table 8.3)

Table 8.5 RURAL MORTALITY RATES FROM THE FIVE PRINCIPAL CAUSES OF DEATH PER 10,000 POPULATION, MICHIGAN COUNTIES, AVERAGE 1935-1944. (Based on 1940 population; by place of residence)

State and County	Rural Death Rates				
	Heart [1](90-95)	Cancer (45-55)	Apoplexy (83ab)	Accidents (169-195)	Nephritis (130-132)
Alcona	35.15	11.17	12.81	10.79	8.42
Alger	25.01	8.51	6.25	14.93	6.07
Allegan	37.36	13.19	13.04	10.15	6.34
Alpena	25.76	9.30	9.30	8.92	3.51
Antrim	37.30	14.14	14.68	7.57	8.11
Arenac	33.03	10.51	9.86	11.15	5.84
Baraga[2]	23.19	9.09	9.19	13.46	3.63
Barry	37.45	13.48	15.60	9.92	9.34
Bay	24.87	10.58	7.10	9.44	8.39
Benzie	39.62	12.69	11.79	12.43	8.46
Berrien	34.39	12.41	10.19	9.36	8.17
Branch	41.83	13.84	15.73	9.94	8.37
Calhoun	31.33	8.85	11.30	7.85	4.11
Cass	37.45	15.38	16.69	12.36	13.25
Charlevoix	42.86	15.11	12.44	10.56	7.30
Cheboygan	33.50	10.41	10.04	9.28	3.13
Chippewa	33.95	8.61	8.86	9.61	4.34
Clare	38.74	11.90	11.46	14.07	8.18
Clinton	29.44	11.15	10.88	8.35	12.00
Crawford	30.81	15.14	6.64	11.42	8.49
Delta	29.15	11.66	9.98	11.66	4.91
Dickinson	27.85	9.94	9.81	8.70	2.82
Eaton	34.97	14.11	11.15	9.48	6.61
Emmet	42.47	14.02	13.30	9.92	5.52
Genesee	22.03	7.94	6.87	7.17	4.24
Gladwin	29.52	11.61	10.97	9.80	7.35
Gogebic	28.45	10.97	10.04	15.43	5.39
Grand Traverse	39.73	11.42	14.44	10.29	6.37
Gratiot[2]	35.24	13.28	10.84	9.15	6.95
Hillsdale	38.26	15.81	16.91	10.21	7.30
Houghton	32.33	14.54	12.02	8.47	6.50
Huron[2]	28.08	12.55	10.19	9.48	6.01
Ingham	26.67	9.92	10.91	9.01	4.88
Ionia	36.62	14.35	12.41	8.32	6.50
Iosco	33.64	14.37	11.80	9.11	6.65
Iron	20.78	10.39	6.14	9.78	5.91
Isabella	28.63	11.67	10.70	9.10	4.32
Jackson	28.08	10.31	9.25	7.38	6.12
Kalamazoo	26.68	9.96	9.39	8.08	5.91
Kalkaska	34.12	11.05	14.15	7.75	4.84
Kent	29.78	11.05	9.38	6.76	4.62
Keweenaw	28.47	12.24	15.73	8.49	8.24

Table 8.3(Continued) RURAL MORTALITY RATES FROM THE FIVE PRINCIPAL CAUSES OF DEATH PER 10,000 POPULATION, MICHIGAN COUNTIES, AVERAGE 1935-1944. (Based on 1940 population; by place of residence)

State and County	Rural Death Rates				
	Heart[1] (90-95)	Cancer (45-55)	Apoplexy (83ab)	Accidents (169-195)	Nephritis (130-132)
Lake	37.93	13.76	15.21	12.08	6.87
Lapeer	31.62	11.33	13.27	9.42	6.16
Leelanau	37.70	12.33	10.91	7.94	6.99
Lenawee[2]	36.39	13.48	14.43	10.57	6.15
Livingston	40.37	14.08	11.22	9.81	4.84
Luce[2]	38.53	6.87	6.20	9.16	4.71
Mackinac[2]	29.56	10.28	10.60	12.07	4.97
Macomb[2]	22.17	9.86	8.87	8.33	5.66
Manistee	42.54	14.76	13.53	9.43	5.02
Marquette	24.14	11.40	17.85	8.38	4.09
Mason	28.57	12.92	13.49	8.80	5.71
Mecosta	35.00	12.17	15.36	9.31	8.64
Menominee	27.71	11.87	8.53	6.82	2.93
Midland	22.25	8.77	5.01	7.63	11.03
Missaukee	30.74	8.46	12.70	7.21	4.35
Monroe	29.64	10.86	9.34	10.26	4.28
Montcalm	38.69	14.57	15.48	12.51	8.16
Montmorency	27.08	11.98	5.99	11.45	8.85
Muskegon	25.49	10.05	8.32	7.93	5.07
Newaygo[2]	37.64	12.29	13.07	7.93	6.84
Oakland	20.52	9.17	7.09	8.03	3.78
Oceana	36.39	14.65	15.93	11.13	5.40
Ogemaw	31.88	9.63	17.20	10.89	4.93
Ontonagon	27.29	11.09	13.29	10.82	5.54
Osceola	38.92	14.88	15.85	10.89	7.43
Oscoda	24.38	11.01	7.08	7.86	8.25
Otsego	35.52	11.50	7.21	9.95	8.58
Ottawa	28.58	13.30	10.17	6.28	5.36
Presque Isle	23.86	10.46	6.32	6.86	4.17
Roscommon	30.53	10.91	7.63	9.81	6.54
Saginaw	25.99	10.63	8.41	8.62	4.95
St. Clair	30.83	12.87	8.36	11.13	7.95
St. Joseph	41.74	16.27	16.49	10.43	10.55
Sanilac	33.54	12.09	14.94	9.09	6.28
Schoolcraft	25.94	9.21	10.67	10.42	5.82
Shiawassee	32.47	15.05	15.40	9.29	9.38
Tuscola	35.50	12.78	11.68	9.10	6.93
Van Buren	45.41	17.72	16.30	11.65	8.69
Washtenaw	27.11	12.32	11.68	9.28	4.58
Wayne[2]	16.73	6.13	3.76	7.46	2.20
Wexford	39.40	12.07	12.56	7.34	9.11
State	29.88	11.42	10.46	9.04	5.90

1. International List Number, 1939.
2. Residence according to the 1930 population.

Source: Annual Reports, Michigan Department of Health, 1935-1944, Table 16.

The highest incidence of rural deaths occurs in the western half of the Lower Peninsula and in the southern tier of counties. This generalization describes the incidence of mortality from heart diseases and apoplexy more accurately than from cancer and nephritis. It is not true for accidents.

Low rural death rates occur most frequently in the highly urbanized areas of the State. This is true, for the most part, for all of the five causes of death.

The distribution of rural deaths from cancer is more dispersed than for diseases of the heart, apoplexy, and nephritis. There is a heavy concentration of high rates from cancer, however, in the southern tier of counties, some noticeably high rates in and around Ionia county, and others along the western coast running from Oceana to Benzie county inclusively. Low death rates are found in the belt of counties running from Monroe on the southern border to Midland and Bay county and thence to the Straits. The Upper Peninsula is generally characterized by low rates, 10 of the 15 counties having rates under 11.3. These variations among the counties are probably due to the differing age distributions, the mean age of deaths from cancer being somewhat lower than for other chronic diseases. Dublin points out, for example, that the average age at death for cancer in the United States in 1930 was 63.35 years, compared with 66.21 for heart diseases.[1]

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1. See Dublin, Louis, et al, op. cit., p. 115.

The Upper Peninsula counties tend to have low rural death rates for the chronic diseases. On the other hand, accidental deaths in rural areas occur most often in this area. Although the highest death rate from accident in the State is in Bay county (18.87), the second and third highest rates are in Upper Peninsula counties, namely, Gogebic and Alger. Menominee has a rate of only 6.82, the third lowest among all counties. It is probable that some of the high accident death rates in the Upper Peninsula are associated with the mining industry.[1] In the Lower Peninsula high death rates for rural people occur more frequently in the northern than in the southern counties.

Rates for nephritis follow the general pattern for chronic diseases except that high rates tend to be concentrated in the inland counties. Although for other degenerative diseases, counties along the western coast from Oceana to Benzie generally have high rates, for nephritis their rates are average, ranging from 4.8 to 5.9. The highest rate, 13.25, occurs in Cass county. As might be expected, the Upper Peninsula counties generally have low rates. Rates are also usually low in the predominantly urban areas.

The relative ranks of the five principal causes of

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1. Dorn, Harold F., op. cit., p. 6, found the accident death rate to be higher in mining than in non-mining areas of Ohio.

death in rural segments of the counties are given in Appendix II, Table 2. The death rate for heart diseases occupies first position in every county. Cancer is the second most fatal disease. However, in four counties of the Upper Peninsula and in one county of northern Michigan it fell to fourth place. Apoplexy, the third principal cause of death in the State, dropped to fifth position in four counties, all of them in the northern part of the Lower Peninsula. Perhaps the greatest variation among death rates occurred for accidents. Although it is the fourth cause of death in the State, it jumped to second place in six counties of the Upper Peninsula, in three counties of the northern part of the Lower Peninsula, and in Wayne. Nephritis, the fifth most fatal disease, ranks second in Clinton and Midland counties, and third in Oscoda.

To further aid in the interpretation of the data, the twelve highest and the twelve lowest death rates in rural areas for each of the five principal causes are listed in Table 8.4. Wayne and Genesee are among the lowest death rate counties for all five causes; Oakland, Midland, and Presque Isle for four of the five causes; and Baraga and Alger for three of the five. Among high death rate counties, Van Buren is listed for all five causes; St. Joseph and Cass for four of the five; and Montcalm and Osceola for three. Thus, low death rates tend to be found in the rural segments of counties with large urban populations whereas high death rates are found in the corresponding

Table 8.4 TWELVE HIGHEST AND LOWEST DEATH RATES FOR FIVE PRINCIPAL CAUSES IN RURAL AREAS, MICHIGAN, AVERAGE 1935-1944.

Heart Diseases

Lowest Death Rates		Highest Death Rates	
Wayne	16.73	Van Buren	45.41
Oakland	20.52	Charlevoix	42.86
Iron	20.78	Manistee	42.54
Genesee	22.03	Emmet	42.47
Macomb	22.17	Branch	41.83
Midland	22.25	St. Joseph	41.74
Baraga	23.19	Livingston	40.37
Presque Isle	23.86	Grand Traverse	39.73
Marquette	24.14	Benzie	39.62
Oscoda	24.38	Wexford	39.40
Bay	24.87	Osceola	38.92
Alger	25.01	Clare	38.74

Cancer

Wayne	6.13	Van Buren	17.72
Luce	6.87	St. Joseph	16.27
Genesee	7.94	Hillsdale	15.81
Missaukee	8.46	Cass	15.38
Alger	8.51	Crawford	15.14
Chippewa	8.61	Charlevoix	15.11
Midland	8.77	Shiawassee	15.05
Calhoun	8.83	Osceola	14.88
Baraga	9.09	Manistee	14.76
Oakland	9.17	Oceana	14.65
Schoolcraft	9.21	Montcalm	14.57
Alpena	9.30	Houghton	14.54

Apoplexy

Wayne	3.76	Marquette	17.85
Midland	5.01	Ogemaw	17.80
Montmorency	5.99	Hillsdale	16.91
Iron	6.14	Cass	16.69
Luce	6.20	St. Joseph	16.49
Alger	6.25	Van Buren	16.30
Presque Isle	6.32	Oceana	15.93
Crawford	6.64	Osceola	15.85
Genesee	6.87	Branch	15.75
Oscoda	7.08	Keweenaw	15.73
Oakland	7.09	Barry	15.60
Bay	7.10	Montcalm	15.48

Table 8.4 (Continued)
TWELVE HIGHEST AND LOWEST DEATH RATES FOR FIVE PRINCIPAL CAUSES IN RURAL AREAS, MICHIGAN, AVERAGE 1935-1944.

Accidents

Lowest Death Rates		Highest Death Rates	
Ottawa	6.28	Gogebic	15.43
Kent	6.76	Alger	14.93
Menominee	6.82	Clare	14.07
Presque Isle	6.86	Baraga	13.46
Genesee	7.17	Montcalm	12.51
Missaukee	7.21	Benzie	12.43
Wexford	7.34	Cass	12.36
Jackson	7.38	Lake	12.08
Wayne	7.46	Mackinac	12.07
Antrim	7.57	Delta	11.66
Midland	7.63	Van Buren	11.65
Kalkaska	7.75	Montmorency	11.45

Nephritis

Wayne	2.20	Cass	13.25
Dickinson	2.82	Clinton	12.00
Menominee	2.93	St. Joseph	10.55
Cheboygan	3.13	Midland	11.03
Alpena	3.51	Shiawassee	9.38
Baraga	3.63	Barry	9.34
Oakland	3.78	Wexford	9.11
Marquette	4.09	Montmorency	8.85
Calhoun	4.11	Alcona	8.82
Presque Isle	4.17	Van Buren	8.69
Genesee	4.24	Mecosta	8.64
Monroe	4.28	Otsego	8.58

Note: Rates based on less than 200 deaths for the ten year period 1935-1944 are underscored.
Source: Table 8.1.

segments of rural counties.

In the foregoing pages, certain counties have appeared consistently within the column of the twelve highest or the twelve lowest death rates, while other counties appear occasionally, and some not at all. The extent to which counties with extremely high or low death rates are concentrated in designated areas seem to follow certain patterns of mortality incidence. Some of the generalizations in this Chapter regarding these patterns are further demonstrated in the following analysis. Table 8.5 indicates the number of times counties in a specified area, for example, the Upper Peninsula, are found among either the twelve highest or the twelve lowest rural death rate counties. Since there are five principal causes of death, a single county has five opportunities to place among those with the twelve highest rates, five opportunities to place among those with the twelve lowest rates, and ten opportunities to place in either extreme.

According to Table 8.6 rural segments of counties in the Upper Peninsula placed among the twelve lowest death rate counties 22.7 percent of their opportunities, or about twice as often as among the twelve highest (10.7 percent). Counties in both the northern and southern part of the Lower Peninsula are found about as often in the twelve highest death rate counties as among the twelve lowest. Counties in the Upper Peninsula occupy positions among the twelve lowest death rates relatively more often

Table 8.5 NUMBER AND PERCENT OF TIMES COUNTIES ARE FOUND AMONG THE TWELVE HIGHEST AND THE TWELVE LOWEST RURAL DEATH RATES FROM THE FIVE PRINCIPAL CAUSES, BY GEOGRAPHICAL AREA, MICHIGAN, 1935-1944

Area	Number of Counties	Placement Chances	Times Placed	Percent
Upper Peninsula	15	75		
Lowest			17	22.7
Highest			8	10.7
Northern Michigan[2]	33	165		
Lowest			22	13.3
Highest			26	15.8
Southern Michigan[2]	35	175		
Lowest			21	12.1
Highest			26	14.9
Urban Counties[3]	11	55		
Lowest			18	32.1
Highest			0	----
Rural Counties[3]	24	120		
Lowest			3	2.5
Highest			26	21.7

1. Southern Michigan includes all counties below an imaginary line running from the most southern point of the coastline at Bay county to the northern boundry line of Muskegon county. Bay county is included among the northern counties and Muskegon among the southern counties. All of the Thumb area is included among the southern counties.

2. A county is classified as urban if more than 50 percent of its population in 1930 was urban. The remaining counties are rural.

Source: For crude rates see Table 8.4.

than counties in either area of the Lower Peninsula, the percents being 22.7 in the Upper Peninsula, 13.1 in northern Michigan and 12.1 in the southern part of the State. If the counties of southern Michigan are divided into counties predominantly rural and counties predominantly urban, the rural segments of urban counties are found among the twelve lowest death rate counties while the rural segments of rural counties are found among the twelve highest death rate counties.

It is interesting to observe that crude death rates from chronic diseases are somewhat lower in the areas where rural levels of living[1] are low, and that the prosperous farming regions in the southern part of Michigan have the highest death rates for these causes.[2] For example, the

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1. The measures of level of living employed are those constructed by Margaret Hagood, op. cit., pp. 22-23. It includes percentages for each of the following: farms with gross income of more than $600, with auto of 1936 or later model; dwelling units with fewer than 1.51 persons per room, with radio, with running water, with mechanical refrigeration; median grade of school completed by persons 25 years of age and over. For an account of the development of the indexes, see "Development of a 1940 Rural-Farm Level of Living Index for Counties," Hagood, Margaret Jarman, Rural Sociology, Vol. 8, No. 2, June 1943, pp. 171-180; "Rural Level of Living Indexes, 1940", in Notes, Rural Sociology, September 1943.

2. Vance writes, "In the main it can be said that the degenerative diseases of age have higher rates in the regions with higher levels of living and show an increase from 1930 to 1940 (Table 100). This is true in both the Nation and the region for heart disease, malignant tumors, cerebral hemorrhage, etc." Vance, Rupert B., op. cit., p. 341.

twelve high mortality counties from cancer have a mean death rate almost twice the size (82%) of the corresponding rate in the low mortality counties. The mean rural level of living index is about 10 percent greater in the areas of high mortality. It is unlikely that mortality differentials of this size would be reversed if adjusted for differing age distributions. Dorn found that in Ohio "the standardized mortality rates from cancer, cerebral hemorrhage, heart disease, and nephritis were slightly higher in the good economic areas."[1] In attempting to explain, he continues in his summary as follows:

> "The fact that the death rates from the important diseases of late adult life are somewhat lower in the poor economic regions would appear at first sight to support the theory that modern medical and public health practices tend to lessen the effects of natural selection and to preserve a larger proportion of the weak and unfit than would otherwise be true. According to this theory, high death rates during infancy and childhood eliminate the least physically fit members of society so that attempts to decrease mortality at those ages, if successful, would weaken the race. It does not seem necessary to examine the validity of this theory at this time, especially inasmuch as there is practically no direct evidence pro or con. It is unquestionably true that modern health activities do preserve for many years the lives of many persons who under conditions existing a century ago would have succumbed at an early age to some disease which is now prevented or cured. Whether or not this affects the physical vigor of the race is a debatable question."[2]

Mott finds it difficult to accept the findings of Dorn in Ohio, namely that areas of poor economic status tend

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1. Dorn, Harold F., op. cit., p. 9.

2. Dorn, Harold F., ibid, p. 8.

to have lower death rates for degenerative diseases than the good economic areas. He suggests that these mortality differentials are probably due to "poor reporting of deaths as well as faulty diagnosis" in the poor economic areas. However, assuming that reported differences exist, he explains the high rates in the good economic areas thus: "Perhaps more obesity in the prosperous sections contributes to a higher occurrence of the degenerative diseases of later life."[1] He rejects, along with Dorn, the thesis that the differentials are reflections of the preservation of weaklings and "the unfit" in early life among the better economic classes. It appears to the writer that the high death rates from degenerative diseases in the better agricultural areas of Michigan can best be explained in terms of selection and migration, although without doubt the registration of deaths is more efficient and faulty diagnosis less prevalent in the southern counties than in other areas of the State. Many rural areas of the Upper Peninsula, as well as of northern Michigan, offer little enticement or encouragement to the elderly farmer either to remain or settle there for his last days. On the other hand, many older farmers in the good agricultural areas of southern Michigan are enjoying all the conveniences of modern life.

Accidents (all forms) is the only non-chronic cause of death presented by county and residence. As might be

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1. Mott, Frederick D., et al, op. cit., p. 72.

expected, it does not follow the patterns of chronic diseases when related to the rural level of living index just presented. Death rates from accident tend to be high in areas where levels of living are low. In the twelve counties with low accident rates, the mean level of living index is 9.5 percent greater than for the high mortality areas. This finding is also in keeping with the Ohio study.[1] Dorn explained the condition as resulting in part from mining accidents. This explanation might likewise apply to the Michigan data,--especially since five of the twelve counties are in the Upper Peninsula.

Thompson, in an analysis of occupational mortality differentials, points out that the differences are not due to occupational hazards alone, and that selectivity plays an important role. "Common unskilled laborers, dockers, and stevedores are frequently men who cannot succeed at other jobs and in the course of time drift into the poorly paid classes where living conditions are very bad... It is perhaps the living conditions enforced by poorly paid work rather than the nature of the work itself that in many cases, though not in all, cause the high death rate."[2] It is quite possible that in Michigan, also, processes of selectivity account for some of the excessive death rates in areas where levels of living are particularly low.

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1. Dorn, Harold F., op. cit., p. 6.

2. Thompson, Warren S., op. cit., pp. 238-239.

URBAN DEATH RATES : HEART
MICHIGAN AV., 1935-1944 = 27.8

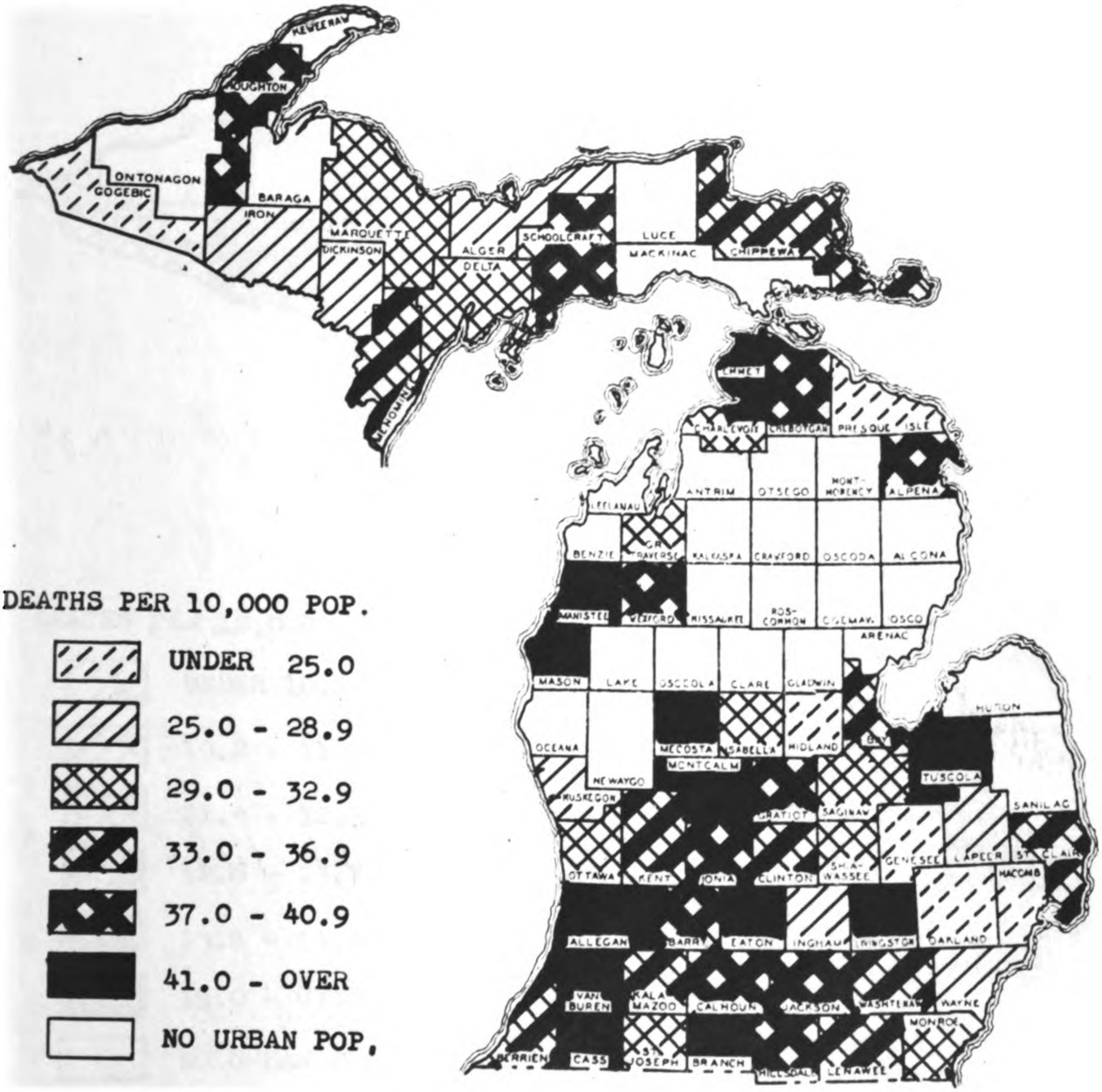


Figure 8.8 (Source: Table 8.6)

URBAN DEATH RATES : CANCER
MICHIGAN AV., 1935-1944 = 11.6

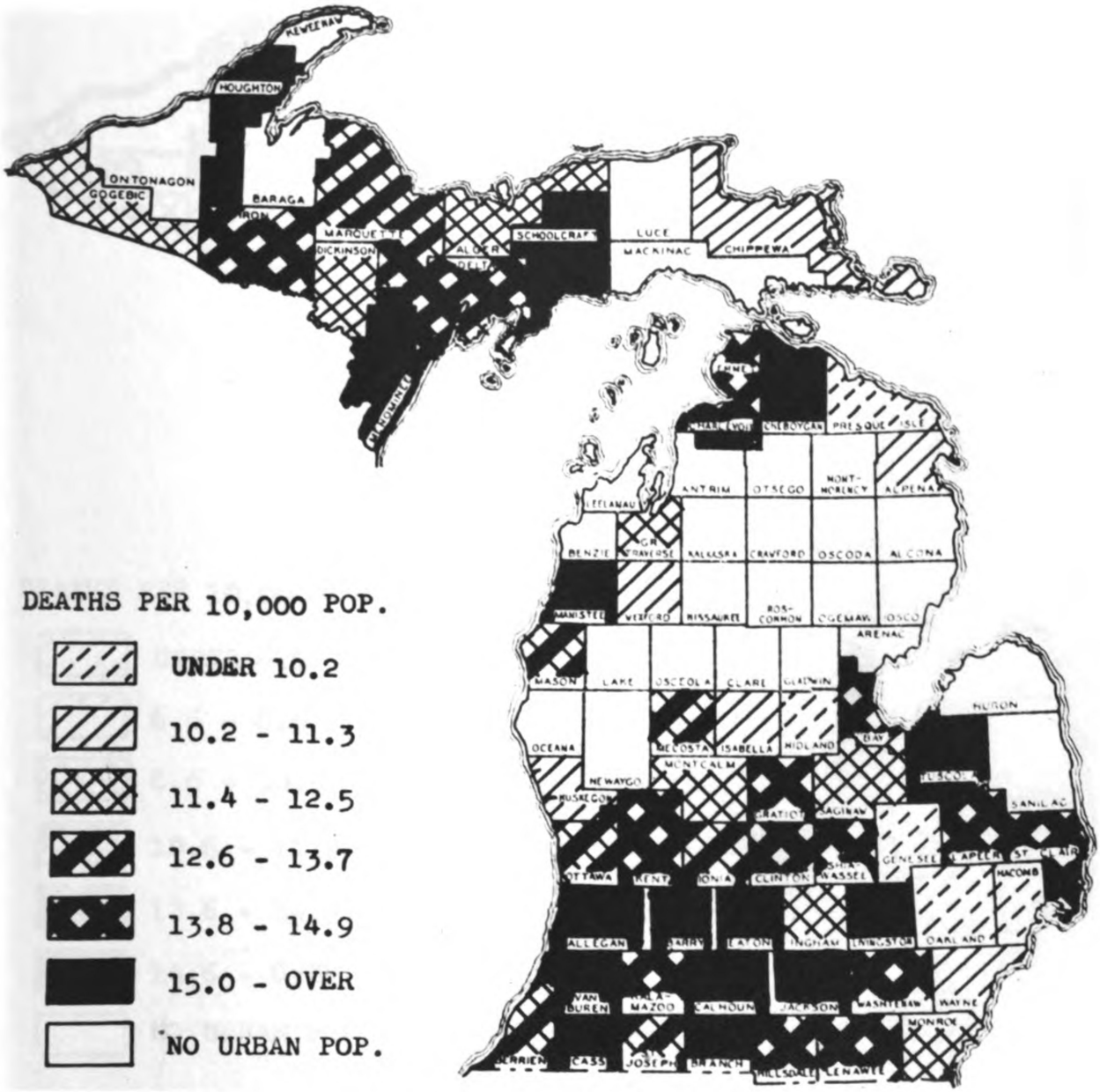


Figure 8.9 (Source: Table 8.6)

URBAN DEATH RATES : APOPLEXY
MICHIGAN AV., 1935-1944 = 7.6

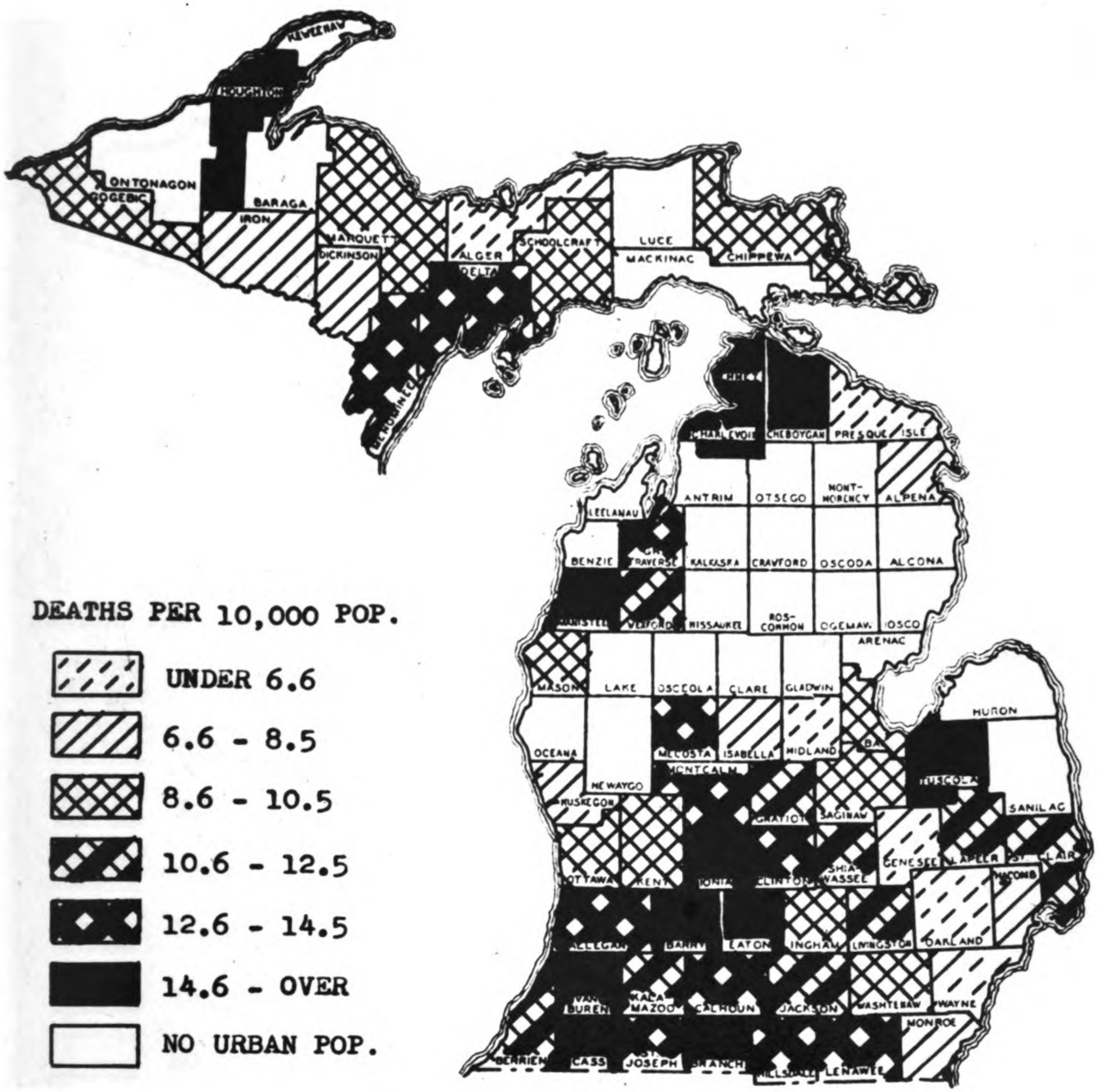


Figure 8.10 (Source: Table 8.6)

URBAN DEATH RATES : ACCIDENTS
MICHIGAN AV., 1935-1944 = 6.8

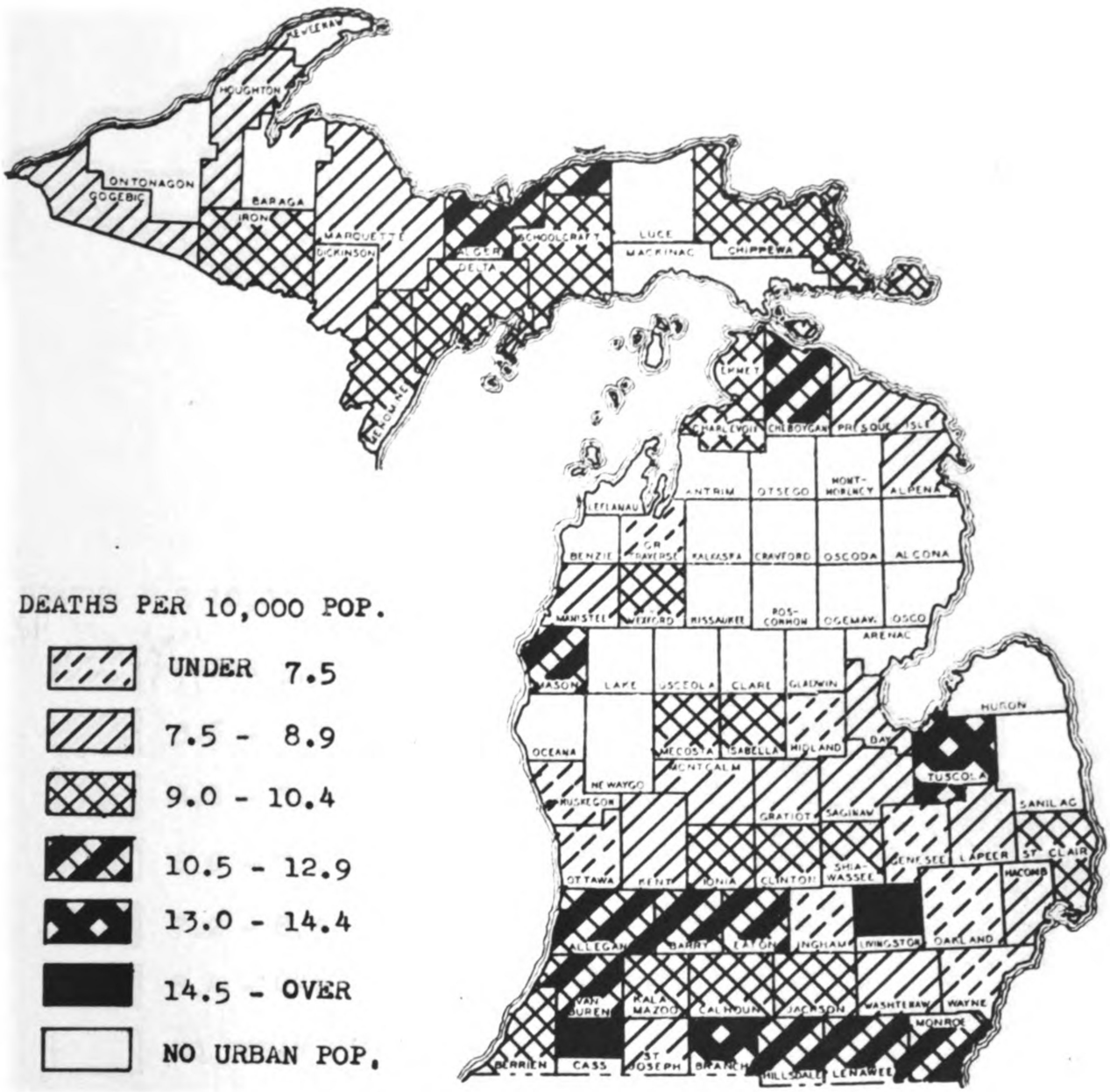


Figure 8.11 (Source: Table 8.6)

URBAN DEATH RATES : NEPHRITIS
MICHIGAN AV., 1935-1944 = 5.2

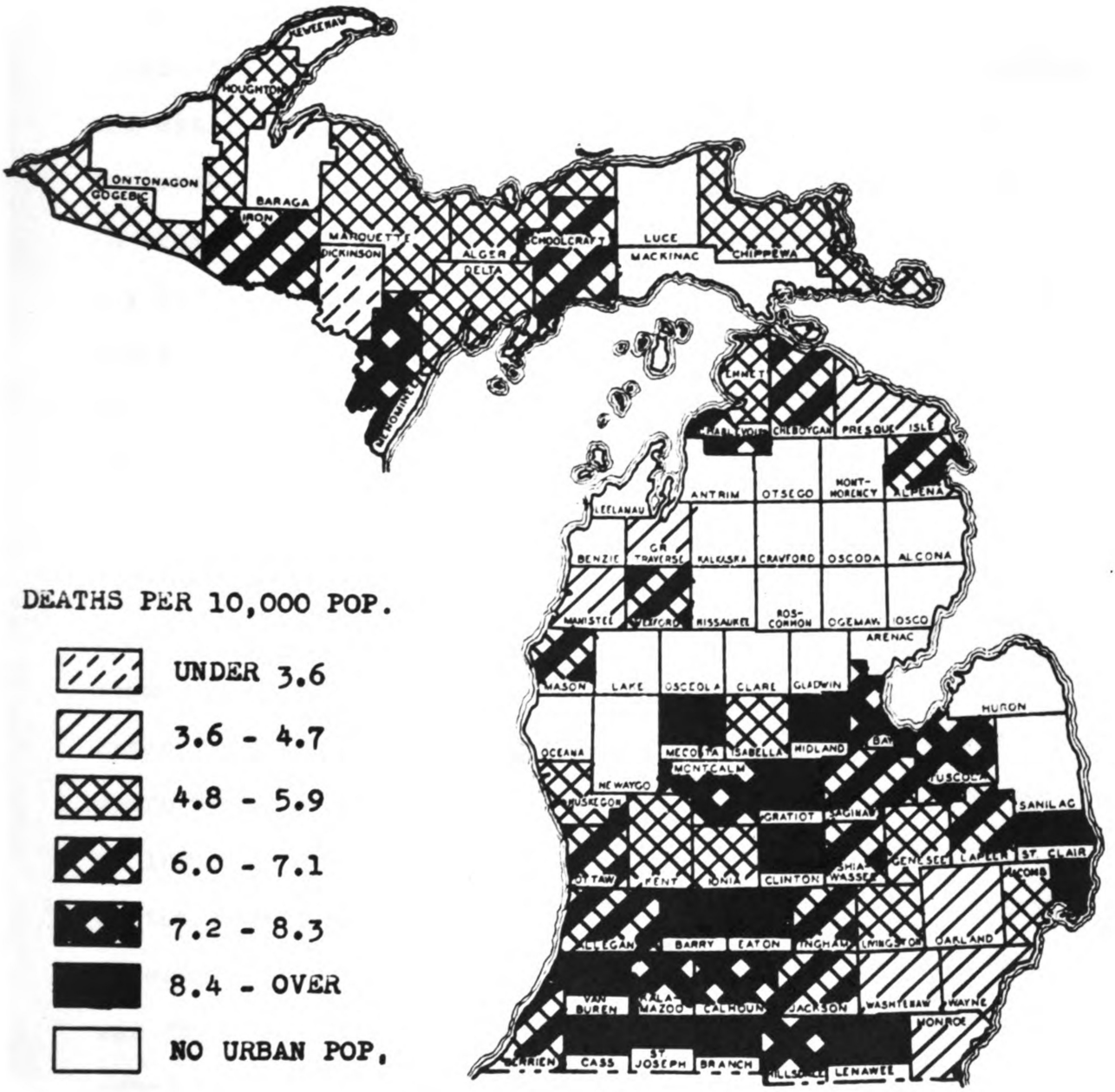


Figure 8.12 (Source: Table 8.6)

Causes of Death in Urban Areas: Non-communicable

Urban death rates for the five principal causes are given in Table 8.6 and Figures 8.8 to 8.12. These data may be summarized briefly as follows: (1) Deaths from chronic diseases in urban areas occur relatively more frequently in the southern and western counties where cities are small and rural populations are predominant; (2) The low urban death rates from chronic diseases tend to occur in areas of large urban populations; (3) Urban places of the Upper Peninsula tend to have mortality rates which are lower for chronic diseases than those of the Lower Peninsula. In this area cancer has high rates compared with other degenerative diseases.

