STATISTICS OF MORBIDITY[1]

by EDGAR SYDENSTRICKER

I

"MORBIDITY" is one of the terms in the definition of which the dictionary resorts to vague synonyms. We are told that morbidity is a "diseased" or "abnormal," "not sound," "not healthy," "sickly" state, and are referred to our livers in order to illustrate its meaning. Further reflection might lead us to ask how much morbidity is "normal" reaction to environment, or what proportion of illnesses is merely an unavoidable concomitant of the wearing out of human clocks, to use Pearl's metaphor, some of which are set by heredity to run a shorter time than others. When is death "normal"? At threescore years and ten, or at the century mark, or even at Methuselah's reputed age? How much of Methuselah's life was occupied in dying?

I am afraid that purely philosophical attempts to define the term will lead to a state of obfuscation—which might well be regarded as a form of morbidity in itself. Let us concede at the outset that morbidity is not as precise a concept as the statistician would desire; that it is a relative term, since one person may feel ill, stay away from work longer, be a greater nuisance than another who has the same objective symptoms; and that morbidity is essentially a subjective phenomenon. But let us take cognizance of the fact that illness, to use the commoner and more expressive term, is an undeniable and frequent experience of every person except, of course, the favored nonagenarian who, after a career devoted to tobacco, hard liquor, and perhaps other gayer irresponsibilities, is alleged in newspaper interviews

[1]De Lamar Lecture in Hygiene at the School of Hygiene and Public Health, the Johns Hopkins University, December 15, 1931.

never to have been sick a day in his life. Unlike birth or death, which can come but once to an individual, illness may occur often, its frequency depending not only upon its nature, its causes, and upon the susceptibility of the person concerned, but also upon its duration in relation to the length of time considered. Obviously the calculus of probability can not be used in morbidity statistics in the same ways as in birth or death statistics. Yet, in spite of difficulties of reducing it to precise statistical unity, illness is a *datum* measurable in fairly exact terms of duration, degree of disability, symptoms, cause, and sequelae. From the point of view of diagnosis it has an obvious advantage over death since the ill person is still subject to observation whereas the dead are unable to give further data except through autopsies. Statistics of illness can afford an indication of vitality that is not less biologically significant and is more illuminating than mortality. They portray the condition of a people's health far more delicately than death rates. They reveal the prevalence and incidence of disease in a population in a manner that is as useful to the student of society as clinical observation of the individual patient is to the physician.

II

The development of morbidity statistics has been very slow, and they are yet in their infancy. Their tardy progress may be ascribed to three principal reasons. One is expressed by the truism that statistics of a given kind are not continuously collected on a large scale unless there is a sufficient demand for their use in some practical way. A second reason is that the demand has come for morbidity statistics of special kinds and for specific population groups; little, if any, standardization in morbidity statistics has been attained. A third reason follows in some sense from the second—a confusion as to the concept of morbidity arising from differ-

ences in the uses to which the statistics are put. In addition to this confusion, differences in methods of collecting data, variety in definitions of a "case" of illness, the existence of peculiar factors that affect the accuracy of the record, the time element involved, and similar difficulties, have been deterrents to the accumulation of a large body of homogeneous morbidity data. It will not be possible upon this occasion to review the history or to forecast the future of morbidity statistics, but the opinion may be ventured that it is doubtful that we shall ever need, and therefore shall ever have, continuous registration of illness in accordance with a standardized procedure such as has been established in the field of natality and mortality. On the other hand, the future development of morbidity data promises great usefulness in two main directions:

(1) As an epidemiological method whereby population groups can be accurately observed continuously in order to ascertain how actual conditions of human society influence the incidence and spread of disease.

(2) As a means of portraying from time to time and for various population groups and areas, the problems of disease in far better perspective than can be given by statistics of mortality or by any other data practicable in the near future.

Our discussion purposely will be centered on the beginnings of morbidity statistics in the second direction, although the greater opportunity for development seems to me to be in the first.

III

Although many kinds of morbidity statistics exist, their varieties may be classified in five general groups. I shall refer to each very briefly in order to present in somewhat greater detail some results of one study of illness.

