Epidemiological Techniques in Home Accident Prevention

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To consider the application of epidemiological techniques to home accidents is to recognize the altered character of preventive medicine. Twenty years ago, even if sufficient information had been available on which to base control programs, not enough interest could have been aroused in the preventive aspects of cancer, diabetes, rheumatoid arthritis, and mental disorder to make possible active public health programs. The broadened concept of preventive medicine has come now to include not only these chronic diseases, but also injuries of accidental origin (*1*). Today's concept also presupposes the inclusion of control activities against traumatic injuries as a practical and reasonable part of medical and public health practice.

The Problem of Accidents

Various indices determine the relative emphasis to be placed on leading threats to health. Deaths, disability, defects, and the availability of effective preventive measures are the usual determinants. If deaths alone are considered, accidents merit serious attention, for, although the total death rate from accidents in the United States decreased from 85.5 per 100,000 population in 1918 to 59.5 in 1950, the relative importance of accidents as a cause of death has increased. In 1950, deaths from accidents ranked fourth in the United States, as compared with sixth position in 1935 (*2*).

Accidents are classified into four principal groupings according to the place of occurrence—those that happen in homes, at work, in public places, and in association with motor vehicles. Our concern here is with home accidents because they are being accepted as within the particular province of public health and preventive medicine, and because, numerically, accidents in the home make up a very large class.

Cause and Prevention

Home accidents caused over 30.5 percent of all accidental deaths in the United States in 1950. It is estimated that approximately one-half of nonfatal accidental injuries were due to home accidents—4,100,000 of a total of 9,000,000—and that 110,000 persons were left with a permanent physical defect as a result of a home accident. Thus, for every accidental death in the home, 145 persons were temporarily disabled, more than for any other class of accident, and 4 suffered a permanent impairment that varied from a minor handicap to complete crippling. Home accidents alone are ranked ninth among the leading causes of

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death, according to the National Safety Council (*3*).

Demographic data such as are mentioned above establish the significance of home accidents as a cause of death, disability, and defect. However, preventive measures and their effectiveness must be evaluated if a case is to be made for the inclusion of home accident control in public health and medical practice. Industry has demonstrated that exact knowledge of industrial accidents will show the way to effective control. All industries reporting to the National Safety Council in 1947–48 revealed a 13-percent decrease in frequency of accidents and a 9-percent decrease in severity of accidents since the base period of 1935–39 (*3*). Trends in occurrence of certain types of motor vehicle accidents have shown a marked improvement as the result of selective control measures made possible by intensive study of the circumstances of accidents. In Massachusetts, for example, holiday automobile accidents happened twice as often during the evening hours as during the morning hours, even though the same number of drivers were on the road at these two peak periods. Also, specific streets and intersections had higher than average rates. On the basis of this information, police officers were stationed at prescribed places at definite times—with a resultant favorable accident record never before attained on holidays (*1*).

These control examples in other classes of accidents emphasize that similar epidemiological knowledge of home accidents is yet to be gained. Just as a few centuries ago ignorance of cause led medical practitioners to ascribe disease to demons, so today we blame bad luck or chance for accidents. Accidents have specific causes, just as have the communicable diseases. Public health has long since abandoned blanket control measures as nonproductive and expensive. What is needed is sufficient knowledge of the three interlocking elements in causation—the host, the agent, and the environment—to permit the application of specific, pinpointed preventive measures.

There is no single cause of accidents in general, nor of any one type of accident (*1*). An approach to the predominant element of cause is made most readily by the method proved useful in the control of communicable diseases and which is now being applied to chronic diseases—the epidemiological method. As applied to home accidents, the epidemiological approach is simply the collection and analysis of all the facts about accidents in a given community—when and where home accidents occur, how they occur, and to whom the accidents happen (*4*).

Methodology of Mass Study

To date, our epidemiological approach to cause in home accidents has suffered from several mistakes in methodology which have made sincere efforts of limited value. First, too great emphasis has been placed on analysis of deaths from accidents. Important as this analysis is, it ignores the critical information to be obtained from the study of nonfatal accidents. If the epidemiological study of diphtheria had depended solely on autopsy findings and the circumstances of deaths from diphtheria, our present knowledge would be sadly deficient. Accidents, too, show a gradient of disease or injury as a result of a prescribed exciting cause—a similar occurrence may lead to loss of life in one individual and, in another, to no more than a loss of equanimity. Only a concerted study of all accidents—those resulting in minor injuries as well as those with major sequalae—will permit a real knowledge of cause.