From a comparison of urban and rural data, certain mortality characteristics of the urban segments of the population appear to be quite similar to those of the rural segments. For example, it may be concluded that urban rates in Michigan counties tend to be high in the areas where rural rates are high; and where urban rates tend to be low rural rates are likewise low. The relative ranks of the five principal causes of death in the urban segment of each county are given in Table 3 of Appendix II. As was true for the rural population of counties, heart diseases occupy first place as a leading cause of death in all instances. Cancer holds second position in urban segments and in no instance falls lower than third place. For the rural segments, cancer is fourth in 4.8 percent of

Table 8.6 URBAN MORTALITY RATES FROM THE FIVE PRINCIPAL CAUSES OF DEATH PER 10,000 POPULATION, MICHIGAN COUNTIES, AVERAGE 1935-1944. (Based on 1940 population; by place of residence)

State and County	Urban Death Rates				
	Heart [1](90-95)	Cancer (45-55)	Apoplexy (83ab)	Accidents (169-195)	Nephritis (130-132)
Alcona	-----	-----	-----	-----	-----
Alger	26.54	11.57	6.58	11.79	5.81
Allegan	43.50	15.72	14.33	10.56	6.66
Alpena	38.10	10.62	8.16	7.65	6.40
Antrim	-----	-----	-----	-----	-----
Arenac	-----	-----	-----	-----	-----
Baraga[2]	-----	-----	-----	-----	-----
Barry	39.05	15.27	21.26	12.17	8.50
Bay	33.51	14.51	10.34	8.17	7.54
Benzie	-----	-----	-----	-----	-----
Berrien	34.18	13.68	10.92	10.36	7.02
Branch	51.07	16.75	19.47	13.75	9.41
Calhoun	40.00	15.21	14.36	9.71	7.27
Cass	44.14	22.77	15.38	14.78	12.78
Charlevoix	32.02	17.56	16.53	9.29	8.26
Cheboygan	38.08	19.92	15.51	11.28	6.87
Chippewa	33.32	10.85	8.90	9.71	5.42
Clare	-----	-----	-----	-----	-----
Clinton	36.41	14.70	14.02	9.04	17.41
Crawford	-----	-----	-----	-----	-----
Delta	29.39	13.89	12.62	9.29	5.55
Dickinson	26.87	11.47	7.34	8.11	3.40
Eaton	49.19	17.60	16.08	11.99	10.79
Emmet	45.19	14.29	15.28	9.63	5.15
Genesee	21.45	9.50	6.39	6.89	4.80
Gladwin	-----	-----	-----	-----	-----
Gogebic	24.38	11.60	10.55	8.17	5.98
Grand Traverse	31.55	11.69	13.84	7.47	4.21
Gratiot[2]	37.35	14.02	10.69	8.74	9.16
Hillsdale	39.49	14.26	13.63	11.28	8.14
Houghton	40.45	19.58	14.72	8.72	5.91
Huron[2]	-----	-----	-----	-----	-----
Ingham	25.97	12.09	9.19	7.32	6.43
Ionia	37.97	13.64	14.69	9.06	5.62
Iosco	-----	-----	-----	-----	-----
Iron	28.91	14.31	8.36	9.06	6.51
Isabella	31.50	10.58	8.08	9.15	4.87
Jackson	38.71	15.20	12.08	9.78	6.94
Kalamazoo	33.53	14.05	12.11	9.39	8.28
Kalkaska	-----	-----	-----	-----	-----
Kent	35.94	14.55	10.38	7.50	5.40
Keweenaw	-----	-----	-----	-----	-----

Table 8.6 (Continued) URBAN MORTALITY RATES FROM THE FIVE PRINCIPAL CAUSES OF DEATH PER 10,000 POPULATION, MICHIGAN COUNTIES, AVERAGE 1935-1944. (Based on 1940 population; by place of residence)

State and County	Urban Death Rates				
	Heart [1](90-95)	Cancer (45-55)	Apoplexy (83ab)	Accidents (169-195)	Nephritis (130-132)
Lake	-----	-----	-----	-----	-----
Lapeer	27.96	14.73	12.30	8.76	6.15
Leelanau	-----	-----	-----	-----	-----
Lenawee[2]	35.77	14.83	13.42	11.03	9.34
Livingston	46.42	16.01	10.67	17.87	5.60
Luce[2]	-----	-----	-----	-----	-----
Mackinac[2]	-----	-----	-----	-----	-----
Macomb[2]	22.17	10.08	8.25	7.65	4.94
Manistee	46.93	18.52	18.63	7.70	4.37
Marquette	32.20	13.37	9.96	8.31	5.86
Mason	42.64	13.56	9.77	10.57	7.15
Mecosta	50.93	13.23	13.03	10.42	12.83
Menominee	35.19	16.13	13.39	9.09	7.72
Midland	16.75	8.91	5.32	6.68	10.64
Missaukee	-----	-----	-----	-----	-----
Monroe	29.06	12.50	7.04	10.71	4.11
Montcalm	45.29	11.84	14.28	8.64	7.89
Montmorency	-----	-----	-----	-----	-----
Muskegon	28.02	10.86	8.53	6.47	5.27
Newaygo[2]	-----	-----	-----	-----	-----
Oakland	20.22	9.20	6.31	6.68	4.21
Oceana	-----	-----	-----	-----	-----
Ogemaw	-----	-----	-----	-----	-----
Ontonagon	-----	-----	-----	-----	-----
Osceola	-----	-----	-----	-----	-----
Oscoda	-----	-----	-----	-----	-----
Otsego	-----	-----	-----	-----	-----
Ottawa	30.20	13.58	9.58	6.35	6.02
Presque Isle	20.51	10.09	3.91	7.81	4.23
Roscommon	-----	-----	-----	-----	-----
Saginaw	31.60	11.79	9.28	7.83	6.47
St. Clair	35.97	14.83	11.97	9.93	8.91
St. Joseph	32.75	13.50	13.65	8.61	9.70
Sanilac	-----	-----	-----	-----	-----
Schoolcraft	37.04	16.11	8.89	9.81	6.11
Shiawassee	31.45	14.76	11.79	9.97	7.01
Tuscola	58.31	23.13	18.89	14.33	7.49
Van Buren	52.27	18.34	17.07	12.22	10.96
Washtenaw	35.32	14.00	9.97	7.72	4.79
Wayne[2]	25.26	10.77	5.71	5.68	4.49
Wexford	39.17	11.36	10.76	9.43	6.19
State	27.80	11.62	7.62	6.81	5.21

1. International List Number, 1939.
2. Residence according to the 1930 population.

Source: Annual Reports, Michigan Department of Health, 1935-1944, Table 16.

the counties. Rates for apoplexy, the third most fatal disease, dropped to fifth place in the urban areas of two counties, Midland and Presque Isle. Four counties occupy this position for rural areas. Accidents, the fourth principal cause of death, rank second in the urban segments of two counties, Isabella and Livingston, whereas for the rural segments it is second in ten counties. Six of these counties are in the Upper Peninsula. In both the rural and urban areas of Midland and Clinton counties, nephritis, the fifth cause of death for the State, is second. This is difficult to explain and is a problem requiring further study.

The twelve highest and the twelve lowest death rates for each of the five principal causes of death in urban areas are listed in Table 8.7. Oakland, Genesee, Macomb, and Wayne counties are among those with low death rates for all five of the principal causes; Midland, Dickinson, and Presque Isle for four of the five causes; and Muskegon, Alger, and Isabella for three of the five. Many of these counties are over 50 percent urban, and the remaining ones have large urban populations. Van Buren, Branch, Eaton, and Cass counties are among the high urban death rate counties for all of the five principal causes of death; Tuscola and Barry for four of the five; and Manistee, Livingston, and Cheboygan for three of the five principal causes. These counties are over 50 percent rural with small cities whose populations without doubt include many

Table 8.7 TWELVE HIGHEST AND LOWEST DEATH RATES FOR FIVE PRINCIPAL CAUSES IN URBAN AREAS, MICHIGAN, AVERAGE 1935-1944

Heart Diseases

Lowest Death Rates		Highest Death Rates	
Midland	16.75	Tuscola	58.31
Oakland	20.22	Van Buren	52.27
Presque Isle	20.51	Branch	51.07
Genesee	21.45	Mecosta	50.93
Macomb	22.17	Eaton	49.19
Gogebic	24.38	Manistee	46.93
Wayne	25.26	Livingston	46.42
Ingham	25.97	Montcalm	45.29
Alger	26.54	Emmet	45.19
Dickinson	26.87	Cass	44.14
Lapeer	27.96	Allegan	43.50
Muskegon	28.02	Mason	42.64

Cancer

Midland	8.91	Tuscola	23.13
Oakland	9.20	Cass	22.77
Genesee	9.50	Cheboygan	19.92
Macomb	10.08	Houghton	19.58
Presque Isle	10.09	Manistee	18.52
Isabella	10.58	Van Buren	18.34
Alpena	10.62	Eaton	17.60
Wayne	10.77	Charlevoix	17.56
Chippewa	10.85	Branch	16.75
Muskegon	10.86	Menominee	16.13
Wexford	11.36	Schoolcraft	16.11
Dickinson	11.47	Livingston	16.01
Alger	11.57	Allegan	15.72

Apoplexy

Presque Isle	3.91	Barry	21.26
Midland	5.32	Branch	19.47
Wayne	5.71	Tuscola	18.89
Oakland	6.31	Manistee	18.63
Genesee	6.39	Van Buren	17.07
Alger	6.58	Charlevoix	16.53
Monroe	7.04	Eaton	16.08
Dickinson	7.34	Cheboygan	15.51
Isabella	8.08	Cass	15.38
Alpena	8.16	Emmet	15.28
Macomb	8.25	Houghton	14.72
Iron	8.36	Ionia	14.69

Table 8.7 (Continued)
TWELVE HIGHEST AND LOWEST DEATH RATES FOR FIVE PRINCIPAL CAUSES IN URBAN AREAS, MICHIGAN, AVERAGE 1935-1944

Accidents

Lowest Death Rates		Highest Death Rates	
Wayne	5.68	Livingston	17.87
Ottawa	6.35	Cass	14.78
Muskegon	6.47	Tuscola	14.33
Oakland	6.68	Branch	13.75
Midland	6.68	Van Burean	12.22
Genesee	6.89	Barry	12.17
Ingham	7.32	Eaton	11.99
Grand Traverse	7.47	Alger	11.79
Kent	7.50	Cheboygan	11.28
Macomb	7.65	Hillsdale	11.28
Alpena	7.65	Lenawee	11.03
Manistee	7.70	Monroe	10.71

Nephritis

Dickinson	3.40	Clinton	17.41
Monroe	4.11	Mecosta	12.83
Grand Traverse	4.21	Cass	12.78
Oakland	4.21	Van Burean	10.96
Presque Isle	4.23	Eaton	10.79
Manistee	4.37	Midland	10.64
Wayne	4.49	St. Joseph	9.70
Washtenaw	4.79	Branch	9.41
Genesee	4.80	Lenawee	9.34
Isabella	4.87	Gratiot	9.16
Macomb	4.94	St. Clair	8.91
Emmet	5.15	Barry	8.50

Note: Rates based on less than 200 deaths for the ten year period 1935-1944 are underscored.
Source: Table 8.2.

retired farmers. Thus the urban segments of predominantly urban counties tend to have low death rates, whereas the corresponding segments of predominantly rural counties tend to have high death rates. Although the high and the low death rates are in part reflections of the age compositions of the respective counties, the implications of the magnitude of death rates are factors in the distribution of health services which cannot be overlooked.

Table 8.8 shows the number of times counties in specified areas, for example, the Upper Peninsula, are found among either the twelve highest or the twelve lowest urban death rate counties for the five principal causes. According to these data, the urban segments of counties in the Upper Peninsula and in northern Michigan tend to be found in the low mortality group more often than among the high group whereas in southern Michigan the reverse is true. Counties of southern Michigan utilized 25.5 percent of their opportunities to place in the high mortality group as contrasted with 18.8 percent in the low group. These counties appear among those with high rates more than twice as often as do counties of the Upper Peninsula. Upper Peninsula counties are found twice as often among those with low rates as among those with high rates, the percent of the total placement opportunities being 20.0 and 10.0. If the counties of southern Michigan are classified as predominantly urban and predominantly rural, the urban segments of urban counties are found more often

Table 8.8 NUMBER AND PERCENT OF TIMES COUNTIES ARE FOUND AMONG THE TWELVE HIGHEST AND TWELVE LOWEST URBAN DEATH RATES FROM THE FIVE PRINCIPAL CAUSES, BY GEOGRAPHICAL AREA, MICHIGAN, 1935-1944

Area	Number of Counties	Placement Chances	Times Placed	Percent
Upper Peninsula	10	50		
Lowest			10	20.0
Highest			5	10.0
Northern Michigan[2]	13	65		
Lowest			20	30.8
Highest			14	21.5
Southern Michigan[2]	33	165		
Lowest			31	18.8
Highest			42	25.5
Urban Counties[3]	11	55		
Lowest			22	40.0
Highest			1	1.8
Rural Counties[3]	22	110		
Lowest			9	8.2
Highest			41	37.3

1. In 1930 there were 56 counties with urban population.

2. See footnote to Table 8.5.

3. A county is classified urban if more than 50 percent of its population in 1930 was urban. The remaining counties are rural.

Source: Table 8.7.

among the low mortality group whereas the corresponding segments of rural counties are found more often among the high mortality group.

These data support indirectly the previous generalization that the Upper Peninsula tends to have low rates for chronic diseases. (Four of the five causes under analysis are chronic diseases.) These data also corroborate the findings that, in general, where urban rates are high, rural rates are high and vice versa.

Infant Mortality Rates by Residence

Infant death rates for the rural part of each county are given in Table 8.9 and graphically in Figure 8.13. Examination of the map shows clearly that rates of rural people in counties of the northern part of the Lower Peninsula, and in the Upper Peninsula, are higher than the corresponding rates of the southern counties of lower Michigan. The counties with the twelve highest and those with the twelve lowest rates, given below, emphasize this concentration of high rates in the Upper Peninsula and in northern Michigan.

Twelve Lowest Death Rates Rural Infant Deaths		Twelve Highest Death Rates Rural Infant Deaths	
Ottawa	30.5	Crawford	68.2
Iosco	31.6	Luce	67.1
Barry	31.7	Gogebic	63.0
Mason	32.5	Alger	60.9
St. Joseph	32.5	Wexford	60.9
Menominee	33.3	Montmorency	60.8

RURAL INFANT MORTALITY RATES
(Allocated to residence)
MICHIGAN, AVE., 1935-1944 = 44.5

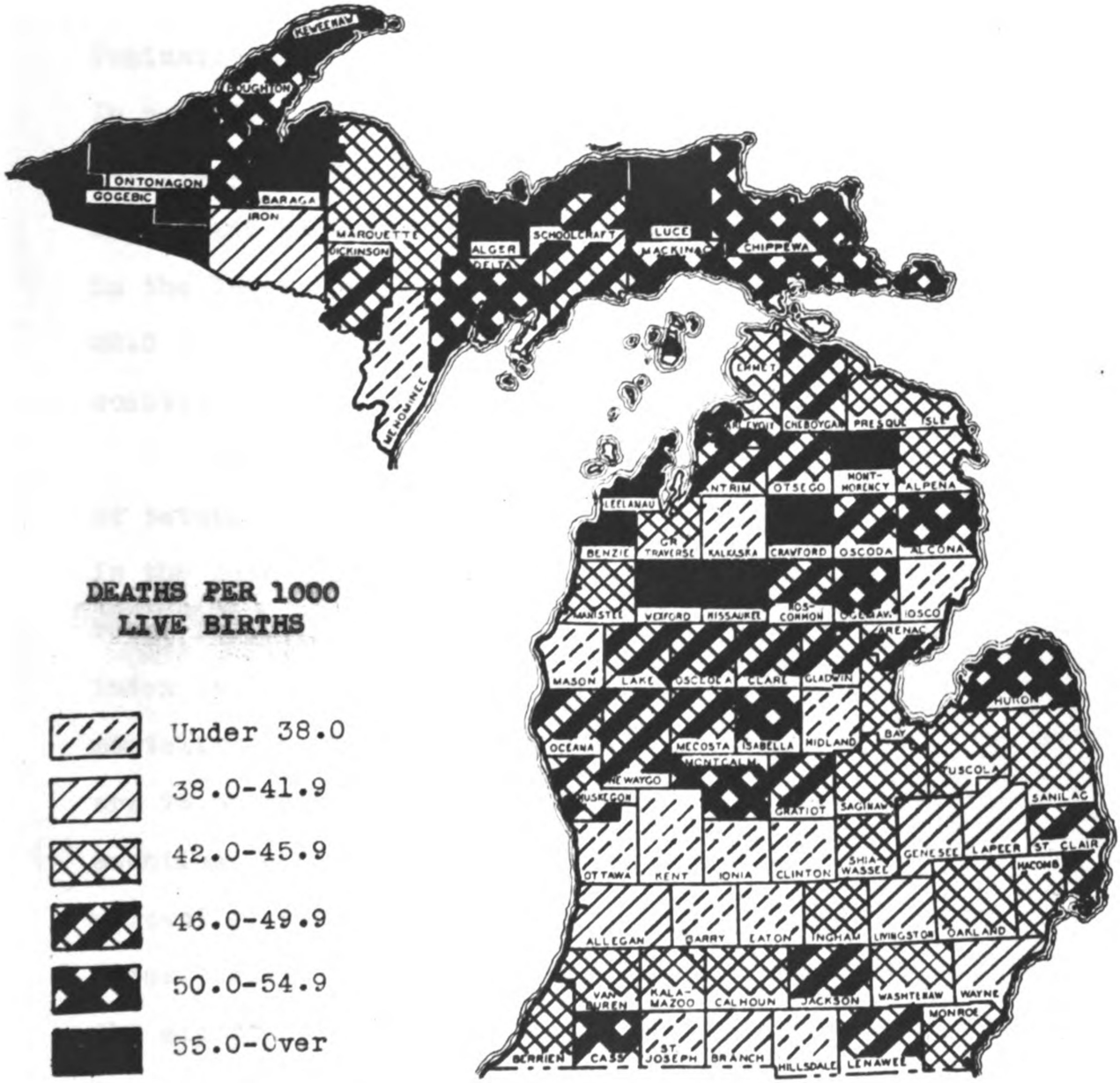


Figure 8.13 (Source: Table 8.9)

Clinton	35.7	Missaukee	59.9
Eaton	36.0	Ontonagon	59.6
Hillsdale	36.9	Leelanau	56.9
Kent	37.4	Keweenaw	56.9
Kalkaska	37.5	Baraga	56.0
Ionia	37.7	Benzie	55.9

Of the twelve high rates, six are in counties of the Upper Peninsula, and six are in counties of northern Michigan. In contrast, eight of the twelve counties with low mortality are in southern Michigan. The exceptions are Iosco, Mason, and Kalkaska in northern Michigan; and Menominee in the Upper Peninsula. The lowest rural infant rate is 30.5 in Ottawa, and the highest is 68.2 in Crawford county.

There is a clear-cut inverse relationship indicated between infant death rates and rural levels of living[1] in the data just presented. In the twelve counties where rural infant mortality is high, the average level of living index is lower than in the twelve counties where infant mortality is low. Death rates in the high mortality counties are 76 percent in excess of rates in the low mortality counties, and the average level of living index is 22.4 percent greater in the counties with low infant death rates. This is not surprising since it is in keeping with the expectations as well as the results of several studies bearing on the relationship of mortality and economic

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1. Source of rural level of living measures: Hagood, Margaret Jarman, "Rural Level of Living Indexes for Counties of the United States, 1940," Bureau of Agricultural Economics, United States Department of Agriculture, Washington, D. C., 1943, pp. 22-23.

Table 8.9 RURAL INFANT MORTALITY RATES PER 1,000 LIVE BIRTHS IN COUNTIES OF MICHIGAN, 10 YEAR AVERAGES BIRTHS AND DEATHS, 1935-1944 (Exclusive of stillbirths; by place of residence)

State and County	Total Number Deaths	Rate	State and County	Total Number Deaths	Rate
Alcona	58	54.6	Lake	40	49.6
Alger	67	60.9	Lapeer	216	39.3
Allegan	255	41.8	Leelanau	90	56.9
Alpena	71	42.4	Lenawee[1]	337	46.2
Antrim	112	48.7	Livingston	110	39.9
Arenac[1]	81	48.5	Luce[1]	102	67.1
Baraga[1]	96	56.0	Mackinac[1]	108	52.5
Barry	93	31.7	Macomb[1]	522	45.6
Bay	258	44.3	Manistee	76	43.6
Benzie	93	55.9	Marquette	130	45.7
Berrien	344	44.6	Mason	54	32.5
Branch	130	40.3	Mecosta	112	46.5
Calhoun	265	43.4	Menominee	90	53.3
Cass	111	50.2	Midland	157	37.8
Charlevoix	108	53.2	Missaukee	106	59.9
Cheboygan	75	47.8	Monroe	293	42.2
Chippewa	145	54.5	Montcalm	230	52.6
Clare	100	49.3	Montmorency	48	60.8
Clinton	156	35.7	Muskegon	337	49.8
Crawford	52	68.2	Newaygo[1]	176	47.1
Delta	156	50.7	Oakland	989	42.1
Dickinson	65	47.4	Oceana	128	47.5
Eaton	142	36.0	Ogemaw	97	51.7
Emmet	90	42.2	Ontonagon	120	59.6
Genesee	661	40.9	Osceola	132	49.6
Gladwin	99	46.9	Oscoda	24	46.2
Gogebic	129	63.0	Otsego	64	49.1
Grand Traverse	87	45.1	Ottawa	210	30.5
Gratiot[1]	253	47.8	Presque Isle	76	43.1
Hillsdale	147	36.9	Roscommon	33	46.0
Houghton	275	51.8	Saginaw	418	43.5
Huron[1]	347	51.2	St. Clair	316	48.9
Ingham	425	43.8	St. Joseph	121	32.5
Ionia	165	37.7	Sanilac	265	45.8
Iosco	52	51.6	Schoolcraft	48	49.5
Iron	82	40.0	Shiawassee	192	43.2
Isabella	190	50.0	Tuscola	285	44.6
Jackson	285	49.5	Van Buren	216	45.4
Kalamazoo	280	42.9	Washtenaw	265	43.3
Kalkaska	43	37.5	Wayne[1]	724	41.8
Kent	538	37.4	Wexford	93	60.9
Keweenaw	35	56.9	State	15,367	44.5

1. Residence based on 1930 population.
Source: Annual Reports, Michigan Department of Health, 1935-1944, Table 8.

status.[1] Dorn, for example, after classifying the counties of Ohio into good and poor agricultural areas (employing these classifications as indicative of economic status), found striking differences in infant death rates between the areas of good and poor economic status, the rate being more than 40 percent greater in the poor economic areas.[2] It should be pointed out that the deaths in Dorn's study, as well as those in the present study, are not classified by economic status of families, thus the evidence must be regarded as an indirect corroboration of the hypothesis.

Examination of Table 8.10 and Figure 8.14 showing the infant death rates for the urban segments of the counties of Michigan reveals a cluster having high death rates in the central part of the Lower Peninsula. These counties include Isabella, which has the second highest rate in the State, namely 63.9. Urban places in the Upper Peninsula also have higher than average death rates with the exceptions of Gogebic, Iron, and Dickinson.

A comparison of the infant death rates for the rural

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1. See: Coombs, L.C., "Economic Differentials in Causes of Death," Medical Care, Vol. I, July 1941, pp. 246-255; Mott, Frederick D. (M.D.), and Roemer, Milton I. (M.D.), Rural Health and Medical Care, McGraw-Hill Book Company, New York, 1948, p. 71-73; Registrar General, The Registrar-General's Decennial Supplement; England and Wales, H.M. Stationery Office, London, England, 1936, Vol. II, p. 211, and pp. 191-210; Thompson, Warren S., op. cit., pp. 234-239.

2. Dorn, Harold F., "Mortality Rates and Economic Status in Rural Areas," Public Health Reports, Vol. 55, No. I, January 5, 1940, pp. 3-12, (Reprint No. 2126, p. 4).

URBAN INFANT MORTALITY RATES
(Allocated to residence)
MICHIGAN, AVE., 1935-1944 = 40.7



Figure 8.14 (Source: Table 8.10)

Table 8.10 URBAN INFANT MORTALITY RATES PER 1,000 LIVE BIRTHS IN COUNTIES OF MICHIGAN, 10 YEAR AVERAGES, BIRTHS AND DEATHS, 1935-1944 (Exclusive of stillbirths; by place of residence)

State and County	Ave. Number Deaths	Rate	State and County	Ave. Number Deaths	Rate
Alcona	---	---	Lake	---	---
Alger	55	53.1	Lapeer	42	44.5
Allegan	65	37.6	Leelanau	---	---
Alpena	123	45.3	Lenawee[1]	164	54.7
Antrim	---	---	Livingston	44	51.2
Arenac	---	---	Luce	---	---
Baraga	---	---	Mackinac	---	---
Barry	47	45.5	Macomb[1]	497	40.8
Bay	507	48.6	Manistee	79	50.2
Benzie	---	---	Marquette	296	50.9
Berrien	344	38.9	Mason	79	42.7
Branch	74	48.8	Mecosta	46	43.9
Calhoun	631	49.0	Menominee	136	47.3
Cass	68	60.6	Midland	143	47.9
Charlevoix	34	51.9	Missaukee	---	---
Cheboygan	76	60.9	Monroe	236	48.2
Chippewa	222	53.5	Montcalm	60	57.2
Clare	---	---	Montmorency	---	---
Clinton	51	57.4	Muskegon	826	54.2
Crawford	---	---	Newaygo	---	---
Delta	255	66.8	Oakland	1,266	39.3
Dickinson	168	44.6	Oceana	---	---
Eaton	104	39.3	Ogemaw	---	---
Emmet	77	60.2	Ontonagon	---	---
Genesee	1,490	44.8	Osceola	---	---
Gladwin	---	---	Oscoda	---	---
Gogebic	145	37.0	Otsego	---	---
Grand Traverse	116	47.1	Ottawa	161	30.2
Gratiot[1]	100	62.6	Presque Isle	41	46.9
Hillsdale	63	49.1	Roscommon	---	---
Houghton	121	52.0	Saginaw	807	45.1
Huron	---	---	St. Clair	411	46.9
Ingham	733	39.7	St. Joseph	85	32.8
Ionia	111	53.0	Sanilac	---	---
Iosco	---	---	Schoolcraft	64	54.5
Iron	48	37.8	Shiawassee	194	53.9
Isabella	114	63.9	Tuscola	45	61.4
Jackson	472	43.8	Van Buren	36	40.6
Kalamazoo	375	29.5	Washtenaw	357	37.8
Kalkaska	---	---	Wayne[1]	13,775	38.3
Kent	1,066	33.9	Wexford	107	49.7
Keweenaw	---	---	State	27,852	40.7

1. Residence based on 1930 population.

Source: Annual Reports, Michigan Department of Health, 1935-1944, Table 8.

and urban segments of the 56 counties of Michigan which have urban places indicates that the rural segments have lower rates than their corresponding urban segments. This is true for 37 of the 56 counties. The counties with the twelve highest rates and those with the twelve lowest, are given below:

Twelve Lowest Death Rates Urban Infant Deaths		Twelve Highest Death Rates Urban Infant Deaths	
Kalamazoo	29.5	Delta	66.8
Ottawa	30.2	Isabella	63.9
St. Joseph	32.8	Gratiot	62.6
Kent	33.9	Tuscola	61.4
Gogebic	37.0	Cheboygan	60.9
Allegan	37.6	Cass	60.6
Iron	37.8	Emmet	60.2
Washtenaw	37.8	Clinton	57.4
Wayne	38.3	Montcalm	57.2
Berrien	38.9	Lenawee	54.7
Eaton	39.3	Schoolcraft	54.5
Oakland	39.3	Muskegon	54.2

Ten of the twelve counties with low death rates are in southern Michigan. The two exceptions are Gogebic and Iron in the Upper Peninsula. On the other hand, seven of the twelve high infant rates for urban segments are also in southern Michigan. Of the remaining segments, two counties are in the Upper Peninsula, namely, Delta and Schoolcraft, and three are in northern Michigan. Delta county has the highest urban infant death rate and Kalamazoo has the lowest one. They are 66.8 and 29.5 respectively.

PART IV

TRENDS OF MORTALITY

CHAPTER IX

MORTALITY CHANGES[1] IN MICHIGAN

Changes in the mortality conditions from one period to another is of tremendous social significance, for along with other vital phenomena they indicate the general direction in which health services should develop. In 1900 more people died from pneumonia (including influenza) than from any other cause; but today heart diseases take the greatest toll.

Rupert F. Vance in his book, All These People, writes of man's effort to survive as taking the form of a defense. The offense consists of all the harmful elements of environment while the defense comprises both man's innate capacity to survive and the supporting environmental influences, such as medical care and health facilities, which are especially designed weapons against illness and death. He continues, "Under ideal environmental conditions the battle would be decided only when the force of inherent vitality crumbles at the end of the life span. We can measure the outcome of this conflict only in terms of performance, as in death rates, morbidity rates, and length of life. In the record

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1. In this chapter mortality data are given, for the most part, by place of occurrence, since relatively few States have allocated deaths to residence prior to 1938. According to Linder and Grove, "... rates for groups of registration States or for individual States would be affected very slightly, if the data were tabulated on a place-of-residence basis." Linder, Forrest E., and Grove, Robert D., op. cit., p. 18.

of performance, biology and environment are so intermingled that no separate accounting is undertaken, or in fact possible."[1]

However, it does not seem reasonable to assume that man's innate physical capacities are so variable that they satisfactorily explain the differing mortality rates found among the various classes of the population. A more likely assumption is that man's innate biological capacity to survive varies little, and that changes in the rates at which people die during a given period reflect primarily changes in environmental conditions.[2]

It is the objective of this Chapter to present the changes in mortality differentials that have occurred in the population of Michigan and in certain segments of that population for selected years. This analysis will include a discussion of mortality change for the total population; for age, sex, and race; for infant and maternal deaths; and for the principal causes of death.[3] In order to evaluate these trends, comparable data are given for the

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1. Vance, Rupert B., op. cit., p. 335.

2. Warren S. Thompson, op. cit., p. 240, makes a similar assumption with respect to mortality differentials between the white and colored populations; compare Forrest E. Linder, et al, op. cit., p. 12; See also Smith, T. Lynn, op. cit., p. 167.

3. The changes in mortality for rural and urban areas cannot be determined because the data are not available. Most of the States did not begin allocating deaths to place of residence until 1938. Michigan adopted this procedure in 1935.

death-registration States of 1910[1] or in some instances for the death-registration States.[2] However, the death-registration States of 1910 are employed almost exclusively because more accurate mortality trends can be secured by using constant areas.[3] In this Chapter, death rates which are adjusted or standardized for differences in age composition are based on the 1940 age distribution[4] of the death-registration States of 1900.[5]

During the 70 years from 1875-1944, the ten-year average crude death rate for Michigan increased from 8.8 per 1,000 population at the beginning of the period to a peak

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1. The death-registration States of 1910 include the following 20 States and District of Columbia: California, Colorado, Connecticut, District of Columbia, Indiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Utah, Vermont, Washington, and Wisconsin.

2. The term "death-registration States" refers to the expanding area covered by States entering the death-registration system and recording deaths by its rules. The number of States varied until 1933 when all of the 48 States were included in the area.

3. Since the death-registration States of 1910 are employed as the Nation in this Chapter, those death rates do not correspond to those used in Chapter VI where the death-registration States are used.

4. The choice and use of standard million populations is discussed in Appendix I, p.318ff.See also Pearl, Raymond, op. cit., pp. 254-260.

5. The death-registration States of 1900 include the following 10 States and the District of Columbia; Connecticut, District of Columbia, Indiana, Maine, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

of 13.5 for 1905-1914,[1] and it has decreased steadily since then (See Table 9.1).[2] Although deaths were numerous during the great influenza epidemic of 1918-1920, the general death rate was not influenced sufficiently to equal that of the preceding decennial period, 1905-1914. Ten-year average death rates are considered better measures of mortality than annual rates, especially for computations of the occurrence of death prior to 1925 because they tend to smooth out fluctuations due to epidemics. However, the computations involved make the use of the rate impractical on a large scale. Inasmuch as rates based on decennial years such as those given in Table 9.2 are considered adequate for showing the general trends of mortality, these have been employed in subsequent data in this Chapter.

Both the crude and age-adjusted death rates given in

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1. See Willcox, Walter F., op. cit., Chapter 13, especially pp. 204-230. See also this dissertation, pp. 29-34 for a consideration of errors in reporting deaths. Presumably, the death rate in Michigan would have been much higher before 1900 if all deaths had been properly recorded. Thus some of the increases shown in these death rates up to 1910, or thereabout, may be due to inefficient registration of deaths. Willcox believes that few communities have absolutely complete registration of deaths, the largest omissions being those under 1 year, especially babies who live only a few hours or days, and deaths from accidents, for example, by drowning in which the body is not found.

2. The general decline of the death rate in western civilization is indicated by Thompson, Warren S., op. cit., p. 218, thus: "... the death rate has been declining in much the same manner as the birth rate during the last few decades. In some countries, indeed, it has been declining somewhat faster than the birth rate in many Western countries."