(1) *Reports of Communicable Diseases.* In a strict sense,

these are not morbidity data since illness is not necessarily involved. They exist, or *should* exist, for a specific purpose, namely the notification of those diseases for which reasonably effective methods of administrative control actually have been devised. Only to a limited extent are communicable disease reports useful for epidemiological studies. As Hedrich and I have shown,[2] not only are the reports of most diseases extremely incomplete but their incompleteness varies according to age.

(2) *Hospital and Clinic Records*. These are of little use in determining the prevalence or incidence of illness in a population, either in terms of a gross rate or from any specific disease. Properly made, as they rarely are, they are valuable for clinical studies and may become more so as the tendency to hospitalization increases and as clinicians become trained in analytical methods.

(3) *Insurance and Industrial Establishment and School Illness Records*. The outstanding examples are the sickness experience of European insurance systems and of absences on account of illness of workers in industrial establishments in the United States. It is essential to bear in mind that important conditions affect the content, meaning, and validity of the data, although the concept of illness is more than usually specific because of technical and arbitrary definitions imposed for administrative reasons. One condition is the inclusion of only persons well enough to be employed. Another is the exclusion of all cases except disabling illnesses. Another is the exclusion of illnesses of short durations by reason of regulations as to the "waiting period," or the period of disabling illness that must elapse before the patient begins to draw sick benefits and therefore before the record of illness begins. Thus the annual disabling illness rate among male industrial workers with a waiting period of one week was 104 per 1,000, whereas the

[2]Sydenstricker, Edgar, and Hedrich, A. W.: Completeness of Reporting of Measles, Whooping Cough, and Chickenpox at Different Ages. *Public Health Reports*, June 28, 1929, lxiv, No. 26, pp. 1537–1543.

rate for males in a large public service company without any waiting period was 1,044 per 1,000.[3] Again, "if wages are lost entirely when the worker is absent on account of sickness," as Brundage has shown, "the record usually shows a much lower rate of absences of relatively short duration than when full wages are paid during sickness" (Fig. 1), although malingering was not found to be an important factor in two establishments studied.[4] Malingering undoubtedly must be regarded as a condition affecting the accuracy of statistics based upon records of disability or absence. The lad who is too sick from a headache to remain in school but finds the fresh air of the baseball field beneficial, may or may not be malingering; at any rate he is often abetted by sympathetic parents. Yet the interesting suggestion has been made by Collins,[5] and illustrated by Downes,[6]

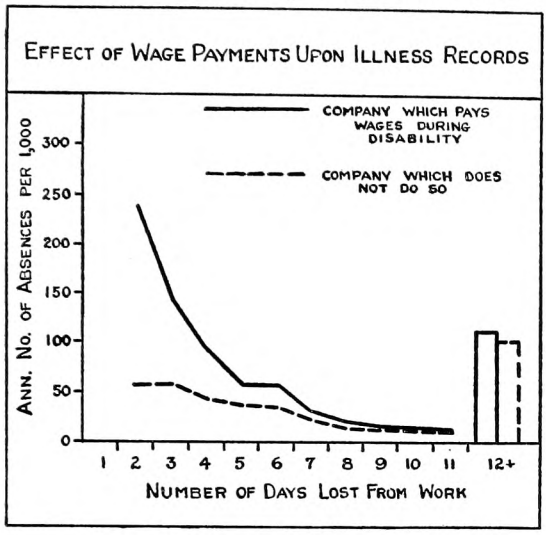


Fig. 1. Frequency of absence due to disability among male employees of a company which pays wages during disability as compared with male employees of a company not paying during disability.

[3]Brundage, Dean K.: The Incidence of Illness Among Wage-Earning Adults. *Journal of Industrial Hygiene*, November, 1930, xii, pp. 342, 347.

[4]*Ibid*, p. 340.

[5]Collins, Selwyn D.: The Place of Sickness Records in the School Health Program. Transactions of the Fifth Annual Meeting of the American Child Hygiene Association, October, 1928.

[6]Downes, Jean: Sickness Records in School Hygiene. *American Journal of Public Health*, November, 1930, xx, pp. 1199–1206.

that records of illness involving absence from school, if kept with some degree of specificity as to the nature of the illness, profitably could be used to complement the findings of the relatively infrequent and usually unsatisfactory physical examinations as a method of referring certain children for diagnosis and treatment.

