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PREVALENCE OF CORONARY HEART DISEASE

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A. General Considerations

The incidence, prevalence and mortality rates of coronary heart disease (CHD) should not be confused but they are all expressions of the relative frequency of the disease and undoubtedly they are closely correlated. Below, the expression "frequency of CHD" will be used, with the understanding that it refers to the age- and sex-specific rate of any of these measures at ages under 70 unless more precise specification is indicated.

Differences between populations and population groups in the frequency of CHD provide clues as to etiology and a basis for the hope of prevention. Undoubtedly there are great differences in the frequency of CHD. For example, it is far higher in the U. S. A. and Finland than in Japan and among the Negroid peoples of Africa, the general order of the difference being perhaps 10 or even 20 to 1. Populations in Italy, Spain and Sweden, the Japanese in Hawaii and the Cape Coloured people of South Africa would seem to be examples of intermediate frequencies of CHD.

However, at present it is not possible to specify the magnitudes of these differences much more precisely and we cannot safely conclude that there is a difference between two populations unless the frequency of CHD is indicated to be something like 2 or 3 times as great in the one than in the other. This places a severe limitation to the incorporation of epidemiological information into the body of data from all sources that can be used in deductions

about CHD. Since key information for such deductions can come only from epidemiological data it is important to consider how better data on the frequency of CHD can be obtained.

In the past, vital statistics on the frequency of CHD in different populations were of questionable comparability in many cases and in spite of much recent improvement serious questions about diagnostic criteria and customs remain. Mortality rates for the sum of all causes of death are reasonably accurate for many countries but little reliance in detail can be placed on vital statistics for population comparisons in regard to frequency of CHD unless these are supported by other evidence. It is helpful, of course, that for certain groups, such as men aged 50-54, the mortality from CHD is so great in the U. S. and some other countries that it dominates the total mortality picture.' Hence, for example, when we observe that the total mortality rate for men aged 50-54 is lower in some countries than in the U. S., it is reasonable to conclude that the low rates of CHD reported by those countries are probably not simply gross underestimates. Such evidence helps to establish the fact of relatively low frequency of CHD in Southern Italy and Japan, for example, but still leaves much uncertainty about precise frequency. It cannot be decided now whether, in fact, the frequency of CHD in Southern Italy is twice or five times that in Japan.

Finer discrimination of frequency of CHD from vital statistics may be possible in comparisons within a population, say between sexes or between ages or between social, economic or occupational groups who are served by the same medical establishment--doctors with the same training and customs and a common system of certification. In some countries it is

probable that distinction could be made with fair reliability between populations of regions that might actually differ by no more than, say, 50 per cent in frequency of CVD. This requires a high degree of uniformity of medical practice and the customs and abilities of the physicians in the several regions. This situation may exist, for example, in Finland and some other parts of Scandinavia and possibly in parts of Italy and Japan.

Dependence on autopsy findings may be suggested as the best method for making sure comparisons between populations. While autopsy data are valuable, for such comparisons they are generally subject to severe limitations. Even when reasonable comparability of post-mortem examinations and pathologists' reports are assured (and this is in itself difficult), the necessary assumption that the population coming to autopsy is a fair sample of the general population is seldom justified. In most parts of the world only a very small proportion of all persons dying come to autopsy and those who do so are demonstrably not a good sample. The autopsy sample is generally heavily weighted with the indigent, with medico-legal cases, with clinical problem cases, and with the effects of personal interests (and bias) of the pathologist and the attending physician.

The attempt may be made to estimate the relative frequency of CHD from the prevalence in hospital populations. Mere comparison of admission or discharge records of individual hospitals are probably worthless in most cases. However, if all, or almost all, hospital patients of each region are included in a survey and if the hospitals are freely used by the general population of the region, such comparisons should have at least suggestive

value. And if the diagnoses attached to the patients are actually checked by independent experts, the result may have considerable value.

But hospital patients at best only represent a fraction of the total morbidity of the population served by the hospital and the question of bias in the use of the hospital by different classes and in the admission of patients with different ailments must be carefully considered. Obviously, age and sex standardization of the patient population is essential. In the question of the relative frequency of CHD some of the possible bias may be removed, or at least lessened, by comparing the relative prevalence of hypertensive and of CHD in the hospitals. For example, in a survey of the medical departments of a considerable number of general hospitals in Boston, Mass., and in Minneapolis and St. Paul, Minnesota, the ratio of CHD to hypertensive heart disease patients was about 2 to 1 but in the corresponding medical departments of a large number of general hospitals in Italy the ratio was about 1 to 4 so that, seemingly, CHD is some 8 times more prevalent, in comparison with hypertensive heart disease, in these U. S. communities than in Italy. The implications are of considerable importance, though these findings alone merely suggest either of two alternatives: the frequency of CHD is excessive in the U. S. cities or that of hypertensive heart disease is excessive in Italy.

But it is clear that other means should be sought to obtain objective information of the frequency of CHD in populations. Since mortality and hospital prevalence data are apt to be either questionable or incomplete or both, and since autopsy data may be seriously biased (or almost unobtainable in many areas), we are forced to conclude that:

1) All of these sources of evidence must be used concurrently and judgment suspended unless all produce essentially the same picture, and

2) Objective surveys must be conducted either on properly selected samples of whole communities or on essentially all persons of given age and sex of whole communities selected as samples.