Second, too many facts about accidents have been gathered haphazardly without well-defined epidemiological objectives, and have been put together with no regard for the varying predominance among causative factors, of the behavior and characteristics of the person suffering the accident, the site of the accident, and the immediate agent giving rise to the event.

Third, in formulating local control programs, too great dependence has been placed on national statistics. Home accidents vary from community to community, depending upon occupation, age of population, housing, economic resources, geographic area, and many other factors. General principles in analysis and prevention may be similar in different areas, but only concentration upon its own home accident occurrence will enable an area, a city, or a State to define its individual situation and thus apply specific control measures.

The task, therefore, is to evolve practical methods that can be used by an individual community to determine the causes of its home accidents. Upon a firm basis of epidemiological knowledge of the disease, control can be built.

There are, of course, a number of ways of going about the epidemiological investigation of home accidents, especially those that are not fatal. There are, also, practical limitations of time, personnel, and funds which face the health department and other community groups which wish to move forward in this important sector.

Experience suggests that when substantial funds are not available, the studies that can be undertaken are limited to such things as collection and analyses of mortality statistics, hospital records, and reports obtained by nurses and sanitarians in the course of their routine visits to the homes in the community. Certainly these inexpensive studies are not complete, nor a cross section of a community problem, but they are indicative of some of the major factors at which preventive measures must be aimed. Any sample survey large enough to be statistically significant within the variance desired becomes an expensive item and, in most cases, can be undertaken only by a few health agencies fortunate enough to obtain supplementary funds for such a project.

Several of the more promising epidemiological approaches to home accidents are described in the following paragraphs. We have had experience in the use of several of these techniques in the community, and others are now being tested.

Mortality Analysis

Although we have criticized the restriction of epidemiological studies of home accidents to mortality data, we do not deny their importance. As a matter of fact, this is a logical point of departure for the community wishing to know the facts concerning accidents occurring locally.

A statistical analysis of accidental deaths during the past 10 years, compiled from death certificates, forms an essential base line for future evaluation of control programs as well as giving some indication of serious hazards in the area. A continuing record of home accident deaths as they occur in the community should be maintained by the health department. Information contained on death certificates is insufficient for this purpose. The State of Kansas and Nassau County (New York) have demonstrated that information about all the circumstances of a fatal home accident, collected from families, physicians, and others concerned with a case, adds immeasurably to epidemiological evaluation.

The "Home Accident Fatality Report," prepared by the National Office of Vital Statistics, Public Health Service, is an important means of developing systematic information on home accident deaths.

Definitions and Terminology

The design of a study of nonfatal injuries in a community involves serious consideration of and decision on several perplexing definitions. For example, what is an accident? A dictionary definition is insufficient. Shall intention rule out a case? Most of us consciously take actions fraught with calculated or undefined but appreciated risk. How shall we dispose of the unsafe act resulting in no injury? Shall resultant injury determine the occurrence of an accident? And, if so, how shall "injury" be defined?

The National Safety Council's definition of an accident excludes any event which results in disability of less than 1 day. Use of this definition has led to uncertainty in many cases. For instance, age greatly influences disability resulting from accidents. A prescribed event may disable an elderly lady for a week or more, but at most may only inconvenience a young child. Furthermore, occupation may determine the degree of disability. An executive who fractures a metacarpal may not miss a day's work. He is able to dictate his letters as usual, but such an injury is incapacitating to a typist in his office.

Other terms requiring definition are: the home; the usual place of residence; the determination of duration of risk in the home; the inclusion of visitors in the list of persons exposed to risk; and indices of economic status and reliability of informants.

Each of these terms needs to be defined prior to an individual study, even though no universal definitions are sought. The important consideration, if confusion is to be avoided, is clarity in definition of terms and agreement among all workers on the type of information to be included before actual collection of facts is undertaken.

Studies of Nonfatal Accidents

The kind of study selected by the community to determine the epidemiological facts of nonfatal accidents will depend on the method of finding cases, and upon the finances and personnel available. The survey may include only one or a combination of case-finding methods.