(4) *Illness Surveys.* These have been made, notably by the Metropolitan Life Insurance Company, to ascertain what the *prevalence* of illness is at a given date in sample populations. The method of these surveys is a simple house-to-house canvass. The results indicate that about 2 per cent of the population, including persons of all ages and at home or at work, are ill. The *incidence* of illness within a given period is not revealed by this method and, when the results are analyzed by cause, obviously the proportion of cases of long duration and of chronic type is much higher than is shown by records of incidence.

(5) *Records of the Incidence of Illness in a Population Continuously or Frequently Observed.* Although this method was first employed on a considerable scale in the field of study of a single disease, pellagra, by Goldberger and myself and our associates,[7] the first attempt so far as I am aware to record all illnesses continuously in a typical population on any considerable scale was made by the United States Public Health Service in Hagerstown, Maryland, in 1921–1924. The same methods, with some elaborations, have been used in several subsequent morbidity and epidemiological studies. The two main purposes of the Hagerstown study were (1) to ascertain the annual illness rate in a representative population and (2) to develop an epidemiological method whereby human populations could be observed for as complete an incidence as possible of various diseases, so far as they are manifested in illness, under actual conditions of community life.

[7]Goldberger, J.; Wheeler, G. A.; and Sydenstricker, Edgar: A Study of the Relation of Diet to Pellagra Incidence in Several Textile Communities of South Carolina in 1916. *Public Health Reports*, 1920, xxxv, pp. 648–713, and later publications.

IV

Before referring to some of the results of this study from the viewpoint of general morbidity, it is important to consider the nature of the data obtained by the method of frequent and continuous observation employed in this and later similar studies.

Experience has shown that the completeness of a record of illness depends upon at least three important conditions. One is its severity and nature; the second is the length of the period for which the informant is asked to report; the third is the subjectivity of the record itself. Nearly every adult will remember an illness due to typhoid fever incident upon himself or in his family if it took place within the preceding ten or twenty years; few will recall a brief illness due to a common cold unless it occurred within a very short period immediately preceding the date of inquiry. Illnesses of a minor kind are observed and remembered when incident upon the informant himself with a greater degree of completeness than when incident upon others, even in the same family.

A few illustrations may be given. The annual incidence of illness of respiratory nature in families reported upon every half month was two attacks per person,[8] whereas in families reported upon at intervals of six to eight weeks it was only about 0.7 attacks per person.[9] The annual illness rate for women reporting upon themselves was 70 per cent higher for respiratory conditions, 130 per cent higher for nervous conditions, and 8 per cent higher for digestive disorders than the rates for women reported upon by others in the same

[8]Townsend, J. G., and Sydenstricker, Edgar: Epidemiological Study of Minor Respiratory Diseases. *Public Health Reports*, January 14, 1927, lxii, No. 2, p. 112.

[9]Sydenstricker, Edgar: A Study of Illness in a General Population Group. *Public Health Reports*, September 24, 1926, lxi, No. 39, p. 12.

household.[10] On the other hand, respiratory attack rates in families where adult males were the informants were higher for themselves than among adult females in the same families whereas all objective observations point to a higher rate among women than among men.[11] Such experiences as these point to the necessity for taking influencing conditions into account that only participation in the collection of the data can possibly reveal.

V

I would have liked very much upon this occasion to have been able to bring you fresh reports upon several field studies of morbidity using or involving the recording of illness by the method of continuous observation of population groups. Unfortunately these studies either are still under way or are as yet in the process of tabulation. One is the observation of a population group of 5,000 in a city of nearly 200,000 people and another is of a group of similar size in a rural area. The purposes of these studies are not merely to secure a record of the illnesses in order to depict the condition of a typical population's health in so far as it is revealed by illness, but to ascertain the extent to which illness is receiving medical service and the population itself is being served in various ways by the public health agencies, both official and unofficial. In these and other field inquiries under way, the reasons why health services of different kinds are not used by the families and individuals are being ascertained in order to learn the attitude of the public and to appraise the efficiency of educational efforts. Thus the underlying method of continuous observation of a population is being applied

[10]Sydenstricker, Edgar: The Illness Rate Among Males and Females. *Public Health Reports*, July 29, 1927, lxii, No. 30, p. 1952.

