

The Use of Epidemiologic Methods in Family Practice

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Epidemiologic methods of research can be readily used in family practice. Since the 19th century, family physicians have used epidemiologic methods in making important contributions to the understanding of disease. Using these methods requires an organized practice including patient registers, encounter data, and detailed records. Descriptive studies can define certain characteristics that are related to disease. Case-control and cohort studies can provide evidence for the association of risk factors and disease. A stepwise outline for carrying out a study is presented.

Epidemiology is the study of disease in groups of people. It is a discipline of methods rather than a body of knowledge. The family physician, being the first contact for medical care in the general population, is in an ideal position to use the methods of epidemiology in the study of disease.

This paper is focused toward how the practicing family physician might use epidemiologic methods. Basic methods are described for studying disease in population groups applicable to family practice and references are provided for more detailed descriptions of research design. Emphasis is placed on studies that can be per-

formed by family physicians themselves or with a little help, not on more sophisticated studies that an epidemiologist might do on family practice populations.

Some epidemiologists make a distinction between epidemiologic research and clinical research.¹ The distinction is that epidemiologists study populations for the development of disease, while clinical researchers study patients with diseases for their progress and outcome. With respect to the family physician who relates to the general population both before and after the development of recognized diseases, this distinction is blurred. Many epidemiologists are crossing over and becoming involved with clinical research. The methods are the same provided that groups of people are studied. This paper describes basic epidemiologic methods for studies by family physicians on groups of people. The term "disease" is used in its broadest definition, ie, a state of "dis-ease," or any definable problem that a patient brings to a physician.

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Historical Precedents

Since prior to specialization virtually all physicians were generalists, much of the early descriptions of disease came from general practitioners. Because methods for studying diseases in population groups were not known, these early descriptions came from anecdotal experiences with individuals or small groups of patients.

Epidemiologic concepts and methods were developed during the late 18th and early 19th centuries. Epidemiologic methods were popularized by John Snow in 1854 in his study of cholera in London.² Since then there has been a string of general practitioners/family physicians in England who have made major contributions to the knowledge of disease using epidemiologic methods. William Budd (1811-1880), a rural general practitioner, kept careful notes and first described the mode of spread of typhoid fever.^{3,4} James Mackenzie (1853-1925) made observations on the irregularities of the pulse and greatly improved the accuracy of diagnosis and prognosis in heart disease.^{4,5} Mackenzie wrote in 1916 what is true today:⁵

The life of a general practitioner is not considered one that can help much in the advance of medicine; . . . You know well that if a man aspires to research work it is to the laboratories or to the hospital wards he is sent. As a result of my experience, I take a very different view, and assert with confidence that medicine will make but halting progress, while whole fields essential to the progress of medicine will remain unexplored, until the general practitioner takes his place as an investigator. The reason for this is that he has opportunities which no other worker possesses—opportunities which are necessary to the solution of problems essential to the advance of medicine. . . .

Will Pickles (1885-1969), a general practitioner in rural England, began at the age of 40 to carefully record data on the infectious diseases in his practice.^{4,5} From his observations he was one of the first to describe Bornholm disease (epidemic pleurodynia); he contributed to the understanding of the incubation period of infectious hepatitis (catarrhal jaundice); and he was the first to describe "farmer's lung." Pickles became the first president of the Royal College of General Practitioners and delivered the Cutter lecture at the Harvard School of Public Health in 1948 on epidemiology in country practice.⁶

More contemporary work has been done by

John Fry in England on the epidemiology of common diseases seen by the family physician.⁷ His recent text provides descriptions of common illnesses based on carefully collected data from his practice along with recommendations for management. His descriptions vary significantly from standard textbooks in which the observations were made largely on hospitalized patients.

With the development of the discipline of family practice in Canada and the United States, epidemiologic studies are beginning to be done by North American family physicians. Some of these will be cited in the discussion of methods.

Practice Prerequisites

Family physicians have unique opportunities for making observations on disease, but must have their practices organized to collect information. The methods of data collection must be simple and inexpensive to be practical for the practicing physician.