Hospital Admissions

Community hospitals in many areas are most cooperative in aiding health departments in home accident studies. A continuing study of admissions to out-patient treatment and to in-patient wards may profitably be utilized to assess the circumstances of more serious home accidents. Hospital records alone usually do not supply the needed epidemiological data, but can be enlarged by an accident history obtained from the patient or from a member of his family, by study of the site of the accident, and by cooperation of the attending physician.

The number of accidents and the relative gravity of the injuries suffered by patients admitted to hospitals will vary from one community to another, depending on availability of hospital facilities, economic status of the population, and customs of the community in seeking hospital treatment. However, a sample drawn from hospital admissions is always highly selective and is not representative of all home accidents occurring in the community. To study hospital admissions alone, as to study deaths alone, is to underrate greatly the medical, economic, and social seriousness of the problem (*4*).

Health Department Routine Activities

A reasonable compromise in epidemiological technique for the health department with limited funds and personnel is to include a home accident survey in the activities of health department employees making routine visits to homes. If other surveys, such as housing, are being conducted by the health department, home accident investigations may easily be added, and may be carried on by the personnel doing the primary survey.

Even better, however, is to have the nurses of the health department and visiting nurse association include—as part of their regular home visit procedure—questions about accidents occurring in the home during the past month. Although a sample drawn from clients of public health nurses rarely will be representative of the total population of the community, this disadvantage is balanced to some extent by extensive knowledge of accidents that occur in that portion of the population in which the health department subsequently may be conducting an accident control program (*5*).

In certain areas in Massachusetts, nonprofessional personnel have been used for studies of this type. We have not accumulated sufficient experience to show the relative value of data so collected and data obtained by professional workers.

A convenient form for recording epidemiological data is used. The household roster is used to calculate the number of persons at risk. All survey workers must be fully informed about the accident problem, the objectives of the study, the definition of terms, and the use of the record form. Each investigator should be provided with a code to the record form.

Extensive Study of Home Accidents

The objective in an extensive study of home accidents is to determine the distribution of accidents in a representative sample of the population, and the controllable causative factors in accident events. Professional investigators are utilized in such a study. Since only one visit is made to designated households, only information on major home accidents is sought. A practical criterion of gravity of injury is whether or not the person was under medical care.

The purpose of this type of study is to provide basic facts about the home, the family, and major home accidents during the preceding

year. Additionally, the information obtained is perhaps the best guide in selecting a sample for the intensive type of study next described.

Granted an adequate sample, the accident prevention program may be planned on information collected in the first year of the study. Continued observations over a 3- to 5-year period would add to knowledge of causation, and, most importantly, serve to evaluate the accomplishments of control measures. However, this approach—as in the case of the intensive investigation described below—requires a substantial investment in time and funds for study design, field work, and analysis and interpretation.

Intensive Study of Causation

Essentially nothing is known to account for the frequency of home accidents in a given population. No adequate data are available concerning the characteristics of the population at risk, the actions and characteristics of the victims of accidents, and technical analysis of the environment in which accidents did and did not occur.

A study designed to obtain data and to assess these features in accident causation would include periodic visits to selected families. Ideally, the group would be made up of a random sample, but a more practical aim is a smaller sample, obtained by stratification or other means to assure that it will be closely representative of the community. The size of the sample is determined by numbers of available investigators—possibly including public health nurses and sanitarians, the frequency of observations, the bulk and variety of information desired, and the limits of variance that will be acceptable in the final results.

The interval between visits is necessarily short if the objective is to record all unforeseen events resulting in physical injury, as determined by specific signs or symptoms. The householder's memory of minor injuries is limited.

Since this type of study is based on the family, transient visitors are excluded, because the essential data on units of exposure to risk is difficult to obtain. However, visitors in the household who spend a period of time equivalent to the interval between inquiries or accidents are included.

Summary and Conclusions

A case is presented for the inclusion of home accident prevention as a major activity of health departments and physicians. The argument rests upon the accident toll in terms of death, disability, and defect.

Specifically directed prevention based on an understanding of cause has proved effective in communicable disease control and is now being utilized in chronic diseases. The epidemiological method of analysis of multiple causation is a recognized part of the study of mass disease and the practice of public health. It should be recognized equally in the approach to mass injuries as a community health problem.

Several techniques of epidemiological study of home accidents are presented as a means to better understanding of home accident causation, and hence, an improved record in deaths, disabilities, and economic loss for the community.

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