Table 9.1

CRUDE MORTALITY RATES (TEN-YEAR AVERAGES) IN MICHIGAN, 1875-1944

Year	Average Number of Deaths	Rates per 1,000 Population	
		Crude	Adjusted (1)
1875-1884(2)	14,382.4	8.79	----(3)
1885-1894(2)	19,388.9	9.26	----(3)
1895-1904(2)	28,806.5	11.90	14.87
1905-1914	37,894.4	13.48	15.83
1915-1924	47,059.0	12.83	15.50
1925-1934	51,411.4	10.62	13.03
1935-1944	53,028.2	10.09	10.96

1 Based on the standard specific death rates of 1940 for the death-registration States of 1900.

2 Michigan was included in the Death-registration States of 1900 and employed her own system prior to this date.

3 Necessary data for age-adjustement are unavailable.

Source: Computed from the Sixty-ninth Annual Report, Michigan Department of Health, 1941, Table 2, pp. 234-235; Annual Reports for 1942-1945, Table 16.

Table 9.2 reveal that people in Michigan died at lower rates than those of the Nation for each decennial period since 1900 with the exception of 1920. This exception is a result of the influenza epidemic of 1918-1920. The crude death rate from influenza in Michigan for 1920 was 81.1, compared with 70.5 per 100,000 population for the Nation, a difference of 10.6. Influenza led to pneumonia in many cases and the difference between death rates from pneumonia in the two areas was even greater, namely 25.6, the rate for

the Nation being only 207.3 compared with 232.9 for Michigan.

Table 9.2

CRUDE AND AGE-ADJUSTED DEATH RATES PER 1,000 POPULATION MICHIGAN AND THE DEATH-REGISTRATION STATES, 1900-1940
(By place of occurrence)

Year	Crude Death Rates[2]			Adjusted Death Rates[1]		
	Michigan	U.S.	Difference U.S.--Mich.	Michigan	U.S.	Difference U.S.--Mich.
1940	9.9	10.8	1.0	10.6	11.2	.6
1930	10.7	11.3	.6	12.4	13.0	.6
1920	14.1	13.1	-1.0	15.0	14.7	-.3
1910	14.2	14.7	.5	14.8	16.2	1.4
1900	14.0	17.2	3.2	15.1	18.0	2.9

[1] Adjusted to the 1940 age distribution of the death-registration States of 1900 by the direct method.

[2] Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, Table 4, p. 154, and Table 9, p. 186.

With the exception of 1920, the differences between the adjusted death rates in Table 9.2 tend to decrease from 1900 to 1940, until for the period 1930-1940 it was quite small, only .6. Both populations are growing older, and, as will be shown later, both the Nation and Michigan have reduced most of their death rates from infectious diseases to a point where they are negligible. The overall decrease of age-adjusted death rates in Michigan and the Nation during the 40 year interval was 28.8 and 37.8 respectively. In attempting to estimate the actual number of lives saved by such decreases, Willcox, studying the death-registration States of 1900, for the period 1900-1930, wrote, "It is perhaps fair to conclude that not fewer than 4,000,000 lives have been saved since 1900."[1]

1. Willcox, Walter F., op. cit., p. 217.

Michigan has an extremely low death rate at the present time, and one might expect the rate to show increases in the near future in view of the rather general aging of the population. Warren S. Thompson, a leading authority on population in the United States, writes of this possibility for the country as a whole thus:

> "In the near future, therefore, we may expect to see the crude death rate (the number of deaths per thousand of the total population) cease to decline and begin to increase in those countries where it is now below 11 or 12. The low rates of today are possible only because population has been increasing very rapidly in the recent past, and the proportion of young people is very high."[1]

Mortality Trends by Age

The age-specific death rates in Michigan and the Nation for the decennial years, 1910-1940, are given in Table 9.3. The death rates for both populations decreased more than 80 percent at ages 1-4, all other groups having relatively lower declines. Except for the group under 1 year, death rates for all age groups under 35 in both Michigan and the Nation decreased more than 50 percent during the period; but from 35 years of age upward the percentage declines are less than 50 percent. (See percentage decrease column in Table 9.3)

All age-specific death rates for both Michigan and the United States decreased from one decennial year to the next, with the exception of 1920. The people of Michigan

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1. Thompson, Warren S., op. cit., p. 219.

Table 9.3

AGE SPECIFIC DEATH RATES PER 1,000 POPULATION MICHIGAN AND THE DEATH REGISTRATION STATES OF 1910 FOR 1910-1940 (By place of occurrence)

Age Group		Year				Percent Decrease 1910-1940	
		1910	1920	1930	1940	Mich.	U.S.
All ages:	U.S.	14.7	13.4	11.5	11.1		24.5
	Mich.	14.2	14.1	10.7	9.9	30.3	
Under 1:	U.S.	132.2	101.2	68.5	48.8		63.1
	Mich.	127.5	110.0	69.7	48.1	62.3	
1 - 4:	U.S.	14.0	9.9	4.9	2.2		84.3
	Mich.	11.3	10.8	5.2	2.2	80.5	
5 -14:	U.S.	2.9	2.7	1.7	1.0		65.5
	Mich.	2.9	3.3	1.8	1.0	65.5	
15-24:	U.S.	4.6	4.6	2.9	1.7		63.1
	Mich.	4.7	5.4	3.1	1.8	61.7	
25-34:	U.S.	6.6	6.6	4.2	2.6		60.6
	Mich.	5.8	7.3	4.1	2.5	56.9	
35-44:	U.S.	9.1	8.1	6.4	4.7		48.4
	Mich.	7.3	8.2	6.3	4.6	37.0	
45-54:	U.S.	13.9	12.2	12.0	10.3		25.9
	Mich.	11.6	11.5	10.8	9.5	18.1	
55-64:	U.S.	26.5	24.5	24.5	22.7		14.3
	Mich.	22.5	23.1	22.0	21.1	6.2	
65-74:	U.S.	56.0	54.3	52.6	49.9		10.9
	Mich.	52.2	52.0	50.2	48.2	7.7	
75-84:	U.S.	123.1	120.5	116.1	115.8		5.9
	Mich.	124.7	124.0	117.5	114.4	8.3	
85-Up:	U.S.	252.4	246.5	235.0	230.6		8.6
	Mich.	264.4	263.8	237.9	236.0	10.8	

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States, 1900-1940, Table 4, p. 154; Table 9, p. 188.

died at slightly higher rates in 1920 than in 1910. This is true of all age groups from 15 through 64 years, a result, undoubtedly, of the toll taken by the influenza and pneumonia epidemic of 1918-1920. In contrast, the death-registration States of 1910 showed no increases in age-specific death rates throughout the 30 year period, although for the years 1910 and 1920 the age-specific rates of the death-registration States for ages 15-34 remain the same. There were slight increases in death rates for two of the older age groups in Michigan, namely, 55-64 for the years 1910 and 1920, and 65-74 for 1920 and 1930. There was no change, either increase or decrease, in the death rate of the United States for age 55-64 for 1920 and 1930.

In previous Chapters, it was pointed out that for 1940 certain pairs of age groups in both Michigan and the United States had age-specific death rates which were approximately the same. These pairs were: (a) all ages and age group 45-54, (b) those under 1 year and age group 65-75, (c) age group 1-4 and 25-34. An examination of the data in Table 9.4 indicates that death rates for the pairs are similar for the years 1930 and 1940 but are quite dissimilar for earlier years. Moreover, differences between them grow larger with each preceding decennial year, with the exception of the first pair. In both Michigan and the United States for 1930 differences for the first pair were less than might be expected. Thus for these pairs of age groups, an equilibrium seems to have been reached which will probably persist

SELECTED AGE-SPECIFIC DEATH RATES, MICHIGAN AND THE DEATH-REGISTRATION STATES OF 1910 FOR 1910-1940

Pairs of Rates	Age Group	Michigan				United States			
		1940	1930	1920	1910	1940	1930	1920	1910
	All ages	9.9	10.7	14.1	14.2	11.1	11.5	13.4	14.7
1	45-54	9.5	10.8	11.5	11.6	10.3	12.0	12.2	13.9
	Difference	.4	.1	2.6	2.6	.8	.5	1.2	.8
	Under 1 Yr.	48.1	69.7	110.0	127.5	48.8	68.5	101.2	132.2
2	65-74	48.2	50.2	52.0	52.2	49.9	52.6	54.3	56.0
	Difference	.1	19.5	58.0	75.3	1.1	15.9	46.9	76.2
	1 - 4	2.2	5.2	10.8	11.3	2.2	4.9	9.9	14.0
3	25-34	2.5	4.1	7.3	5.8	2.6	4.2	6.6	6.6
	Difference	.3	1.1	3.5	5.5	.4	.7	3.3	7.4

Source of death rates: Table 9.3.

until new methods of control are developed in one or the other of the contrasting age groups.

Mortality Differentials By Sex

For each decade from 1910 to 1940, the death rates of males and females decreased in both the Nation and Michigan. (See Table 9.6) The age-adjusted death rate of males in Michigan for the year 1940 is 23.8 percent lower than it was in 1910, the rates being 11.81 and 15.49 respectively. Over the same period, the death rates of males in the Nation decreased slightly more than in Michigan, or 28.2 percent. The rates were 12.48 and 17.37 per 1,000 population. Although this is a sizable improvement, the death rate of females decreased proportionately more over the same years, Michigan again having a lower percentage decrease than the Nation:

	Percentage decrease of age-adjusted death rates 1910-1940 (See Table 9.6)	
	Males	Females
Michigan	23.8	33.2
United States	28.2	36.4

The death rates of both males and females in Michigan for the year 1910 were lower than corresponding rates for the Nation, and therefore, would not be expected to show higher percentage decreases from that year to 1940.

The crude death rates decrease in a similar manner, females having higher percentage decreases than males in both areas. However, the crude death rates for both males and females in Michigan decreased more than the correspond-

ing rates for the Nation, for the decennial years 1910-1940. This is due primarily to the more rapid aging of the population of the United States during the 30 years. In 1940 there were 7.9 percent more people 45 years or over in the United States than in 1910, whereas the corresponding figure for Michigan was 3.9 percent (Table 9.5).

Table 9.5

PROPORTION OF POPULATION, MICHIGAN AND DEATH-REGISTRATION STATES OF 1910 FOR 1910 and 1940, BY AGE GROUPS

Age groups	Percentage distribution of population			
	Michigan		United States	
	1940	1910	1940	1910
All Ages	100.0	100.0	100.0	100.0
Under 15	25.0	29.6	22.6	28.7
15 - 44	48.5	47.8	48.5	50.3
45 - 64	20.2	16.9	21.5	16.0
65 - Over	6.3	5.7	7.4	5.0
Total No.	5,256,106	2,810,173	70,859,153	47,250,693

Source: Computed from Vital Statistics Rates in the United States 1900-1940, Population Tables, Table II, p. 898, Table IX, p. 1006.

As for the decennial periods between the years 1910 and 1940, the year 1920 is exceptional in that death rates do not follow expected trends because of the influenza epidemic. Females had particularly high rates in Michigan during the epidemic years. Both the crude and age-adjusted death rates were higher in 1920 than in 1910 or 1930. The adjusted rate increased 5.9 percent from 1910 to 1920 and the crude

ate 3.7 percent. In contrast, both the crude and age-adusted death rates of females in the United States decreased, he percentage decrease being 5.8 and 5.1 respectively (See able 9.6). It is probable that women, because of their ome nursing responsibilities, were actually more exposed han men to influenza. Moreover, the disease seemed to be articularly fatal to pregnant women.[1] The death rate of ales decreased less than one percent in Michigan as compared with 11.1 percent for the United States.

By 1930 death rates for both males and females in chigan had decreased substantially. The age-adjusted eath rate of females dropped 23 percent from 1920 to 1930 hereas the corresponding rates for males dropped only 14.1 ercent. These percentage declines in Michigan were greater an corresponding decreases for the Nation, which were 19.5 rcent for females and 9.3 percent for males.

From 1930 to 1940, the age-adjusted rate for females Michigan fell from 11.50 to 9.42, a decrease of 18.1 perent. During the same period, the rates for females of the ited States decreased only 16.7 percent. The percentage ecreases in age-adjusted death rates from 1930 to 1940 were onsiderably less for males than for females in both Michigan d the United States. These decreases were 10.6 percent in

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The death rate from puerperal causes in the United States was 15.3 in 1910, 17.8 in 1920, and 10.6 in 1940. For the peak year of the epidemic (1918) it was 21.7. The death rate from puerperal causes in Michigan was 16.5 in 1915 and in 1920 it was 23.2.

CRUDE AND AGE-ADJUSTED[1] DEATH RATES PER 1,000 POPULATION, AND PERCENT CHANGE BY DECADES, MICHIGAN AND THE DEATH-REGISTRATION STATES OF 1910 FOR 1910-1940, BY SEX
(By place of occurrence)

		Death Rates per 1,000 Population							
		United States		Michigan		United States		Michigan	
Year	Sex	Crude Rate	Percent[2] Change	Crude Rate	Percent[2] Change	Adjusted Rate	Percent[2] Change	Adjusted Rate	Percent[2] Change
1940									
	Male	12.3	- .8	10.9	- 3.5	12.48	-10.9	11.81	-10.6
	Female	10.0	-4.8	8.9	-10.1	9.50	-16.7	9.42	-18.1
1930									
	Male	12.4	-10.8	11.3	-20.4	14.01	- 9.3	13.21	-14.1
	Female	10.5	-19.2	9.9	-28.8	11.41	-19.5	11.50	-23.0
1920									
	Male	13.9	-10.9	14.2	- 4.7	15.45	-11.1	15.38	- .7
	Female	13.0	- 5.8	13.9	- 3.7	14.18	- 5.1	14.94	- 5.9
1910									
	Male	15.6		14.9		17.37		15.49	
	Female	13.8		13.4		14.94		14.11	

[1] Adjusted to the 1940 age distribution of the Death-Registration States of 1900 by the direct method.

[2] Percent change in death rate over preceding decade.

Source: Crude death rates from Vital Statistics Rates in United States 1900-1940, Table 4, p. 154, and Table 5, p. 164.

Michigan and 10.9 in the United States. Thus, the percentage decrease for male deaths was greater for the Nation than for Michigan although the death rates in Michigan for both years were lower.

Michigan, in most instances, has lower crude and adjusted death rates for the period under consideration than the United States. In 1920 death rates in the State for both sexes exceeded those of the Nation. This was true also for the age-adjusted death rate for females in 1930. However, it was only .09 in excess of the rate for the United States. The mortality differentials between Michigan and the United States for each sex are given in Table 9.7.

Table 9.7

DIFFERENCES IN DEATH RATES BETWEEN MICHIGAN AND THE DEATH-REGISTRATION STATES OF 1910 FOR EACH SEX, 1910-1940

	Excess of Death Rates of the United States over Michigan			
	Crude		Adjusted	
Year	Male	Female	Male	Female
1940	1.4	1.1	.67	.08
1930	1.1	.6	.80	-.09
1920	- .3	- .9	.07	-.76
1910	.7	.4	1.88	.83

Source: Based on death rates given in Table 9.6.

Death rates for males are higher than those for females in both Michigan and the United States for all the decennial years under study. The excess death rates of males over fe-

males is given in Table 9.8. These sex-mortality differentials increase from 1910 to 1940 with the exception of the epidemic year of 1920 for Michigan. No satisfactory explanations of the excess of death rates of males over those of females have been given, although authorities such as Willcox[1] and Pearl[2] attribute this mortality differential primarily to biological differences.[3]

Table 9.8

DIFFERENCES IN SEX-SPECIFIC DEATH RATES, MICHIGAN AND THE DEATH-REGISTRATION STATES OF 1910 FOR 1910-1940

Year	Excess Death Rates of Males over Females			
	Crude		Adjusted	
	United States	Michigan	United States	Michigan
1940	2.3	2.0	2.98	2.39
1930	1.9	1.4	2.60	1.71
1920	.9	.3	1.27	.44
1910	1.8	1.5	2.43	1.38

Source: Based on death rates in Table 9.6.

Perhaps the most accurate estimates of the changes that have taken place during the 30 year period as a result of the force of mortality in Michigan may be obtained by examining the age-specific death rates by sex, presented in Table 9.9 and their change from 1910 to 1940. From these

1. See Willcox, Walter F., op. cit., p. 120.
2. See Pearl, Raymond, op. cit., p. 183.
3. See Appendix IV for an elaboration of a social causation hypothesis of the sex-mortality differential; it is referred to here only as a possible explanation since it is not formally tested in this dissertation.

Table 9.9

AGE AND SEX-SPECIFIC DEATH RATES FROM ALL CAUSES PER 1,000 POPULATION, MICHIGAN, 1910 AND 1940
(By place of occurrence)

Ages	Death rates per 1,000 pop: 1910 Male	1910 Female	1940 Male	1940 Female	Difference: 1910 - 1940 Male	1910 - 1940 Female	100 X Diff. / 1910 Spec.Rate Male	100 X Diff. / 1910 Spec.Rate Female
Total Crude	14.9	13.4	10.9	8.9	- 4.0	- 4.5	26.8	33.6
0 - 1	142.8	111.8	55.1	40.8	-87.7	-71.0	61.4	63.5
1 - 4	12.0	10.7	2.3	2.0	- 9.7	- 8.7	80.8	81.3
5 -14	3.0	2.8	1.1	0.8	- 1.9	- 2.0	63.3	71.4
15-24	4.6	4.8	2.0	1.5	- 2.6	- 3.3	56.5	68.8
25-34	5.8	5.8	2.8	2.2	- 3.0	- 3.6	51.7	62.1
35-44	7.3	7.3	5.0	4.1	- 2.3	- 3.2	31.5	43.8
45-54	12.0	11.2	10.9	7.9	- 1.1	- 3.3	9.2	29.5
55-64	23.9	21.0	24.1	17.9	+ .2	- 3.1	+ .8	14.8
65-74	54.9	49.3	53.4	42.8	- 1.5	- 6.5	2.7	13.2
75-84	129.9	119.2	122.5	106.6	- 7.4	-12.6	5.7	10.6
85-up	274.7	254.3	247.4	227.0	-27.3	-27.3	9.9	10.7
Total Adjusted (1)	15.49	14.11	11.81	9.42	-3.68	-4.69	23.8	33.2

(1) Adjusted to the 1940 age distribution of the death-registration States of 1900 by the direct method.

Source: Specific Rates are from Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Bureau of the Census, Table 5, p. 164.

data the following generalizations may be made:

1. Death rates by age and sex have declined remarkably in Michigan during the 30 year interval from 1910 to 1940. Both of the sexes in all but one age group (55-64) had lower death rates in 1940 than in 1910. Therefore, to the extent that age and sex mortality rates measure the health of the population, the improvement in health conditions in Michigan during the period studied seems quite impressive.

2. Declines in death rates were greatest at the beginning of the life cycle and in early youth, and smallest at the end. This is true for both of the sexes. Since the death rates are normally highest in the youngest and the oldest age groups, it is to be expected that most of the decreases would occur in these age groups. However, inasmuch as the death rates of the younger segments of the population cannot continue to fall greatly some of them being extremely low at present, further improvements will have to come by speeding up decreases among the older age groups. It would seem that no further reduction of mortality among the aged can be anticipated unless medical science learns the secret of staying the degenerative processes. Inasmuch as the social environment is a conditioning factor in these processes, some control, within biological limits, should be possible.

3. Death rates of females declined more than those of

males for all age groups.[1] In three age groups (45-74) percentage declines for females were three or more times the magnitude of corresponding declines for males. For the years 15-45, which include the childbearing period for women and the most productive working period for men, the reduction in the death rate among females is from 8 to 12 percent greater than that for males.

The changes that have taken place in age-sex-mortality rates in the United States during the 30 year period are similar to those which have occurred in Michigan (See Tables 9.10 and 9.11). The death rates for males were higher than those for females in 1910 and in 1940 for all age groups. Although the death rates of males were higher, and thus could be expected to have had greater percentage declines from 1910-1940, the percentage decreases at all ages were lower for males than for females. This was also true for Michigan.

A comparison of sex-specific death rates by age for the Nation and for Michigan shows that during the 30 year interval the percentage changes have been less for Michigan than for the United States. (See Table 9.11.) Among females, there were three age groups for which declines were slightly greater in Michigan, namely, those 15-24, and the two age groups 75-84 and 85 years and over. When compared with the

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1. Pearl, Raymond, op. cit., pp. 180-183, shows that during the period 1910-1930 death rates for the registration States of 1910 decreases more for females than males from birth up to the age of 20 and from 50 years upward.

Table 9.10

AGE AND SEX-SPECIFIC DEATH RATES FROM ALL CAUSES PER 1,000 POPULATION, REGISTRATION STATES OF 1910 AND DISTRICT OF COLUMBIA, 1910 AND 1940 (By place of occurrence)

	Death Rate per 1,000 population				Difference: 1910-1940		100 X Difference: 1910 Death Rate	
	1910		1940					
Age	Male	Female	Male	Female	Male	Female	Male	Female
Total Crude	15.6	13.8	12.3	10.0	3.3	3.8	21.2	27.5
0 - 1	146.0	118.0	55.2	42.2	90.8	75.8	62.2	64.2
1 - 4	14.7	13.4	8.4	2.1	12.3	11.3	83.7	84.3
5 -14	3.0	2.9	1.1	.8	1.9	2.1	63.3	72.4
15-24	4.9	4.2	2.0	1.4	2.9	2.8	59.2	66.7
25-34	7.0	6.2	2.9	2.3	4.1	3.9	58.6	62.9
35-44	10.0	8.0	5.4	4.0	4.6	4.0	46.0	50.0
45-54	15.4	12.2	12.2	8.3	3.2	3.9	20.8	32.0
55-64	29.0	23.8	26.8	18.4	2.2	5.4	7.6	22.7
65-74	59.2	52.7	56.4	43.8	2.8	8.9	4.7	16.9
75-84	128.5	118.3	124.3	108.3	4.2	10.0	3.3	8.5
85-up	258.0	248.0	243.5	221.7	14.5	26.3	5.6	10.6
Total Adjusted (1)	17.37	14.94	12.48	9.50	4.89	5.44	28.2	36.4

(1) Adjusted to the 1940 age distribution of the death-registration States of 1910 by the direct method.

Source: Crude death rates from Linder, Forrest E., and Grove, Robert D., Vital Statistics in the United States 1900-1940, Table 9, p. 188.

Table 9.11

DIFFERENCES IN AGE-SEX-SPECIFIC DEATH RATES AND PERCENTAGE DECLINE, MICHIGAN AND DEATH-REGISTRATION STATES OF 1910 FOR 1910 AND 1940

Age	Excess of Death Rate 1910 over 1940				Percentage Decline 1910 to 1940: 100 X Difference / 1910 Specific Death Rate			
	Male		Female		Male		Female	
	U.S.	Mich.	U.S.	Mich.	U.S.	Mich.	U.S.	Mich.
Total Crude	3.3	4.0	3.8	4.5	21.2	26.8	27.5	33.6
0 - 1	90.8	87.7	75.8	71.0	62.2	61.4	64.2	63.5
1 - 4	12.3	9.7	11.3	8.7	83.7	80.8	84.3	81.3
5 -14	1.9	1.9	2.1	2.0	63.3	63.3	72.4	71.4
15-24	2.9	2.6	2.8	3.3	59.2	56.5	66.7	68.8
25-34	4.1	3.0	3.9	3.6	58.6	51.7	62.9	62.1
35-44	4.6	2.3	4.0	3.2	46.0	31.5	50.0	43.8
45-54	3.2	1.1	3.9	3.3	20.8	9.2	32.0	29.5
55-64	2.2	- .2	5.4	3.1	7.6	- .8	22.7	14.8
65-74	2.8	1.5	8.9	6.5	4.7	2.7	16.9	13.2
75-84	4.2	7.4	10.0	12.6	3.3	5.7	8.5	10.6
85-up	14.5	27.3	26.3	27.3	5.6	9.9	10.6	10.7
Total Adjusted (1)	4.89	3.68	5.44	4.69	28.2	23.8	36.4	33.2

(1) Adjusted to the 1940 age distribution of the death-registration States of 1910 by the direct method.

Source: Tables 9.9 and 9.10.

Nation, males in Michigan fared even worse. Only two age groups had greater decreases than the Nation, those 75-84 and those 85 years and over. However, these proportionately lower mortality changes are to be expected, because Michigan had lower age-sex-specific death rates than the United States in both 1910 and 1940 for all except three of the age groups.

Mortality Changes by Race

The mortality changes in the white and colored groups of Michigan are found in Table 9.12 where they may be compared with corresponding improvements in the Nation. Death rates are higher for colored people than for white people for the four decennial years under study. This is true for both the crude and the age-adjusted death rates. The mortality differentials by race, based on Table 9.12 are as follows:

Year	Excess of Death Rates of Colored Population Over White	
	Crude	Adjusted
1940	2.8	6.09
1930	6.2	10.22
1920	11.9	15.04
1910	11.0	9.85

The excess mortality of colored over white people was greatest in 1920, at which time the adjusted death rate for nonwhites was more than twice that of the whites, namely, 29.84 as compared with 14.80 per 1,000 population. Moreover, the crude death rate in Michigan for 1920 was 86.2 percent higher for colored than for white people. The largest mortality

Table 9.12

CRUDE AND AGE-ADJUSTED[1] DEATH RATES PER 1,000 POPULATION, MICHIGAN AND THE DEATH-REGISTRATION STATES OF 1910 FOR 1910-1940, BY RACE (Data by place of occurrence)

Year	Race	Death rates per 1,000 population			
		Crude		Adjusted	
		Michigan	United States	Michigan	United States
1940	Colored	12.6	14.2	16.46	16.89
	White	9.8	11.0	10.37	10.75
1930	Colored	16.6	17.3	22.23	22.06
	White	10.4	11.2	12.01	12.45
1920	Colored	25.7	21.1	29.84	24.13
	White	13.8	13.2	14.80	14.58
1910	Colored	25.1	21.9	24.85	24.45
	White	14.1	14.6	15.00	15.96

[1] Adjusted to the 1940 age distribution of the death-registration States of 1900 by the direct method.

Source: Crude death rates from Vital Statistics Rates in the United States 1900-1940, Table 9, p. 189, Table 4, p. 154.

differential by race (15.04) occurred in 1920, but the difference has become less with each succeeding decade, indicating that mortality conditions among the two populations have become more nearly equal each ten-year period.

Death rates in Michigan have decreased relatively more for the colored than for the white population from 1910-1940. This is true for both the crude and the age-adjusted death rates. The percentage declines of each racial group for the period under consideration are indicated below:

Race	Percentage Decline of Death Rates, 1910 to 1940	
	Crude	Adjusted
White	30.5	30.9
Colored	49.8	33.8

A comparison of mortality rates by age groups for 1910 and 1940 given in Table 9.13 permits a more refined analysis of the changes which have taken place among the racial groups. Non-whites in Michigan have shown greater percentage declines in death rates than whites for all age groups under 25 years of age and for those 65 years and over. The specific death rate of colored infants under 1 year of age was phenomenally high in 1910,-- being approximately identical with the rate of the oldest age group presented, those 85 years of age and over. The rates were 188.6 and 188.7 respectively. By 1940 the death rate for colored infants under 1 year of age had declined to 67.2, a reduction of 64.4 percent. In 1910 the rate for white infants under 1 year of age was 127.0 and by 1940 it had dropped to 47.3 per 1,000 population, a decline

Table 9.13

RACE SPECIFIC DEATH RATES PER 1,000 POPULATION AND PERCENT CHANGE, MICHIGAN, 1910 AND 1940, BY AGE (By place of occurrence)

Age	1910		1940		Percent decline: 100 X Difference 1910-40 / Specific Rate 1910	
	White	All Other	White	All Other	White	All Other
Total Crude	14.1	25.1	9.8	12.6	30.5	49.8
0 - 1	127.0	188.6	47.3	67.2	62.8	64.4
1 - 4	11.3	21.1	2.1	3.9	81.4	81.5
5 -14	2.9	8.9	1.0	1.4	65.5	84.3
15-24	4.6	14.6	1.6	5.0	65.2	65.8
25-34	5.7	15.1	2.2	6.9	61.4	54.3
35-44	7.2	15.7	4.2	11.0	41.7	29.9
45-54	11.5	26.1	9.0	21.9	21.7	16.1
55-64	22.4	33.7	20.8	36.0	7.2	∤ 6.8
65-74	52.1	69.8	47.9	57.5	8.1	17.6
75-84	124.6	134.9	114.3	122.4	8.3	9.3
85-up	265.7	188.7	238.9	126.1	10.1	33.2
Total Adjusted (1)	15.00	24.85	10.37	16.46	30.9	33.8

(1) Adjusted to the 1940 age distribution of the death-registration States of 1900 by the direct method.

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 4, p. 154.

of 62.8 percent. As expected, both the white and colored populations had relatively small declines among the age groups 45 years and over. Instead of decreasing, the death rate for one age group among the non-whites, those 55-64, increased from 33.7 per 1,000 population in 1910 to 36.0 in 1940.

As was true in Michigan, crude and age-adjusted death rates for colored people in the Nation were higher than for white people from 1910 to 1940, but the differences by race are less than corresponding differences in Michigan, except for the year 1940. These differences are given in Table 9.14.

Age-adjusted death rates for the white segment of the Nation were slightly higher than those for Michigan except for the year 1920. (See Table 9.15.) The influenza epidemic took a larger proportion of lives in Michigan than in the United States in 1920, which probably explains this exception.

Table 9.14

DIFFERENCES IN DEATH RATES, MICHIGAN AND THE DEATH REGISTRATION STATES OF 1910 FOR 1910 and 1940, BY RACE

Year	Excess of Death Rates of colored over death rates of white, 1910 and 1940			
	Michigan		United States	
	Crude	Adjusted	Crude	Adjusted
1940	2.8	6.09	3.2	6.14
1930	6.2	10.22	6.1	9.61
1920	11.9	15.04	7.9	9.55
1910	11.0	9.85	7.3	8.49

Source: Computed from Table 9.12.

Table 9.15

DIFFERENCES IN AGE-ADJUSTED DEATH RATES, MICHIGAN AND THE DEATH REGISTRATION STATES OF 1910 FOR 1910 TO 1940

Year	Adjusted death rates and differences					
	Colored			White		
	Death Rates:			Death Rates:		
	Mich.	U.S.	Difference	Mich.	U. S.	Difference
1940	16.46	16.89	.43	10.37	10.75	.38
1930	22.23	22.06	.17	12.01	12.45	.44
1920	29.84	24.13	5.71	14.80	14.58	.22
1910	24.85	24.45	.40	15.00	15.96	.96

Source: Computed from Table 9.12.

In contrast to the trend for the white race, age-adjusted death rates for the colored segment of the population in the United States were lower than those in Michigan except for 1940. A contributing factor might be differences in reporting procedures. Michigan's non-white population was located chiefly in Detroit where reporting techniques were well developed in contrast to areas of the United States in which the registration system has operated inefficiently until recently. Differences between the age-adjusted death rates of the non-white population in Michigan and the United States together with the corresponding differences for the white population in these two areas are given above. This difference for colored persons was excessive for Michigan in 1920. It is probable that both general levels of living and availability of facilities were contributing factors to a high death rate among the non-whites during the influenza

epidemic.

Crude death rates have decreased relatively more for the non-white than for the white population in the Nation which is comparable to the trends in Michigan.[1] However, when the death rates for the United States are adjusted for age, the situation is reversed, the white population decreasing at a greater rate than the non-whites. This is not true for Michigan. The percentage decreases are presented below:

Percentage decline of death rates, 1910 to 1940

	Michigan		United States	
	Crude	Adjusted	Crude	Adjusted
White	30.5	30.9	24.7	32.7
Colored	49.8	33.8	35.2	30.9

Source: Computed from Tables 9.13 and 9.16.

Age-specific death rates by race for 1910 and 1940 and percentage declines for the Nation are presented in Table 9.16. White and colored segments have approximately the same percentage decreases for those under 15 years, but above this age the whites have a definite advantage for all age groups.[2] This is contrary to the corresponding differentials

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1. See Mott, Frederick D., et. al., op. cit., p. 56; and Kemp, Louise, et al., op. cit., p. 8, for comparable findings.

2. On the basis of life-table death rates Warren S. Thompson arrived at similar conclusions for the death-registration States of 1920 for the period 1920-1940, op. cit., p. 140.

Table 9.16

RACE SPECIFIC DEATH RATES PER 1,000 POPULATION AND PERCENT CHANGE, DEATH-REGISTRATION STATES OF 1910 for 1910 AND 1940, BY AGE (Data by place of occurrence)

Age	1910		1940		Percent decline: 100 X Difference 1910-40 / Specific Rate 1910	
	White	All Other	White	All Other	White	All Other
Total Crude	14.6	21.9	11.0	14.2	24.7	35.2
0 - 1	129.7	241.9	47.0	87.4	63.8	63.9
1 - 4	13.7	28.6	2.1	4.3	84.7	85.0
5 -14	2.9	5.7	.9	1.7	69.0	70.2
15-24	4.4	10.4	1.6	5.0	63.6	51.9
25-34	6.4	12.3	2.3	7.3	64.1	40.7
35-44	8.8	17.3	4.4	11.7	50.0	32.4
45-54	13.6	25.0	9.8	21.9	28.0	12.4
55-64	26.2	39.0	22.2	37.5	15.3	3.9
65-74	55.8	65.0	49.6	62.3	11.1	4.2
75-84	123.5	104.3	115.8	115.1	6.2	∤ 10.4
85-up	254.6	177.6	232.2	178.2	8.8	∤ .3
Total Adjusted (1)	15.96	24.45	10.75	16.89	32.7	30.9

(1) Adjusted to the 1940 age distribution of the death-registration States of 1900 by the direct method.

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 9, p. 189.

in Michigan, the colored population having higher declines than the white for ages 65 and over.

A comparison of mortality changes by sex and race in Michigan is presented for the years 1910 and 1940 in Table 9.17 and corresponding data for the Nation in Table 9.18.[1] In general, these data show that the death rates of both males and females in the two racial categories have decreased substantially during this 30 year interval. In Michigan the actual differences in the rates for both sexes are greater for the colored than the white groups, although the percentage decreases are greater for the white segments. (Table 9.17)

The excess of the age-adjusted sex specific death rates by race in the Nation given in Table 9.18 below over corresponding rates for Michigan in Table 9.17 indicate that the differences were much greater in 1910 than in 1940. For example, colored males in Michigan and the Nation had death rates of 27.77 and 33.43 respectively in 1910, a difference of 5.66; while in 1940 corresponding death rates were 20.33 and 20.87, giving a difference of .54. The mortality differential for colored females in Michigan and the Nation decreased from 5.30 in 1910 to approximately equal rates in 1940. The differentials for males and females of the white

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1. Adjusted death rates in Tables 9.17 and 9.18 are computed by the indirect method, which employs standard specific death rates as a standard rather than a standard million population. It was necessary to use the indirect method in adjusting the death rates by sex and race because the age-specific death rates, required for the direct method, were not available for Michigan.

Table 9.17

AGE-ADJUSTED[1] DEATH RATES PER 1,000 POPULATION AND DIFFERENCES MICHIGAN, 1910 AND 1940, BY RACE AND SEX

Year	Death Rates per 1,000 population			
	Colored		White	
	Male	Female	Male	Female
1910	27.77	25.58	17.13	15.56
1940	20.33	17.66	11.60	9.19
Difference	7.44	7.92	5.53	6.37
100 X Difference / 1910 Death Rate	26.8	31.0	32.3	40.9

[1] Based on the standard specific death rates of 1940 for the death-registration States of 1900.

Table 9.18

AGE-ADJUSTED[1] DEATH RATES PER 1,000 POPULATION AND DIFFERENCES DEATH-REGISTRATION STATES OF 1910, 1910 AND 1940, BY RACE AND SEX

Year	Death rates per 1,000 population			
	Colored		White	
	Male	Female	Male	Female
1910	33.43	30.88	19.68	16.63
1940	20.87	17.63	12.21	9.33
Difference	12.56	13.25	7.47	7.30
100 X Difference / 1910 Death Rate	37.6	42.9	38.0	43.9

[1] Based on the 1940 standard specific death rates of the death-registration States of 1900.

race follow the same trend, although in 1910 the differences between Michigan and the Nation were not so great for either males or females. Thus, it appears that mortality differentials between Michigan and the Nation by sex and race are gradually being leveled. However, the percentage decline for each sex by race is still greater for the white than the colored population.

Mortality Change by Cause

The causes of death presented in Table 9.19 reveal that in Michigan death rates from most of the leading diseases in 1910 had been reduced considerably by 1940. Among the ten principal causes in 1910 only two, heart diseases and cancer, had higher death rates in 1940. These two causes of death increased primarily because of the aging population in Michigan. Diabetes mellitus, another degenerative disease, increased 80.4 percent, and by 1940 was among the ten principal causes.[1] This cause ranked fifteenth in 1910 and ninth in 1940.

Both suicide and homicide are among those causes of death which increased between the years 1910 and 1940, their percentage increases being respectively 2.2 and 20.0. Death rates from motor vehicle accident multiplied at a phenomenal rate, namely 1,722.2 percent, or from 1.8 per 100,000 in 1910 to 32.8 in 1940. This trend coincides

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1. This corroborates the findings reported by Bortz. See Stieglitz, Edward J., op. cit., pp. 226-227.