[11]Sydenstricker, Edgar: Sex Differences in the Incidence of Certain Diseases at Different Ages. *Public Health Reports*, May 25, 1928, lxiii, No. 21, pp. 1269–1270.

in these two studies as a mode of measuring the effectiveness, from an important point of view, of public and private medicine—using the term "medicine" in its broad sense. A third study, in which this method is being employed, was conducted on a large scale in the United States in order to find out, with far greater accuracy than ever before, the extent to which families of different economic status actually availed themselves of medical, hospital, and other services and the actual costs of these services in detail for every illness during the period of a year. This inquiry extended into communities of different types and sizes and in many geographic areas of the country.

This particular method of the morbidity study—the continuous or frequent observation of a population—is thus being adopted for other purposes in the fields of public health and medical economics. It is essentially the method of the field zoologist, botanist, and the laboratory worker applied to the study of human populations living under conditions as they are found, but with far greater possibilities of precision in and completeness of observation than routine records made for other purposes can ever achieve. It will doubtless become a most valuable epidemiological tool as the technique of observation for specific diseases is divided and improved through experience. I need not refer here to the studies of respiratory affections conducted at the Johns Hopkins University which are notable examples of this use of the method. Epidemiological method, however, does not lie within our subject; I merely mention it in order to illustrate the fact that the study of morbidity is developing into an epidemiological mode that is both scientific and practicable.

VI

For an illustration of morbidity studies used to depict the

health of a population we may turn to the one made in Hagerstown.

The Hagerstown morbidity study[12] included 16,517 "years of observation," or an equivalent of a population of 7,079 persons observed continuously for twenty-eight months beginning December, 1921. Illnesses were recorded as reported to experienced field investigators visiting each family every six to eight weeks, the reports being made by the household informant (usually the wife) either as experienced by herself or as she observed them in her family.

The results of the study indicated that a fairly accurate record of real illnesses was secured. Less than 5 per cent of the illnesses of exactly stated durations recorded were one day or less in duration. Approximately 40 per cent were not only disabling but caused confinement to bed. It is evident, therefore, that in the main the illnesses recorded were more than trivial in their character, in spite of the fact that in some instances mere symptoms were given as diagnoses. The incidence of acute attacks of specific and generally recognizable diseases was, we believe, recorded with a satisfactory degree of completeness. On the other hand, the incidence of mild attacks, as for example, of coryza, was quite incompletely recorded as judged by data on minor respiratory attacks obtained later by more intensive methods for other population groups.

For this population 17,847 illnesses were recorded in the twenty-eight month period, an annual rate of 1,081 per 1,000 years of life observed, or about one illness per person per year. This illness rate was over 100 times the annual death rate in the same population.

[12]Sydenstricker, Edgar: Hagerstown Morbidity Studies. A Study of Illness in a Typical Population Group. Reprints 1113, 1116, 1134, 1163, 1167, 1172, 1225, 1227, 1229, 1294, 1303, and 1312 from the *Public Health Reports*.

Perhaps the most interesting results of this first morbidity study of a typical population related to the variations in the incidence of illness according to age. Up to the time the Hagerstown study was made the only data on adults came from "sickness" records of European insurance systems, English voluntary sick benefit societies, and a few American industrial employee funds. Nearly all of these records include only absences from work due to illness lasting a week or longer, and naturally indicate a rapid rise in the rate according to age because they reflected the serious illnesses only. The Hagerstown study showed that for a group composed of persons at work and at home the illness rate was high even in the younger adult ages and did not rise so quickly with age. The study also furnished data for the first time on children and adolescents with the surprising result that the peak of illness incidence was to be found in childhood and the lowest in the age period 15-24 years, a finding that has been confirmed by later studies employing similar methods. (Fig. 2)

