The Linacre Quarterly

Volume 30 | Number 2 Article 2

May 1963

The Application of Statistical Method to Public Health

Con J. Fecher

THE APPLICATION OF STATISTICAL METHOD TO PUBLIC HEALTH

CON J. FECHER, PH.D.

What influence has vital statistics had upon the lengthening of life in the last century? How has the application of statistical method helped in solving some of the health problems of religious in the United States? A national Committee on Health Care of Religious has proposed a health program for men and women in the religious life. What is the role of the community superior and the physician in this program? How can religious communities offset the high cost of drugs, medical and hospital care in the future?

I shall attempt to answer these and related questions in the light of present public health, and in particular, to what degree they are related to religious.

Since mortality from certain diseases such as cancer and heart conditions is not a constant quantity and subject to very considerable variation, it is equally obvious that the factor of variability is similar to the underlying causes influencing the frequency of death. The fact that statistical method in medicine is the one science that can possibly arrive at a scientific conjecture or hypothesis of these many variables, it has been of exceptional practical value to the medical profession in using these inferences, which direct research workers along definite lines and in prescribed areas thereby arriving at scientific conclusions.

Advances in medicine have been made along three main avenues: bedside observation and treatment of sick individuals; laboratory observation and experiment, and statistical measurement and analysis of causes of death and diseases that affect the human population. It is the last avenue that I wish to develop. The study of mortality, health and disease in groups of people rather than of individuals has an important and long history. Many times a disease has been controlled by statistical or empirical measures long before laboratory study had explained the disease process itself. For example: it was learned by statistical measurement that cholera incidence and prevalence was due to the use of certain earmarked liquids more than 40 years before Koch identified the actual micro-organism. Etiological agents causing communicable diseases, tuberculosis and even cancer were pinpointed long before the actual organism had been established. Today, systematic observation of population by application of statistical method continues at an ever increasing pace in the search for clues causing chronic diseases, influencing growth and aging. These studies are the basis to ascertain the needs for hospital facilities, medical and dental services and future medical costs.

EARLY RECORDS OF STATISTICAL MEDICAL RESEARCH

The era of scientific statistical medical research began approximately one hundred years ago when statisticians proceeded to collect vital statistics of births and deaths. It is a fact that early studies of longevity had been made as far back as the middle of the 17th century by John Graunt, in 1662. So far as possible, his book analyzed the weekly returns of christenings and burials in the city of London. These records had been kept irregularly and usually at times when the plague turned popular attention to such matters. In reviewing these old records which I was privileged to do in 1962, one cannot overlook the imperfection of the data at his disposal and allow for inaccuracies in arriving at an average length of life of only 18.2 years. No doubt the high death rate from periodic plagues had had extreme influence on his conclusions. Notwithstanding the faulty data of Graunt's, his conclusions attracted attention and inspired men to make similar studies in other European countries.

It was the beginning of a sincere effort, though a faulty and abbreviated one, to study the health of people by comparing gains and losses in longevity for different periods. A contemporary of Graunt was one, Halley, the great English astronomer, who was considered a scientific worker in this field. He made a study of the records of births and deaths of Breslau in Silesia around 1700. Reviewing the original study in London, I found that it indicated the average length of life for each five years with an average length at birth of 33.5 years. He had no record of the age composition of the population but considered it stationary. Because of the inaccuracy of the method, these expectations cannot be regarded as exact. Nevertheless, this was the first document of average length of life by quinauennial years which came nearer to the truth than any other table known at the time.

Those who today are solicitous about more religious vocations and in improving the health status of religious may be encouraged that similar interest had been evident in the 17th and 18th centuries. Deparcieux, a Catholic French statistician, in cooperation with the Benedictines, Augustinians and other male and female religious orders in and about Paris, was able to formulate life tables based on the deceased members from 1685 to 1745. In examining the original treatise in Paris, *"Essai sur les probabilities de la duree de la vie Humaine,"* Deparcieux compared his life tables with those of Halley and other tables available. He found that the average age length of life of nuns was longer than that of the general population of London, Breslau and certain towns in Holland, while that of the monks was similar to the general population.

It is of interest to note that as far back as 200 years women had a longer life expectancy than men. The statistics of Deparcieux were somewhat refined by the German statistician, Casper, in 1835, arriving at similar conclusions. The most recent and scientific study of the age differential of the two sexes in religious life is that of Francis C. Madigan, S.J., in 1957.[1] He found the sisters to have more than five years longer life expectancy than brothers. Deparcieux, having been interested in religious vocations, did not fail to emphasize the advantages of communal living of that day.