Table 9.19

DEATH RATES PER 100,000 POPULATION BY CAUSE, MICHIGAN, AND PERCENT CHANGE, 1910 TO 1940 (By place of occurrence)

Cause of death	Death rates per 100,000 population, Michigan 1910	Michigan 1940	Difference	100 X Diff. / Death rate 1910
Diseases of the heart	167.0	293.6	126.6	↑ 75.8
Pneumonia & influenza	109.7	52.8	56.9	51.9
Tuberculosis (all forms)	97.2	33.6	63.6	65.4
Diarrhea, enteritis, etc.	103.0	4.6	98.4	95.5
Intracranial lesions of vascular origin	104.7	89.5	15.2	14.5
Nephritis	68.3	56.7	11.6	17.0
Accidents (non-vehicle)	74.1	42.1	32.0	43.2
Cancer (all forms)	74.6	119.4	44.8	↑ 60.1
Premature births	39.3	24.0	15.3	38.9
Bronchitis	26.3	3.2	23.1	87.8
Typhoid, paratyphoid fever	23.5	.2	23.3	99.1
Diphtheria	17.5	.4	17.1	97.7
Diabetes mellitus	14.8	26.7	11.9	↑ 80.4
Puerperal causes	16.7	5.5	11.2	67.1
Suicide	13.6	13.9	.3	↑ 2.2
Congenital malformation	15.9	13.9	2.0	12.6
Syphilis	12.6	11.5	1.1	8.7
Cirrhosis of the liver	12.2	9.2	3.0	24.6
Measles	9.0	.3	8.7	96.7
Hernia & intestinal obs.	13.8	9.2	4.6	33.3
Whooping cough	10.9	1.1	9.8	89.9
Scarlet fever	10.7	.8	9.9	92.5
Appendicitis	12.7	9.8	2.9	22.8
Dysentery	6.4	.3	6.1	95.3
Alcoholism	3.6	1.2	2.4	66.7
Homicide	2.5	3.0	.5	↑ 20.0
Ulcer of the stomach	3.5	6.0	2.5	↑ 71.4
Diseases of prostate	4.0	5.7	1.7	↑ 42.5
Biliary calculi	2.9	3.7	.8	↑ 27.6
Accidents, vehicle	1.8	32.8	31.0	↑1722.2
Goiter, exophthalmic	2.4	3.7	1.3	↑ 54.2
Malaria	.7	.0	.7	100.0
Cerebrospinal meningitis	.2	.4	.2	↑ 100.0
Senility	51.3	6.4	44.9	87.5
Ill-defined causes	32.6	4.1	28.5	87.4
All causes	1408.3	991.4	416.9	29.6

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 20, pp. 344-381.

with the growth of the automobile industry. The death rate from accidents other than motor vehicle, one of the ten principal causes of death in 1910 as well as in 1940, decreased 43.2 percent during the 30 year period. Since this was an era of industrial expansion when high accident rates could be expected, one might assume that the public has learned its lessons in safety well.

Pneumonia, including influenza, was the second principal cause of death in 1910, having a rate of 109.7 per 100,000 population. By 1940 it had decreased 51.9 percent and ranked fifth as a principal cause. Bronchitis and tuberculosis were both among the ten leading causes of death in 1910. By 1940 rates for bronchitis were reduced from 26.3 to 3.2 per 100,000 population. Although rates from tuberculosis decreased 65.4 percent during the period under consideration, it is still among the ten principal causes of death. Thus, in Michigan those causes of death which increased during the 30 year interval were chronic diseases, with the possible exception of cerebrospinal meningitis, whereas mortality rates from communicable diseases showed substantial declines.

To assist in evaluating the change of mortality classified by cause in Michigan corresponding data are

presented for the Nation[1] in Table 9.20.

Comparison of Michigan data with that of the Nation in Table 9.21 shows that the State had lower death rates than the Nation for 20 of the 35 causes in 1910. Although both populations show increases and decreases for the same causes of death, except for homicide, (Table 9.21 the last two columns), the number for which the death rates are higher in Michigan than in the Nation decreased from 15 in 1910 to 10 in 1940. The ratios of death rates which were

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1. As pointed out earlier, the Nation is defined in this Chapter as the death-registration States of 1910, in order that more accurate comparisons of mortality change might be obtained. How do mortality rates of Michigan and the death-registration States of 1910 compare as to efficiency of classification and reporting of deaths? This question may be answered partially by comparing the death rates for senility and ill-defined causes of death in the two populations. (See Chapter I, pp. 29-34, for discussion of sources of error which influence original data on which cause-specific death rates are based.) Such a comparison is presented as follows:

	Death rates per 100,000 population			
	1910		1940	
	Senility	Ill-Defined Causes	Senility	Ill-Defined Causes
Michigan	51.3	32.6	6.4	4.1
D.R.S. 1910	25.5	22.0	4.0	3.6
Difference:	25.8	10.6	2.4	.5

Source: Linder and Grove, op. cit., Table 18, pp. 312 and 320, and Table 20, p. 381.

It would appear that on the basis of this test the D.R.S. of 1910 have more accurate mortality data than Michigan for the years 1910 to 1940, although the differences of death rates for these two causes in 1940 are small.

Table 9.20

DEATH RATES PER 100,000 BY CAUSE, D.R.S.[1] OF 1910, AND PERCENT CHANGE, 1910 TO 1940 (By place of occurrence)

Cause of death	Death rates per 100,000 population			
	D.R.S. 1910	D.R.S. 1940	Difference	100 X Diff. / Death rate 1910
Diseases of the heart	158.9	343.9	185.0	↑ 116.4
Pneumonia and influenza	155.9	60.6	95.3	61.1
Tuberculosis (all forms)	153.8	42.5	111.3	72.4
Diarrhea, enteritis, etc.	115.4	5.7	109.7	95.1
Intracranial lesions of vascular origin	95.8	92.9	2.9	3.0
Nephritis	94.8	76.8	18.0	19.0
Accidents (non-vehicle)	82.7	47.7	35.0	42.3
Cancer (all forms)	76.2	142.4	66.2	↑ 86.9
Premature births	37.7	21.4	16.3	43.2
Bronchitis	23.9	3.1	20.8	87.0
Typhoid, paratyphoid fever	22.5	.5	22.0	97.8
Diphtheria	21.1	.4	20.7	98.1
Diabetes mellitus	15.3	32.6	17.3	↑ 113.1
Puerperal causes	15.3	4.9	10.4	68.0
Suicide	15.3	16.7	1.4	↑ 9.2
Congenital malformation	15.2	10.8	4.4	29.0
Syphilis	13.5	13.5	0.0	0.0
Cirrhosis of the liver	13.3	10.4	2.9	21.8
Measles	12.4	.2	12.2	98.4
Hernia & intestinal obs.	12.1	9.5	2.6	21.5
Whooping cough	11.6	1.3	10.3	88.8
Scarlet fever	11.4	.5	10.9	95.6
Appendicitis	10.8	9.9	.9	8.3
Dysentery	6.0	.5	5.5	91.7
Alcoholism	5.5	2.3	3.2	58.2
Homicide	4.6	3.2	1.4	30.4
Ulcer of the stomach	4.0	7.5	3.5	↑ 87.5
Diseases of prostate	3.7	7.0	3.3	↑ 89.2
Biliary calculi	2.7	4.4	1.7	↑ 63.0
Accidents, vehicle	1.8	26.2	24.4	↑1355.6
Goiter, exophthalmic	1.2	3.3	2.1	↑ 175.0
Malaria	1.1	.1	1.0	90.9
Cerebrospinal meningitis	.3	.5	.2	↑ 66.7
Senility	25.5	4.0	21.5	84.3
Ill-defined causes	22.0	3.6	18.4	83.6
All causes	1468.0	1113.1	354.9	24.2

1 D.R.S. of 1910 is abbreviation for death-registration States of 1910.

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 18, pp. 306-321.

higher in Michigan for the year 1910 are listed below with the corresponding ratios in 1940.

Cause	Causes of death with higher death rates in Michigan than in the Nation in 1910	
	1910	1940
Heart diseases	95.1	117.1
Intracranial lesions	91.5	103.8
Premature births	95.9	89.2
Bronchitis	90.9	96.9
Typhoid fever	95.7	250.0
Puerperal causes	91.6	89.1
Congenital malformation	95.6	77.7
Hernia	87.7	103.3
Appendicitis	85.0	101.0
Dysentery	93.8	166.7
Diseases of Prostate	92.5	122.8
Biliary calculi	93.1	118.9
Goiter	50.0	89.2
Senility	49.7	62.5
Ill-defined causes	67.5	87.8

Source: Table 9.21.

Of the 15 death rates which were higher in Michigan in 1910, eight were higher in the Nation for the year 1940. Two causes which had lower rates in Michigan in 1910 had higher rates than the Nation in 1940. They are measles and scarlet fever, mortality in the Nation being 66.7 and 62.5 percent as high respectively, for these causes as it was in Michigan. The death rate for motor vehicle accidents was identical in the two populations in 1910, namely, 1.8, but by 1940 it had increased to 32.8 in Michigan as compared with 26.2 for the Nation.

In the United States, death rates for 10 of the 35 causes increased during the 30 year interval, but in Michigan rates for 11 of them increased. These causes are indicated

by pluses in Table 9.21. Of the causes that increased in both areas, the percentage changes were higher for eight of the ten in the Nation. Of the 23 that decreased in both groups, fourteen had greater percentage declines in Michigan. Thus of the causes that increased during the 30 year period, higher percentage increases occurred in the Nation, but of those which decreased, percentage declines were greater in Michigan.

Change of Infant Mortality

Infant mortality rates for Michigan and the birth-registration States[1] of the United States are given in Table 9.22, for the years 1915-1940 inclusively. During these 26 years Michigan has made remarkable improvements in saving the lives of infants. The rate in 1915 was 86.0, which is more than twice that of 1940, namely,

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1. The birth-registration States of 1915 would havebeen a more appropriate group with which to compare infant and maternal mortality rates of Michigan over a number of years, because a majority of these nine States were also in the death-registration States of 1910. However, the data is not available. The "birth-registration States", which are used as a comparable group here, comprise the expanding group of States entering the national birth-registration system. Michigan was among the birth-registration States of 1915, which included also Connecticut, District of Columbia, Maine, Massachusetts, Minnesota, New Hampshire, New York, Pennsylvania, and Vermont. By 1920 the birth-registration States had increased to 22 States and the District of Columbia, while in 1933 all of the States were included. To be admitted to the birth-registration States, a State must demonstrate that at least 90 percent of all births are properly registered. For a discussion of completeness of registration of births and deaths, see Chapter I, pp. 29-34.

Table 9.21

RATIO OF DEATH RATES AND PERCENT CHANGE FOR THE DEATH-REGISTRATION STATES OF 1910 AND MICHIGAN, BY PRINCIPAL CAUSE OF DEATH, 1910 AND 1940

Cause of Death	Ratio of Death Rates X 100		Percent Change 1910 to 1940	
	D.R.S.1910 / Michigan 1940	D.R.S.1910 / Michigan 1910	Michigan	D.R.S. of 1910
Diseases of the heart	117.1	95.1	↗ 75.8	↗116.4
Pneumonia and influenza	114.8	142.1	- 51.9	- 61.1
Tuberculosis (all forms)	126.5	158.2	- 65.4	- 72.4
Diarrhea, enteritis, etc.	123.9	112.0	- 95.5	- 95.1
Intracranial lesions of vascular origin	103.8	91.5	- 14.5	- 3.0
Nephritis	135.4	138.8	- 17.0	- 19.0
Accidents (non-vehicle)	113.3	111.6	- 43.2	- 42.3
Cancer (all forms)	119.3	102.1	↗ 60.1	↗ 86.9
Premature births	89.2	95.9	- 38.9	- 43.2
Bronchitis	96.9	90.9	- 87.8	- 87.0
Typhoid fever	250.0	95.7	- 99.1	- 97.8
Diphtheria	100.0	120.6	- 97.7	- 98.1
Diabetes mellitus	122.1	103.4	↗ 80.4	↗113.1
Puerperal causes (all)	89.1	91.6	- 67.1	- 68.0
Suicide	120.1	112.5	↗ 2.2	↗ 9.2
Congenital malformation	77.7	95.6	- 12.6	- 29.0
Syphilis	117.4	107.1	- 8.7	0.0
Cirrhosis	113.0	109.0	- 24.6	- 21.8
Measles	66.7	137.8	- 96.7	- 98.4
Hernia & intestinal obs.	103.3	87.7	- 33.3	- 21.5
Whooping cough	118.2	106.4	- 89.9	- 88.8
Scarlet fever	62.5	106.5	- 92.5	- 95.6
Appendicitis	101.0	85.0	- 22.8	- 8.3
Dysentery	166.7	93.8	- 95.3	- 91.7
Alcoholism	191.7	152.8	- 66.7	- 58.2
Homicide	106.7	184.0	↗ 20.0	- 30.4
Ulcer of the stomach	125.0	114.3	↗ 71.4	↗ 87.5
Diseases of the prostate	122.8	92.5	↗ 42.5	↗ 89.2
Biliary calculi	118.9	93.1	↗ 27.6	↗ 63.0
Accidents, vehicle	79.9	100.0	↗ 1722.2	↗1355.6
Goiter, exophthalmic	89.2	50.0	↗ 54.2	↗175.0
Malaria	---	157.1	-100.0	- 90.9
Cerebrospinal meningitis	125.0	150.0	↗100.0	↗ 66.7
Senility	62.5	49.7	- 87.5	- 84.3
Ill-defined causes	87.8	67.5	- 87.4	- 83.6
All causes	112.3	104.2	- 29.6	- 24.2

Source: Tables 9.19 and 9.20.

Table 9.22

INFANT MORTALITY RATES BY RACE, BIRTH-REGISTRATION STATES AND MICHIGAN, 1915-1940. (By place of occurrence for 1915-1938; by place of residence for 1939 and 1940)

	Number of deaths under 1 year per 1,000 live births					
	Michigan			Birth Registration States		
Year	Total	White	Colored	Total	White	Colored
1940	40.7	40.0	56.7	47.0	43.2	73.8
1939	41.8	41.2	57.2	48.0	44.3	74.2
1938	44.6	43.9	61.5	51.0	47.1	79.1
1937	47.9	46.9	75.6	54.4	50.3	83.2
1936	50.7	49.9	71.0	57.1	52.9	87.6
1935	47.7	47.1	64.2	55.7	51.9	83.2
1934	52.0	51.3	71.7	60.1	54.5	94.4
1933	50.5	49.7	71.0	58.1	52.8	91.3
1932	54.0	53.4	67.6	57.6	53.3	86.2
1931	57.0	55.6	93.5	61.6	57.4	93.1
1930	62.7	61.5	91.9	64.6	60.1	99.9
1929	66.4	64.9	109.0	67.6	63.2	102.2
1928	69.4	67.5	126.3	68.7	64.0	106.2
1927	67.7	66.5	101.7	64.6	60.6	100.1
1926	77.2	75.7	124.4	73.3	70.0	111.8
1925	75.3	73.3	148.9	71.7	68.3	110.8
1924	72.3	70.6	126.4	70.8	66.8	112.9
1923	80.3	78.7	147.2	77.1	73.5	117.4
1922	74.5	73.5	126.8	76.2	73.2	110.0
1921	78.6	77.7	125.3	75.6	72.5	108.5
1920	91.7	90.3	179.5	85.8	82.1	131.7
1919	89.7	89.0	147.0	86.6	83.0	130.5
1918	89.1	88.4	154.7	100.9	97.4	161.2
1917	88.3	87.9	157.8	93.8	90.5	150.7
1916	96.1	95.5	199.1	101.0	99.0	184.9
1915	86.0	85.6	159.9	99.9	98.6	181.2

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 28, p. 578, pp. 589-590.

40.7.[1] Though the trend of the rate in general has been downward, the rate has not decreased consistently year by year. The highest rate was in 1916, while the next highest occurred in 1920. From 1916 through 1920 infant death rates were higher than the rate for 1915, but from 1921 through 1940 they were lower.

Michigan had lower infant death rates than the Nation for 17 of the 26 years, including 1915-1918, the year 1922, and 1929-1940 inclusively. The highest rate for the two populations occurred in 1916, and the lowest for both was in 1940.

The percentage decrease of infant death rates during the 26 year interval 1915-1940 and the average annual decreases for Michigan and the Nation are given in Table 9.23. According to these computations the rate in the Nation had a higher percentage decline and average annual decrease than occurred in Michigan. However, comparison of the rates for each year do not appear to bear out this conclusion. Data corresponding to those given in Table 9.23 were computed for the 25 years from 1916-1940, and the results show Michigan to have slightly higher percentage decreases as shown immediately below:

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1. This trend is generally true for the United States and for most other Western countries. See Pearl, Raymond, op. cit., Table 25, p. 192, and Thompson, Warren S., op. cit., pp. 221-222. See, also, Kumlien, W. F., op. cit., p. 11.

Table 9.23

INFANT MORTALITY RATES (DEATHS UNDER ONE YEAR PER 1,000 LIVE BIRTHS), PERCENT DECREASE, AND AVERAGE ANNUAL DECREASE, MICHIGAN AND THE BIRTH-REGISTRATION STATES, 1915 TO 1940, BY RACE

Race	(1) B.R.S. Michigan	Infant Death Rates 1915	1940	Diff.	Percent Decline: 100 X Diff. / 1915 Rate	Average Annual Decline 1915-1940
Total	B.R.S.	99.9	47.0	52.9	53.0	2.03
	Michigan	86.0	40.7	45.3	52.7	1.74
White	B.R.S.	98.6	43.2	55.4	56.2	2.13
	Michigan	85.6	40.0	45.6	53.3	1.75
Colored	B.R.S.	181.2	73.8	107.4	59.3	4.13
	Michigan	159.9	56.7	103.2	64.5	3.97

(1) B.R.S. is the abbreviation for Birth-registration States of the United States.

Source: Infant death rates from Table 9.22.

	Percent decrease of Infant Death Rate 1916-1940	Average Annual Decrease
B.R.S.	53.6	2.16
Michigan	57.6	2.22

Infant death rates of the white population in Michigan exceeded the corresponding rates in the Nation for the years 1919 through 1932, except for the year 1931, while the rates of colored persons exceeded the rates for the Nation from 1917 to 1929, except for the year 1918. The infant death rates of the colored populations in both areas decreased more than those for their corresponding white segments.

Changes in Maternal Mortality

"Until recently almost no success had been achieved in preventing death from complications of pregnancy and childbirth if the recorded maternal mortality rate is accepted as the measure of progress."[1] This statement, written by Dorn, pertains to the United States as a whole, but it describes just as well the corresponding trend in Michigan. From 1915 to 1929 the maternal death rate decreased only from 6.7 to 6.6, fluctuating slightly above or below these rates during the intervening years (Table 9.24).[2] Although a slight downward trend is observable from 1929 to the present, the rate had decreased only 21.2 percent by 1936, contrasted with a 44.2 percentage decrease during the last four years, 1936-1940. The rate for the Nation was lower than for Michigan

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1. Dorn, Harold F., op. cit., p. 2.
2. Kumlien, W. F., (op. cit., p. 10) describes a similar fluctuating pattern in South Dakota for these years.

Table 9.24

MATERNAL MORTALITY RATES BY RACE, BIRTH-REGISTRATION STATES AND MICHIGAN, 1915-1940. (By place of occurrence for 1915-1938; by place of residence for 1939 and 1940)

	Number of deaths of mothers per 1,000 live births					
	Michigan			Birth Registration States		
Year	Total	White	Colored	Total	White	Colored
1940	2.9	2.8	4.6	3.8	3.2	7.7
1939	3.1	3.1	3.6	4.0	3.5	7.6
1938	3.7	3.5	8.7	4.4	3.8	8.5
1937	3.6	3.5	7.2	4.9	4.4	8.6
1936	5.2	5.0	11.1	5.7	5.1	9.7
1935	5.3	5.1	9.8	5.8	5.3	9.5
1934	5.7	5.6	8.8	5.9	5.4	9.0
1933	6.1	5.9	10.8	6.2	5.6	9.7
1932	6.0	5.9	8.6	6.3	5.8	9.8
1931	6.0	5.9	9.8	6.6	6.0	11.1
1930	6.2	6.2	7.4	6.7	6.1	11.7
1929	6.6	6.4	10.3	7.0	6.3	12.0
1928	6.6	6.5	11.6	6.9	6.3	12.1
1927	6.8	6.6	12.3	6.5	5.9	11.3
1926	6.7	6.6	11.0	6.6	6.2	10.7
1925	6.4	6.2	12.7	6.5	6.0	11.6
1924	6.5	6.4	11.6	6.6	6.1	11.8
1923	7.0	6.9	12.2	6.7	6.3	10.9
1922	6.9	6.7	12.5	6.6	6.3	10.7
1921	6.9	6.7	14.5	6.8	6.4	10.8
1920	9.3	9.3	11.8	8.0	7.6	12.8
1919	7.7	7.6	13.5	7.4	7.0	12.4
1918	8.6	8.5	17.3	9.2	8.9	13.9
1917	7.4	7.4	10.3	6.6	6.3	11.8
1916	6.8	6.7	19.9	6.2	6.1	11.8
1915	6.7	6.7	10.7	6.1	6.0	10.6

Source: Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 37, p. 622, pp. 633-634.

in 1915, but by 1940 the positions had reversed, Michigan having a rate of 2.9 compared with 3.8 for the Nation. It may be concluded, therefore, that Michigan has shown slightly greater improvements than the Nation in reducing the death rate from puerperal causes.

Table 9.25 shows the maternal death rates and percentage changes from 1915-1940, classified by race. The rate for the white population of Michigan decreased only slightly more than for the colored, but in the Nation the decrease for the colored group compared unfavorably with that of the white population.[1]

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1. The colored population of Michigan is predominantly urban, while in the Nation it is largely rural. According to Dorn, Harold F., (op. cit., p. 8), it is probable that the maternal death rate is decreasing more rapidly in urban than in rural areas. The death rates of the urban colored in Michigan are generally much lower than for the rural colored population.

Table 9.25

MATERNAL MORTALITY RATES (DEATHS OF MOTHERS PER 1,000 LIVE BIRTHS), PERCENT DECREASE, AND AVERAGE ANNUAL DECREASE, MICHIGAN AND THE BIRTH-REGISTRATION STATES, 1915 TO 1940, BY RACE (By place of occurrence 1915-1938; by place of residence 1939-1940)

Race	(1) B.R.S. Michigan	Maternal Death Rate 1915	Maternal Death Rate 1940	Maternal Death Rate Diff.	Percent Decline: 100 X Diff./1915 Rate	Average Annual Decline 1915-1940
Total	B.R.S.	6.1	3.8	2.3	37.7	.088
	Michigan	6.7	2.9	3.8	56.7	.146
White	B.R.S.	6.0	3.2	2.8	46.7	.108
	Michigan	6.7	2.8	3.9	58.2	.150
Colored	B.R.S.	10.6	7.7	2.9	27.4	.112
	Michigan	10.7	4.6	6.1	57.0	.235

(1) B.R.S. is the abbreviation for Birth-registration States of the United States.

Note: Rates based on less than 20 deaths are underscored.

Source: Maternal death rates from Table 9.24.

CHAPTER X

SUMMARY AND CONCLUSIONS

Objectives and Methods

The general objectives of this study are as follows: first, to describe systematically the mortality characteristics of the population of Michigan for the year 1940 and to indicate the major changes which have taken place from 1910 to 1940; and, second, to determine whether certain generalizations about mortality are true in Michigan, to record the exceptions, and to make any new generalizations which may be observed during the analysis. Death rates have been analyzed for several classes of the population, namely, residence, race, age, sex, and cause of death, and the results compared with corresponding data for the Nation. In addition, ten-year average rates (1935-1944) have been computed for each county to show the incidence of death in localities of the State.

The measures of mortality employed throughout the study include the crude death rate, the age-adjusted death rate, the infant mortality rate, and the maternal mortality rate. The sources of data have been the official reports and publications of the State and National Bureaus of Vital Statistics.

Findings

1. The rural population has a lower death rate than the

urban population. This proposition is generally true for the country as a whole for both the crude and the age-adjusted rates. In Michigan, however, it is true only when the rate is adjusted for age, the crude rate being higher for rural than for urban people. This is a reflection of the larger proportion of aged people in the rural population. Moreover, rural people tend to have higher death rates than the urban group for the younger ages (1-24 years) and for the older ages (75 years and over). Crude death rates for most of the principal causes of death are higher for rural than for urban residents, but when adjusted for differing age distributions, they are lower in rural areas.

2. Among urban residents of Michigan, those living in small cities (2500-10,000) have the highest crude death rate, while people living in large cities (100,000 and over) have the lowest rate. This condition apparently results from the tendency of the retired farmer to settle in nearby small cities.

In the United States all of the various size cities have both crude and age-adjusted rates in excess of corresponding rates in Michigan. Both series of death rates vary inversely with the size of the city in the State, but in the Nation this is not true.

3. Crude death rates are higher for the colored than for the white population. The colored people in Michigan die at a rate 28.6 percent higher than that for white persons. When adjusted for age, the rate for non-whites

exceeds that for whites by 63.3 percent. This pattern of mortality, favorable to the white segment, persists when the data are classified by residence (including various size cities), by age and sex, and by cause of death. This is, also, generally true for the Nation.

The rural colored people of Michigan have crude and age-adjusted death rates more than twice as high as those of the rural white group. Moreover, greater mortality differences occur between whites and non-whites in rural areas than between the same groups in urban places. Rural death rates for the colored population are about twice the corresponding rates in urban areas.

Mortality patterns for the United States vary in some of the details. Although both crude and age-adjusted death rates for the colored segment are higher than for the white, the differentials between the racial groups are not as great in the Nation as in Michigan. Moreover, urban rates for non-whites are higher than rural rates (whether crude or adjusted), the reverse relationship being true in Michigan.

4. Males have higher death rates than females. This generalization is true for both Michigan and the Nation for data classified by residence, for both racial segments, and for nearly all age groups. Exceptions to the proposition occur at ages 5-24 and 35-44 for colored persons. A part of such deaths is usually attributed to lack of care given expectant mothers during pregnancy and childbirth.

5. Heart diseases are the chief cause of death in Michigan, in all counties of Michigan, and in the United States. Death rates from cancer are second highest in the State and the Nation, and in most of the counties of Michigan. Of the ten principal causes of death, two are communicable diseases and the remaining eight, non-communicable.

In Michigan rates from tuberculosis are higher in the urban than in the rural population. This rate is exaggerated by Detroit as well as the Upper Peninsula. Colored residents die of this disease six times as often as white people.

Rates from syphilis are higher in the country than in the city. Furthermore, they are about six times as high among non-whites as whites. Deaths from this cause are more frequent among males.

Suicide is far more prevalent among rural white males than any other class. It is twice as prevalent among whites as non-whites. In contrast to the white population, urban colored males are more prone to commit suicide than rural colored males. Homicide is found more often among non-whites than whites.

For those diseases which afflict both of the sexes, males have higher death rates than females except for diabetes mellitus which proves fatal more often to women.

6. A larger number of infants die annually in rural areas for each 1,000 live births than in urban areas. Among urban residents, those living in small cities have

the highest infant death rate and those in large-size cities the lowest. Michigan has lower rates than the Nation for all residence classes. Within the Nation's urban population, infant death rates vary inversely with the size of the city. The same relationship, however, is not true of Michigan.

Proportionately more colored infants succumb before reaching their first birthday than white infants. In the State infant death rates are much higher in rural than in urban areas but the reverse is true for the Nation.

7. In Michigan fewer mothers per 1,000 live births die from childbirth in rural than in urban areas. However, the differential between the urban and the rural rate in the Nation is small. In both Michigan and the United States the highest death rate occurs in small cities. However, the lowest rate in the State is found among rural women; whereas in the Nation, women living in cities of 100,000 or more occupy the most advantageous position.

8. A declining death rate characterizes all segments of the population of Michigan for the period 1910-1940. As is generally true, the greater decreases occurred among the younger ages and only slight declines took place among the older ages. Death rates of females declined more than those of males in all age groups. The colored population has made greater proportional gains than the white population. This is partially a function of the high rates which prevailed at the beginning of the period. Among the major

causes of death in 1910, only diseases of the heart, cancer, and diabetes mellitus show an increase for the period under consideration. In 1910 four communicable diseases were listed among the ten principal causes of death in Michigan, but by 1940 only two of these remained on the list, and their rates had dropped considerably. Pneumonia and influenza dropped from second position to fifth, and tuberculosis from fifth position to seventh. All communicable disease rates in Michigan decreased for the period with the exception of cerebrospinal meningitis, which increased slightly.

IMPLICATIONS

Some of the implications of the findings of this study are discussed in more detail below:

Michigan leads the Nation in the control of communicable diseases. This is no accident. The urgency of the need for such control was imperative. During the early years of Michigan history the State with its many swamps and swales was known as the "home of malaria." In 1910 four of the leading causes of death were from communicable diseases. Even as late as 1920 the death rate from pneumonia and influenza, and from bronchitis were substantially higher in Michigan than the Nation. But hard work and well-directed effort, accompanied by a rising level of living, brought results. By 1940 only pneumonia and tuberculosis remained among the ten leading causes of death. Moreover, by this time, the Nation's rate for both causes was over 40 percent

higher than that in Michigan.

However, the State does not have a spotless record. Tuberculosis rates are excessive in Wayne county and in the western half of the Upper Peninsula. While it is recognized that the rates in the Upper Peninsula are probably associated with the generally low level of living of that area, this excuse can hardly be given for Wayne county. Perhaps the high rates found among colored people is the explanation. In any event, it is to be hoped that the intensive health education and the increased facilities for care now being directed into these areas will do much to equalize the situation throughout the State.

Even as mortality studies of a few decades ago indicated a need for programs to eliminate the communicable and preventable illnesses, so mortality studies today are focusing attention on the need for research and health programs in the field of degenerative diseases. Five of the ten principal causes of death are degenerative in nature, and they account for 59.3 percent of all deaths in Michigan. They result in part from an aging population. That public health programs today are not directed against these diseases, which are taking the greatest toll of death, is common knowledge. Aside from the humane principles involved, there are at least two basic reasons why we should be concerned with these problems:

1. The increasing economic and social loss from the toll of chronic illness and death among the working population.

2. The cost of social adjustment for the older aged group, retired from productive work because of the onset of degenerative diseases.

A part of the poor showing that has been made in the control of degenerative diseases when contrasted with the great inroads that have been made upon certain infectious and contagious diseases in Michigan can be attributed to the characteristic attitudes of both lay and professional people. Stieglitz, in his collection of works on Geriatric Medicine, deplores the common attitudes of the medical fraternity, the public health officials, and lay leaders, who assume that the chronic diseases are of such a nature that little can be done to prevent or stay their course. He observes that "biologists and physicians have been strangely content to take the phenomena of aging as a matter of course."[1] In his Chapter on "Orientation," he says, "The study of aging as a process has been conspicuously neglected until very recently... But a change in attitude will come and it must come soon, for there is true urgency in the need to know more about aging and the aged... The apparent boon of great longevity may become a curse, a terrible danger. Long life without health is not only an individual, personal tragedy, but a social evil seriously threatening national economy."[2]

With this quickening concern about the problems of

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1. Stieglitz, Edward, ed., Geriatric Medicine, W.B. Saunders Co., Philadelphia, Pennsylvania, 1944, p. 3 ff.

2. Stieglitz, Edward, ibid, pp. 3-4.

chronic illness has come also the realization of our lack of knowledge about them. Mr. Stieglitz continues: "It is impossible in our present ignorance to say what aging is, what it does, or why or how it does it. Very little is known; much of what we think we know is merely superstition. Some is more purely wishful thinking. But the consciousness of ignorance is distinctly encouraging."[1]

One might easily contend that in the past our attitude toward the control of degenerative diseases was one of pessimism and fatalism. The point of view which seemed to motivate these early efforts was that of helping those to live who had their lives before them. There is nothing pessimistic with this attitude unless it is emphasized to the point where people are not concerned with the possibility that death can be stayed. Modern physicians approach the hazards of degenerative disease with more hope. Furthermore, these more optimistic views are not limited to a consideration of one or two more tractable disease entities but seem to apply to many of them. The following excerpts by leading authorities will serve as illustrations:

Walter S. Priest, Associate in medicine, Northwestern University Medical School, and Attending physician at the Cardiac Clinic of Evanston Hospital has this to say regarding cardiovascular-renal disease:

> "It is common knowledge that cardiovascular-renal diseases are first in the list of causes of death, exceeding by four times the second on the list,

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1. Stieglitz, Edward, ibid, p. 5.

> cancer .... When the death rate is adjusted for a changing age distribution of the population, the picture is not so black, however.... There is actually a decline in all groups, slight in the group seventy to seventy-four, but increasing with each lower five-year period untillforty-five to forty-nine, where, in 1935, the rate was slightly less than 400 per 100,000, as against 550 in 1911.... The fact of the improved rate is the important thing and should stimulate research calculated to discover the reasons, with the hope that further decline may be brought about within the next twenty-five to fifty years."[1]

Regarding the nephropathies, John P. Peters, School of medicine, Yale University, and Associate Physician, New Haven Hospital states:

> "Whether the irreducible remnant of idiopathic senile nephropathies prove to be large or negligibly small, the most immediately favorable approach to the problem of renal gerontology is a concerted effort to prevent or cure the diseases of earlier life that contribute to the total .... These ends can be achieved only if both public and physicians abandon their cavalier attitudes toward the relatively trivial disorders in which these conditions originate. It will require also that medical practice be oriented toward prevention rather than cure; that it be organized to follow persons in and out of disease, the apparently healthy as well as the evidently ailing."[2]

Concerning diabetes mellitus, which takes its largest death toll of females, Edward L. Bortz, Graduate School of Medicine, University of Pennsylvania, writes:

> "It is true that large numbers of individuals with diabetes succumb before they attain the later years of life. However, knowledge available concerning the nature of diabetes and methods for treatment is of such practicable

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1. Stieglitz, Edward, ibid, pp. 441-442.

2. Stieglitz, Edward, ibid, pp. 653-654.

> value that for every diabetic who dies someone is probably to blame. The doctor himself may be at fault in his lack of understanding of proper diet regulation, the use of exercise and the prescription of insulin. The modern treatment of diabetes today offers highly effective control measures to stay the ravages that occur within the body in the uncontrolled diabetic condition. Or it may be the patient who is at fault in failing to follow the physician's instruction, or, as too often happens, by sheer neglect and disinterest in his own welfare. It was Montaigne who once said 'people don't die, they kill themselves."[1]

As for cancer, one needs only to pick up the morning paper to learn of the fight for prevention and control of this plague of mankind. Obviously, the millions of dollars spent annually in research is testimony to our belief that this second most destructive disease can be conquered if we will.

And finally, with our increasing interest in degenerative disease, has come the realization that we have inadequate treatment facilities. Quoting from the report of the Kellogg Foundation entitled Hospital Resources and Needs, we find this statement:

> "For instance, the great decrease in deaths from communicable diseases in recent years has lessened the need for isolation hospitals. On the other hand, increases in deaths due to cancer, heart disease, and other diseases of mature and old people emphasize the need for increased facilities for such cases."[2]

It is interesting to assume that the health departments of the Nation, both state and local, will at some time

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1. Stieglitz, Edward, ibid, p. 226.

2. Report of the Michigan Hospital Survey, op. cit., p. 52.

in the future, be given the official function and full responsibility of reducing our casualties from degenerative diseases and from accident, as well as those from communicable diseases. There should be active health programs directed to the problems of each age group, giving due emphasis and importance to the adult population and especially to the older age groups in proportion to their numbers in the population. This does not imply any slackening interest in the control of communicable diseases. It is rather the problem of keeping the gains already made while reaching out to conquer other enemies. This would entail provisions for the control of all types of activity which are known to be major threats to the lives of citizens, some of which are not considered as within the sphere of a health department program, for example, the prevention of accidents. In the meantime mortality studies are among the chief indicators of these problems and their relationship to each other.

Rural counties of Michigan have greater need for the expansion of health facilities than urban counties. The average toll of death levied on the rural population is 17 percent greater than in urban areas. This mortality condition occurs primarily because elderly people are relatively more numerous in rural communities throughout the State. For the same reason, largely, the population of rural cities (2,500-10,000) is decimated at a rate approximately 25 percent higher than that of the total urban popu-

lation. As would be expected, the degenerative diseases take a far greater toll in rural areas than in urban. The four leading causes of death, heart diseases, cancer, intracranial lesions of vascular origin, and nephritis, take the lives of rural residents at a rate of 119 per 100,000 population in excess of the urban rate which is 521.4. But what percent of the really modern and well equiped clinics for heart disease would one expect to find in cities of 10,000 or under, though they might be serving a large tributary area?

It is true that the rural population has a lower age-adjusted death rate than the urban, and that this rate is considered an acceptable measure of the environmental conditions conducive to good health. But it should not be used by society to rationalize away its responsibility to the people who are actually living and dying in a given community. Because of the relatively greater number of rural residents under 15 and over 55 years of age, the demand for health facilities is relatively greater. Where there is much death there is ordinarily many days of illness. Furthermore, there is often considerable imbalance between the nature and extent of facilities for care and treatment, and the nature and extent of illnesses. The highest incidence of death from chronic diseases occurs in the rural counties of the State where the special facilities required for diagnosis and treatment of these ailments are probably least available.