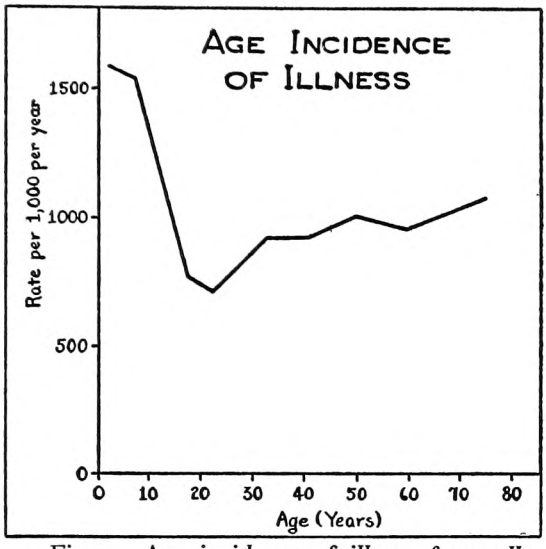


Fig. 2. Age incidence of illness from all causes in Hagerstown, Maryland, as observed in a general population group, December 1, 1921—March 31, 1924.

This extraordinary age variation in the illness rate may be interpreted from various points of view, but before you venture any interpretations of it, certain other general considerations should be taken into account.

One is the fact that the proportion of persons suffering frequent attacks, two or more illnesses per year, was highest (45 per cent) in childhood (2–9 years), lowest at 20–24 years (11 per cent), rising gradually to a level of about 21 per cent beginning with the age of 35. Thus the age variation in illness was partly due to the age distribution of frequently sick individuals. The proportion of persons sick once a year was about the same in every age period. On the other hand, the proportion of persons free from illness during the period was lowest in childhood (5 per cent at 3–4 years), sharply rising through adolescence to a maximum of 30 per cent at 20–24 years, and thereafter declining until the end of the life span. (Fig. 3)

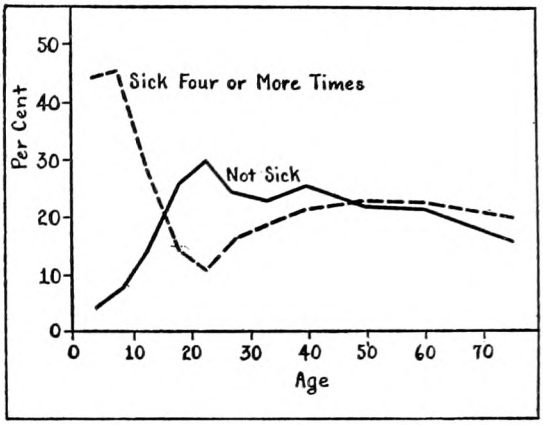


Fig. 3. Proportion of persons at different ages who suffered a specified number of illnesses during twenty-six months.

A second consideration is the age variation in the severity of cases of sickness. Severity may be measured in various ways—by duration, degree of incapacitation, cause or nature of the attack, or by fatality. In order to suggest in a general way the ill person's resistance to death at different ages, a convenient mode of expression is the ratio for different age periods. The anticipated variations are clearly indicated, namely that his greatest resistance to death is in childhood, the age period 5–14; his lowest resistance is in infancy and early childhood (0–4 years) and toward the end of the natural life span. Ability to *survive* illness thus varies markedly from resistance to attacks of illness at different ages,

particularly in childhood (5–14) when the average individual suffers from illness frequently but has a relatively small chance of dying, and in the older years when not only does his susceptibility to illness increase but also his chances of death. This is due partly, of course, to differences in the nature of illness occurring at these ages and partly to the diminished ability to resist the diseases which manifest themselves in morbidity. (Fig. 4)