A number of life tables relating to the population of various foreign countries were formulated in the next 100 years. If the reader wishes to pursue them in greater detail, a comprehensive description can be found in the publication, *Biometrika,* 1941-43, "Medical Statistics From Graunt to Farr," by Greenwood in England. All of these early tables were based on births and deaths, disregarding the age composition of the population. We must admit, even though faulty methods were used, they influenced and encouraged those in authority to improve the health population of the period.

Of recent years medical men and statisticians interested in demography have and are exploring the data of these early centuries. Dr. S. Peller of New York City, noted physician and statistician, found the average length of life of the ruling classes of Europe for the period 1480 to 1579 was approximately 30 years. Dr. Louis Henry, Senior Demographer, Institute National d'Etudes Demographiques, Paris, is at present exploring the vital statistics of the population of France for the period 1714 to 1814. These two men are using the present scientific approach to the formulation of life tables, a method that began with Dr. William Farr, Registrar General of England and Wales, in 1843. The greatest contribution by Dr. Farr was in establishing a method, measuring life expectancy at every age. He exerted a tremendous influence upon health officials in administrative capacity and especially upon members of the medical profession to provide him with more accurate and uniform health data. It was he who educated them to the uses to which such data could be put in formulating a health program. An important biographical account of Dr. Farr by Mr. Greenwood can be found in the publication, *The Lancet,* 1933.

[1] Madigan, Francis C., S. J., "Sex Mortality Differentials," *Milbank Quarterly.* April, 1957.

MORTALITY AND LIFE EXPECTANCY

Since life expectancy in years is computed on mortality rates, further significant detail is added to the picture by taking into account the increasing or decreasing mortality rate from each specific cause of death at successive ages from birth to death. Briefly, a series of mortality rates of successive ages is known as a Mortality Table. It is a human document, a kind of story of man's efforts to prolong life at its maximum. Certain biological and environmental factors set a limit to the length of life which give character to the mortality table. On the basis of the table, it is possible to ascertain the probability of dying (ratio of number of dying to the number of living) from certain causes of death like tuberculosis or cancer at any particular age. Comparing the length of life in years lived at a given age in the past with that of current date one is able to calculate the aver-

age number of years that had been gained or lost by the group.

AMERICAN LIFE TABLES

The practice of collecting birth and death statistics on an annual basis in the United States was initiated by the Bureau of Census in ten States in 1900. It was not until 1920 that official life tables were prepared by Elbertie Foudray, Chief of the Bureau. Successive tables based on census data have been prepared each ten years. They represent definite gains or losses of longevity of the population not only at birth but at all ages. These tables are not figures of dry bones only but give an insight into the mortality changes at the various ages as related to such other factors as sex, race, marital state, socio-economic status and the relative frequency of the many causes of death.

Statistical medical research of the last thirty years had been directed to the reduction and almost complete elimination of communicable diseases including tuberculosis. Currently it is now directed mainly to that of cancer and heart diseases. In addition to the life tables of the Bureau, much credit in providing statistical medical information must be given to the studies and health investigations of actuaries of a number of life insurance companies. Attention should be called to Mr. Arthur Hunter of the New York Life, Dr. Frederick L. Hoffman of Prudential, whose international cancer studies of the past half-century are known world-wide, and to Dr. Louis I. Dublin of the Metropolitan, who waged a 40 year successful campaign against tuberculosis.

The reader up to this point might be tempted to say the foregoing is belaboring the point of the scientific development of mortality and life expectancy tables. However, it is to be noted that the fundamental basis of all statistical inquiries is the Law of Large Numbers. The accuracy of the statistical judgment is in proportion to the mass of the material considered, the thoroughness of the method of analysis and in particular to the correctness of the data. In conformity to the last principle, if the reader is to be on more solid ground in evaluating the influence of vital statistics upon a health program for religious, it is imperative that those who are responsible for recording future mortality and morbidity data of religious adopt standard health forms.

WHAT HAS BEEN ACCOMPLISHED IN COLLECTING MEDICAL STATISTICS FOR MEMBERS OF RELIGIOUS COMMUNITIES IN THE UNITED STATES

It was near the end of the first quarter of the 20th century when the writer as a Fellow at the Catholic University of America had the opportunity to contact men at that institution who had a keen interest in the health of the teaching nun. The Sisters' College, an institution affiliated with Catholic University, had been established. Father Edwin V. O'Hara, later to become Bishop, and his brother, Frank O'Hara, Dean of the School of Economics, were the first to suggest the study. Bishop Thomas J. Shahan, Rector of the University, also became extremely interested. He recognized the problem of obtaining the necessary statistical information, suggested and consented to provide the prestige of the University in name and in spirit to obtain the data. Wholehearted cooperation of sisters at the College and their superiors assured immediate success of the project. It is to be noted that life tables of religious in the United States had their origin but a few years ago, after the construction of the first official life tables of the Census Bureau under Miss Foudray. She and the actuaries of insurance companies mentioned above, not only expressed their interest in the project but gave advice and provided scientific help and facilities in completing it.