If mortality rates are taken as measures of health, colored people in Michigan are underprivileged. The age-adjusted death rate for this group is more than a third higher than for the white population. Communicable disease death rates, considered among the better indicators of the health level of a community, are notoriously higher among non-whites than whites. Among the colored population, syphilis is the second highest cause of death in rural areas and tuberculosis is the second highest in urban areas. Among corresponding segments of white people, syphilis ranks thirteenth and tuberculosis, eighth.

The situation of the Negroes in Michigan (who constitute 96.3 percent of the non-white group) is ecologically quite different from that of their Southern neighbors. In Michigan they constitute an invading minority group. Notwithstanding equal rights principles expressed in free access of non-whites to the public institutions of the community, freedom of intercourse between the racial groups is restricted by the customs and mores of the people. Health progress depends not only on access to health facilities, but also on the building up of a set of attitudes and habits which bring the people to the facility. Because the educational and economic levels of the colored population are generally inferior to that of the whites, and because of the conflict situations in which the colored person often finds himself, Negroes suffer from the kind of intellectual and emotional blocs which keep people from forming constructive

health attitudes and habits. Inasmuch as such blocs, under present conditions, will probably be levelled more rapidly by enlightened members of their own kind, one might expect the urban colored of Michigan, where the Negro population is numerous, to respond more readily to health education and health opportunities, and hence to have higher levels of living and lower death rates than the corresponding group in rural areas. An examination of the age-adjusted death rates indicates this is likely to be true. Rural colored rates are 67.3 percent higher than urban rates, and communicable disease rates are also higher in rural areas.

Apparently, non-whites make use of health instruction and health facilities when opportunity and incentive is given them although the quality of their performance may not be quite as high as that of the white population. This is best illustrated by examining death rates from syphilis. Programs for the control of veneral disease in Michigan are more comprehensive in urban than in rural areas. If colored people were to make use of the opportunities which they have, one would expect to find syphilis rates for the urban colored population considerably lower than those for the corresponding segment of the rural population. These rates are 36.4 and 304.7 respectively. One task facing those interested in the promotion of public health among colored people is the extension of health education and health facilities to rural areas.

Females have a definite survival advantage over males. This fact itself is attracting considerable attention. Many

attribute this differential to the biological superiority of the female (especially for those under five years of age). Others quite frankly say they have no explanation. The opening sentence in a popular article entitled "How to Keep Your Husband Healthy?"[1] begins: "No one has ever discovered why men refuse to wear galoshes, resist long underwear, and are repelled by practically any edible that isn't steak and potatoes." The same authors quote Dr. Edgar V. Allen at the Mayo Clinic in a description of the American husband as follows: "His blood pressure is high, his arteries hardening, his temper short. He is irritable, nervous and melancholic. His brain is weary, his muscles tired, his stomach acid." The authors then summarize as follows: "It is a portrait which your husband will hardly recognize, much less acknowledge. It is largely this capacity for self-delusion on the part of the married American male that makes him the least healthy member of the family unit today."

It is the contention of the author of this dissertation that females live longer chiefly because of the differing behavior roles of the sexes, and that the individual male is not as deluded as the above authors would have us think. Consciously or unconsciously, he is forced into the position he takes by male roles already defined by the group to which have been assigned status values. The American male is paying dearly for the privilege of occupying his particular sta-

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1. Robbins, Jhan and June, "How to Keep Your Husband Healthy?" Magazine Section, The Sunday Star, Washington,D.C., September 26, 1948, p. 4.

tus in our society. It is probable that many of the undesirable characteristics of the male role from a health standpoint could be eliminated,--for example, the idea that it is "sissy" to go to a doctor. These concepts are not necessarily essential to the male role as now structured. Attitudes and values inherent in this role which are health hazards should be sought out through scientific research and their implications taught as part of the health training of youth.

Infant and maternal death rates are lower in Michigan than in the Nation. Within Michigan, more infants die in the country but more mothers during childbirth and pregnancy die in the city. This appears to be associated with the level of living. The infant death rate, considered by many as the most sensitive index of health care, is beginning to mirror the superior advantages offered urban mothers in child care and training. These programs should be extended to rural areas. The maternal death rate, on the other hand, reflects the strain of urbanization. Urban mothers undergo childbirth at later ages than rural women, and tend to limit the size of their families, sometimes at great personal risk to themselves. The tempo of the city, its system of values, and its way of life do not seem to be as conducive to the physical and mental well-being of prospective mothers as are the rural patterns.

RECOMMENDATIONS

On the basis of the findings of this study and the

analyses that have been made, the following recommendations are presented in the hope that they will assist the State in improving its health programs and in extending its present position of leadership.

1. That a systematic analysis of the State's mortality characteristics be made every ten years.

2. Inclusion of either five or ten-year average annual age-adjusted death rates for the counties of Michigan by residence and leading causes of death in the State Health Department Reports, or in special publications.

3. The initiation of local studies of health facilities and attitudes of the public toward health needs, preferably by local institutions through State aid.

4. The development of research on the unhealthy aspects of role behavior, especially occupational and sex roles, and the incorporation of findings in public health education programs.

5. The expansion of preventative and research programs especially designed to increase our knowledge and control of the degenerative diseases.

6. More intensive health education programs for colored people, especially for those in rural areas.

7. A survey of all health programs and activities in the State as a first step in organizing a complete preventative program for chronic and other diseases which may be under-emphasized at present.

8. The expansion of both private and public programs to

include diagnosis and some treatment of non-infectious diseases, especially in rural areas.

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APPENDICES

APPENDIX I
MORTALITY RATES: DEFINITIONS, COMPUTATIONS, AND EVALUATIONS

The interpretation of mortality rates, especially their implications in the local community, is usually sociological in nature. However, there are rather precise definitions of various vital statistic rates which have been carefully formulated by statisticians, especially biostatisticians, which should serve as guides in the interpretation of vital data. In the following pages, a brief discussion is presented of the basic mortality rates employed in this study. Various authorities are relied upon for concepts, formulas, and evaluations. The rates described are the crude, specific, and adjusted (standardized) death rates. The material is organized in outline form as follows:

1. Definition
2. Nomenclature
3. Data required for computation
5. Advantages and disadvantages

CRUDE RESIDENT DEATH RATES

Defined:

"The crude rate for an area which most nearly approximates the total probability of death is a rate computed by dividing the deaths occurring to that population regardless of where those deaths occur by the resident population of that area. This rate is called the 'resident death rate' and is based on deaths tabulated according to place of residence."[1]

"The crude resident death rate is a direct measure of the effects of mortality on the population which actually is living in an area, and therefore has value in a historical sense of recording the number of people per 1,000 mid-year population who actually died."[2]

Information Required to Compute Crude Resident Death Rates:

1. The number of deaths of residents in an area during a given period of time.
2. The total resident population of a given area and period of time.

Advantages of the Crude Resident Death Rate:

1. It is the most common, simple, and perhaps the most valuable, death rate.
2. It is easy and simple to compute.

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1 Linder, Forrest E. and Grove, Robert D., op. cit., p. 38.
2 Hagood, Margaret Jarman, Statistics for Sociologists, Reynal and Hitchcock, Inc., New York, N.Y., 1941, p. 823.

3. Information required for its computation is usually readily available.
4. Crude death rates may be interpreted both as a toll of deaths in an area and as a probability number, if the exact number exposed to the risk of death is used as the denominator.
5. Crude death rates are valid numbers, "...and comparisons can justifiably be made in spite of any differences in the population composition of compared groups of people, or in the conditions under which they are exposed to death."[1]

Disadvantages of the Crude Death Rate:

1. It is difficult to obtain the exact number of persons exposed to the risk of death in an area for a given period of time because of the constantly changing population base.[2]
2. There is some uncertainty that the numerator (number of deaths) represents the actual deaths occurring to the population group used in the denominator.
3. Death rates computed from the place of occurrence of death do not have a probability meaning showing the chances of death. The resident death rate does have the possibility of showing the probability of death in an area.

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[1] Linder, Forrest E. and Grove, Robert D., op. cit., p. 40.
[2] Linder, Forrest E. and Grove, Robert D., ibid, p. 37.

4. Crude death rates are questionable when considered as measures of the force of mortality. According to Pearl, "So many variables besides those essentially lethal can (and do) influence the stated values of crude death-rates as to make them rather untrustworthy for any but the broadest and roughest conclusions and estimates."[1] This criticism is based primarily on differences in the age characteristics of the population, though in certain areas sex and race may also influence the crude rate.
5. Crude death rates must be used with utmost caution and reservation in comparisons of one locality or one time with another--unless it be shown that the age and sex constitutions are similar in the areas compared.

SPECIFIC DEATH RATES

Defined:

Specific death rates may be defined as the number of deaths in a specific class of the population divided by the population in that specific class multiplied by 1,000.

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[1] Pearl, Raymond, op. cit., p. 177.

Nomenclature:

Rates may be made specific for many characteristics of the population, (i.e., specific rates). It is customary and preferable to add the name of the population characteristic for identification and clarity.

Examples:
1. Age-specific death rates
2. Age-sex-specific rates
3. Sex-specific rates
4. Race-specific rates
5. Age-Sex-Race-Specific Rates

Advantages:

1. Specific death rates by age are considered by some authorities as the best measures of the real force of mortality.[1]
2. Specific rates represent the chance or probability of death more nearly than crude rates, since they are more refined.
3. Age-specific death rates are the basis for adjusting rates by the direct method.
4. Age-specific death rates serve as the standard for standardizing rates by the indirect method.

Disadvantages:

1. Mortality data is not tabulated for a large number of socio-psychological traits. Data is available for age, sex, residence (rural, urban), and race. Information on residence and race is frequently not tabulated and presented for public

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[1]Pearl, Raymond, ibid., p. 179.

use.

2. Age-specific rates require the population by age groups, which sometimes is not available for intercensal years, especially for small areas.

DEATH RATIO

Defined:

The death ratio may be defined as an index showing the numerical relation between one cause of death (or group of related causes) and total deaths, or between deaths at a given age with deaths for all ages.

Nomenclature:

1. "Proportionate mortality." (Linder, Forrest E., and Grove, Robert D.)
2. "Death Ratio." (Pearl, Raymond)

Since Professor Pearl has been the principal advocate of this index, his terminology will be used, namely, "death ratio."

Information Necessary for Computation:

1. The number of deaths in a specified class for a given time.
2. The total number of deaths for all classes during a given time.

Advantages:

1. On a cause basis, a death ratio "measures the probability that in a given total number of deaths from all causes a particular one will be from one

particular cause, say tuberculosis of the lungs."[1] Likewise, this index measures the probability that in a given total number of deaths in all age groups a particular death will be in one particular age group, say 65-69.

2. The death ratio has validity and usefulness when employed in studies concerned with the kind of probability described in Advantage number 1.

3. This index has been effectively employed in research on diseases and the construction of life tables.[2]

4. According to Pearl, "... death ratios are coming more and more into use as an effective statistical technique to bring out important changes in the mortality pattern of a population (see Welling, for example)."[3] ("The Changing Aspect of Age at Death." Comm. Health Bull., Vol. 52, pp. 291-292, Nov. 1938.)

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[1] Pearl, Raymond, ibid., p. 202.

[2] See: a. Greenwood, M., and Tebb, A.E., "An Inquiry into the Prevalence and Etiology of Tuberculosis Among Industrial Workers, With Special Reference to Female Munition Workers," Med. Res. Comm., Spec. Rept. Ser. No. 22, London, 1919.
b. Fisher, A., An Elementary Treatise on Frequency Curves and Their Application in the Analysis of Death Curves and Life Tables. Translated from the Danish by E.A. Vigfusson, New York (Macmillan), 1922, pp. xv ff 240).

[3] Pearl, Raymond, op. cit., p. 205.

5. The population of the area for a given time is not required for computation of death ratios.
6. In cases where the population is not available to compute other death rates, the death ratio is sometimes substituted for death rates.[1]
7. Death ratios "may also have a certain rhetorical value in discussions listing or ranking in order of importance the principal causes of death." [1]
8. Death ratios "can be used to compare the relative importance of different causes for the same area."[1]
9. "Whenever the population base is the same for a group of specific rates, the corresponding death ratios will be in direct proportion to the rates."[1]

Disadvantages:

1. Death ratios, like most other mortality rates, are percentage figures, and thus they are subject to the same limitations and possible misinterpretations as percentages.
2. Since both the numerator and denominator of the death ratio are deaths, and thus variable quantities, they are affected by the same biological forces. For this reason, death ratios cannot be highly precise measures, especially, since one

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[1] Linder, Forrest E., and Grove, Robert D., op. cit., p. 51.

can never be sure as to what portion of the death ratio is due to the numerator or the denominator. Pearl claims that the same criticism applies to any death rate, for the population figure in the denominator, or any other more precisely defined part of population, is not an invariable quantity.[1]

3. When substituted for death rates, death ratios have two defects: (a) changes in the death rate for a cause will not be reflected by the ratio if the death rates for other causes are changing proportionally, (b) changes in a death ratio may indicate either (1) an increase or decrease in mortality for that cause, or (2) an opposite change in the mortality for the other causes.[2] These are the possible misinterpretations of the death ratios. Obviously, these possible misinterpretations are not likely to be made when the data is studied carefully and additional analyses made in cases of doubt.
4. Death ratios, like certain other mortality indices, are not in general use.

Evaluation:

The death ratio may be of value in a study where the objective is to present the relation of principal causes,

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[1] Pearl, Raymond, op. cit., p. 202.
[2] Linder, Forrest E. and Grove, Robert D., op. cit., p. 50.

or their ranks, within a particular area in an effort to analyze and point out the health problems found there. They cannot be compared with ratios of another area.

ADJUSTED DEATH RATES (OR STANDARDIZED)[1]

Defined:

In general, adjustment of death rates may be defined as the modification of crude death rates of areas to show what they would have been had the population in the areas been constituted as to age, sex, or age and sex, (or any other characteristic of the population) like the population chosen as a standard.

Nomenclature:

Names of the various methods of adjusting death rates will be presented when the methods are discussed.

Adjusted death rates may differ in two ways:

(1) in method of adjustment employed.

(2) in population chosen as the standard.

Objectives of Adjusted Death Rates:

1. Age-adjusted death rates are attempts to "express the mortality of a population of changing or abnormal age distribution by a single figure calculat-

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[1] The Committee on Forms and Methods of Statistical Practice of the American Public Health Association recommends the use of the term "adjusted" in preference to "standardized" as the latter term has been used to cover other widely different definitions by statisticians. See American Public Health Association Yearbook, 1937-1938, p. 165.

ed in such a way that the changes or abnormalities in constitution do not appreciably affect it."[1]

2. "...the problem is to suggest as substitutes for the crude death rate the simplest practicable rates, such as might be used by a health officer who is asked at a meeting how the city death rate compares with the rural, or whether it is true that mortality in the state is rising."[2]

Standard Population and Use of Standard Million

1. A standard population is required for adjusting the death rate by the direct method.
2. The population chosen as a standard must be selected with the type of comparisons and purposes of the research being conducted clearly in mind.
3. The standard population used should be fairly typical but different from the populations in the communities whose mortalities are to be compared.
4. Only those adjusted death rates standardized on the same population are comparable.
5. Actual populations at a specific time are used as standards by expressing them on a per-million or per-thousand basis.
6. Examples of standard million populations:[3]
   (1) England and Wales 1901
   (2) A population proposed by the International

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1 The Registrar-General's Statistical Review of England and Wales for the year 1937. New Annual Series, No. 17, Text. H.M. Stationery Office, London, 1940, p. 10.

2 Report of the Committee on Forms and Methods of Statistical Practice of the American Public Health Association, American Public Health Association Year Book, 1939-1940, p. 125.

3 Linder, Forrest E. and Grove, Robert D., op. cit., p. 80.

Statistical Institute 1917

(3) United States 1930 and 1940

(4) United States life table (whites and negroes) 1929-31.

Standard Specific Death Rates:

1. Standard specific rates are required for adjusting the death rates by the indirect method.
2. There are specific mortalities that can logically be set up as yardsticks, against which the rates of the community can be measured.
3. National specific rates are frequently taken as a standard for comparisons of subdivisions, or ideal specific rates might be used.[1]

Age-sex-Adjusted Death Rates:

Some authorities believe that for the majority of purposes for which death rates may be adjusted, age variation is the only factor important enough to cause the crude rate to be significantly biased. When adjustment for sex differences as well as for age differences is required, the rates must be obtained specific for sex as well as for age, and these must be multiplied by the standard population of the given age and sex. In most cases where it is desirable to adjust for age differences, it is theoretically desirable also to adjust for sex differences, but the added refinement usually makes little difference in the result. For this reason, in areas where the sex-ratio is fairly well balanced,

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[1] Dublin, Louis I., and Lotka, Alfred J., op. cit., p. 191.

it is of little advantage to adjust for both age and sex. For purposes of showing the computations necessary for age-sex-adjusted death rates, an example will be presented using the standard white population of the United States, 1930, and employing the direct method. (See Table III)

$$\text{Age-sex-adjusted death rate, direct method} = \frac{\text{Male plus female expected deaths Michigan 1940}}{\text{Population of Standard Community (whites U.S.,1930)}} \times 1{,}000$$

Males plus females = 1,000,000

It should be pointed out that this formula does give an adjusted rate independent of varying sex proportions and varying age distributions, but does not permit comparison of male and female rates, specific rates being referred to different standards (the male to male and female to female).[1]

METHODS OF ADJUSTING DEATH RATES

There are three methods for adjusting mortality rates in common use. Each method has its advantages and disadvantages, and each may be preferred at times, depending upon the purposes of the particular study. These methods are known by various names, but the following terms are preferred:

Adjusted death rates, indirect method
Adjusted death rates, direct method
Equivalent average rates method.

The life table death rate (or the reciprocal of the "expectation of life at birth") is also in common use; however, this rate, requiring the construction of life tables, is so

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[1] Linder, Forrest E., and Grove, Robert D., op. cit., p. 68.

laborious to compute that it will not be illustrated. The three methods listed above will be discussed and an example of each presented in detail.

ADJUSTED DEATH RATES, INDIRECT METHOD

Defined:

An adjusted death rate, indirect method, "... is an abstract or theoretic figure derived by applying the specific death-rates of the general population, or of some standard imaginary population, to the actually existing age and sex distribution of the living population of a particular locality to determine what would be the number of deaths in that locality if the specific death-rates of the standard population prevailed there, and then dividing the number of deaths so obtained by the actual total living population of the locality. The figure so obtained is then employed... in the computation of an adjustment factor which is applied to the observed crude death-rate of the locality to give finally the adjusted death-rate (indirect method) of the locality."[1]

Nomenclature:

1. Age-adjusted death rate, indirect method: Used by Linder, Forrest E., and Grove, Robert D., and recommended by the Committee on Forms and

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[1] Pearl, Raymond, op. cit., pp. 270-271.

Methods of Statistical Practice of the American Public Health Association.[1] (4, p. 165)

2. Age-adjusted death-rates (A), Raymond Pearl.[2]
3. Indirect method of standardization, Sir Arthur Newsholme.[3]
4. Standardized death rates, Indirect Method, Hagood.[4]

Information Required:

1. The specific-age group death rates of the population being used as the standard. (Standard specific rates)
2. The population for which death rates are to be adjusted by age groups.

Advantages:

1. The indirect method is used currently in the Annual Volumes of The Registrar-General's Statistical Review for England and Wales, which gives the method some prestige and authority.
2. The method is equally as reliable as other methods (Direct).[5]

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1 Committee on Forms and Methods of Statistical Practice of the American Public Health Association, American Public Health Association Yearbook, 1937-1938, p. 165.

2 Op. cit., p. 270.

3 Newsholme, Sir Arthur, The Elements of Vital Statistics in Their Bearing on Social and Public Health Problems, D. Appleton and Company, New York, N.Y., 1924, p. 222.

4 Hagood, Margaret Jarman, op. cit., p. 822.

5 Pearl, Raymond, op. cit., p. 270.

3. Standard specific death rates of the United States are easily available.
4. The indirect method does not require the number of deaths in the locality to be adjusted by age groups. Thus, populations or small areas which do not tabulate deaths by age can be adjusted.
5. Less labor and time is required than for the direct method.
6. The indirect method is more useful in adjusting local death rates in intercensal years. Newsholme says, "The factor of correction (standardizing factor) once ascertained, can be employed, with approximate accuracy during an entire decennial period, provided that no great change occurs in the character of the population."[1]

Disadvantages:

1. The indirect method is considered less refined by some authorities, who regard it as an approximation of the direct method. (This is not generally considered to be true. Note Pearl's statement in Advantage 2 above.)

Adjusting the Death Rate of Michigan by the Indirect Method:

Applying the standard specific death rates for the United States, 1940, to the population age groups of Michigan,

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[1] Newsholme, Sir Arthur, op. cit., p. 222.

the "expected deaths" are obtained which would have occurred had the United States had the same population age distribution as Michigan. Deaths occurring in Michigan have not yet entered the computations. The sum of the expected deaths in each age group divided by the population of Michigan, 1940, and the result in turn divided into the crude rate of the standard population gives an adjustment factor. This adjustment factor multiplied by the crude death rate of Michigan gives the standardized death rate of Michigan using the indirect method.

An example of the indirect method worked out in detail for Michigan, 1940, is presented in Table I. The results obtained by employing the indirect and direct methods to adjust the death rate of Michigan are:

Indirect method:	10.08
Direct method:	10.19

TABLE I COMPUTATIONS FOR STANDARDIZING THE DEATH RATE OF MICHIGAN, 1940, FOR AGE, USING THE AGE SPECIFIC DEATH RATES OF THE UNITED STATES, 1940, AS THE STANDARD: INDIRECT METHOD.

Age	Standard Specific Death Rates per 100,000 Population (U.S., 1940)	Michigan Population 1940	Michigan Expected Deaths $\frac{(1)\times(2)}{100,000}$
	Col. 1	Col. 2	Col. 3
0----- 4	1,287	431,384	5,552
5----- 9	108	418,855	452
10-----14	99	463,917	459
15-----19	172	478,220	823
20-----24	240	457,151	1,097
25-----34	306	848,848	2,597
35-----44	520	763,633	3,971
45-----54	1,060	654,347	6,936
55-----64	2,226	408,897	9,102
65-----74	4,799	229,842	11,510
75---Over	12,910	101,012	13,041
Total	1,075	5,256,106	55,540

Note: Population enumerated as of 4-1-40. Population of unknown ages, if any, excluded.

Formula: Set up for death rates per 1,000 population.

$$Mim = \frac{\frac{Ds}{Ps}}{\frac{\text{Sum of } (Msa \times Pua}{\text{Sum of Pua}} \times (k)} \times \frac{Du}{Pu} \quad \text{where}$$

Mim = Age-adjusted death rate, indirect method
Ds = Deaths in standard population
Ps = Standard population
Msa = Standard specific rate
Pua = Population per age group in area to be standardized
Du = Deaths in area to be standardized
Pu = Population in area to be standardized
k = 1,000.

$$Mim = \frac{10.75}{\frac{55,540 \times 1,000}{5,256,106}} \times 9.91 = \frac{10.75}{.010566 \times 1,000} \times 9.91$$

$$= \frac{10.75}{10.57} \times 9.91 = 1.0170 \times 9.91 = 10.08$$



ADJUSTED DEATH RATE, DIRECT METHOD

Defined:

"In its simplest form the direct method relates the age-specific death rates of a given community to some population taken as a standard, to find for each age group what the expected number of deaths in the standard population would be if the age-specific mortality of the community applied. This is accomplished by multiplying the specific rate for each age group by the population for the corresponding age group in the standard population. The adjusted death rate, direct method (Mdm), is formed by adding the expected deaths for each age group and dividing the sum by the total population that was taken as a standard."[1]

Nomenclature:

The direct method has been referred to by various terms:

1. "Corrected death rates." The Registrar-General of England and Wales named the method "corrected death rates" originally.
2. "Standardized rates." When adopted by the United States Bureau of the Census in 1911, the method was called "standardized rate."
3. "Adjusted rates." Professor G. C. Whipple of Harvard, and other authorities on vital statistics prefer the term "adjusted rates."

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[1] Linder, Forrest E. and Grove, Robert D., op. cit., p. 66.

4. "Age-adjusted," "Age-sex-adjusted rate." These terms are recommended by the Committee on Forms and Methods of Statistical Practice of the American Public Health Association. It is preferable also to state somewhere the particular method employed, such as "Age-adjusted death rate, direct method."

Information Required in Use of Direct Method:

1. The standard million age distribution based on a community suitable to the purposes of the research being conducted.
2. The population by age groups of the locality for which death rates are to be adjusted.
3. The number of deaths by age groups for the locality to be adjusted.
4. The age-specific death rates of the locality to be adjusted.

Advantages:

1. The direct method is employed by the United States Bureau of the Census. Because it is the official method of the government, it gains prestige and authority. The United States Department of Health recommends the method to State Health Departments.
2. The direct method is equally as reliable as other methods. In fact, it is claimed by some authorities to be a little more accurate.

Disadvantages:

1. The direct method requires deaths by ages for the locality to be adjusted.
2. Computations are more laborious and time-consuming then for the indirect method.
3. It requires a "standard million" which is an additional computation if a suitable one is not available.

Adjusting the Death Rate of Michigan by the Direct Method:

Applying the age-specific death rates of Michigan to the age groups of the chosen standard population of 1,000,000 (United States, 1940), one obtains the "expected number of deaths," that is, the number of deaths which would occur if the population of Michigan had the same age distribution as that of the United States in 1940. The sum of the expected number of deaths divided by the population in the standard community, (1,000,000) and this quotient multiplied by 1,000 gives an age adjusted death rate for Michigan per 1,000 population.

$$\text{Age-adjusted death rate, direct method} = \frac{\text{Sum of expected number deaths}}{\text{Population of standard community (1,000,000)}} \times 1{,}000$$

An example of this method of adjusting the death rate for age is worked out in detail in Table II. Michigan data for 1940 is used.

Table III illustrates the mechanics necessary for adjusting the white death rate of Michigan, 1940, for both age and sex as based on the age distribution of whites in the

TABLE II COMPUTATIONS FOR STANDARDIZING THE DEATH RATE FOR MICHIGAN, 1940, FOR AGE DISTRIBUTION, USING THE TOTAL POPULATION OF THE CONTINENTAL UNITED STATES, APRIL 1, 1940, AS THE STANDARD POPULATION: DIRECT METHOD, PER 1,000 PEOPLE.

Age	Standard Million for the U.S. 1940	MICHIGAN Population 1940	MICHIGAN Deaths 1940	Specific Death Rates per 100,000 Population (3 ÷ 2)	Expected Deaths in Standard Million $\frac{4 \times 1}{100,000}$
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
0--- 4	80,100	431,384	4,783	1,109	888
5--- 9	81,100	418,855	418	100	81
10---14	89,200	463,917	453	98	87
15---19	93,700	478,220	718	150	141
20---24	88,000	457,151	914	200	176
25---34	162,100	848,848	2,101	248	402
35---44	139,200	763,633	3,472	455	633
45---54	117,800	654,347	6,255	956	1,126
55---64	80,300	408,897	8,649	2,115	1,698
65---74	48,400	229,842	11,077	4,819	2,332
75-Over	20,100	101,012	13,227	13,094	2,632
Total	1,000,000	5,256,106	52,092	991	10,196
Unknown			25		

Note: Death and population of unknown ages, if any, are excluded from Columns 2 and 3, but are included in totals.

Source: Sixty-ninth Annual Report, Michigan Department of Health, Lansing, Michigan, 1941, Table 13, p. 264.

$$Mdm = \frac{\text{Sum of (Mua.Psa)}}{\text{Sum of Psa}} \text{ k where,}$$

Mdm = Age-adjusted death rate, direct method
Mua = Specific death rates of a given community
Psa = Population by age groups in standard million, U.S. 1940
k = 1,000

Mdm (Michigan) = $\frac{\text{Sum of (5) Expected deaths in a standard million}}{\text{Sum of (1) standard million for the U.S. 1940}} \times 1,000$

$$= \frac{10,196}{1,000,000} \times 1,000$$

$$= .010196 \times 1,000$$

$$= 10.20 = 10.2$$

TABLE III COMPUTATIONS FOR STANDARDIZING THE WHITE DEATH RATE FOR MICHIGAN, 1940, FOR AGE AND SEX, USING THE WHITE POPULATION OF THE CONTINENTAL UNITED STATES, APRIL 1, 1930, AS THE STANDARD POPULATION: DIRECT METHOD.

MALE

Age	White Standard Million for the U.S. 1930	MICHIGAN WHITE Population 1940	MICHIGAN WHITE Deaths	Age Specific Rates, 1940, per 100,000 Population (3)÷(2) x 100,000	Expected Rates in Standard Million (4) x (1) / 100,000
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
0--- 4	46,434	212,100	2,632	1,241	576
5--- 9	51,099	204,242	230	113	58
10---14	49.090	226,837	245	108	53
15---19	46,552	232,192	409	176	82
20---24	42,894	218,346	460	211	91
25---29	39,042	208,867	481	230	90
30---34	37,316	196,949	548	278	104
35---39	38,345	192,696	725	376	144
40---44	34,322	182,292	1,013	556	191
45---49	30,279	181,243	1,496	825	250
50---54	25,880	157,247	2,055	1,307	338
55---59	20,455	119,032	2,375	1,995	408
60---64	16,446	90,703	2,621	2,890	475
65---69	12,161	67,035	2,922	4,359	530
70---74	8,580	46,374	3,118	6,724	577
75-Over	7,827	48,304	6,655	13,777	1,078
Total	506,722	2,584,459	28,005	1,084	5,045

Note: Twenty male deaths included in the total, of unknown age, which are excluded from the age groups.

Source: Standard Million: from Hagood, Margaret J., Statistics for Sociologists, Reynal and Hitchcock, Inc., New York 1941, p. 840-841.
Deaths: from Vital Statistics of the United States, 1940, Part II, Table 9, p. 190-191.

Formula: (Set up for death rates per 1,000 population.)
Age-sex adjusted death rate: Direct method: (Mdm)

$$Mdm = \frac{\text{Sum of (mMua x mPsa plus fMua x fPsa)}}{\text{Sum of (mPsa plus fPsa)}}$$ where

mMua = Specific male death rate of a given community
fMua = Specific female death rate of a given community
mPsa = Male population by age groups in standard million, U.S., 1930.
fPsa = Female population by age groups in standard million, U.S., 1930.

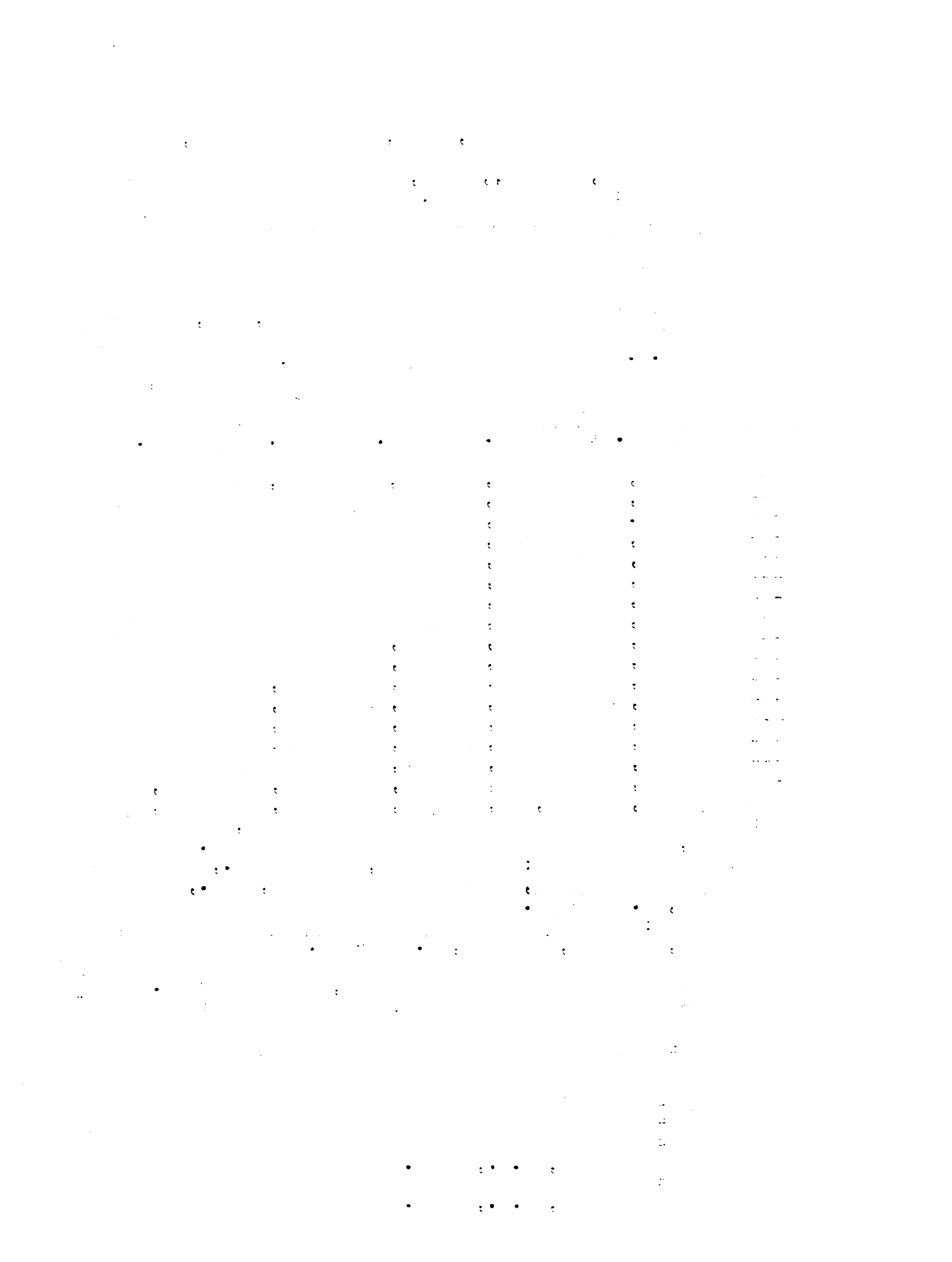


TABLE III (Continued)
COMPUTATIONS FOR STANDARDIZING THE WHITE DEATH RATE FOR MICHIGAN, 1940, FOR AGE AND SEX, USING THE WHITE POPULATION OF THE CONTINENTAL UNITED STATES, APRIL 1, 1930, AS THE STANDARD POPULATION: DIRECT METHOD

	FEMALE				
	White Standard Million for the United States	MICHIGAN WHITE		Age Specific Rates, 1940 per 100,000 Population	Expected Rates in Standard Million
Age	1930	Population 1940	Deaths 1940	8 / 7 . 100,000	(6) x (9) / 100,000
	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10
0--- 4	44,821	202,341	1,875	927	415
5--- 9	49,613	197,186	165	84	42
10---14	47,855	218,641	171	78	37
15---19	46,396	228,474	226	99	46
20---24	44,121	221,291	359	162	71
25---29	39,770	208,837	362	173	69
30---34	37,232	192,417	428	222	83
35---39	36,881	178,965	548	306	113
40---44	31,849	165,760	728	439	140
45---49	27,844	156,743	923	589	164
50---54	23,841	133,763	1,262	943	225
55---59	19,009	104,639	1,539	1,471	280
60---64	15,515	83,828	1,759	2,098	326
65---69	11,692	65,150	2,223	3,412	399
70---74	8,316	46,154	2,528	5,477	455
75-Over	8,523	50,995	6,338	12,429	1,059
Total	493,278	2,455,184	21,446	873	3,924

Note: Twelve female deaths of unknown age included in the total which are excluded from the age groups.

Source: Standard Million: Hagood, Margaret J., Statistics for Sociologists, Reynal and Hitchcock, Inc., New York, 1941, p. 840-841.
Deaths: from Vital Statistics of the United States, 1940, Part II, Table 9, p. 190-191.

Age-Sex Adjusted Death Rate of White Race, Michigan, 1940

$$= \frac{\text{Sum Col 5 plus Sum Col 10}}{\text{Sum Col 1 plus Sum Col 6}} \times 1{,}000$$

$$= \frac{5045 \text{ plus } 3924}{506{,}722 \text{ plus } 493{,}278} =$$

$$\frac{8{,}969}{1{,}000{,}000} \times 1{,}000$$

$$= .008969 \times 1{,}000 = 8.969 = 9.0$$

United States in 1930. The adjusted death rate is obtained for age and sex as follows:

$$\text{Age-Sex-adjusted Death Rate of White Race Michigan, 1940} = \frac{\text{Sum Col. 5 plus Col. 10}}{\text{Sum of Col. 1 plus Col. 6}} \times 1{,}000$$

The Standard Million:

White population of the United States, 1930, (Col. 1 and Col. 6) in Table III is the number of persons in each age-sex group in a population of 1,000,000 which has the same age-sex distribution as the white population of the United States in 1930. This standard million can be used for any age-sex-adjustment of death rates for which the white population of the United States in 1930 is an appropriate choice.