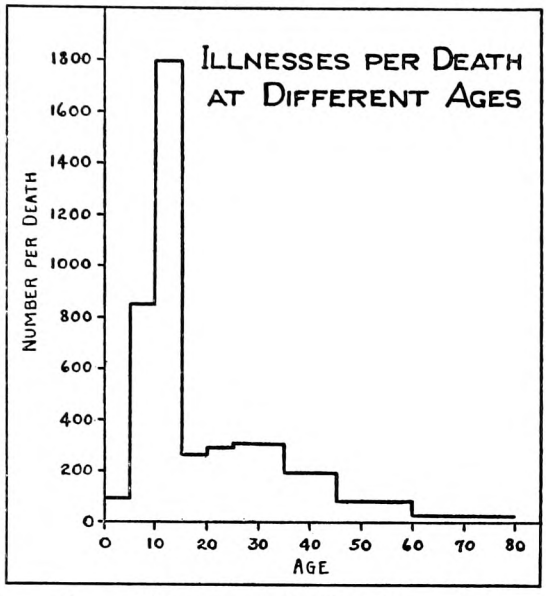


Fig. 4. Illnesses per death at different ages in the white population of Hagerstown, Maryland, December 1, 1921–March 31, 1924.

A third consideration is of basic importance — the cause or nature of illness at different ages. I can only summarize very briefly the data collected in the Hagerstown and subsequent studies. The generally known fact that each period of life is characterized by its own distribution of the causes of illness was more clearly and completely defined. In childhood, illness other than respiratory is caused chiefly by communicable diseases, diseases and conditions of the skin, ears, eyes, and teeth, and nervous and digestive disorders; in old age, illness other than respiratory is caused by the