

Studies Bearing on Coronary Heart Disease in South African Populations *

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SUMMARY

In South Africa, populations may be observed in various stages of transition from primitiveness to sophistication. Among them there are different prevalences of coronary heart disease (CHD); it is very common in Whites, somewhat less common in Indians, but remains rare in Bantu. Information on these populations is presented in relation to expectation of life and age structure, prevalences of serum cholesterol level, hypertension, overweight, smoking, physical inactivity and stress. It is considered that risk factors, in respect of CHD proneness, do not have the same connotations of noxiousness in different populations. In seeking to avoid the ill-effects of CHD risk factors, it is considered that the likelihood of persons, particularly the young, significantly altering their habits to reduce or delay CHD, is very remote.

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It is customary for a speaker to acknowledge that he is honoured in having been asked to address a gathering of this eminence. I feel I have been awarded a double honour since I am neither cardiologist nor clinician, but a laboratory worker, who, over many years, has been privileged to carry out numerous studies in the field. My primary interest is nutrition, not only as it affects biochemistry and metabolism, but as it influences, indeed controls, the prevalence of several diseases. On the one hand there are the diseases of deficiency, which occur principally in our non-White populations, and include protein calorie malnutrition (marasmus, kwashiorkor), rickets, scurvy, and pellagra. On the other hand, there is nutritional excess, which promotes many conditions or diseases of major public health importance, not only in affluent societies, but in the more privileged section of developing populations in urban areas. Such problems are obesity, hypertension, diabetes, coronary heart disease, and certain types of cancer.

I have depicted a very wide field of endeavour which involves enormous work even in keeping abreast of the relevant literature, apart from trying to make studies in depth. However, firstly, I have been engaged in research for approaching 30 years; and secondly, I and my assistants are full-time investigators.

I will now describe some of our work bearing on coronary heart disease (CHD) in our South African populations.

THE AGE STRUCTURE OF SOUTH AFRICAN POPULATIONS

The first risk factor in coronary heart disease is age; it is the only known factor against which no avoiding action can be taken. The question arises, what are the age structures and what are the respective expectations of life in our different populations? Without accurate information on these aspects, it is difficult to make satisfactory comparisons of prevalences of conditions or diseases.

Whites

South African Whites compare poorly with most western populations. Some values for expectation of life for males and females are, South Africans, 65 and 69 years; USA Whites, 68 and 71 years; Swedes, 70 and 75 years. The poor showing of South African males has been ascribed to the high mortality rate among young men from road accidents, and among our men of young middle age, from coronary heart disease.

It would be wrong to think that given time, the adverse mortality situation in South African Whites will necessarily improve. In the USA, Burch¹ has recently shown that mean expectations of life at birth of both Whites and Negroes reached plateaux 20 years ago. Yet the figures for USA Whites are some years lower than those for Swedes.

The situation, however, is even more sombre than what has been depicted. Expectation of life of Whites, not at birth, but at late middle age, has risen only very slightly in the last 300 years. At 60 years the increase has been 4-6 years; at 80 years, less than a year. In most western populations, death rates fell continuously until about 1950. Yet by 1959, in 22 countries in Europe, death rates had risen in 8, and by 1969, in 16 countries. This alarming situation is only partially explicable on the basis of lower child mortality, smaller families, and the ageing of populations. It would be unwise to expect that knowledge of how to control or retard our 'killer' diseases will necessarily become available in the near future. However, even should the requisite information be forthcoming, it is necessary to recognize that were all deaths from cancer and cardiovascular-renal disease eliminated, the increase in expectation of life would not be very great; Burch has noted that in the USA, the elimination of deaths (both sexes) from these two causes, would increase current expectation of life at birth only by 1½ and 7½ years, respectively.¹

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Briefly, the mortality situation among our White population compares poorly with that of many White populations overseas, and there is little likelihood of improvement in the future.

Bantu

Expectation of life at birth, calculated to be roughly 45-50 years, is much lower than that of Whites. Yet differences in respective age structures after middle age, are small. In the 1970 census, in populations of 50 or more years, the proportions which exceed 70 or more years are, Bantu, 21%; South African Whites, 20,5%. If aged populations only are considered, Bantu are superior in longevity; proportionately, there are about twenty times more centenarians among Bantu than Whites. The still high mortality rate among very young Bantu, with consequent lowering expectation of life at birth, obscures the large proportion of long-living Bantu.