EQUIVALENT AVERAGE RATE METHOD

Defined:

This method is defined as "...an arithmetical mean of the rates of quinquennial groups of ages up to some convenient limit of age such as 65, this being equivalent to calculating a standardized death-rate at ages under 65 based upon a population equally distributed over the 13 age groups."[1]

Raymond Pearl first suggested this method in 1923. G. U. Yule proposed and adapted the method to the study of

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[1] Linder, Forrest E. and Grove, Robert D., op. cit., p. 81. See also The Registrar-General's Statistical Review of England and Wales for the Year 1937. New Annual Series, No. 17, Text. H. M. Stationery Office, London, 1940, p. 11.

differential occupational mortalities in 1934 and used it extensively.[1]

Information Required in Adjusting Death Rates:

1. The specific-age death rates for the locality to be adjusted. (up to age 65)
2. Weights for the size of the age group: (Weights consist of 1 for each five-year age group, 2 for each ten-year age group, etc.)
3. The weighted specific rate must be obtained by multiplying the weights by the age-specific death rates of the community to be adjusted.

An example of the computation of an adjusted death rate for Michigan, 1940, by this method is given in Table IV.

Advantages:

1. It is independent of any standard population.
2. The method is useful in comparing international death rates where populations by age distribution are uncertain. Yule has used the method extensively for studying occupational mortality where the population over age 65 is not important.
3. The Equivalent Rates method of adjusting death rates is the easiest and the quickest to compute of the three methods discussed.

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[1] Yule, G. U., "On Some Points Relating to Vital Statistics, More Especially Statistics of Occupational Mortality," Journal of the Royal Statistical Society, vol. 97, 1934, p. 1084.

TABLE IV COMPUTATIONS FOR STANDARDIZING THE DEATH RATE PER 100,000 POPULATION, MICHIGAN, 1940, FOR AGE, USING THE EQUIVALENT AVERAGE DEATH RATE METHOD.

Age	Michigan Specific Rates per 100,000 Population Col. 1	Weights for Size of Age Groups Col. 2	Weighted Specific Rate (2) x (1) Col. 3
0--- 4	1,109	1	1,109
5--- 9	100	1	100
10---14	98	1	98
15---19	150	1	150
20---24	200	1	200
25---34	248	2	496
35---44	455	2	910
45---54	956	2	1,912
55---64	2,115	2	4,230
Total		13	9,205
65 plus	7,346		

Note: Deaths and population of unknown ages, if any, excluded.

Equivalent average death rate = $\frac{\text{Sum of (Mua . Wci)}}{\text{Sum of Wci . k}}$ where

Mua = Age-specific death rates of given community
Wci = Weight of class interval
k = 100

Equivalent average death rate = $\frac{\text{Sum of weighted specific rates (Column 3)}}{\text{Sum of weights for class interval (Column 2) times 100}}$

$$= \frac{9,205}{13 \cdot 100}$$

$$= \frac{9,205}{1,300}$$

$$= 7.08$$

Disadvantages:

1. The equivalent average rates method cannot be safely employed in studying general mortality for all ages.
2. According to Linder and Grove, "The requirement that the average (or sum) be cut off at 'some convenient limit of age such as 65' is necessary for two reasons: first, because without such a limit it would be difficult to assign a weight to the open-end age group (for example, '65 years and over'); and second, because if the limit were set too high, the index would be over-whelmingly dominated by the specific rates of the later ages."[1]
3. The weighting system must be kept up-to-date.

ADVANTAGES OF ADJUSTED DEATH RATES

1. Age-adjusted death rates of local areas can be compared without being influenced by abnormal age distributions. Since age is held constant, any differences that may appear in the rates of local areas will not be due to abnormal age distributions.
2. There is economy of expression in the use of adjusted death rates. A single figure may measure

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[1] Linder, Forrest E. and Grove, Robert D., op. cit., pp. 81-82.

the deaths of an area, holding constant age, sex, race, residence, or any combination of these which available data suggests may be unduly influencing crude rates. This single figure may be compared to a similarly computed rate for other areas, greatly reducing the number of tables and comparisons while at the same time being more precise and reliable.

3. Adjusted rates are truer measures of the real force of mortality in areas or regions of a nation or state than are crude rates.
4. The principle employed in adjusting rates may be used to estimate crude death rates in future years.
5. The adjustment of death rates now is not impracticable because of the time and labor required for computation, and the cost involved, if modern calculating machines are available.

DISADVANTAGES OF ADJUSTED DEATH RATES

1. Adjusted death rates eliminate any variation present due to age, and by so doing also eliminate any variables which may be associated with the age of the population. In communities where health problems may be determined largely by the peculiar characteristics of the age distribution,

age-adjusted death rates may not reflect the health problems characteristic of the age groups which are predominant in the population.

2. Adjusted rates may exaggerate the differences in crude rates rather than reducing the amount of dispersion between them. The Registrar-General of England and Wales states, "The correction for differences in age distribution accentuates the contrasts between the mortalities of the northern industrial towns and the residential and agricultural towns rather than diminishing them."[1] He explains that "Far from accounting for part of the wide differences in mortality rates between individual county boroughs, the peculiarities in age distribution tend in general to mask these differences, the more favorably circumstanced towns having larger proportions of old people."[2]

3. Adjusted death rates are limited for use in public health data due to the lack of power of the human mind (untrained in statistics) to grasp the full meaning of a number of characteristics combined in a single figure.

4. The requirement of population by age groups hinders

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[1] Linder, Forrest E. and Grove, Robert D., op. cit., p. 87.
[2] Linder, Forrest E. and Grove, Robert D., ibid, p. 87.

the use of the methods for adjusting death rates in local areas between decennial years. Estimated populations by age groups are not usually available in local areas.

MORTALITY FORMULAS

1. Crude resident death rate:

$$\frac{\text{Number of deaths of residents in area for specified period}}{\text{Total residents of given area for the same specified time}} \times 1{,}000$$

2. Recorded death rates:
(by place of occurrence)

$$\frac{\text{Number of deaths occurring in area for specified period}}{\text{Total population of area for same specified time}} \times 1{,}000$$

3. Age-Specific Death Rates:

$$\frac{\text{Deaths occurring to persons in given age group for specified time}}{\text{Persons exposed to risk of death in same age group for same period}} \times 1{,}000$$

4. Sex-Specific Death Rates:

$$\frac{\text{Deaths occurring to persons in given sex group for given time}}{\text{Persons exposed to risk of death in same sex group for same period}} \times 1{,}000$$

5. Cause-Specific Death Rate:

$$\frac{\text{Deaths from specific cause for given area and period}}{\text{Total population exposed to risk of death, same area and period}} \times 1{,}000$$

6. Age-Adjusted Death Rate:
(Direct Method)

$$\frac{\text{Sum of (Age-specific death rates given area} \times \text{Population by age groups in stand mil.)}}{\text{Standard million}} \times 1{,}000$$

7. Age-Adjusted Death Rate:
(Indirect Method)

$$\frac{\text{Crude death rate of standard population}}{\text{Sum of (Standard specific rates)} \times \text{(Population by age group in area to be adjusted)}} \times \text{(Crude death rate in area to be adjusted)}$$

$$\frac{}{\text{Population of area to be adjusted}} \times 1{,}000$$

8. Death Ratio:

$$\frac{\text{Deaths in specified class for given period of time}}{\text{Total deaths during the same period}} \times 1{,}000$$

9. Infant Death Rate:

$$\frac{\text{Deaths under 1 year of age except stillbirths, specified period}}{\text{Total live births during same period}} \times 1{,}000$$

10. Maternal Mortality Death Rate:

$$\frac{\text{All deaths from puerperal causes for given area and time}}{\text{Number of live births forsame area and period}} \times 1{,}000$$

11. Under 5-Year Death Rate:

$$\frac{\text{All deaths at ages 0-4 except stillbirths, given area and time}}{\text{Total living population at ages 0-4, same area and time}} \times 1{,}000$$

Appendix II Table 1

RANK OF TEN LEADING CAUSES OF DEATH AND SUICIDES PER 10,000 POPULATION, BY COUNTY, MICHIGAN, AVERAGE 1935-1944

County	Rank of Death Rates by Cause in Each County										
	Heart	Cancer	Apoplexy	Accidents	Pneumonia	Nephritis	T.B.	Premature Births	Diabetes	Arteriosclerosis	Suicide
State	1	2	3	4	5	6	7	8	9	10	11
Alcona	1	3	2	4	6	5	9	7	8	11	10
Alger	1	3	5	2	4	6	7	8	9	11	10
Allegan	1	2	3	4	6	5	10	9	7	8	11
Alpena	1	3	2	4	6	5	9	10	7	8	11
Antrim	1	3	2	5	6	4	10	8.5	8.5	7	11
Arenac	1	3	4	2	5	6	7	8	9	11	10
Baraga	1	4	3	2	5	7	6	8	10	11	9
Barry	1	3	2	4	6	5	11	9	8	7	10
Bay	1	2	3	4	5	6	9	7	8	10	11
Benzie	1	2	4	3	6	5	10	8	9	7	11
Berrien	1	2	3	4	6	5	9	7.5	7.5	10	11
Branch	1	3	2	4	6	5	10.5	8.5	7	8.5	10.5
Calhoun	1	3	2	4	5	6	8.5	7	8.5	10	11
Cass	1	2	3	5	6	4	9.5	9.5	7	8	11
Charlevoix	1	2	3	4	6	5	9	7	8	10	11
Cheboygan	1	2	3	4	5	6	10	7	9	8	11
Chippewa	1	2	4	3	5	6	8	7	9	10	11
Clare	1	3	4	2	5	6	10	8	7	9	11
Clinton	1	3	4	5	6	2	10.5	9	8	7	10.5
Crawford	1	2	5	3	6	4	9.5	8	7	9.5	11

Table 1 Continued

County	Rank of Death Rates by Cause in Each County										
	Heart	Cancer	Apoplexy	Accidents	Pneumonia	Nephritis	T.B.	Premature Births	Diabetes	Arteriosclerosis	Suicide
Delta	1	2	3	4	5	6	7	8	9	10	11
Dickinson	1	2	4	3	7	6	5	9	8	10	11
Eaton	1	2	3	4	6	5	11	9	8	7	10
Emmet	1	2.5	2.5	4	5	6	7	8	9.5	9.5	11
Genesee	1	2	4	3	5	6	8	7	10	9	11
Gladwin	1	2	3	4	6	5	9	7	8	10	11
Gogebic	1	2	4	3	6	7	5	8	9	11	10
Grand Traverse	1	3	2	4	5	6	9	7.5	7.5	10	11
Gratiot	1	2	3	4	6	5	10	9	8	7	11
Hillsdale	1	3	2	4	6	5	10	11	8	7	9
Houghton	1	2	3	4	7	6	5	9	8	11	10
Huron	1	2	3	4	5	6	10	7	9	8	11
Ingham	1	2	3	4	6	5	11	7	8	9	10
Ionia	1	2	3	4	6	5	10	9	8	7	11
Iosco	1	2	3	4	6	5	9	8	10	7	11
Iron	1	2	4	3	6	5	7	9	8	10	11
Isabella	1	2	3	4	5	6	9	8	10	7	11
Jackson	1	2	3	4	6	5	10	9	8	7	11
Kalamazoo	1	2	3	4	6	5	10	9	7.5	7.5	11
Kalkaska	1	3	2	5	4	6	9	8	10	7	11
Kent	1	2	3	4	6	5	9.5	9.5	7	8	11
Keweenaw	1	3	2	4	8	5	6	11	7	9	10
Lake	1	3	2	4	5	6	8	11	7	10	9
Lapeer	1	3	2	4	6	5	9	10	7	8	11
Leelanau	1	2	3	4	6	5	7	9	8	10.5	10.5

Table 1 Continued

County	Rank of Death Rates by Cause in Each County										
	Heart	Cancer	Apoplexy	Accidents	Pneumonia	Nephritis	T.B.	Premature Births	Diabetes	Arteriosclerosis	Suicide
Lenawee	1	3	2	4	6	5	10	9	8	7	11
Livingston	1	2	4	3	5	7	10.5	8	9	6	10.5
Luce	1	3	4	2	5	6	8	7	9	11	10
Mackinac	1	4	3	2	5	6	9	8	7	10	11
Macomb	1	2	3	4	5	6	8	8	8	10	11
Manistee	1	2	3	4	5	6	9	10	8	7	11
Marquette	1	2	3	4	5	6	7	9	8	11	10
Mason	1	2	3	4	6	5	7	10	9	8	11
Mecosta	1	2	3	4	6	5	10	9	8	7	11
Menominee	1	2	3	4	6.5	6.5	5	9	8	10	11
Midland	1	3	5	4	6	2	9	7	8	10.5	10.5
Missaukee	1	3	2	4	5	7	9	6	8	11	10
Monroe	1	2	4	3	5	6	8	7	9	10	11
Montcalm	1	3	2	4	6	5	10	9	8	7	11
Montmorency	1	2	6	3	5	4	8.5	7	8.5	10.5	10.5
Muskegon	1	2	3	5	4	6	9	7	8	10	11
Newaygo	1	3	2	4	6	5	10	8	7	9	11
Oakland	1	2	4	3	5	6	8	7	9	10	11
Oceana	1	2	3	4	7	6	9.5	10	8	5	9.5
Ogemaw	1	4	2	3	5	6	9	7	8	10	11
Ontonagon	1	3	2	4	5	7	6	8	9	11	10
Osceola	1	3	2	4	6	5	10	9	8	7	11
Oscoda	1	2	5	4	6	3	9	7	9	9	11
Otsego	1	2	5	3	6	4	8	7	11	9.5	9.5
Ottawa	1	2	3	4	6.5	5	10	9	6.5	8	11

Table 1 Continued

County	Rank of Death Rates by Cause in Each County										
	Heart	Cancer	Apoplexy	Accidents	Pneumonia	Nephritis	T.B.	Premature Births	Diabetes	Arteriosclerosis	Suicide
Presque Isle	1	2	4	3	5	6	7	8	9	10	11
Roscommon	1	2	4	3	6	5	7	11	8	9.5	9.5
Saginaw	1	2	3	4	5	6	9	7	8	10	11
Sanilac	1	3	2	4	6	5	9	8	7	10	11
Schoolcraft	1	2	4	3	6	5	7	8	9	11	10
Shiawassee	1	2	3	5	6	4	10	9	8	7	11
St. Clair	1	2	3	4	5	6	9	8	7	10	11
St. Joseph	1	3	2	4	5	6	9	10	8	7	11
Tuscola	1	2	3	4	6	5	9	8	7	10	11
Van Buren	1	2	3	4	6	5	9.5	9.5	8	7	11
Washtenaw	1	2	3	4	5	6	8	9	10	7	11
Wayne	1	2	5	4	3	7	6	8	9	11	10
Wexford	1	2	3	4	6	5	7	8.5	8.5	10	11

Source: Tables 7.2-7.7.

APPENDIX II

Table 8 RANK OF FIVE PRINCIPAL CAUSES OF DEATH IN RURAL AREAS, BY COUNTY, MICHIGAN 1935-1944 (Rates per 10,000 population)

State and County	Heart	Cancer	Apoplexy	Accident	Nephritis
State	1	2	3	4	5
Alcona	1	3	2	4	5
Alger	1	3	4	2	5
Allegan	1	2	3	4	5
Alpena	1	2.5	2.5	4	5
Antrim	1	3	2	4	5
Arenac	1	3	4	2	5
Baraga[1]	1	4	3	2	5
Barry	1	3	2	4	5
Bay	1	3	4	2	5
Benzie	1	2	4	3	5
Berrien	1	2	3	4	5
Branch	1	3	2	4	5
Calhoun	1	3	2	4	5
Cass	1	3	2	5	4
Charlevoix	1	2	3	4	5
Cheboygan	1	2	3	4	5
Chippewa	1	4	3	2	5
Clare	1	3	4	2	5
Clinton	1	3	4	5	2
Crawford	1	2	3	3	4
Delta	1	2.5	4	2.5	5
Dickinson	1	2	3	4	5
Eaton	1	2	3	4	5
Emmet	1	2	3	4	5
Genesee	1	2	4	3	5
Gladwin	1	2	3	4	5
Gogebic	1	3	4	2	5
Grand Traverse	1	3	2	4	5
Gratiot[1]	1	2	3	4	5
Hillsdale	1	3	2	4	5
Houghton	1	2	3	4	5
Huron	1	2	3	4	5
Ingham	1	3	2	4	5
Ionia	1	2	3	4	5
Iosco	1	2	3	4	5
Iron	1	2	4	3	5
Isabella	1	2	3	4	5
Jackson	1	2	3	4	5
Kalamazoo	1	2	3	4	5
Kalkaska	1	3	2	4	5

Table 2 Continued

State and County	Heart	Cancer	Apoplexy	Accident	Nephritis
Kent	1	2	3	4	5
Keweenaw	1	3	2	4	5
Lake	1	3	2	4	5
Lapeer	1	3	2	4	5
Leelanau	1	2	3	4	5
Lenawee[1]	1	3	2	4	5
Livingston	1	2	3	4	5
Luce[1]	1	3	4	2	5
Mackinac[1]	1	4	3	2	5
Macomb[1]	1	2	3	4	5
Manistee	1	2	3	4	5
Marquette	1	3	2	4	5
Mason	1	3	2	4	5
Mecosta	1	3	2	4	5
Menominee	1	2	3	4	5
Midland	1	3	5	4	2
Missaukee	1	3	2	4	5
Monroe	1	2	4	3	5
Montcalm	1	3	2	4	5
Montmorency	1	2	5	3	4
Muskegon	1	2	3	4	5
Newaygo[1]	1	3	2	4	5
Oakland	1	2	4	3	5
Oceana	1	3	2	4	5
Ogemaw	1	4	2	3	5
Ontonagon	1	3	2	4	5
Osceola	1	3	2	4	5
Oscoda	1	2	5	4	3
Otsego	1	2	5	3	4
Ottawa	1	2	3	4	5
Presque Isle	1	2	4	3	5
Roscommon	1	2	4	3	5
Saginaw	1	2	4	3	5
St. Clair	1	2	4	3	5
St. Joseph	1	3	2	5	4
Sanilac	1	3	2	5	4
Schoolcraft	1	4	2	3	5
Shiawassee	1	3	2	5	4
Tuscola	1	2	3	4	5
Van Buren	1	2	3	4	5
Washtenaw	1	2	3	4	5
Wayne[1]	1	3	4	2	5
Wexford	1	3	2	5	4

1. Contains one or more urban places which were included with the rural in the Reports of the Michigan Department of Health, 1935-1940. These places are included with the rural throughout the ten year period, 1935-1944.

APPENDIX II

Table 3 RANK OF FIVE PRINCIPAL CAUSES OF DEATH IN URBAN AREAS, BY COUNTY, MICHIGAN 1935-1944 (Rates per 10,000 population)

State and County	Heart	Cancer	Apoplexy	Accident	Nephritis
State	1	2	3	4	5
Alger	1	2	3	4	5
Allegan	1	2	3	4	5
Alpena	1	2	3	4	5
Barry	1	3	2	4	5
Bay	1	2	3	4	5
Berrien	1	2	3	4	5
Branch	1	3	2	4	5
Calhoun	1	2	3	4	5
Cass	1	2	3	4	5
Charlevoix	1	2	3	4	5
Cheboygan	1	2	3	4	5
Chippewa	1	2	4	3	5
Clinton	1	3	4	5	2
Delta	1	2	3	4	5
Dickinson	1	2	4	3	5
Eaton	1	2	3	4	5
Emmet	1	3	2	4	5
Genesee	1	2	4	3	5
Gogebic	1	2	3	4	5
Grand Traverse	1	3	2	4	5
Gratiot[1]	1	2	3	5	4
Hillsdale	1	2	3	4	5
Houghton	1	2	3	4	5
Ingham	1	2	3	4	5
Ionia	1	3	2	4	5
Iron	1	2	4	3	5
Isabella	1	3	4	2	5
Jackson	1	2	3	4	5
Kalamazoo	1	2	3	4	5
Kent	1	2	3	4	5
Lapeer	1	2	3	4	5
Lenawee[1]	1	2	3	4	5
Livingston	1	3	4	2	5
Macomb[1]	1	2	3	4	5
Manistee	1	3	2	4	5
Marquette	1	2	3	4	5
Mason	1	2	4	3	5
Mecosta	1	2	3	5	4
Menominee	1	2	3	4	5
Midland	1	3	5	4	2

Table 3 Continued

State and County	Heart	Cancer	Apoplexy	Accident	Nephritis
Monroe	1	2	4	3	5
Montcalm	1	3	2	4	5
Muskegon	1	2	3	4	5
Oakland	1	2	4	3	5
Ottawa	1	2	3	4	5
Presque Isle	1	2	5	3	4
Saginaw	1	2	3	4	5
St. Clair	1	2	3	4	5
St. Joseph	1	3	2	5	4
Schoolcraft	1	2	4	3	5
Shiawassee	1	2	3	4	5
Tuscola	1	2	3	4	5
Van Buren	1	2	3	4	5
Washtenaw	1	2	3	4	5
Wayne[1]	1	2	3	4	5
Wexford	1	2	3	4	5

1. Does not include one or more urban places which were included with the rural in the Reports of the Michigan Department of Health, 1935-1940. These places are included in the rural throughout the ten year period, 1935-1944 for purposes of computing the ten-year average death rates.

Source: Table

Table 4 TOTAL NUMBER OF DEATHS FROM ALL CAUSES, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	530,282		
Alcona	636	Lake	640
Alger	1,138	Lapeer	3,566
Allegan	5,140	Leelanau	949
Alpena	2,160	Lenawee	7,023
Antrim	1,401	Livingston	2,681
Arenac	1,006	Luce	761
Baraga	1,036	Mackinac	1,041
Barry	2,981	Macomb	9,489
Bay	8,227	Manistee	2,466
Benzie	1,075	Marquette	5,185
Berrien	10,315	Mason	2,356
Branch	3,769	Mecosta	2,289
Calhoun	11,470	Menominee	2,747
Cass	3,244	Midland	2,261
Charlevoix	1,730	Missaukee	849
Cheboygan	1,666	Monroe	5,944
Chippewa	3,116	Montcalm	3,995
Clare	1,193	Montmorency	408
Clinton	3,101	Muskegon	9,648
Crawford	452	Newaygo	2,290
Delta	3,778	Oakland	20,744
Dickinson	2,725	Oceana	2,025
Eaton	4,414	Ogemaw	1,016
Emmet	2,082	Ontonagon	1,288
Genesee	19,341	Osceola	1,777
Gladwin	1,000	Oscoda	227
Gogebic	3,424	Otsego	646
Grand Traverse	2,696	Ottawa	5,773
Gratiot	3,921	Presque Isle	1,139
Hillsdale	3,998	Roscommon	375
Houghton	5,947	Saginaw	13,581
Huron	3,526	Sanilac	3,590
Ingham	12,707	Schoolcraft	1,054
Ionia	4,475	Shiawassee	5,010
Iosco	939	St. Clair	9,163
Iron	1,847	St. Joseph	4,281
Isabella	2,737	Tuscola	4,318
Jackson	10,546	Van Buren	5,126
Kalamazoo	10,814	Washtenaw	8,756
Kalkaska	585	Wayne	179,008
Kent	25,693	Wexford	2,258
Keweenaw	488		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 5 TOTAL NUMBER OF BIRTHS, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Births	State and County	Total Number of Births
State	1,028,519		
Alcona	1,063	Lake	807
Alger	2,135	Lapeer	5,325
Allegan	7,742	Leelanau	1,582
Alpena	4,393	Lenawee	10,294
Antrim	2,301	Livingston	3,620
Arenac	1,670	Luce	1,521
Baraga	1,714	Mackinac	2,058
Barry	3,970	Macomb	23,622
Bay	16,251	Manistee	3,318
Benzie	1,665	Marquette	8,664
Berrien	16,566	Mason	3,508
Branch	4,741	Mecosta	3,458
Calhoun	18,982	Menominee	5,573
Cass	3,336	Midland	7,132
Charlevoix	2,684	Missaukee	1,896
Cheboygan	2,816	Monroe	11,845
Chippewa	6,808	Montcalm	5,419
Clare	2,027	Montmorency	790
Clinton	5,257	Muskegon	22,002
Crawford	762	Newaygo	3,734
Delta	6,896	Oakland	55,683
Dickinson	5,135	Oceana	2,696
Eaton	6,589	Ogemaw	1,878
Emmet	3,410	Ontonagon	2,015
Genesee	49,398	Osceola	2,660
Gladwin	2,111	Oscoda	519
Gogebic	5,962	Otsego	1,303
Grand Traverse	4,391	Ottawa	12,218
Gratiot	6,899	Presque Isle	2,639
Hillsdale	5,264	Roscommon	717
Houghton	7,635	Saginaw	27,491
Huron	6,775	Sanilac	5,786
Ingham	28,169	Schoolcraft	2,145
Ionia	6,470	Shiawassee	8,044
Iosco	1,645	St. Clair	15,228
Iron	3,318	St. Joseph	6,317
Isabella	5,584	Tuscola	7,116
Jackson	16,538	Van Buren	5,640
Kalamazoo	19,232	Washtenaw	15,576
Kalkaska	1,147	Wayne	377,137
Kent	45,800	Wexford	3,682
Keweenaw	615		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 6 TOTAL NUMBER OF DEATHS FROM HEART DISEASE, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	149,925		
Alcona	192	Lake	182
Alger	261	Lapeer	996
Allegan	1,612	Leelanau	318
Alpena	693	Lenawee	1,924
Antrim	409	Livingston	865
Arenac	305	Luce	286
Baraga	217	Mackinac	279
Barry	855	Macomb	2,386
Bay	2,279	Manistee	823
Benzie	309	Marquette	1,398
Berrien	3,056	Mason	676
Branch	1,149	Mecosta	671
Calhoun	3,446	Menominee	766
Cass	854	Midland	546
Charlevoix	527	Missaukee	247
Cheboygan	483	Monroe	1,727
Chippewa	934	Montcalm	1,141
Clare	355	Montmorency	104
Clinton	816	Muskegon	2,570
Crawford	116	Newaygo	726
Delta	997	Oakland	5,170
Dickinson	780	Oceana	539
Eaton	1,371	Ogemaw	278
Emmet	687	Ontonagon	310
Genesee	4,932	Osceola	518
Gladwin	277	Oscoda	62
Gogebic	819	Otsego	207
Grand Traverse	811	Ottawa	1,748
Gratiot	1,150	Presque Isle	282
Hillsdale	1,121	Roscommon	112
Houghton	1,647	Saginaw	3,855
Huron	915	Sanilac	1,010
Ingham	3,422	Schoolcraft	307
Ionia	1,322	Shiawassee	1,320
Iosco	288	St. Clair	2,555
Iron	478	St. Joseph	1,200
Isabella	768	Tuscola	1,337
Jackson	3,142	Van Buren	1,627
Kalamazoo	3,041	Washtenaw	2,535
Kalkaska	176	Wayne	50,101
Kent	8,389	Wexford	706
Keweenaw	114		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 7 TOTAL NUMBER OF DEATHS FROM CANCER, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	60,752		
Alcona	61	Lake	66
Alger	100	Lapeer	382
Allegan	572	Leelanau	104
Alpena	210	Lenawee	735
Antrim	155	Livingston	301
Arenac	97	Luce	51
Baraga	85	Mackinac	97
Barry	314	Macomb	1,072
Bay	982	Manistee	305
Benzie	99	Marquette	601
Berrien	1,158	Mason	256
Branch	379	Mecosta	211
Calhoun	1,196	Menominee	339
Cass	374	Midland	239
Charlevoix	204	Missaukee	68
Cheboygan	196	Monroe	667
Chippewa	275	Montcalm	402
Clare	109	Montmorency	46
Clinton	313	Muskegon	1,001
Crawford	57	Newaygo	237
Delta	441	Oakland	2,335
Dickinson	317	Oceana	217
Eaton	525	Ogemaw	84
Emmet	223	Ontonagon	126
Genesee	2,052	Osceola	198
Gladwin	109	Oscoda	28
Gogebic	362	Otsego	67
Grand Traverse	271	Ottawa	801
Gratiot	433	Presque Isle	127
Hillsdale	450	Roscommon	40
Houghton	759	Saginaw	1,483
Huron	409	Sanilac	364
Ingham	1,485	Schoolcraft	125
Ionia	505	Shiawassee	615
Iosco	123	St. Clair	1,059
Iron	238	St. Joseph	478
Isabella	294	Tuscola	488
Jackson	1,203	Van Buren	625
Kalamazoo	1,218	Washtenaw	1,066
Kalkaska	57	Wayne	21,262
Kent	3,315	Wexford	210
Keweenaw	49		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 8 TOTAL NUMBER OF DEATHS FROM APOPLEXY, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	45,270		
Alcona	70	Lake	73
Alger	65	Lapeer	421
Allegan	556	Leelanau	92
Alpena	217	Lenawee	752
Antrim	161	Livingston	232
Arenac	91	Luce	46
Baraga	86	Mackinac	100
Barry	382	Macomb	925
Bay	688	Manistee	294
Benzie	92	Marquette	438
Berrien	938	Mason	229
Branch	434	Mecosta	248
Calhoun	1,239	Menominee	262
Cass	359	Midland	139
Charlevoix	174	Missaukee	102
Cheboygan	168	Monroe	505
Chippewa	247	Montcalm	436
Clare	105	Montmorency	23
Clinton	304	Muskegon	800
Crawford	25	Newaygo	252
Delta	392	Oakland	1,690
Dickinson	231	Oceana	236
Eaton	442	Ogemaw	150
Emmet	223	Ontonagon	151
Genesee	1,492	Osceola	211
Gladwin	105	Oscoda	18
Gogebic	330	Otsego	42
Grand Traverse	329	Ottawa	591
Gratiot	348	Presque Isle	70
Hillsdale	471	Roscommon	28
Houghton	608	Saginaw	1,169
Huron	332	Sanilac	450
Ingham	1,362	Schoolcraft	92
Ionia	467	Shiawassee	480
Iosco	101	St. Clair	890
Iron	140	St. Joseph	484
Isabella	256	Tuscola	439
Jackson	1,002	Van Buren	576
Kalamazoo	1,087	Washtenaw	872
Kalkaska	75	Wayne	11,322
Kent	8,480	Wexford	208
Keweenaw	63		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 9 TOTAL NUMBER OF DEATHS FROM ACCIDENTS, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	7,399		
Alcona	59	Lake	58
Alger	138	Lapeer	299
Allegan	428	Leelanau	67
Alpena	169	Lenawee	568
Antrim	83	Livingston	235
Arenac	103	Luce	79
Baraga	126	Mackinac	114
Barry	236	Macomb	864
Bay	647	Manistee	159
Benzie	97	Marquette	393
Berrien	875	Mason	186
Branch	285	Mecosta	163
Calhoun	846	Menominee	193
Cass	283	Midland	197
Charlevoix	134	Missaukee	58
Cheboygan	138	Monroe	610
Chippewa	269	Montcalm	337
Clare	129	Montmorency	44
Clinton	226	Muskegon	657
Crawford	43	Newaygo	153
Delta	350	Oakland	1,848
Dickinson	238	Oceana	165
Eaton	355	Ogemaw	95
Emmet	155	Ontonagon	123
Genesee	1,592	Osceola	145
Gladwin	92	Oscoda	20
Gogebic	338	Otsego	58
Grand Traverse	200	Ottawa	377
Gratiot	292	Presque Isle	87
Hillsdale	304	Roscommon	36
Houghton	407	Saginaw	1,060
Huron	309	Sanilac	274
Ingham	1,030	Schoolcraft	96
Ionia	305	Shiawassee	395
Iosco	78	St. Clair	801
Iron	193	St. Joseph	306
Isabella	237	Tuscola	341
Jackson	807	Van Buren	412
Kalamazoo	880	Washtenaw	685
Kalkaska	40	Wayne	11,632
Kent	1,792	Wexford	160
Keweenaw	34		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 10 TOTAL NUMBER OF DEATHS FROM PNEUMONIA, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	30,029		
Alcona	26	Lake	40
Alger	77	Lapeer	189
Allegan	195	Leelanau	41
Alpena	94	Lenawee	352
Antrim	78	Livingston	154
Arenac	59	Luce	40
Baraga	54	Mackinac	73
Barry	126	Macomb	589
Bay	396	Manistee	104
Benzie	42	Marquette	275
Berrien	509	Mason	85
Branch	185	Mecosta	98
Calhoun	613	Menominee	122
Cass	144	Midland	119
Charlevoix	72	Missaukee	41
Cheboygan	77	Monroe	342
Chippewa	156	Montcalm	153
Clare	83	Montmorency	32
Clinton	140	Muskegon	668
Crawford	20	Newaygo	183
Delta	232	Oakland	1,232
Dickinson	139	Oceana	74
Eaton	181	Ogemaw	56
Emmet	93	Ontonagon	71
Genesee	1,413	Osceola	65
Gladwin	59	Oscoda	16
Gogebic	191	Otsego	33
Grand Traverse	142	Ottawa	175
Gratiot	162	Presque Isle	65
Hillsdale	192	Roscommon	22
Houghton	241	Saginaw	787
Huron	204	Sanilac	175
Ingham	553	Schoolcraft	58
Ionia	185	Shiawassee	229
Iosco	36	St. Clair	441
Iron	106	St. Joseph	232
Isabella	133	Tuscola	206
Jackson	451	Van Buren	195
Kalamazoo	531	Washtenaw	432
Kalkaska	43	Wayne	12,244
Kent	1,004	Wexford	127
Keweenaw	17		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 11 TOTAL NUMBER OF DEATHS FROM NEPHRITIS, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	28,707		
Alcona	46	Lake	33
Alger	58	Lapeer	198
Allegan	268	Leelanau	59
Alpena	110	Lenawee	407
Antrim	89	Livingston	104
Arenac	54	Luce	35
Baraga	34	Mackinac	47
Barry	207	Macomb	574
Bay	589	Manistee	87
Benzie	66	Marquette	250
Berrien	681	Mason	184
Branch	228	Mecosta	167
Calhoun	568	Menominee	122
Cass	288	Midland	295
Charlevoix	98	Missaukee	35
Cheboygan	64	Monroe	248
Chippewa	138	Montcalm	232
Clare	75	Montmorency	34
Clinton	344	Muskegon	492
Crawford	32	Newaygo	132
Delta	180	Oakland	1,023
Dickinson	93	Oceana	80
Eaton	278	Ogemaw	43
Emmet	85	Ontonagon	65
Genesee	1,055	Osceola	99
Gladwin	69	Oscoda	21
Gogebic	184	Otsego	50
Grand Traverse	118	Ottawa	337
Gratiot	240	Presque Isle	51
Hillsdale	218	Roscommon	24
Houghton	302	Saginaw	772
Huron	196	Sanilac	189
Ingham	774	Schoolcraft	57
Ionia	223	Shiawassee	345
Iosco	57	St. Clair	644
Iron	124	St. Joseph	323
Isabella	117	Tuscola	249
Jackson	611	Van Buren	316
Kalamazoo	720	Washtenaw	379
Kalkaska	25	Wayne	8,822
Kent	1,271	Wexford	135
Keweenaw	33		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 12 TOTAL NUMBER OF DEATHS FROM TUBERCULOSIS, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	18,852		
Alcona	9	Lake	14
Alger	56	Lapeer	68
Allegan	79	Leelanau	29
Alpena	54	Lenawee	131
Antrim	22	Livingston	40
Arenac	30	Luce	23
Baraga	52	Mackinac	31
Barry	28	Macomb	266
Bay	156	Manistee	72
Benzie	22	Marquette	214
Berrien	255	Mason	78
Branch	48	Mecosta	33
Calhoun	253	Menominee	129
Cass	50	Midland	32
Charlevoix	30	Missaukee	11
Cheboygan	33	Monroe	145
Chippewa	79	Montcalm	58
Clare	20	Montmorency	9
Clinton	42	Muskegon	220
Crawford	8	Newaygo	34
Delta	159	Oakland	499
Dickinson	165	Oceana	27
Eaton	52	Ogemaw	21
Emmet	56	Ontonagon	67
Genesee	584	Osceola	25
Gladwin	13	Oscoda	4
Gogebic	253	Otsego	10
Grand Traverse	73	Ottawa	96
Gratiot	58	Presque Isle	45
Hillsdale	44	Roscommon	10
Houghton	331	Saginaw	374
Huron	71	Sanilac	70
Ingham	196	Schoolcraft	33
Ionia	57	Shiawassee	69
Iosco	20	St. Clair	190
Iron	89	St. Joseph	70
Isabella	69	Tuscola	80
Jackson	189	Van Buren	81
Kalamazoo	191	Washtenaw	208
Kalkaska	13	Wayne	10,664
Kent	525	Wexford	35
Keweenaw	23		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 13 TOTAL NUMBER OF DEATHS FROM PREMATURE BIRTHS, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	14,196		
Alcona	19	Lake	5
Alger	42	Lapeer	52
Allegan	94	Leelanau	24
Alpena	56	Lenawee	165
Antrim	25	Livingston	63
Arenac	27	Luce	30
Baraga	27	Mackinac	37
Barry	55	Macomb	269
Bay	262	Manistee	57
Benzie	25	Marquette	135
Berrien	232	Mason	37
Branch	76	Mecosta	46
Calhoun	326	Menominee	88
Cass	50	Midland	76
Charlevoix	49	Missaukee	36
Cheboygan	53	Monroe	178
Chippewa	104	Montcalm	87
Clare	28	Montmorency	14
Clinton	69	Muskegon	391
Crawford	14	Newaygo	54
Delta	107	Oakland	787
Dickinson	77	Oceana	21
Eaton	76	Ogemaw	38
Emmet	51	Ontonagon	36
Genesee	766	Osceola	32
Gladwin	26	Oscoda	6
Gogebic	87	Otsego	13
Grand Traverse	76	Ottawa	119
Gratiot	97	Presque Isle	33
Hillsdale	56	Roscommon	5
Houghton	98	Saginaw	385
Huron	104	Sanilac	66
Ingham	389	Schoolcraft	28
Ionia	70	Shiawassee	127
Iosco	26	St. Clair	207
Iron	46	St. Joseph	64
Isabella	79	Tuscola	86
Jackson	239	Van Buren	79
Kalamazoo	232	Washtenaw	206
Kalkaska	16	Wayne	5,066
Kent	525	Wexford	65
Keweenaw	9		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 14 TOTAL NUMBER OF DEATHS FROM DIABETES, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	13,719		
Alcona	12	Lake	18
Alger	25	Lapeer	110
Allegan	143	Leelanau	28
Alpena	63	Lenawee	192
Antrim	25	Livingston	50
Arenac	25	Luce	10
Baraga	14	Mackinac	23
Barry	71	Macomb	268
Bay	229	Manistee	74
Benzie	24	Marquette	157
Berrien	283	Mason	62
Branch	92	Mecosta	74
Calhoun	258	Menominee	92
Cass	76	Midland	50
Charlevoix	37	Missaukee	24
Cheboygan	36	Monroe	134
Chippewa	66	Montcalm	89
Clare	33	Montmorency	9
Clinton	86	Muskegon	261
Crawford	15	Newaygo	57
Delta	103	Oakland	470
Dickinson	87	Oceana	55
Eaton	99	Ogemaw	23
Emmet	44	Ontonagon	23
Genesee	408	Osceola	41
Gladwin	20	Oscoda	4
Gogebic	78	Otsego	6
Grand Traverse	76	Ottawa	175
Gratiot	113	Presque Isle	25
Hillsdale	94	Roscommon	8
Houghton	190	Saginaw	370
Huron	78	Sanilac	80
Ingham	327	Schoolcraft	21
Ionia	113	Shiawassee	150
Iosco	15	St. Clair	287
Iron	52	St. Joseph	120
Isabella	59	Tuscola	103
Jackson	290	Van Buren	101
Kalamazoo	250	Washtenaw	196
Kalkaska	6	Wayne	4,766
Kent	715	Wexford	65
Keweenaw	18		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 15 TOTAL NUMBER OF DEATHS FROM ARTERIOSCLEROSIS, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	9,783		
Alcona	10	Lake	4
Alger	13	Lapeer	81
Allegan	124	Leelanau	10
Alpena	60	Lenawee	216
Antrim	32	Livingston	113
Arenac	10	Luce	5
Baraga	13	Mackinac	14
Barry	89	Macomb	98
Bay	104	Manistee	76
Benzie	41	Marquette	77
Berrien	179	Mason	71
Branch	75	Mecosta	97
Calhoun	239	Menominee	48
Cass	59	Midland	27
Charlevoix	26	Missaukee	6
Cheboygan	50	Monroe	98
Chippewa	57	Montcalm	133
Clare	26	Montmorency	5
Clinton	113	Muskegon	148
Crawford	8	Newaygo	50
Delta	54	Oakland	418
Dickinson	58	Oceana	84
Eaton	134	Ogemaw	14
Emmet	44	Ontonagon	13
Genesee	506	Osceola	42
Gladwin	12	Oscoda	4
Gogebic	43	Otsego	7
Grand Traverse	38	Ottawa	146
Gratiot	127	Presque Isle	12
Hillsdale	174	Roscommon	6
Houghton	70	Saginaw	312
Huron	99	Sanilac	56
Ingham	215	Schoolcraft	7
Ionia	174	Shiawassee	174
Iosco	32	St. Clair	184
Iron	13	St. Joseph	165
Isabella	108	Tuscola	69
Jackson	303	Van Buren	107
Kalamazoo	250	Washtenaw	329
Kalkaska	18	Wayne	1,730
Kent	688	Wexford	27
Keweenaw	12		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 16 TOTAL NUMBER OF DEATHS FROM SUICIDES, BY COUNTY, MICHIGAN, 1933-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	6,617		
Alcona	12	Lake	10
Alger	14	Lapeer	36
Allegan	55	Leelanau	10
Alpena	24	Lenawee	112
Antrim	10	Livingston	39
Arenac	12	Luce	7
Baraga	25	Mackinac	12
Barry	42	Macomb	138
Bay	79	Manistee	16
Benzie	9	Marquette	82
Berrien	163	Mason	29
Branch	48	Mecosta	30
Calhoun	182	Menominee	28
Cass	49	Midland	27
Charlevoix	22	Missaukee	8
Cheboygan	15	Monroe	83
Chippewa	41	Montcalm	30
Clare	12	Montmorency	5
Clinton	44	Muskegon	93
Crawford	7	Newaygo	28
Delta	43	Oakland	279
Dickinson	38	Oceana	27
Eaton	71	Ogemaw	10
Emmet	15	Ontonagon	25
Genesee	252	Osceola	12
Gladwin	13	Oscoda	3
Gogebic	56	Otsego	7
Grand Traverse	30	Ottawa	57
Gratiot	46	Presque Isle	11
Hillsdale	60	Roscommon	6
Houghton	80	Saginaw	134
Huron	57	Sanilac	52
Ingham	159	Schoolcraft	11
Ionia	52	Shiawassee	87
Iosco	10	St. Clair	93
Iron	39	St. Joseph	42
Isabella	27	Tuscola	48
Jackson	143	Van Buren	73
Kalamazoo	144	Washtenaw	128
Kalkaska	1	Wayne	2,214
Kent	239	Wexford	25
Keweenaw	10		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1933-1944, Table 16, pp.