Most of the historical studies cited above were the result of the physician carrying a notebook to record observations. This simplest method has some merit but many limitations. The information will be limited to what the physician decides beforehand to record and will probably change over time.

Other methods of organizing patient information which can be used for epidemiologic study are becoming widely used in family practice. A uniform registration of all patients in a practice will provide a denominator (population at risk) to which a group of patients can be related. This registration form must contain at a minimum the age, sex, race, and date of entry of each patient. Other useful information would be marital status, education, and socioeconomic level.

The use of an encounter form for each patient visit is a very valuable source of information. It should contain at a minimum the date of visit, identification of patient and provider, and a listing of the problems dealt with during the encounter. This information can be manually collected or filed in a computer. From such encounter data, a physician can index or profile the diseases seen in practice and select certain diseases for audit or study. The most common problem with interpreting encounter data and comparing it with other

practices is the variation in number of return visits a patient may make for the same problem.

The patient register or the encounter data will provide access to another valuable source of information, the patient record. The use of problem-oriented records allows for an organized source of information that is necessary for studies.

A more detailed description of the need for and use of patient registers, encounter data, and patient records is provided by Newell⁸ and Eimerl.⁹

The use of the patient register as the denominator or population at risk can be criticized as not being reflective of the general population, or the true population at risk. Also, encounter data from one practice can be criticized as not being a representative group of all persons with a disease. These limitations must be considered for each practice when reporting observations. A discussion of the problem of appropriate denominators in family practice research is provided by Bass¹⁰ and White.¹¹

With these prerequisites, various epidemiologic methods of study can be performed by family physicians. A more detailed description of the methods described below can be found in epidemiologic texts such as Freidman¹ (highly readable and simplified), and MacMahon¹² (more detailed standard text).

Descriptive Studies

Studies which describe the nature of disease in groups of people have been the most commonly used epidemiologic method in family practice. Descriptive studies are concerned with describing relationships between a disease and certain characteristics of a population. These characteristics should be divided into the categories of: *Person* (To whom does a disease occur?), *Place* (Where does it occur?), and *Time* (When does it occur?). Personal characteristics are usually the most detailed and should include age, sex, race, and others, such as marital status, education, and socioeconomic level where appropriate.

Because family physicians have the opportunity to observe disease at its earliest stages, they may contribute greatly to the understanding of the natural history of disease. Family physicians often comment that many diseases, for example rheumatoid arthritis, look different in their offices than as described in textbooks of medicine. Refer-

ence was made previously to the work of John Fry in describing the natural history of common diseases.⁷ Other similar work by family physicians is that of Hodgkin¹³ and McWhinney.¹⁴ These are sparse examples of the vast amount of knowledge that could be obtained about the early nature of disease.

The simplest method of descriptive epidemiology is that of collecting a series of cases of a certain disease in practice and describing them as a group in relation to the characteristics mentioned above. This series should be representative of all the cases of this disease in the practice, or all the cases over a period of time, to avoid describing a biased group. These cases can be obtained through encounter data, and their description will depend on appropriately detailed patient registers and records. Recent studies of this type in family practice have been done on patients with asthma¹⁵ and low back pain.¹⁶ Both of these studies reveal disease characteristics which are different from those usually described for specialty clinic populations.

These studies are limited, however, in not describing the frequency or *rate* of the disease in the population studied. Calculating a rate requires knowledge of the population from which the patients were taken (denominator group). The rates most commonly used in descriptive epidemiology are *prevalence* and *incidence*. The prevalence of a disease is the number of cases in the defined population at a certain point in time:

$$\text{Prevalence} = \frac{\text{Number of Cases}}{\text{Study Population}} \text{ (usually per 1,000)}$$

The incidence of a disease is the number of new cases that occur in a defined population over a period of time:

$$\text{Incidence} = \frac{\text{No. of New Cases}}{\text{Study Population}} \text{ (usually per 1,000/yr)}$$

Recent descriptive studies in family practice have been done on chest pain¹⁷ and thyroid disease¹⁸ containing information on prevalence or incidence. These studies have also shown striking differences from the usual emphasis of subspecialists and have implications for the education

of family physicians. They also provide a better understanding of the symptom or disease in the general population.