It is difficult to decide on a sample that is actually random or properly stratified in all matters that may be related to such a disease as CHD. Even if such an ideal sample were selected it may be impossible to secure cooperation of all or almost all of the persons selected. Actually, it may be easier and safer to select a few communities as samples of a larger population and then to attempt to study all of the persons in those communities who are of appropriate age and sex. This method would seem suitable for first trial in areas where towns are not so large as to make unwieldy units. Carried through properly, this would at least assure reliable data on the frequency of CHD in the communities concerned. If other characteristics of those communities were studied in parallel, at least some important interrelationships should emerge. In other words, the relationships between frequency of CHD and other characteristics of populations could be examined even though the communities studies were not representative of the whole countries or regions in which they exist.

B. Outline of Proposed Plan

It is proposed that, initially at least, attention be concentrated on men aged 50-64, inclusive. In a high CHD area such as in the U. S. or Finland, if all men of that age were examined it may be estimated that evidence

of CHD would be found in something like 60 men per 1000, that blood pressure over 160/100 would occur in perhaps 200 per 1000, and that one or another definite abnormality of the electrocardiogram would be found in perhaps 150 per 1000. It can be shown, then, that if 1000 men of this age in another population were examined the two populations could be considered to differ, with $P = 0.05$, if only 45 men in the second population were found to have CHD. And if only 500 men were examined, a CHD yield of about 19 (i.e. 38 per 1000) would be significantly lower (at $P = 0.05$) and any fewer than this would show a difference of still greater significance.

Accordingly, to show a difference in frequency of CHD compared with the U. S., of any population in which the frequency of CHD is of the order of half or less that of the U. S., examinations on about 400 men of this age should suffice. This is a crude estimate but it seems clear that it would not be necessary to deal with impossibly large populations of men to be examined. The following brief outline suggests a possible plan.

1) Select communities or regions that will each contain a total of from 500 to 1000 men aged 50-64 and where it may be hoped to develop the necessary co-operation.

2) Obtain a roster, accurate to within 5%, of all the men of the age in the population, including those who are ill, retired, etc., as well as those at work. Do not include transients.

3) Get at least some information about apparent health on not less than 95% of these men and actually see not less than 90% of them, including especially those who are not at work or about whom there may be some question of health.

4) The men seen should have a physical examination, 12-lead E. C. G. and history. The schedule could be limited to items that may reveal CHD and the findings should be recorded in an objective check list, with special notes where needed, covering B. P., heart sounds, rales, edema, dyspnea, orthopnea, nocturia, pains in the chest, arm, hand and throat, etc., as well as the detailed information to be had from the E. C. G. A brief step test followed by a 3-lead E. C. G. would be desirable. For those men with suspicious findings, such special procedures as may be indicated and possible should be applied (e. g. eye grounds, qualitative urinalysis, Wasserman, etc.). Also record height, weight, skinfolds, bi-cristal and bi-acromial diameters and get notes on smoking, occupation and personal idiosyncrasies.

5) Blood samples for cholesterol (total and beta) should be secured from all men suspected of CHD and from a random sample of the order of N = 50 of those judged clinically healthy.

6) All death certificates in the test region for men of the age under study for a previous 2 years should be examined. Where indicated and possible, there should be an attempt to get fuller details from the attending physician and the family.

7) Arrangements should be made to carry out a dietary survey on a sample of the community, emphasizing % fat calories with specifications of type of fats. If possible the survey should be repeated in at least two different seasons.

Such a program would require careful planning and preparation of the community, great attention to developing proper public relation and enlisting the active support of all community leaders. The actual work with the men should not start before the ground is thoroughly prepared, every detail

meticulously examined and real security obtained about the cooperation to be forthcoming. This would probably entail numerous visits to the community over a period of many weeks. In the actual prosecution of the work, participation of local physicians and others known and liked in the community should be provided.

A rough estimate of the staff and time required for the active phase of the work in one such survey would be two internists, one nurse or technician, two dietitians, a chief of operations and several local aides all engaged for a working time of four or five weeks. The preparatory work on the spot might mean the equivalent of ten or twelve days for two persons, presuming that success would be achieved in enlisting local volunteers to help. Equipment needed would include one or two electrocardiographs, a small centrifuge, tubes, racks, needles and syringes, recording paper and forms, 2 sphygmomanometers, anthropometric devices, and, if possible, equipment for paper electrophoresis to handle a load of 20 or 30 samples (in duplicate) a week. Where syphilis is prevalent, provision would be necessary for Wasserman or other blood test. An automobile would be essential.

C. Regions for Consideration

Regions should be selected that appear to have greatest potential interest and where the practical prospects for full cooperation are greatest. This requires intimate knowledge of local conditions and psychology plus exploratory visits and discussions. Obviously attention should be concentrated on such regions as promise to afford the sharpest contrasts in frequency of CHD, in habitual diet, and in other factors that may be related to

the development of CHD or are deemed worthy of examination. Relative stability and homogeneity of the populations should be considered.

Regions that have promise in these regards appear to be found in Italy (South and North), Finland (East and West), Greece (Crete), Japan (Kyushu), Yugoslavia, Sweden and the Netherlands. In the U. S. suitable populations could be organized for study in several regions, including Minnesota, upper New York State, Massachusetts and elsewhere.

Japan and Southern Italy (including Sardinia and Sicily) seem to be important because of the indications of very low frequency of CHD. Finland seems to be important because of the indication of high frequency of CHD in rural populations with important differences between East and West. Northern Italy, and more particularly the Po Valley, affords a contrast, in comparison with the South, in apparent frequency of CHD associated with dietary differences. Crete and certain areas of the far South of Italy are interesting because diets high in total fat but low in meat and dairy fats are prevalent. The various regions in the U. S. all seem to be high in frequency of CHD, though some differences may actually exist, and high in diet fats with the fats running to a common pattern. Sharp contrasts must be sought elsewhere.

In any case, uniformity of methods and analysis is essential for all regions selected for study.