Table 17 TOTAL NUMBER OF DEATHS FROM SYPHILIS AND GONOCOCCUS, BY COUNTY, MICHIGAN, 1935-1944

State and County	Total Number of Deaths	State and County	Total Number of Deaths
State	4,832		
Alcona	3	Lake	10
Alger	8	Lapeer	10
Allegan	17	Leelanau	1
Alpena	11	Lenawee	24
Antrim	2	Livingston	15
Arenac	4	Luce	3
Baraga	6	Mackinac	6
Barry	10	Macomb	73
Bay	66	Manistee	13
Benzie	5	Marquette	23
Berrien	85	Mason	23
Branch	20	Mecosta	16
Calhoun	123	Menominee	10
Cass	15	Midland	12
Charlevoix	13	Missaukee	--
Cheboygan	8	Monroe	41
Chippewa	28	Montcalm	25
Clare	3	Montmorency	2
Clinton	9	Muskegon	93
Crawford	4	Newaygo	15
Delta	16	Oakland	185
Dickinson	8	Oceana	10
Eaton	28	Ogemaw	3
Emmet	9	Ontonagon	2
Genesee	180	Osceola	1
Gladwin	2	Oscoda	2
Gogebic	24	Otsego	3
Grand Traverse	20	Ottawa	17
Gratiot	23	Presque Isle	2
Hillsdale	15	Roscommon	5
Houghton	31	Saginaw	144
Huron	7	Sanilac	13
Ingham	112	Schoolcraft	6
Ionia	19	Shiawassee	26
Iosco	2	St. Clair	47
Iron	14	St. Joseph	24
Isabella	18	Tuscola	18
Jackson	89	Van Buren	22
Kalamazoo	80	Washtenaw	50
Kalkaska	5	Wayne	2,491
Kent	192	Wexford	10
Keweenaw	2		

Source: Computed from the Annual Reports of the Michigan Department of Health, Lansing, Michigan, 1935-1944, Table 16, pp.

Table 18 NUMBER OF URBAN AND RURAL DEATHS FROM ALL CAUSES PER 1,000 POPULATION, MICHIGAN COUNTIES, 1935-1944 (By place of residence)

State and County	Number Rural Deaths	Number Urban Deaths	State and County	Number Rural Deaths	Number Urban Deaths
Alcona	636	---	Lake	640	---
Alger	651	487	Lapeer	2,928	638
Allegan	4,042	1,098	Leelanau	949	---
Alpena	720	1,440	Lenawee[1]	5,047	1,976
Antrim	1,401	---	Livingston	2,066	615
Arenac	1,006	---	Luce[1]	761	---
Baraga[1]	1,036	---	Mackinac[1]	1,041	---
Barry	2,205	776	Macomb[1]	5,206	4,283
Bay	2,528	5,699	Manistee	1,249	1,217
Benzie	1,075	---	Marquette	1,490	3,695
Berrien	5,346	4,969	Mason	1,218	1,138
Branch	2,511	1,258	Mecosta	1,524	765
Calhoun	3,723	7,747	Menominee	1,358	1,389
Cass	2,359	885	Midland	1,404	857
Charlevoix	1,356	374	Missaukee	849	---
Cheboygan	860	806	Monroe	3,893	2,051
Chippewa	1,300	1,816	Montcalm	3,254	741
Clare	1,193	---	Montmorency	408	---
Clinton	2,459	642	Muskegon	3,028	6,620
Crawford	452	---	Newaygo[1]	2,290	---
Delta	1,517	2,261	Oakland	9,160	11,584
Dickinson	758	1,967	Oceana	2,025	---
Eaton	2,522	1,892	Ogemaw	1,016	---
Emmet	1,228	854	Ontonagon	1,288	---
Genesee	5,903	13,438	Osceola	1,777	---
Gladwin	1,000	---	Oscoda	287	---
Gogebic	1,287	2,137	Otsego	646	---
Grand Traverse	1,135	1,561	Ottawa	3,129	2,644
Gratiot[1]	2,997	924	Presque Isle	868	271
Hillsdale	3,096	902	Roscommon	375	---
Houghton	4,101	1,846	Saginaw	4,464	9,117
Huron[1]	3,526	---	St. Clair	4,062	5,101
Ingham	4,155	8,552	St. Joseph	2,605	1,676
Ionia	3,027	1,448	Sanilac	3,590	---
Iosco	939	---	Schoolcraft	397	657
Iron	1,070	777	Shiawassee	2,858	2,152
Isabella	1,848	889	Tuscola	3,745	573
Jackson	4,055	6,491	Van Buren	4,369	757
Kalamazoo	4,283	6,531	Washtenaw	4,035	4,721
Kalkaska	585	---	Wayne[1]	5,979	173,029
Kent	7,191	18,502	Wexford	1,045	1,213
Keweenaw	488	---	State	191,833	338,449

1. Residence according to the 1930 population.
Source: Annual Reports, Michigan Department of Health, 1935-1944, Table 16.

Table 19 RURAL DEATHS FROM THE FIVE PRINCIPAL CAUSES OF DEATH PER 10,000 POPULATION, MICHIGAN COUNTIES, AVERAGE 1935-1944 (Based on 1940 population; by place of residence.)

State and County	Number of Rural Deaths				
	[1] Heart (90-95)	Cancer (45-55)	Apoplexy (83ab)	Accidents (169-195)	Nephritis (130-132)
Alcona	192	61	70	59	46
Alger	144	49	36	86	35
Allegan	1,266	447	442	344	215
Alpena	205	74	74	71	28
Antrim	409	155	161	83	89
Arenac[2]	305	97	91	103	54
Baraga[2]	217	85	86	126	34
Barry	653	235	272	173	163
Bay	672	286	192	255	227
Benzie	309	99	92	97	66
Berrien	1,654	597	490	450	393
Branch	774	256	291	184	155
Calhoun	1,164	328	420	292	153
Cass	633	260	282	209	224
Charlevoix	434	153	126	107	74
Cheboygan	267	83	80	74	25
Chippewa	406	105	106	115	52
Clare	355	109	105	129	75
Clinton	655	248	242	186	267
Crawford	116	57	25	43	32
Delta	415	166	142	166	70
Dickinson	227	81	80	71	23
Eaton	756	305	241	205	143
Emmet	415	137	130	97	54
Genesee	1,609	580	502	524	310
Gladwin	277	109	103	92	69
Gogebic	306	118	108	166	58
Grand Traverse	355	102	129	92	57
Gratiot[2]	881	332	271	229	174
Hillsdale	869	359	384	232	166
Houghton	1,114	501	414	292	224
Huron[2]	915	409	332	309	196
Ingham	1,151	428	471	389	211
Ionia	924	362	313	210	164
Iosco	288	123	101	78	57
Iron	274	137	81	129	78
Isabella	503	205	188	160	76
Jackson	1,220	448	402	321	266
Kalamazoo	1,227	458	432	372	272
Kalkaska	176	57	73	40	25
Kent	2,309	857	724	522	357
Keweenaw	114	49	63	34	33

Table 19(Continued) RURAL DEATHS FROM THE FIVE PRINCIPAL CAUSES OF DEATH PER 10,000 POPULATION, MICHIGAN COUNTIES, AVERAGE 1935-1944 (Based on 1940 population; by place of residence.)

State and County	Number of Rural Deaths				
	Heart [1](90-95)	Cancer (45-55)	Apoplexy (83ab)	Accidents (169-195)	Nephritis (130-132)
Lake	182	66	73	58	33
Lapeer	846	303	355	252	165
Leelanau	318	104	92	67	59
Lenawee[2]	1,415	524	561	411	274
Livingston	691	241	192	168	83
Luce[2]	286	51	46	68	35
Mackinac[2]	279	97	100	114	47
Macomb[2]	1,317	586	527	495	336
Manistee	415	144	132	92	49
Marquette	360	170	117	125	61
Mason	305	138	144	94	61
Mecosta	417	145	183	111	103
Menominee	406	174	125	100	43
Midland	375	147	84	128	185
Missaukee	247	68	102	58	35
Monroe	1,190	436	375	412	172
Montcalm	900	339	360	291	190
Montmorency	104	46	23	44	34
Muskegon	784	309	256	244	156
Newaygo[2]	726	237	252	153	132
Oakland	2,277	1,018	787	892	420
Oceana	539	217	236	165	80
Ogemaw	278	84	150	95	43
Ontonagon	310	126	151	123	63
Osceola	518	198	211	145	99
Oscoda	62	28	18	20	21
Otsego	207	67	42	58	50
Ottawa	950	442	338	209	178
Presque Isle	219	96	58	63	38
Roscommon	112	40	28	36	24
Saginaw	1,239	507	401	411	236
St. Clair	1,121	468	413	405	289
St. Joseph	744	290	294	186	188
Sanilac	1,010	364	450	274	189
Schoolcraft	107	38	44	43	24
Shiawassee	768	356	273	220	222
Tuscola	1,158	417	381	297	226
Van Buren	1,379	538	495	354	264
Washtenaw	1,054	479	454	361	178
Wayne[2]	1,610	590	362	718	212
Wexford	320	98	102	67	74
State	54,698	20,909	19,154	16,554	10,861

1. International List Number, 1939.
2. Residence according to the 1930 population.

Source: Annual Reports, Michigan Department of Health, 1935-1944, Table 16.

Table 20 URBAN DEATHS FROM THE FIVE PRINCIPAL CAUSES OF DEATH PER 10,000 POPULATION, MICHIGAN COUNTIES, AVERAGE 1935-1944 (Based on 1940 population; by place of residence.)

State and County	Number of Urban Deaths				
	Heart[1] (90-95)	Cancer (45-55)	Apoplexy (83ab)	Accidents (169-195)	Nephritis (130-132)
Alcona	---	---	---	---	---
Alger	117	51	29	52	23
Allegan	346	125	114	84	53
Alpena	488	136	143	98	82
Antrim	---	---	---	---	---
Arenac	---	---	---	---	---
Baraga[2]	---	---	---	---	---
Barry	202	79	110	63	44
Bay	1,607	696	496	392	362
Benzie	---	---	---	---	---
Berrien	1,402	561	448	425	288
Branch	375	123	143	101	73
Calhoun	2,282	868	819	554	415
Cass	221	114	77	74	64
Charlevoix	93	51	48	27	24
Cheboygan	216	113	88	64	39
Chippewa	528	172	141	154	86
Clare	---	---	---	---	---
Clinton	161	65	62	40	77
Crawford	---	---	---	---	---
Delta	582	275	250	184	110
Dickinson	553	236	151	167	70
Eaton	615	220	201	150	135
Emmet	272	86	92	58	31
Genesee	3,523	1,472	990	1,068	745
Gladwin	---	---	---	---	---
Gogebic	513	244	222	172	126
Grand Traverse	456	169	200	108	61
Gratiot[2]	269	101	77	63	66
Hillsdale	252	91	87	72	52
Houghton	533	258	194	115	78
Huron[2]	---	---	---	---	---
Ingham	2,271	1,057	891	641	563
Ionia	398	143	154	95	59
Iosco	---	---	---	---	---
Iron	204	101	59	64	46
Isabella	265	89	68	77	41
Jackson	1,922	755	600	486	345
Kalamazoo	1,814	760	655	508	448
Kalkaska	---	---	---	---	---
Kent	6,080	2,458	1,756	1,270	914
Keweenaw	---	---	---	---	---

Table 20 (Continued) URBAN DEATHS FROM THE FIVE PRINCIPAL CAUSES OF DEATH PER 10,000 POPULATION, MICHIGAN COUNTIES, AVERAGE 1935-1944 (Based on 1940 population; by place of residence.)

State and County	Number of Urban Deaths				
	[1] Heart (90-95)	Cancer (45-55)	Apoplexy (83ab)	Accidents (169-195)	Nephritis (130-132)
Lake	---	---	---	---	---
Lapeer	150	79	66	47	33
Leelanau	---	---	---	---	---
Lenawee[2]	509	211	191	157	133
Livingston	174	60	40	67	21
Luce[2]	---	---	---	---	---
Mackinac[2]	---	---	---	---	---
Macomb[2]	1,069	486	398	369	238
Manistee	408	161	162	67	58
Marquette	1,038	431	321	268	189
Mason	371	118	85	92	63
Mecosta	254	66	65	52	64
Menominee	360	165	137	93	79
Midland	173	92	55	69	110
Missaukee	---	---	---	---	---
Monroe	537	231	130	198	76
Montcalm	241	63	76	46	42
Montmorency	---	---	---	---	---
Muskegon	1,786	692	544	413	336
Newaygo[2]	---	---	---	---	---
Oakland	2,893	1,317	903	956	603
Oceana	---	---	---	---	---
Ogemaw	---	---	---	---	---
Ontonagon	---	---	---	---	---
Osceola	---	---	---	---	---
Oscoda	---	---	---	---	---
Otsego	---	---	---	---	---
Ottawa	798	359	253	168	159
Presque Isle	63	31	12	24	13
Roscommon	---	---	---	---	---
Saginaw	2,616	976	768	649	536
St. Clair	1,434	591	477	396	355
St. Joseph	456	188	190	120	135
Sanilac	---	---	---	---	---
Schoolcraft	200	87	48	55	33
Shiawassee	552	259	207	175	123
Tuscola	179	71	58	44	23
Van Buren	248	87	81	58	52
Washtenaw	1,481	587	418	324	201
Wayne[2]	48,491	20,672	10,960	10,914	8,610
Wexford	386	112	106	93	61
State	95,226	39,811	26,116	23,338	17,846

1. International List Number, 1939.
2. Residence according to the 1930 population.

Source: Annual Reports, Michigan Department of Health, 1935-1944, Table 16.

Table 21 TOTAL NUMBER OF INFANT DEATHS IN COUNTIES OF MICHIGAN, 1935-1944 (Exclusive of stillbirths. By place of residence)

State and County	Number of Deaths	State and County	Number of Deaths
Alcona	58	Lake	40
Alger	122	Lapeer	258
Allegan	320	Leelanau	90
Alpena	194	Lenawee	501
Antrim	112	Livingston	154
Arenac	81	Luce	102
Baraga	96	Mackinac	108
Barry	140	Macomb	1,019
Bay	765	Manistee	155
Benzie	93	Marquette	426
Berrien	688	Mason	133
Branch	204	Mecosta	158
Calhoun	896	Menominee	226
Cass	179	Midland	300
Charlevoix	142	Missaukee	106
Cheboygan	151	Monroe	529
Chippewa	367	Montcalm	290
Clare	100	Montmorency	48
Clinton	207	Muskegon	1,163
Crawford	52	Newaygo	176
Delta	411	Oakland	2,255
Dickinson	233	Oceana	128
Eaton	246	Ogemaw	97
Emmet	167	Ontonagon	120
Genesee	2,151	Osceola	132
Gladwin	99	Oscoda	24
Gogebic	274	Otsego	64
Grand Traverse	203	Ottawa	371
Gratiot	353	Presque Isle	117
Hillsdale	210	Roscommon	33
Houghton	396	Saginaw	1,225
Huron	347	St. Clair	727
Ingham	1,158	St. Joseph	206
Ionia	276	Sanilac	265
Iosco	52	Schoolcraft	112
Iron	130	Shiawassee	386
Isabella	504	Tuscola	330
Jackson	757	Van Buren	252
Kalamazoo	655	Washtenaw	622
Kalkaska	43	Wayne	14,499
Kent	1,604	Wexford	200
Keweenaw	35	State	43,218

Source: Annual Reports of the Michigan Department of Health, 1935-1944, Table 8.

APPENDIX III

INTERNATIONAL LIST OF CAUSES OF DEATH[1]

(The fifth revision of the detailed International List)

I. Infectious and Parasitic Diseases

1. Typhoid fever
2. Paratyphoid fever
3. Plague
4. Cholera
5. Undulant fever (brucellosis)
6. Cerebrospinal (meningococcus) meningitis
7. Anthrax (infection by Bacillus anthracis)
8. Scarlet fever
9. Whooping cough
10. Diphtheria (infection by C.diphtheriae)
11. Erysipelas
12. Tetanus

13-22. Tuberculosis (all forms)

13. Tuberculosis of the respiratory system(including the bronchial and mediastinal lymph nodes)
14. Tuberculosis of the meninges and central nervous system
15. Tuberculosis of the intestines and peritoneum
16. Tuberculosis of the vertebral column
17. Tuberculosis of the bones and joints(except vertebral column)
18. Tuberculosis of the skin and subcutaneous cellular tissue
19. Tuberculosis of the lymphatic system(except bronchial, mediastinal, mesenteric, and retroperitoneal lymph nodes)
20. Tuberculosis of the genito-urinary system
21. Tuberculosis of other organs
22. Disseminated tuberculosis
23. Leprosy
24. Septicemia and purulent infection (nonpuerperal)
25. Gonococcus infection
26. Other diseases due to bacteria (except dysentery)
27. Dysentery
28. Malaria
29. Other diseases due to parasitic protozoa (except spirochetes)

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1. This list, revised in 1938, is currently in use. Since the list was adopted formally in 1893, it has had five revisions as follows; 1900, 1909, 1920, 1929, and 1938.



I. Infectious and Parasitic Diseases-con.

30. Syphilis (all forms)
30a. Locomotor ataxia (tabes dorsalis)
30b. General paralysis of the insane
30d. Aneurysm of the aorta
30c,e-g. Other forms of syphilis
31. Relapsing fever
32. Other diseases due to spirochetes
33a. Influenza, respiratory complications specified
33b. Influenza, respiratory complications not specified
34. Smallpox

35. Measles
36. Acute poliomyelitis and acute polioencephalitis
37. Acute infectious encephalitis (lethargic)
38. Other diseases due to filtrable viruses
39. Typhus fever, typhus-like diseases (due to Rickettsia)
40. Ankylostomiasis

41. Hydatid disease
42. Other diseases caused by helminths
43. Mycoses
44. Other infectious and parasitic diseases

II. Cancer and other tumors

45-55. Cancer and other malignant tumors
45. Cancer of the buccal cavity and pharynx
45a. Cancer of lip
45b. Cancer of tongue
45c. Cancer of mouth
45d. Cancer of jaw bone
45e. Cancer of unspecified parts of the buccal cavity
45f. Cancer of pharynx

46. Cancer of the digestive organs and peritoneum
46a. Cancer of esophagus
46b. Cancer of stomach
46c. Cancer of duodenum
46d. Cancer of rectum and anus
46e. Cancer of intestines (except duodenum and rectum)
46f. Cancer of liver and biliary passages
46g. Cancer of pancreas
46h. Cancer of mesentery and peritoneum
46m. Cancer of other and unspecified sites

47. Cancer of the respiratory system
47a. Cancer of larynx
47d,e. Cancer of lung and pleura
47b,c,f. Cancer of other respiratory organs

II.-Cancer and other tumors cont'd.

48. Cancer of the uterus
49. Cancer of other female genital organs
49a, b. Cancer of ovary, fallopian tube, and parametrium
49c-e. Cancer of vagina, vulva, other and unspecified sites

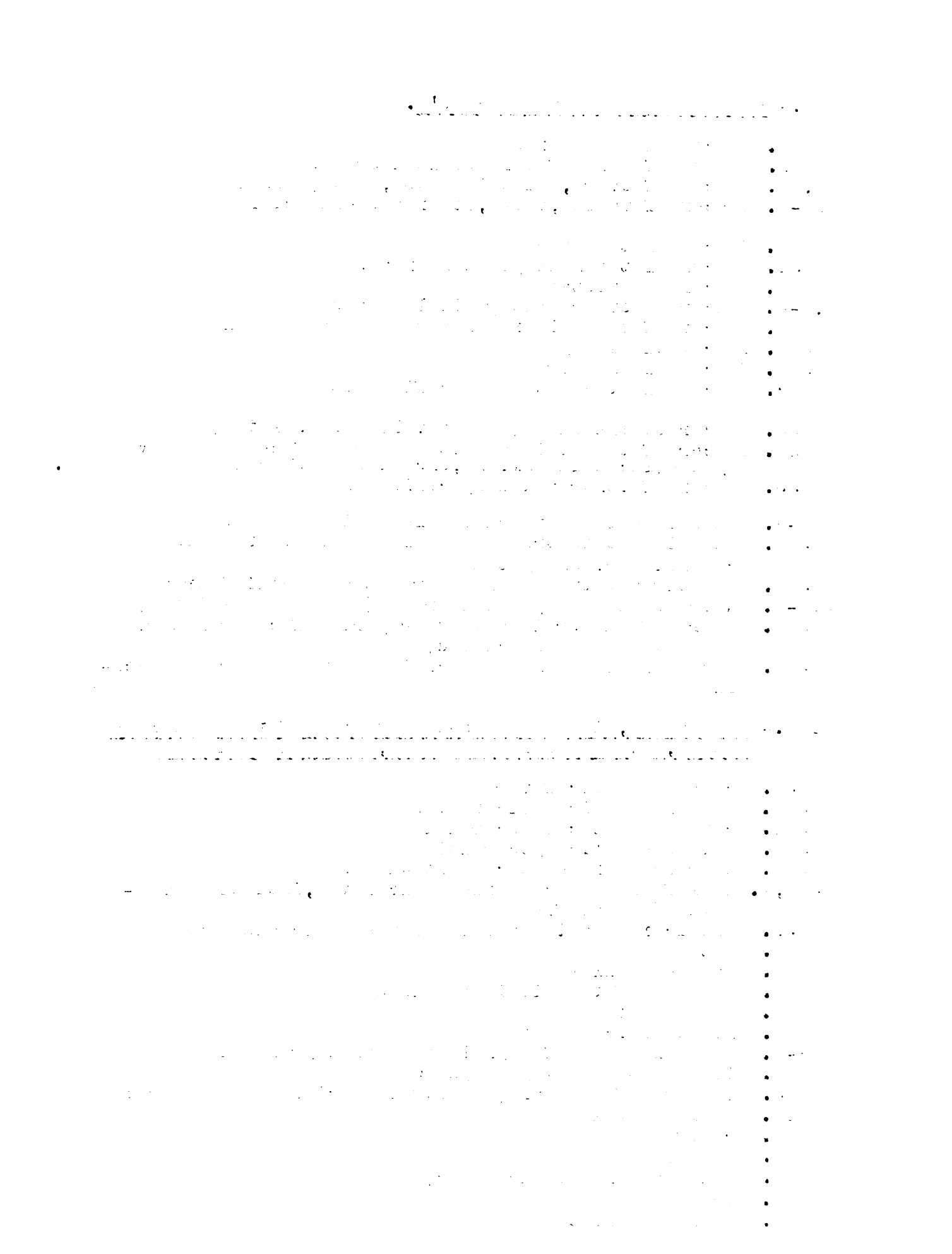
50. Cancer of the breast
51. Cancer of the male genital organs
51b. Cancer of prostate
51a, c-e. Cancer of other male genital organs
52. Cancer of the urinary organs (male and female)
52a. Cancer of kidney
52b. Cancer of bladder
52c. Cancer of other and unspecified sites

53. Cancer of the skin (except vulva and scrotum)
54. Cancer of the brain and other parts of central nervous system (including glioma, except when specified as benign).
55. Cancer of other and unspecified organs

56a-c. Nonmalignant tumors of female genital organs
56d. Nonmalignant tumors of the brain and other parts of the central nervous system
56e. Nonmalignant tumors of other and unspecified organs
57a-c. Tumors of female genital organs (nature unspecified)
57d. Tumors of the brain and other parts of central nervous system (nature unspecified)
57e. Tumors of other and unspecified organs (nature unspecified)

III.- Rheumatism, diseases of nutrition and of the endocrine glands, other general diseases, and avitaminoses

58. Acute rheumatic fever
58a. Acute rheumatic pericarditis
58b. Acute rheumatic endocarditis
58c. Acute rheumatic myocarditis
58d. Other acute rheumatic heart diseases
58e, f. Other forms of acute rheumatic fever, including rheumatism (unqualified)
59. Chronic rheumatism and other rheumatic diseases
60. Gout
61. Diabetes mellitus
62. Diseases of the pituitary gland
63a. Simple goiter
63b. Exophthalmic goiter
63c-e. Other diseases of thyroid and parathyroid glands
64. Diseases of the thymus gland
65. Diseases of adrenal glands (not specified as tuberculous)
66. Other general diseases
67. Scurvy
68. Beriberi
69. Pellagra (except alcoholic)
70. Rickets
71. Other avitaminoses



IV. Diseases of the blood and blood-forming organs

72. Hemorrhagic conditions
73a. Pernicious anemia
73b-d. Other anemias(except splenic)
74a. Leukemias
74b. Aleukemias
75. Diseases of the spleen
76. Other diseases of the blood and blood-forming organs

V. Chronic poisoning and intoxication

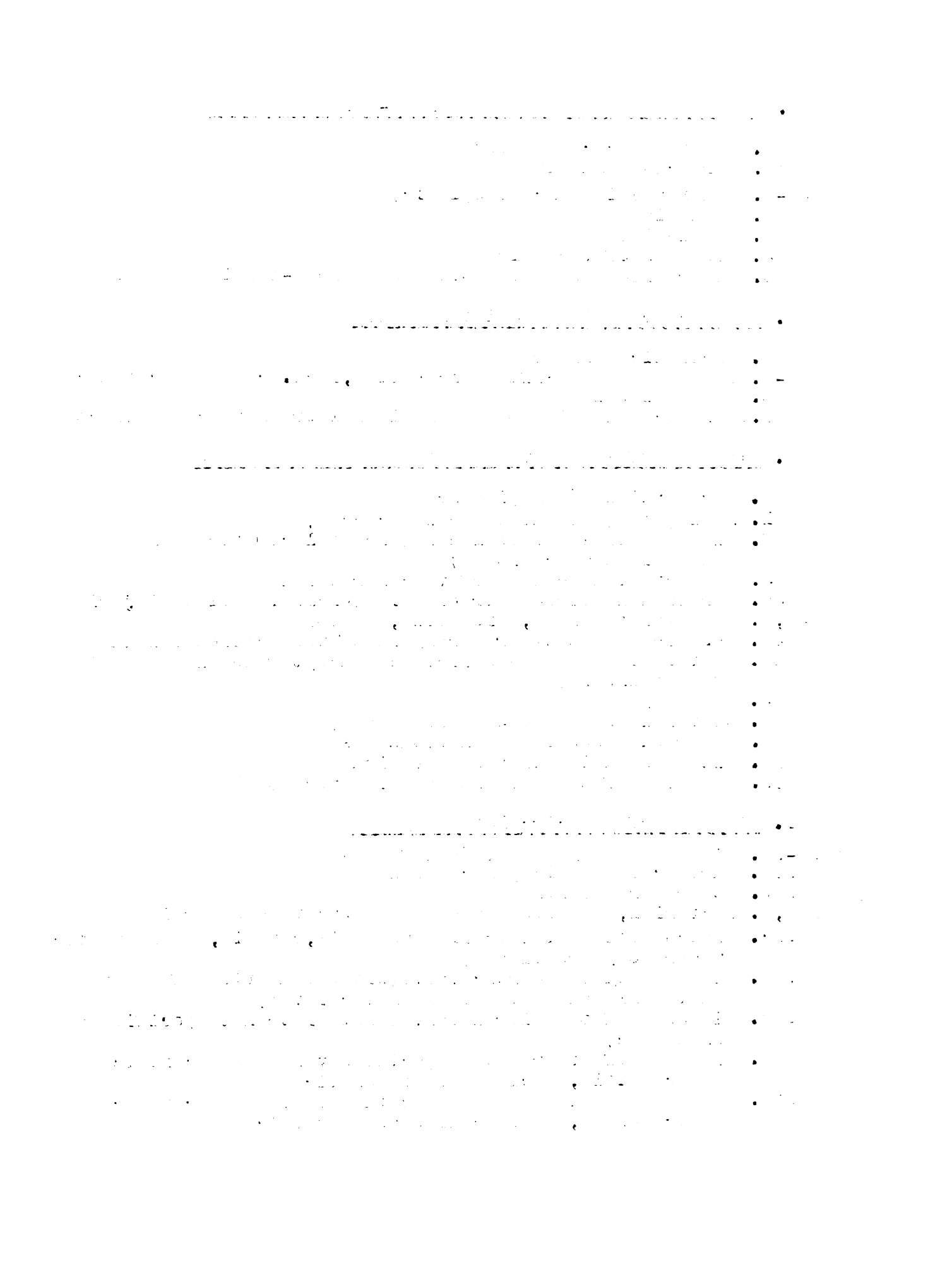
77a. Alcoholic pellagra
77b-e. Other and unspecified alcoholism,incl.acute and chronic
78. Lead poisoning
79. Chronic poisoning by other mineral or organic substances

VI. Diseases of the nervous system and sense organs

80. Encephalitis (nonepidemic)
81. Meningitis(not due to meningococcus)
82. Diseases of the spinal cord(except locomotor ataxia and disseminated sclerosis)
83. Intracranial lesions of vascular origin
83a. Cerebral hemorrhage or effusion(excluding birth injuries)
83b,c. Cerebral embolism,thrombosis,and softening
83d. Hemiplegia and other paralysis of unspecified origin
84. Mental diseases and deficiency(except general paralysis of the insane)
85. Epilepsy
86. Convulsions (under 5 years of age)
87. Other diseases of the nervous system
88. Diseases of the organs of vision
89. Diseases of the ear and mastoid process

VII. Diseases of the circulatory system

90-95. Diseases of the heart (all forms)
90a. Chronic rheumatic pericarditis
90b. Other pericarditis
91a,b. Bacterial, and other acute or subacute endocarditis
91c. Endocarditis(not specified as acute,chronic, or rheumatic, under 45 years of age)
92a. Diseases of the aortic valve(without mention of diseases of the mitral valve or rheumatic fever)
92b. Diseases of the mitral valve(whether or not specified as rheumatic)
92c. Diseases of other and unspecified valves and chronic endocarditis,specified as rheumatic
92d. Diseases of other and unspecified valves and chronic endocarditis,not specified as rheumatic



VII.-Diseases of the circulatory system -cont'd.