If a family physician fulfills the practice prerequisites, he/she could use descriptive epidemiology to look at his/her entire practice. One study described for a single family physician: the most frequent reasons for visits, the incidence of illness in major categories for different age groups, the types of illness under a category such as infectious disease, the distribution of patients by age, number of illnesses and visits, and the distribution of referrals.¹⁹

In a major study which helped define the content of family practice, encounter data from 118 family physicians in Virginia with 88,000 patients were tabulated to describe the rank order of diagnoses by frequency, disease category, and age/sex distribution in family practice.²⁰⁻²²

Though descriptive studies can provide very important information, they fail to provide the excitement of analyzing the causation of disease or the efficacy of treatment. Two methods of analytic epidemiology readily applicable to family practice are case-control studies and cohort studies.

Case-Control Studies

When a family physician observes an apparent association between an exposure and the development of a problem, he will generate an hypothesis regarding this association. Unfortunately, he may make clinical decisions on the basis of this hypothesis without confirming it in the literature or testing it. If he does check the literature and is unable to find a satisfactory description of this association, it behooves him to test his hypothesis before making clinical decisions on it. This test may provide the first medical evidence for this association. Usually the simplest and cheapest way to test for a hypothesized association in clinical practice is with a case-control study.

In a case-control study, a representative group of patients with the problem under study is compared to a control group without the problem for differences in the frequency or rate of the hypothesized exposure. The most important part of a case-control study is the careful selection of cases and controls. This is done through the use of encounter data for the cases and the patient regis-

ter for the controls. The cases should be representative of the population of patients with the problem. The number of cases selected should be great enough to be likely to provide significant differences in the data. The size that is necessary depends on the strength of the association, and usually the minimum size group is 25. This may require a collaborative effort using the practices of more than one physician.

The control group should be as much like the group of cases as possible with respect to the characteristics of person, place, and time, differing most significantly in an absence of the problem under study. For example the controls should have the same distribution of age, sex, and race as the cases. This will avoid having confounding factors affect the results of the study, ie, factors other than the hypothesized exposure which are related to the disease and differ in the two groups. If feasible, each member of the control group can be matched to a member of the cases, giving a paired arrangement.

The results of a case-control study, if they confirm the hypothesis, are usually described as a ratio or *relative risk*:

$$\text{Relative Risk} = \frac{\text{Rate of the exposure in cases}}{\text{Rate of the exposure in controls}}$$

Though case-control studies may appear rigid and difficult, they can be done readily in family practice. The family physician performs a crude case-control study when he observes that ten patients come into his office in one day with diarrhea and a history of being at a community picnic the night before. The association is confirmed upon observing that a few or none of his patients with other problems were at the picnic. A more sophisticated example might follow an observation that many young women with elevated blood pressures are taking oral contraceptives. To test this association, now well known in the literature,^{23,24} a family physician might use encounter data to select cases of women in a certain age group with elevated blood pressure and use the patient register and patient records to select a control group with normal blood pressures. He would then compare the two groups for the rate of taking oral contraceptives.

There are numerous possibilities of case-control

studies that could be done by family physicians. Many factors that are related to the development of disease are unknown, yet exist closest to the physician who sees the earliest manifestation of disease. The psychosocial factors related to disease development are largely untested.

Though the more definitive case-control studies are performed through university centers using large groups, smaller studies, which are usually imperfect, done by single or small groups of physicians, often give the first clues of an association. Family physicians can join with local university centers and participate in collaborative studies, a model for this having been described by Hesbacher et al.²⁵

Cohort Studies

Cohort studies are generally the most valuable method in epidemiology when they can be applied. They provide the most direct measurement of the risk of disease development. A cohort is a group of people with a common characteristic, usually an exposure, that is followed over a period of time for the development of disease. The method is simply observing for certain events in the cohort chosen for study.