organic group of diseases and conditions, those of the circulatory system, nervous system, and kidneys. Illnesses resulting from all these causes are at their lowest level in adolescence and young adult ages. The only major cause which results in a

higher rate of disability in young adult life than at any other age is the puerperal condition, and this, of course, relates to females only. Certain specific causes of illness do have their highest incidence in the young adult period of life, such as venereal diseases, typhoid fever, and pulmonary tuberculosis, except under conditions of special strain or hazard. But, by and large, this is the age most free from illness. (Figs. 5, 6)

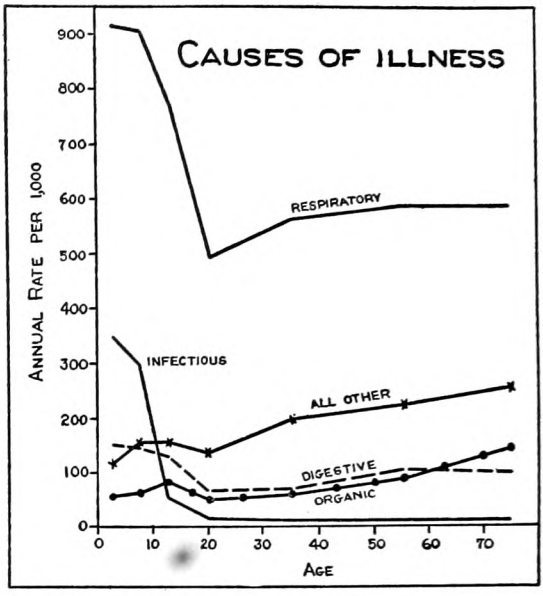
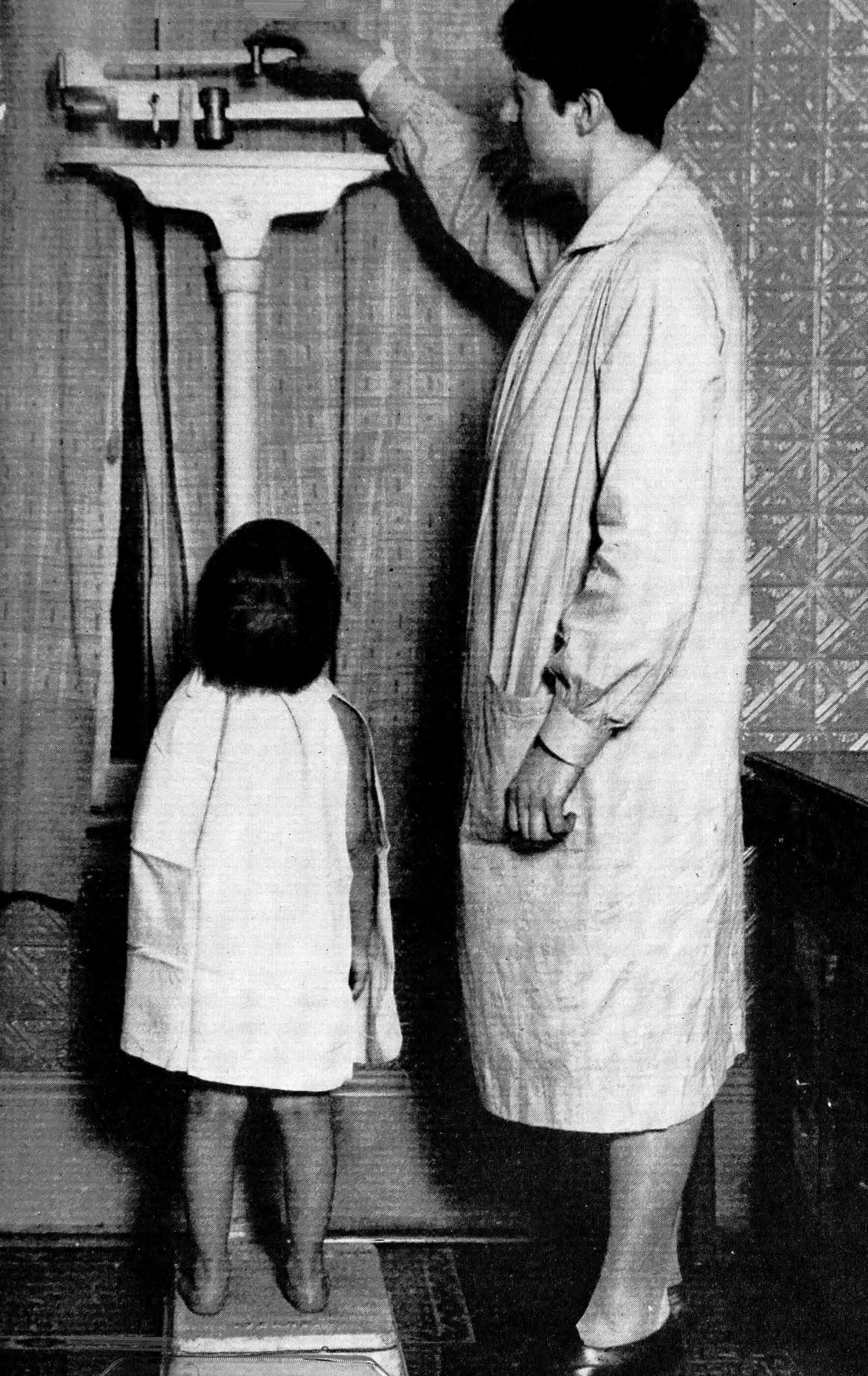