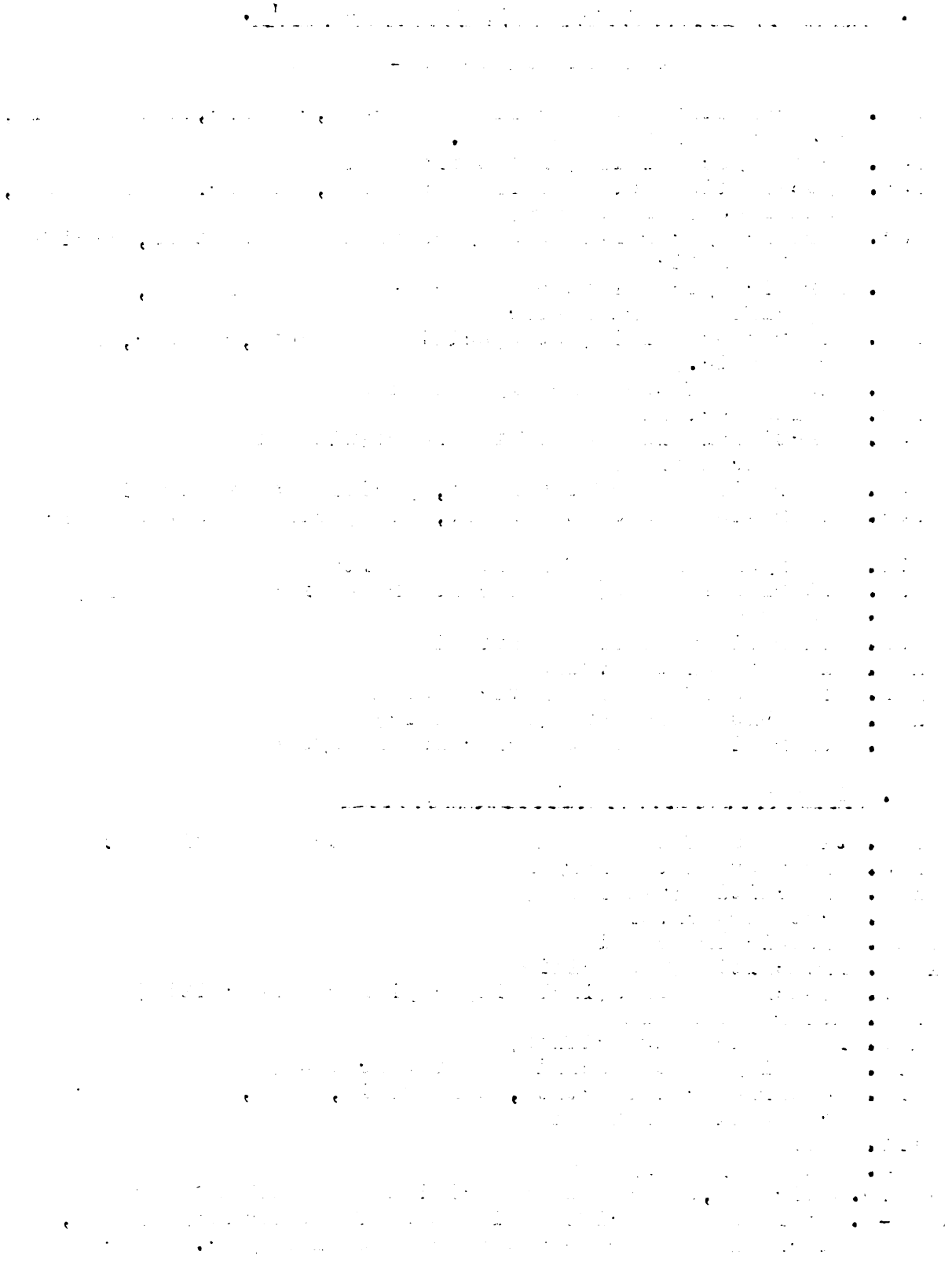
Diseases of the heart(all forms)-Continued

92c. Endocarditis(not specified as acute,chronic,or rheumatic, (45 years of age and over).
93a. Acute myocarditis (except rheumatic)
93b. Myocarditis (not specified as acute,chronic,or rheumatic, under 45 years of age)
93c. Chronic myocarditis and myocardial degeneration,specified as rheumatic
93d. Chronic myocarditis and myocardial degeneration, not specified as rheumatic
93e. Other myocarditis(not specified as acute,chronic,or rheumatic.)
94a. Diseases of the coronary arteries
94b. Angina pectoris
95a. Functional diseases of the heart(without mention of organic lesion)
95b. Other diseases of the heart,specified as rheumatic
95c. Other diseases of the heart,not specified as rheumatic

96. Aneurysm (except of heart and aorta)
97. Arteriosclerosis(except coronary or renal sclerosis)
98. Gangrene
99. Other diseases of the arteries
100. Diseases of the veins
101. Diseases of the lymphatic system
102. High blood pressure (idiopathic)
103. Other diseases of the circulatory system

VIII. Diseases of the respiratory system

104. Diseases of the nasal fossae and accessory sinuses
105. Diseases of the larynx
106. Bronchitis (all forms)
106a. Acute bronchitis
106b. Chronic bronchitis
106c. Bronchitis (unspecified)
107. Bronchopneumonia(including capillary bronchitis)
108. Lobar pneumonia
109. Pneumonia (unspecified)
110. Pleurisy (not specified as tuberculous)
111. Hemorrhagic infarction, thrombosis,edema,and chronic congestion of the lungs
112. Asthma
113. Pulmonary emphysema
114a,b. Silicosis,other and unspecified forms of pneumoconioses
114c-e. Other and unspecified diseases of respiratory system, including gangrene and abscess of lung(exc.tuberculosis)



IX. Diseases of the digestive system

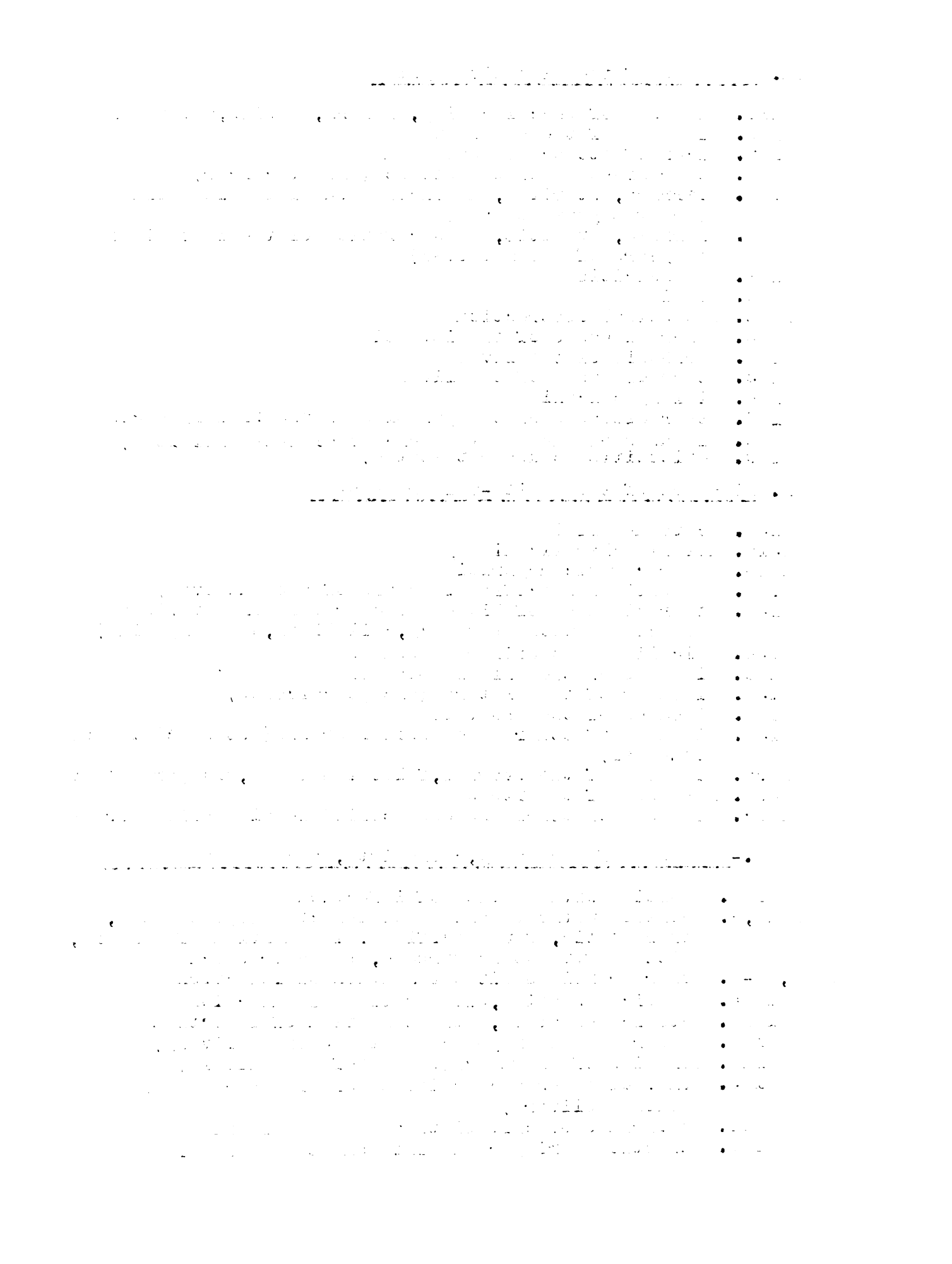
115. Diseases of buccal cavity, pharynx, tonsils, and adnexa
116. Diseases of the esophagus
117. Ulcer of stomach or duodenum
118. Other diseases of the stomach (except cancer)
119. Diarrhea, enteritis, and ulceration of the intestines (under 2 years of age)
120. Diarrhea, enteritis, and ulceration of the intestines (2 years of age and over)
121. Appendicitis
122a. Hernia
122b. Intestinal obstruction
123. Other diseases of the intestines
124. Cirrhosis of the liver
125. Other diseases of the liver
126. Biliary calculi
127. Other diseases of the gallbladder and biliary ducts
128. Diseases of the pancreas (except diabetes mellitus)
129. Peritonitis (cause not stated)

X. Diseases of the genito-urinary system

130. Acute nephritis
131a. Arteriosclerotic kidney
131b. Other chronic nephritis
132. Nephritis unspecified (10 years of age and over)
133. Other diseases of kidneys and ureters (except diseases associated with pregnancy, childbirth, or puerperium)
134. Calculi of the urinary passages
135. Diseases of the urinary bladder
136. Diseases of the urethra (except calculus)
137. Diseases of the prostate
138. Diseases of other male genital organs (not specified as venereal)
139a. Diseases of the ovaries, fallopian tubes, and parametria
139b. Diseases of the uterus
139c. Diseases of other and unspecified female genital organs

XI.-Diseases of pregnancy, childbirth, and the puerperium

140. Abortion with mention of infection
141a,c. Abortion without mention of infection (spontaneous, therapeutic, or unspecified), with mention of toxemia, with or without hemorrhage, trauma or shock
141b, d-f. Other abortions without mention of infection
142a. Ectopic gestation, with mention of infection
142b. Ectopic gestation, without mention of infection
143. Hemorrhage of pregnancy (death before delivery)
144. Toxemias of pregnancy (death before delivery)
145. Other diseases and accidents of pregnancy (death before delivery)
146. Hemorrhage of childbirth and the puerperium
147. Infection during childbirth and the puerperium



XI.-Diseases of pregnancy, childbirth and the puerperium-Con.

148. Puerperal toxemias(excluding death before delivery)
149. Other accidents and specified conditions of childbirth
150. Other and unspecified conditions of childbirth and the puerperium

XII.-Diseases of the skin and cellular tissue

151. Carbuncle and furuncle
152. Phlegmon and acute abscess
153. Other diseases of the skin and cellular tissue

XIII.-Diseases of the bones and organs of movement.

154. Osteomyelitis and periostitis
155. Other diseases of bones(except tuberculosis)
156. Diseases of joints and other organs of movement

XIV.-Congenital malformations

157a-d. Congenital malformations of central nervous system
157e,f. Congenital malformations of cardiovascular system
157g,h,m. Other congenital malformations

XV.-Diseases peculiar to the first year of life

158. Congenital debility (cause not stated)
159. Premature birth(cause not stated)
160. Injury at birth
161. Other diseases peculiar to first year of life

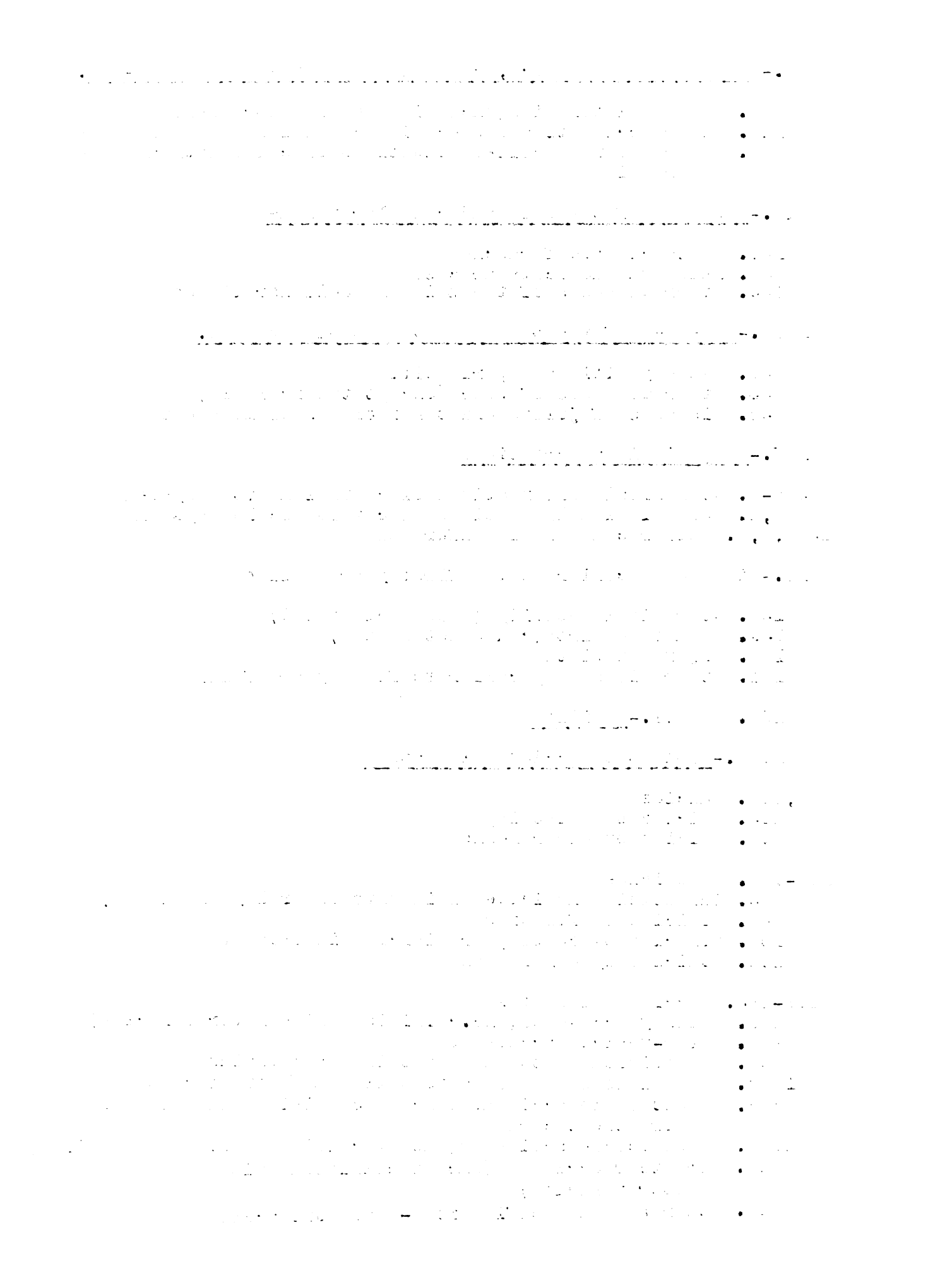
162. XVI.-Senility

XVII.-Violent or accidental deaths

163,164. Suicide
163. Suicide by poisoning
164. Suicide by other means

165-168. Homicide
165. Infanticide(homicide of infants under 1 year of age)
166. Homicide by firearms
167. Homicide by cutting or piercing instruments
168. Homicide by other means

169-195. Accidental deaths
169. Railway accidents(exc.collisions with motor vehicles)
170. Motor-vehicle accidents
170a. Collisions between automobiles and trains
170b. Collisions between automobiles and street cars
170c. Automobile accidents(except collisions with trains or street cars)
170d. Motorcycle accidents(except collisions with automobiles)
171a. Streetcar accidents(except collisions with trains or motor vehicles)
171b. Other and unspecified road-transport accidents



XVII.-Violent or accidental deaths-Con.

Accidental deaths

172. Water-transport accidents
173. Air-transport accidents
174. Accidents in mines and quarries
175a-c. Agricultural accidents
175d,e. Forestry accidents

176. Other accidents involving machinery
177. Food poisoning
178. Accidental absorption of poisonous gas
179. Acute accidental poisoning by solids or liquids
180. Conflagration
181. Accidental burns(except conflagration)
182. Accidental mechanical suffocation
183. Accidental drowning
184. Accidental injury by firearms
185. Accidental injury by cutting or piercing instruments
186a. Accidental injury by fall
186b. Accidental injury by crushing
187. Cataclysm(all deaths attributed to a cataclysm,regardless of their nature)
188. Injury by animals(not specified as venomous or occurring in the course of agricultural and forestry operations)
189. Hunger or thirst
190. Excessive cold
191. Excessive heat
192. Lightning
193. Accidents due to electric currents(except lightning)
194. Poisoning by venomous animals(not occurring in the course of agricultural and forestry operations)
195a. Sequelae of preventive immunization,inoculation,or vaccination.
195b. Other accidents due to medical or surgical intervention.
195d. Obstruction,suffocation,or puncture by ingested objects
195c,e. Other and unspecified accidents

196. Deaths of military personnel during operations of war
197. Deaths of civilians due to operations of war
198. Legal executions

XVIII.-Ill-defined and unknown causes

199. Sudden death
200a. Ill-defined causes
200b,c. Unknown or unspecified causes



APPENDIX IV

(The following material is presented here because it is outside the scope of the study as outlined but suggests an approach to the study of mortality differentials which may be fruitful if systematically developed.)

MORTALITY DIFFERENTIALS AND SEX ROLES: AN EXPLANATORY HYPOTHESIS

Students of mortality have been intrigued by the relatively persistent excess of male over female deaths for a period of years. As early as 1665, John Graunt observed that "Physicians have two women patients to one man, and yet more men die than women."[1] But it is yet to be explained satisfactorily. Perhaps during the time of Graunt the explanation would have been rooted in the concept of the evil nature or sinfulness of the male which, if given a sociological interpretation, would be closer to the hypothesis offered here than that of current writers who attribute sex mortality differentials to the biological make-up of the sexes. Early scholars (Pearl[2] and Willcox[3]) ascribed the differential to the biological superiority of the female, but recently emphasis is being given to social causes as an explanation of the difference (Thompson[4] and Landis[5]). All contemporary authorities, however, have not adopted the

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1. Graunt, John, Natural and Political Observations Made Upon the Bills of Mortality, (Edited with Introduction by Walter F. Willcox), The John Hopkins Press, Baltimore, Maryland, 1939, p. xiii.

2. Pearl, Raymond, op. cit., pp. 181-183.

3. Willcox, Walter F., op. cit., p. 120.

4. Landis, Paul H., op. cit., p. 214.

sociological explanation. For example, Whelpton recognizes social factors as possible causes of the variation but he stresses the statement "... that biological differences between the sexes cause an important part of the differential mortality."[1] He cites the same evidence as other adherents of the biological explanation, namely, the higher death rate for boy than for girl babies. That the infant mortality sex differential is a result of biological factors is acceptable to most students; however, the differential has increased over a period, partly at least, because of the decrease in births per family. Social factors underlie the decisions of parents to have fewer children, and, thus, even the infant mortality sex-ratio favoring the female cannot be wholly attributed to biological influences.

These are examples of the old dilemma, biological versus environmental explanations of behavior, which has produced little more than a long list of untestable hypotheses.[2] Although Whelpton asserts that the maternal death rate is "clearly"[3] a biological matter, as strong a claim can be made for the sociological explanation. Are maternal deaths not

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1. Whelpton, P. K., Needed Population Research, The Science Press Company, Lancaster, Pennsylvania, 1938, p. 115.

2. Brown says emphatically that not a single question pertaining to a single trait has been answered by the biological versus environmental arguments. See Brown, J.F., Psychology and the Social Order, McGraw-Hill Book Co., Inc., New York, 1936; (Selection reprinted in Readings in General Sociology, Edited by Robert W. O'Brien, Pacific Books-Publishers, Palo Alto, California, 1947, pp. 117-118.)

3. Whelpton, P. K., op. cit., p. 115.

considered by many authorities as largely preventable today? Besides, what kind of hypothesis pertaining to both sexes could one test employing the maternal death rate? Vance is apparently accepting the biological explanation when he writes as follows in All These People: "Since the wastage of male life by stillbirth and infant death is especially high, it seems probable that the really frail sex is the male, while nature protects the future child-bearer by endowing her with greater vitality and resistance to disease."[1]

In so far as could be ascertained the mortality sex-ratio has not been studied systematically to test any particular explanatory hypothesis, although the generalization that males have higher death rates than females has been known for well over 100 years. The sociologist has done little more than to repeat the biological explanation which originated among the early demographers and physicians. As Whelpton suggests, research is needed to explain the differential even though society may or may not choose to reduce that portion of it which can be modified.[2]

In the following pages, a social causation hypothesis is presented as a possible explanation of mortality sex differentials, namely, that the degree of obedience to sex roles[3]

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1. Vance, Rupert B., op. cit., p. 47.
2. Whelpton, P. K., op. cit., p. 115.
3. Sex role is defined as mutually related systems of attitudes and values ascribed by society to males and females. See Linton, Ralph, The Cultural Background of Personality, D. Appleton-Century Co., Inc., 1945; (Selection reprinted in Readings in Social Psychology, Edited by Theodore M. Newcomb, Eugene L. Hartley, and others, Henry Holt and Company, New York, 1947, p. 368).

which affect health varies inversely with the degree of environmental resistance to their enforcement, other things being equal. Only certain aspects of the hypothesis, those involving data prepared for this dissertation, are discussed. The analysis is based on the following assumptions:

1. The prescribed rules which characterize the sex roles dominant in the United States force the male into greater health risk situations than the female. The sex role systems are constructed so that the male is required to expose himself to danger more than the female if he behaves as a male should. With a quantitative measure of the differential sex role exposure to health risk situations this assumption would be unnecessary and a more exact test of the hypothesis would be possible.

2. Sex roles defined by the general culture permeate all major segments of the society, whether or not they are enforced in a particular class. However, isolated groups, such as certain Indians who are not exposed to the general cultural compulsions, cannot be assumed to possess the dominant sex patterns of behavior.

3. Medical science has developed in such a fashion that its benefits are equally available to males and females. It may be that some diseases peculiar to one of the sexes have received more attention from medical scientists than corresponding diseases for the other sex. It is assumed that these offset each other. In any event, deaths or illnesses which could be designated as primarily due to an undeveloped field

of medical science affecting only one of the sexes would comprise a relatively small proportion of the total deaths or illnesses in a given population for a specific period of time.

4. Properly calculated death rates are indexes of obedience to sex behavior rules defined by the sex roles. With this meaning a higher death rate is expected for males than females because the male role requires greater exposure to health risk situations. If death rates of males and females are equal, granted the first assumption above, environmental resistances are preventing the sex roles from operating.

The sex roles are given by the culture; they are segments of the social structure. Furthermore the male and female roles are constructed so that, although their rules are quite different, they are closely interlocked as to division of labor, social functions, and moral values. In our society the sex behavior system demands that the male assume the role of the protector,--- even at great personal sacrifice,--- in behalf of the female who is to be protected. This is interpreted by some as a socialized expression of the self-perpetuation drive. However, the overt expression of the male sex role is fortified by the development of a subjective attitudinal system of behavior toward risks encumbent upon the male, some aspects of which are irrational to the survival of either of the sexes. For example, the protector role of the male which requires that women be removed first from a sinking ship has survival value for the female, and therefore has a rational basis, but the male attitude

that it is sissy to go to a doctor has no survival value for either sex.[1] Thus the very nature of the sex structure demands that the male assume certain health hazards as the protector, and certain others as a "true male." The sex role for the female, on the other hand, is so constructed as to encourage her to adapt herself protectively to environmental health risks. Thus if permitted to operate unhampered as controls of behavior in a given environment, sex roles would produce a certain differential health index (death rate) which would be fairly constant, other things being equal.

However, within the same environment there are conditions (resistances) which may prevent the operation of the sex behavior controls. Poverty, for example, often forces women into risk situations from which they would be protected in a higher economic group. Thus one could expect a greater degree of obedience to prescribed behavior of the sexes affecting health in areas or classes where environmental resistances to sex roles are low because the general economic and cultural levels of the people are high. For example among Negroes, one would expect the degree of obedience to sex roles to be low because of the great environmental resistances to the role imposed by their economic status and education. And urban people would be able to obey the prescribed sex behavior rules more than rural people

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1. It is these irrational aspects of the role which should be subjected to further research and clearly identified.

because of their greater control of environmental resistance to such behavior as indicated by their higher standards of living and greater variety of vocational opportunities when pressed. Moreover the availability of health facilities makes it possible for the urban female to make the most of the advantageous position in which the sex role places her.

The Female Role and Health

The female role requires that women be both healthy and attractive, if not beautiful, since marriage and child-rearing are its ultimate objectives. To be beautiful is one of the basic themes in the advertising beamed to the American woman. With beauty come health and happiness. Hence the young girl is groomed from childhood for the adult role which she is to play. These are among the most powerful health drives for women. Traditionally her role is that of the weaker sex. Further the experiences of puberty and childbirth make contacts with the physician a normal event. Thus she establishes early the "going to the doctor" habit. Moreover the essential nature of the duties and functions she performs in a modern society do not impose great physical risks upon her.

The Male Role and Health

The male role is more or less the converse of that of the female. Masculinity has few aspirations to be beautiful, and there is very little, if any, relation between the concept of beauty and health in the male system

of behavior. The male role provides no reason for acquiring the "going to the doctor habit." Sickly boys are labeled as "sissies." The male is not aware of "father" and "occupational" roles until in the teen ages, although good health contributes greatly to the successful fulfillment of these roles. Furthermore the occupations probably do not eliminate him for physical handicaps or health reasons as completely as the traditional role of marriage eliminates the unattractive female. Even for marriage and having a family good health is not necessarily a prerequisite. Perhaps the only part of the male role that contributes to health is the athletic drive, the worship of athletic heroes, but even this adds to his health risks if his participation is too strenuous over a long period.

Adaptability of Sex Roles to Environmental Changes Affecting Health

If the assumption is accepted that death rates measure the degree of obedience to or the enforcement of the rules regulating social behavior of the sexes, the degree of environmental resistance to the prescribed behavior can be estimated roughly on a "more or less than" level. Granted the assumptions, other things being equal, two propositions logically follow: (1) The greater the degree of obedience to the rules defined by sex roles the lower the death rate of females, the higher the death rate of males, and the greater their ratio; (2) The greater the mortality sex-ratio the less the resistances to the rules defined by sex roles,

and the lower the mortality sex-ratio the greater the resistances to the rules defined by the sex roles.[1]

With the foregoing assumptions and definitions in mind, one question to be considered is whether the degree of obedience to the male role affecting survival change as rapidly as obedience to the female role. Employing the age-adjusted death rate for each sex as a measure of obedience to the role, one wishes to know in which role conformity decreased the most. The data in Table 1 shows that the female not only has a lower death rate but also that her death rate decreases more than that of the male over a period of time. The respective percentage decreases are 36.4 and 28.2 for age-adjusted death rates.

Table 1

CRUDE AND AGE-ADJUSTED[1] DEATH RATES PER 1,000 POPULATION, DEATH REGISTRATION STATES OF 1910, FOR THE YEARS 1910 AND 1940, BY SEX

Year	Male		Female	
	Crude	Age Adjusted	Crude	Age Adjusted
1910	15.6	17.37	13.8	14.94
1940	12.3	12.48	10.0	9.50
Percent Decrease	21.2	28.2	27.5	36.4

[1] Adjusted to the 1940 age distribution of the death-registration States of 1910 by the direct method.
Source: Table 9.10.

1. It occurs to the writer that one condition under which this would not hold is that of a class of the population where the sex roles are extremely powerful producing a high mortality sex-ratio and where the resistances, although great, are not powerful enough to level the sex behavior rules. Such a condition might be found, for example, among a people with upper class or nobility culture values but who now have low levels of living.

One may conclude from these data that the female role was able to take advantage of decreasing environmental resistances affecting health over a period to a greater degree than the male role.

Table 2

MORTALITY SEX-RATIOS OF THE DEATH REGISTRATION STATES OF 1910, FOR 1910 TO 1940 (Death rates adjusted for age)[1]

Year	Death Rate: $\frac{\text{Male Rate}}{\text{Female Rate}} \times 100$
	United States
1940	131.4
1930	122.8
1920	109.0
1910	116.3

[1] These death rates are adjusted to the 1940 age distribution of the death-registration States of 1900 by the direct method.

Source: Computed from adjusted death rates given in Table 9.6.

The significant fact to be observed in Table 2 is that the mortality sex-ratio increased from 1910-1940, with the exception of the year 1920. One cannot conclude from this, however, that the nature of the male and female roles are becoming more divergent. But the trend is additional supporting evidence for the hypothesis that female sex roles are more adaptable to social changes which increase survival. By implication the trend indicates that environmental resistances have decreased, except for the year 1920, permitting

the sex roles to produce an increasing mortality sex-differential. Although there may have been changes in the rules governing the social behavior of the male and the female, in order to have produced such differentials by the changes alone, there would have been necessary a great increase in masculinity and femininity of the respective sex roles. Changes in the roles themselves, if they occurred, are likely to have been in the opposite direction, namely, decreases in masculinity and femininity. It is more likely that the network of social rules governing the female, including all of the mores which surround her, are of such nature as to permit, and in many cases to encourage, the female to make the most of improvements in medicine and in health care.

Adaptability of Sex Roles and Health In Different Classes of the Population

Another question is whether the degree of obedience to sex role compulsions affecting survival increases more for one class than another. If so the mortality sex-ratio trend should reveal the pattern, and the class having the greater environmental resistances would be identified. It is of interest to know whether the mortality sex differential increases faster for rural or urban people, white or colored groups, high or low income groups. Only one of these, namely, race, can be considered, because other data are unavailable (see Table 3).

Mortality sex-ratios are substantially higher for the white than for the colored population. Moreover the ratios

of whites show slightly greater increases from 1910 to 1940 than those of non-whites. These increases were 12.28 and 10.01 respectively. In 1920 the death rates of males and females were approximately equal for colored people, the ratio being 101.95. For the same year the white ratio was 109.28, which was the lowest of the four decennial years. This was the aftermath of the influenza epidemic. These low differentials illustrate that where the sex structure prescribes protection for the female, she tends to receive it unless hardships of the environment prevent the operation of the protective rules, or uncontrollable epidemics tend to overshadow them. Thus when times are extremely difficult, for instance, during war, bombings, floods, or great epidemics, the female is exposed to more nearly the same risks as the male and dies at about the same rate.

Table 3

MORTALITY SEX-RATIOS OF THE DEATH REGISTRATION STATES OF 1910, FOR 1910 TO 1940, BY RACE (Death rates adjusted for age)[1]

Year	Mortality Sex-Ratio	
	Colored	White
1940	117.75	130.72
1930	111.12	123.01
1920	101.95	109.28
1910	106.99	116.42

[1] Adjusted rates are based on the 1940 standard million population of the death-registration States of 1900.

Source: Computed from age specific death rates given in Vital Statistics Rates in the United States 1900-1940, Table 9, p. 189.

These data indicate that the white sex roles are able to express themselves through the control of behavior more completely than those of the colored, a difference which in turn reflects a low degree of environmental resistance among the white and high resistance for the colored group.

Sex Roles In Rural-Urban Areas and Health

Do males and females respond to prescribed behavior rules for the sexes in rural areas more than in urban areas? The answer is "no" according to the data in Table 4. In 1940, the rural area has a lower mortality sex ratio than any of the various sized cities of the United States. This means that environmental resistances to the roles were of such a nature in rural areas as to prevent the male and female roles from producing a high mortality sex differential.

To the extent that the sex role explanation of mortality differentials is tenable, the male living in small American cities responds to the prescribed rules for males more completely than males in large cities. He has higher death rates than males in other urban places. Furthermore, the difference between his death rate and that of the female living in the small city is greater than the corresponding difference in any other sized city or in rural areas (see Table 4).[1]

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1. Eliminating the infants, where biological differences between the sexes may be an influence, and all those under 15 years where the sex roles may not be completely established as controls of behavior, the age-adjusted mortality sex-ratio for white people in small American cities was 141.7 compared with 140.4 for the total population. The corresponding ratios for colored people were 128.7 and 128.2.

According to this analysis, therefore, the environmental resistances are less in the small city than in other sized cities, and, being less restricted, the sex roles operate more completely producing a greater differential mortality by sex.

Table 4

AGE-ADJUSTED[1] DEATH RATES PER 1,000 POPULATION AND MORTALITY SEX-RATIOS, UNITED STATES, 1940, BY SEX AND RESIDENCE

Residence	Rates per 1,000 population				Male/Female x 100	
	White		Colored			
	Male	Female	Male	Female	White	Colored
Total	11.6	8.8	16.9	15.0	131.8	112.7
Cities:						
100,000 over	12.5	9.1	19.1	15.6	137.4	123.1
10,000-100,000	12.4	9.0	20.8	16.9	137.8	123.4
2,500-10,000	13.2	9.4	22.3	17.4	140.4	128.2
Rural	10.3	8.2	15.1	13.6	125.6	111.0

[1] Adjusted to the age distribution of the United States, 1940, by the direct method.

Source: Based on age-specific death rates given in Linder, Forrest E., and Grove, Robert D., Vital Statistics Rates in the United States 1900-1940, Table 24.

It was suggested in Chapter IV of this dissertation, while observing the Michigan mortality data, that the combined effects of the tempo of city life and its stresses and strains on sex roles as one passes from the younger to the older ages was harder on males than females. In spite of the fact that the urban female is more and more taking up work outside of the home, according to this analysis the

protective aspects of her role tend to be maintained,[1] although the urban female still has a slightly higher death rate than the rural female. That she tends to maintain her role is indicated by the fact that the difference between rates of females in rural and urban areas is less than the corresponding difference of rates for males. The tendency of urban females to accept "outside the home" jobs therefore should not be over-emphasized in considerations of its effect upon sex roles. Her duties do not usually carry with them enough responsibility to create great worry and her failure in a job seldom offers a real threat to her status as a woman.

On the other hand, the urban male is surrounded by occupational stress and strain. Although many urban wives work, the responsibility of economic security for the family rests firmly upon the shoulders of the husband. In the male role system, the husband is responsible for "bringing home the bacon", even if the wife in some cases does bring it most of the time. In the relatively few urban families where the female is the economic mainstay, the situation is likely to be explained vaguely as a condition resulting from the husband's illnesses or misfortunes. Furthermore, the man of the house, unless he is very exceptional, might be expected

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1. See, for example: J. E. Walters, "Women in Industry," The Annals of the American Academy of Political and Social Science, September 1943, pp. 56-62; Elizabeth M. Culver, "Women in the Service," ibid., pp. 63-68. These articles illustrate some of the problems created by attempts to maintain the female role in emergency situations.

to have some sort of inferiority complex, a condition accentuated, at least, by the operation of pressures associated with the sex roles. Such conditions, of course, increase the health risks of the urban male.

Summary

The essential facts upon which this analysis has been based are as follows:

1. The death rates of both males and females are decreasing, but the difference between their rates is increasing.

2. Mortality sex-ratios are substantially higher for white than colored people. Moreover the ratios of non-whites have increased less than those of whites.

3. The rural mortality sex-ratio is lower than for various sized cities.

4. The highest mortality sex-ratio occurs in small cities of 2,500-10,000 population. Here the male has the highest death rate among all residential groups.

5. The mortality sex-ratio is highly variable both in time and among different classes of the population. Among residential groups it varies from 111 to 128 for colored people and from 125 to 140 for the white population.

In terms of the approach developed, these facts seem to warrant the following tenative statements pertaining to the health of sex roles:

1. The female compared with the male role is more adaptable to social changes which increase survival.

2. Sex roles among colored people, compared with those among the white population, are not enforced as efficiently, reflecting greater restrictions placed upon them by the environment.

3. Rules governing the social behavior of the sexes are not enforced as completely in rural as in urban areas. The male and female roles are probably as well defined among rural people but are not enforced because of environmental resistances related to lower standards of living, including lack of health facilities and ability to purchase medical care.

4. Apparently in the small American city (2,500-10,000), the expected behavior of males and females is enforced more completely, in so far as it affects survival, than in larger cities or in rural areas. This appears to be true for both white and colored people.

5. The variability of the mortality sex-ratio is, at least, a strong argument in favor of the social causation hypothesis of mortality differentials.

Additional research is needed to identify the particular attitudes inherent to the male role which contribute most to health risks. This is primarily the task of sociologists and other social scientists. When accomplished it becomes the responsibility of health leaders to interpret such research findings in terms of health needs and health programs. In the words of Anderson, "... the mandate of the people seems clearly to place upon the health department a

responsibility for concerning itself with all forces of mortality, whether due to environmental, communicable, nutritional, physiological, or psychological factors."[1]

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1. Anderson, Gaylord W., "The Political Impact of Modern Science on Public Health," The Annals of the American Academy of Political and Social Science, January 1947, p. 127.

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