The first study of the length of life of nuns in the United States was completed in 1927 based on a group of 25,000 members for the period 1900-1924. The findings of the study brought to the attention of the superiors the fact that the tuberculosis death rate among the teaching sisters was far too great for the entire 25-year period as compared to that of other women. Accordingly, superiors, having been alerted to the tremendous inroads of the scourge of tuberculosis upon the younger members of the sisterhoods, introduced the necessary facilities to cope with the disease. Within the next ten years a number of communities constructed private hospitals, sanatoriums, infirmaries and rest homes for these members.

The second and more recent mortality survey, in 1957, showed that these communities had reaped benefits increasingly, and brought tuberculosis under control.[2] The writer in planning an expansion of the earlier study increased the group to 90,000 members with 90 communities participating. This made it possible to observe the lives of many thousands of nuns for more than a half-century, 1900-1954. This survey directs further medical research in important areas that have been recommended by the Committee on Health of Religious. Findings may be summarized as follows: 1) sisters have decidedly lower death rates in the younger and middle age groups than the white women in the United States; 2) sisters today have a three year longer life expectancy than white females at age 20 years; 3) because of the increase of certain causes of death of sisters in the first ten and twenty years of communal life, further exploration in this period is necessary. The Health Care Committee recommends the adoption of a standard pre-entrance examination and a standard health record system by all communities. Supplementing mortality data, it further recommends the collection of medical statistics on diseases (morbidity) for at least five years, and 4) the ever increasing longevity of nuns has changed the age pattern of the group substantially. Today, with 55% of sister population 45 years and older and 25% 60 years and older, the effect of chronic disabilities upon future administrative, economic and medical problems of communities must be anticipated.

[2]Fecher, Con J., Ph.D., "Mortality and Morbidity Studies of Religious," THE LINACRE QUARTERLY, November, 1960.

MORTALITY SURVEY OF RELIGIOUS CLERGY UNDERTAKEN IN 1960

In view of the interest shown by the provincials of religious orders of men in the study of health of nuns, a mortality study of 32,000 members of religious clergy was completed in 1962. The investigation considered members of 45 religious communities, including Benedictines, Dominicans, Franciscans, Jesuits and other major religious orders of men in the United States from 1900 to 1959. How long has been the life span of men living in religious communities since the turn of the century? Has the increase in longevity kept pace with that of men in other walks of life? It is to be noted when comparing the life table of 1905 with that of 1955, a young man of age 20 years beginning his life work as a religious at any time during the period 1900-1909 could expect to live an average life span of an additional 44.5 years, while one beginning his work at the same age in the last ten years, 1950-1959, might expect to devote an additional 52.5 years to his career. The gain of 8 years, no doubt, was mainly due to the control and almost complete elimination of tuberculosis and other communicable diseases at all ages. Does the average life span of the religious compare favorably with that of men in general? The nearest comparable group would be that of the white males of our country based on the 1901-1910 registration area. They had a life expectancy of an additional 42.4 years at age 20 in this early period while a group of similar white males for the year 1957 indicated 49.9 additional years or approximately a gain of 7.5 years.

It is revealing to note that men in religious life have 2.6 years longer life span at age 20 than white men in other walks of life. At first glance it might appear that further improvement in health of men in religious life is not a serious problem or a need for further study. On the contrary, facts indicate that the age spread from 35 to age 50 needs intensive exploration because of a higher mortality. Due to the fact that specific causes of death were not available, the writer was unable to measure the extent of gains or losses in longevity from particular causes of death. In no small measure can we ask what is chiefly responsible for this odd and disturbing mortality rate of religious men in the middle and later life period. Uncovering the increased mortality experience of the clergy in this age bracket is most significant and confirms the importance and value of collecting the statistics. Unfortunately one is limited to a general interpretation to causes of death. Therefore, a second mortality study has been recommended covering the three year period, 1960-1962. All effort with the cooperation of the provincials will be made to obtain exact causes of death in the age bracket 35 to 50 years.

MORBIDITY

Mortality data alone fail to provide an adequate health picture of a community since there are many disabilities that do not terminate in death but do present important health problems. It is the studied opinion of many in the field of health that learning about mortality data today are post mortem facts that should have been explored by means of morbidity information yesterday. Morbidity measures the nature and extent of sickness or injury of a group in terms of prevalence, incidence, degree of severity and duration of the condition. Our gravest health problems today, such as heart disease, mental illness and cancer, seem to be caused not by a single offending characteristic of either the environment, of the individual himself or the etiological agent or agents, but rather by a multiplicity of factors. Some of these are found within the constitutional makeup of the individual and some within the environment in which he lives. It appears to be a long and complicated chain of preceding events influencing the individual of the particular disease. Collecting morbidity data will allow the statistician to use the epidemiological method to discover associations of the disease with particular factors in the social or physical environment of the individual. By this method he will be able to encourage and direct the medical profession to more intensive clinical and experimental studies.