Fig. 5. Causes of illness at different ages in a white population group in Hagerstown, Maryland, December 1, 1921–March 31, 1924. Under infectious diseases are included the "epidemic, endemic and infectious diseases" and under "organic" the following: diseases of the eyes, ears, circulatory system, teeth and gums, kidney and genito-urinary system.

The predominating importance of respiratory diseases and conditions as causes of illness at all ages is a striking fact, but their great height in childhood, their lowest level in adolescent and young adult period (15–24 years), and their gradual rise with the advance of age had not been depicted statistically. Respiratory illnesses were more frequent at both extremes of life than any other general disease group; although, with the exception of infectious diseases, circulatory diseases, and diseases of the bones and of "organs of locomotion," which so clumsily describe diseases that affect certain muscles, nearly all of the major groups of causes of illness tend to appear among the very young and among the old.



In contrast to the organic troubles which so definitely begin to be manifested in middle life and which characterize old age, are the infections and the diseases and conditions affecting the skin, teeth, eyes, and ears that occur with greatest frequency in childhood.

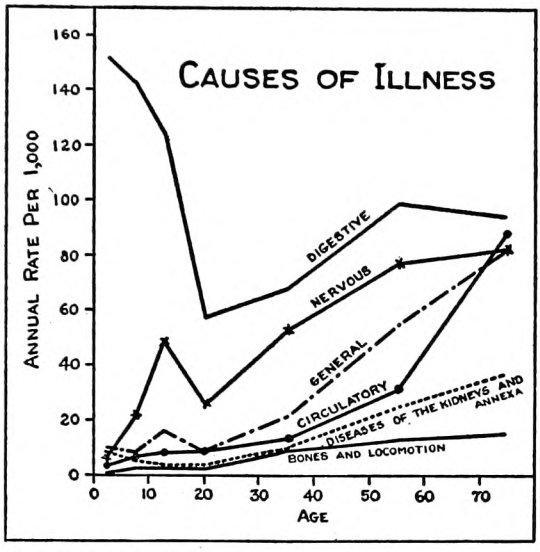


Fig. 6. Variations, according to age, of certain groups of diseases which were primary causes of illness in a white population group in Hagerstown, Maryland, December 1, 1921–March 31, 1924.

A fourth consideration is the differential illness rates according to family economic status. After taking into account the differences in the age distribution of persons in different economic classes, the annual illness rates for Hagerstown were 991 per 1,000 for the highest economic class, 1,068 for the middle or "moderate circumstances" class, and 1,113 for the "poor." These differences are not of the same magnitude as those found previously for infant mortality, tuberculosis, or pellagra, for example. Doubtless one reason was that the classes were not so sharply defined since the classification was based on the general impression of the investigator over two years of observation rather than upon an exact appraisal of income. A somewhat detailed analysis of the data, however, revealed the facts that the association of illness with poor economic status (1) appeared for certain causes only, and (2) was indicated in adult life and not in childhood or adolescence. An association

with poor economic status was indicated for respiratory diseases, rheumatism, nervous conditions and disorders, and accidents. The commoner infectious diseases—measles, whooping cough, and chickenpox, for example—were not respectors of economic class. The lack of an association with favorable economic status with respect to diseases and conditions of the eyes and ears and of the circulatory, digestive, and eliminatory organs, may reflect the fact that such cases were more frequently attended by physicians and therefore more accurately described for the higher economic class than for the lower.

VII

From the many interesting and suggestive data yielded by morbidity studies of this nature we may select one more fact. It is this: The general picture given by records of illness according to cause—or, more precisely, according to the *kind* of morbidity—is in sharp contrast to that given by mortality statistics. Respiratory diseases and disorders account for 60 per cent of illness as against about 20 per cent of deaths; the general group of "epidemic, endemic, and infectious" diseases accounts for 8 per cent of illnesses, whereas only about 2 per cent of the deaths were ascribable to this group; digestive diseases and disorders caused or characterized 10 per cent of the illnesses as against 6 per cent of the total mortality. On the other hand, the group of "general" diseases (which includes cancer), the diseases of the nervous and circulatory systems, and the diseases of the kidneys and annexa were relatively much more important causes of mortality than of morbidity. The diseases of the heart and circulatory system show the sharpest contrast, 24 per cent of deaths being ascribed to these conditions as against only 2 per cent of illnesses. In other words, these diseases manifest themselves in relatively few instances of illness, although un-

doubtedly they shorten life and make life less efficient and enjoyable while it lasts.

VIII

I hesitate to draw the most obvious conclusion from the facts so far yielded by all studies of morbidity because I do not like to close on a note that might be thought discouraging. I have confidence, however, in the stimulating challenge of facts. You may remember the soliloquy of *Faustus* upon the choice of a profession, written nearly 350 years ago by Christopher Marlowe, in which he weighed the success of medicine in these words:

> "Summum bonus medicinae sanitas
> The end of physic is our body's health.
> Why, Faustus, hast thou not attained that end?
> Are not thy bills hung up as monuments, whereby
> Whole cities have escap'd the plague, and
> Thousand desperate maladies been cured?"

So, today, we may apply to preventive medicine the test afforded by statistics of illness. It is true that some of the plagues and pestilences of Marlowe's day have been banished from a part of the world; that many more maladies have yielded to modern treatment; that millions of people have escaped certain diseases and have lived lengthened lives. These achievements are monuments indeed to scientific discoveries and to the unselfish art of medicine. Yet undeniable morbidity experience in the twentieth century is overwhelming evidence that the goal of preventive medicine, which is a healthy people, is far from being reached. It is impossible to escape the conclusion to which these statistics drive us, that public health and the practice of medicine have as yet barely touched the task of *preventing* the conditions which manifest themselves in actual illness and all that illness implies.