Editorial

The Framingham Study

An Epidemiological Approach to Coronary Heart Disease

FOR MANY YEARS atherosclerosis and diseases related to it were considered the inevitable result of the "aging process." Those seeking to discover possible causes of atherosclerotic disease were considered members of Mencken's "Cult of Hope," striving to find solutions to insoluble problems.

In spite of the pessimism surrounding atherosclerotic disease, an increasing number of intensive investigations involving clinical, laboratory, and epidemiological research have greatly advanced our understanding of the nature of this disease and its determinants. Through epidemiological studies in particular, much has been learned concerning the circumstances under which coronary heart disease arises and flourishes. Such studies have also provided a basis for the development of preventive programs in coronary heart disease, the major adult health problem in the United States.

The Heart Disease Epidemiology Study of the National Heart Institute in Framingham, Massachusetts, was one of the first to undertake successfully a detailed epidemiological study of this disease. An abortive attempt to undertake a population study of heart disease had been previously made by Sir James MacKenzie in 1920, but because of the limited resources available it was abandoned.

International epidemiological studies, necessarily limited to gross observations, provided indirect evidence that certain host and environmental characteristics were related to the reported death rates from coronary heart disease in different geographic areas. The findings of these studies provided a stimulus for more definitive investigation of a number of factors in relation to the development of this disease.

Armed with a number of hypotheses derived from such studies, combined with observations from clinical medicine, the Public Health Service through its National Heart Institute established a center for the prospective investigation of factors possibly related to the development of coronary heart disease and hypertension. This study was established in Framingham, Massachusetts, in 1949 and has continued its surveillance of the Framingham population up to the present time.

The rationale for the study, its organization, and the methods employed were reported in detail early in the study. In brief, an adult population was selected by random sampling methods. This study population was examined and various characteristics were described. The population was then classified on the basis of pertinent characteristics and the rates of development of disease determined in the different subgroups. From this approach the incidence of the disease could be determined and the importance of various personal habits and traits in the development of coronary
heart disease assessed. It was also anticipated that a more complete picture of the natural history of this disease would eventually emerge.

The initial expectations of this study have been largely fulfilled. Although, to date, not much light has been shed on the epidemiology of “hypertension,” many important associations between the development of coronary heart disease and host and environmental factors have been clearly established. The first conclusions, based on very small numbers of subjects developing the disease, were available after 4 years of follow-up.4 Further surveillance of the population sample has supported the original observations and has at regular intervals added further information by assessing additional factors, new hypotheses, and the details of the relationships already established.5

Credible data on the incidence of coronary heart disease, including asymptomatic as well as overt manifestations, are obtainable only from epidemiological studies of general populations. The Framingham study has been one of the few sources for accurate data on the incidence of the various manifestations of coronary heart disease.

The major objective of an epidemiological investigation is to determine the characteristics of those persons who are especially susceptible to the disease under investigation. The Framingham study has clearly demonstrated that certain attributes are strongly related to the development of coronary heart disease. Included are elevated lipid levels, elevated blood pressure, excess body weight, lack of physical activity, the cigarette smoking habit, low vital capacity, gout, and diabetes. When more than one of these “risk factors” were present, a marked increase in susceptibility was found. In addition to establishing the importance of various risk factors, it has been possible to demonstrate their independent contribution and interrelationships and to make some inferences regarding their mode of action.

For persons otherwise predisposed to coronary heart disease because of hypertension, elevated lipid levels, or diabetes, who showed evidence of certain electrocardiographic abnormalities not currently considered diagnostic of coronary heart disease, the risk of developing overt disease was extremely high. These electrocardiographic abnormalities may represent myocardial involvement due to ischemia.

From observations in the Framingham study it has become clear that by using ordinary office procedures the physician can readily identify coronary-prone individuals as well as those with asymptomatic disease. The nature of the risk factors identified suggests that appropriate, safe, and reasonable preventive measures may be applied which may delay the onset of overt disease.

Knowledge of the natural history of coronary heart disease obtained from the Framingham study has served to emphasize the need for a preventive approach. The high rate of sudden death and the frequency of unrecognized myocardial infarction, which has proved far from innocuous, indicate that a therapeutic approach alone is insufficient.

In addition to identifying factors which relate to the development of initial attacks of coronary heart disease, it has been possible to explore circumstances possibly precipitating attacks in predisposed individuals and those affecting survival once an attack occurs. Factors precipitating heart attacks and those adversely affecting survival were not necessarily those related to the development of the underlying process, although the more severe the coronary artery atherosclerosis, the more likely was the attack to be fatal.

The relative success of the Framingham study in meeting its objective served to spark a whole series of prospective studies designed to investigate chronic disease in general and cardiovascular disease in particular. Many studies in dissimilar populations have served to confirm and extend the Framingham observations, emphasizing the fundamental biological nature of the relationships established.6-8 In 1962, in conjunction with the Albany heart study, it was possible to examine jointly the relationship of cigarette smoking to risk of coronary heart disease in great detail, adding much to the understanding of the
relationship of this habit to development of the disease. Similar efforts to pool and combine the results of prospective epidemiological studies are underway.

As is generally the case, investigations in Framingham have raised almost as many questions as have been answered. The details of the relationships established are now being explored in an effort to establish the independent contribution of these multiple interrelated factors to development of disease and the mechanism involved. At present, the etiology of the disease appears to be multifactorial with no single essential factor yet identified.

Periodically new hypotheses have been developed and the additional observations necessary have been recorded. Additional follow-up will be required to assess the relation of factors recently introduced (for example, pre-beta lipoprotein, triglyceride, emotional stress, physical fitness, and clotting factors among others) to development of the disease.

As time has passed, the population has aged sufficiently that strokes and peripheral vascular disease are developing in increasing numbers. Factors predisposing to these manifestations of atherosclerosis are already being identified. The investigation of the several major manifestations of atherosclerosis is being actively pursued.

The Framingham study has demonstrated that the prospective epidemiological approach in chronic disease is of value. This intensive, careful study of a relatively small population group should continue to provide useful information concerning the nature of atherosclerotic and hypertensive disease for many years to come.

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References
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_Circulation_. 1966;34:553-555
doi: 10.1161/01.CIR.34.4.553

_Circulation_ is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
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