The United States Government is the largest agency in gathering morbidity statistics. Though a few earlier disability surveys had been made by the Health Department, the Government began collecting data in 1957 and since that year a continuing survey of illness and disability of the nation has been collected annually. The many difficulties in collecting and interpreting morbidity data in the past have been solved to some degree today. It is now possible to cover a defined population of known size and composition. Data is now available for both the well and the sick, and the meaning of illness, its severity and duration can be more clearly defined so that rates can now be computed scientifically. The Committee on Health of Religious recommends the use of the standard Medical Identification Card for each religious member participating. This card is to carry entries of disabilities from which scientific morbidity rates can be computed.

ROLE OF THE RELIGIOUS SUPERIOR AND THE PHYSICIAN

By virtue of the position that accurate and uniform medical statistics holds in the field of preventive medicine today, superiors of religious orders and the respective physicians can provide a tremendous wealth of knowledge about the factors which influence the well-being of the nation. They represent a group of 240,000 strong, 175,000 sisters and 65,00 clergy and brothers in the United States, living under similar economic, social and educational conditions. When periodic physical examinations are uniformly carried out, supplemented with morbidity data from individual Medical Identification Cards, the two avenues will provide a pool of medical information that will be of inestimable value not only to the religious member but also to those in authority. Both will be able to evaluate and recognize the physical and mental limitations of the member. Fundamentally, the future health program for religious should be con-

sidered a three-way program, being influenced by the physician, the superior and the individual member. Each of these, in addition to their contribution to maintaining a high level of well-being of every religious member at all times, have the ability to provide accurate and uniform health information on standard medical forms. These forms are now being supplied by the Catholic Hospital Association.

At long last, we are able to give a count-down, covering a period of more than thirty years, for a successful launching of a nationwide Health Program for Religious in the United States.

7) Mortality Survey of 25,000 nuns in 1927 alerting the communities to the high mortality from tuberculosis;

6) Mortality survey of 90,000 nuns in 1957, calling attention to the higher mortality in the first years of communal life;

5) Organization of a national Committee on Health Care of Religious in 1959, with James T. Nix, M.D. as chairman, at the suggestion of The Catholic Hospital Association and the National Federation of Catholic Physicians' Guilds;

4) Cooperation of Conference of Major Religious Superiors of Women placing the health program as one of the important items on its agenda;

3) Mortality survey of 32,000 members of the clergy in 1960 pointing to the need of a more intensive exploration of their mortality in the 35 to 50 age bracket;

2) A Research Grant awarded to James T. Nix Clinic by the American Cancer Society for a more detailed study of mortality in nuns in the United States for the year 1963, with particular emphasis on cancer deaths;

1) Morbidity project of 30,000 nuns participating, now in progress, this to show trends and correlations of various disabilities and to study diseases by the epidemiological method, and furthermore, to compute morbidity rates for ascertaining hospital facilities, health service and future medical costs;

0) A nationwide Health Program successfully launched in these areas:

a) Adoption of a standardized medical record system for future mortality and morbidity data;

b) Adoption of a standard Pre-entrance Physical Examination Form and Annual Physical Examination Form;

c) Establishment of a centrally located agency providing drugs and hospital facilities at cost to all members;

d) Grouping Catholic hospitals on a regional basis for hospitalization of religious at standardized or near-cost basis;

e) Development of a prepaid, self-insurance health plan for participating religious communities with rates based on tables as computed from the morbidity project now in progress.

Con J. Fecher, Ph.D., C.L.U., is professor of Economics at the University of Dayton, Dayton, Ohio. With thirty years of underwriting experience with the New York Life Insurance Co. he now heads the insurance and actuarial department. Dr. Fecher is currently the statistician of the national Committee on Health Care of Religious. He is author of "Mortality and Morbidity Studies of Religious" and co-author with James T. Nix, M.D., chairman of the committee, of "If Only She Were a Little Younger," which appeared in previous issues of THE LINACRE QUARTERLY. He has published numerous articles concerned with the health of nuns in *Time*, *America*, *Commonweal* and the *Catholic School Journal* in the past thirty years.

The aim of this article is to trace the influence of the application of medical statistics on public health and in particular on health of religious.

MEMORIAL MASS . . . . . .

The annual Memorial Mass for deceased members of the American Medical Association and the National Federation of Catholic Physicians' Guilds will be offered at St. Nicholas Church, Atlantic City, New Jersey, Sunday morning, June 16. Time: 7:00 a.m. Catholic physicians and their families attending the AMA convention which begins that day are urged to assist at this Mass.