Because family physicians by nature follow their patients over long periods of time, cohort studies can be performed readily in family practice. These studies are usually done prospectively, and their main disadvantage is that they require waiting a period of time for results. A cohort study can be done retrospectively by selecting a study population in the past and then observing what happened over a period of time, but often the records lack the necessary consistent information.

As with a case-control study, the decision to do a cohort study is made after generating an hypothesis about an association or course of events. The decision regarding which method to use depends upon the nature of the problem and how quickly the physician wants to have results. If both are feasible, the cohort study is usually preferred since it allows a direct observation of the hypothesized association under a study protocol. In the example of the association between oral contraceptives and elevated blood pressure, a cohort study would be the selection of a group starting on oral contraceptives and following them over a period of time for the development of ele-

vated blood pressures.²³ Epidemiologic methods are complimentary and cohort studies are often done after descriptive or case-control studies.

Several cohort studies could be done at the same time by one or a group of family physicians, providing an "organized curiosity" to the practice. Some examples of cohorts for study are: diabetic or hypertensive patients for the development of complications, a group with an industrial exposure for the development of lung disease, separated couples for changes in sickness behavior, all patients over 70 years for certain problems, breast-fed and bottle-fed infants for early infection, postmyocardial infarction patients for future employment in a community. The list is endless. It is important in beginning a study to have a protocol for what patients will enter the study, what is to be observed, and how the observation is to be done. In most instances, the protocol will not be different from good medical practice and will not be an added expense.

A specialized type of cohort study is the experimental trial. Here a certain intervention, such as a drug or other treatment, is given to the cohort group and results are observed. Experience has shown that in order for the results of an experimental trial to be meaningful, a carefully selected control group should also be observed. The control group is usually given a placebo intervention. If possible, both the patients and the investigators should be blinded (unaware) as to the treatment or control groups during the intervention and observation, hence the term double-blind, controlled clinical trial. A family physician can perform small-scale experimental studies, for example, studying the efficacy of a patient education technique or a new treatment modality such as diathermy. Usually experimental studies require elaborate protocols to prevent bias and are expensive, requiring a collaborative effort with a university center. In all experimental studies, the ethical considerations and informed consent must be addressed.

Carrying Out a Study

If a family physician decides to use one of these epidemiologic methods to study a problem, he must be organized to be successful. The following steps for carrying out a study have been synthesized from Friedman,¹ Newell,⁸ and Eimerl:⁹

1. Define the problem and the question(s) to be

answered in the study. Write them down. Generate a hypothesis if appropriate.

2. Look at what is known about the problem. The regional university library or local medical society may have an information service which can be very helpful in searching the literature.

3. Write out a rough draft of a protocol or study plan. This will be modified after steps 4 and 5.

4. Obtain advice regarding the study plan. Local physicians who have done similar research can be helpful. Someone knowledgeable in epidemiology and/or biostatistics should review the study plan with respect to the necessary group sizes and data analysis.

5. Present the plan to important local persons that should know about the study, for example, hospital administrators, local health officers, and the medical society.

6. Collect the data. Be sure to have standardized forms that are used for every case. It is often helpful to pretest these forms on a few cases for unanticipated problems.

7. Analyze the data. Look at examples of similar studies for the use of tables and diagrams. Samples from this paper are: descriptive^{1,7,11,15-22}, case-control^{1,11} and cohort.^{1,11,24} Perform or have performed for you the appropriate statistical tests.^{26,27}

8. Report the data. This is usually separated into an introduction, a statement of the methods, the results, and a discussion. Again, a look at examples of similar studies is helpful.

If the hypothesis is confirmed by the study, it should be critically evaluated. What other factors might explain the observed difference or association? Could the results be due to some bias in the sampling? Virtually every study, no matter how conclusive, needs to be repeated using the same or different epidemiologic methods.

Conclusions

Most family physicians have an awareness that the body of medical knowledge in standard texts does not quite fit what they observe in practice. An understanding of basic epidemiologic methods of research that can be readily applied to family practice can make one eager to investigate this hiatus. The possibilities are vast. Applying research to patient care in order to better understand patient problems should lead to increased physician satisfaction and improved patient care.

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