Indians

In age structure and expectation of life at birth, the Indian population differs considerably from that of Whites and Bantu. Among rural Indians in India, one large study made in 1951 in Mysore, showed that the first 10 causes of death were infections.² Expectation of life at birth was 52 years; at 5 years it was 56 years. Of those over 50 years, 14% were 70 or more years. In South African Indians, the corresponding figures in 1970 were roughly 58 years, 59 years and 10%. Hence, from 5 years onwards the local Indian population, which enjoys much better economic circumstances, has very little life expectancy advantage over the indigent rural Indian population in India; causes of death have simply changed from infections to degenerative diseases. For the segment at middle-age and beyond, local Indians are worse off than their compatriots in India. This adverse situation also prevails with the Malay population. In Bosmont, Johannesburg, there is a large middle-class population of these people, among whom three-quarters or more have cars and Bantu servants; yet of those of 50 years and over, only 8% reach 70 or more years. Corresponding proportions for Bantu are 21%, South African Whites 20,5%, and British 26%. Thus, South African Indian and Malay populations in Johannesburg have a diminishing expectation of life at middle age, which is apparently more marked than that of any other known population.^{3,4} Indeed, the only other population among whom expectation of life at middle age has been shown to be decreasing to a less marked degree, is the Jewish population in the USA.⁵

CORONARY HEART DISEASE MORTALITY SITUATIONS IN WHITE, INDIAN AND BANTU POPULATIONS

Whites

South African Whites have a very high mortality rate from CHD. No good CHD prevalence study has yet been made in this country. In 1962 we carried out a small

investigation on the personnel of a motor company. ECG studies yielded results which were consistent with the high CHD mortality figure mentioned. An inquiry was made of death certificates of White persons in Johannesburg who died from CHD during 1962: our observations again underlined the high mortality from CHD, and indicated, moreover, that the Jewish moiety was especially prone to succumb to the disease.⁶ In 1971, in this city, in White males of 55 to 64 years, mortality rate was 885 per 100 000. Current corresponding figures for USA, Australia, and England and Wales, were, 906, 894, 673, per 100 000.

Indians

Death certificate data were obtained for Indians dying from CHD in Johannesburg in 1962.⁶ In Rustenburg, in 1966, ECG and clinical studies were carried out by Professor H. C. Seftel on virtually all Indians (namely 55) of 50 or more years. The results in both types of investigations, together with the information given by Professor J. Wainwright on Indians in Durban, leave no doubt that the CHD problem in this ethnic group is of much the same severity as that prevailing among South African Whites. There is one distinctive difference. In India, atherosclerosis, when severe, appears to develop a decade earlier; moreover, peak mortality from CHD also occurs a decade earlier. In one large series, it was reported that 95% of mortality from CHD occurred in the 45-59-year-period; the corresponding proportion for South African Whites is about 40%. Information available on Indians in Durban is in agreement with earlier CHD noted in India.

Bantu

To illustrate the prevalence of CHD, the best perspective in urban Bantu may be arrived at by considering the population in Soweto, Johannesburg, and calculating how many cases of CHD would be expected to occur annually in a White population of the same size and age structure. Employing information published on several series of Whites overseas,⁷ then among the 90 000 persons in Soweto aged 50-59 years, 600 cases of CHD would be expected. Among the 15 000 aged 60-69 years, 375 cases would be expected. Among 7 500 of 70+ years, 225 cases, thus making a total of roughly 1 200 cases or sudden deaths from CHD annually. The accuracy of this figure is not important. What is the actual CHD situation among the Bantu population in Soweto? At Baragwanath Hospital, according to Dr A. Schmaman, there are still only 2-3 deaths from CHD per annum. At the non-European Hospital in Johannesburg, according to Professor H. C. Seftel, there is about one case or so per month. Deaths from CHD in Bantu in Cape Town and Durban are also very rare. Thus, CHD is still very uncommon among urban Bantu. In one investigation on 296 Bantu 'pensioners' (60+ years) made in 1963 by Professor H. C. Seftel and Dr K. J. Keeley, only one person with an obvious infarct was detected.⁸ More recently my group has carried out ECG studies on a random population, 259 males and females aged 60+ years, at Zola, Soweto,

and on a group of elderly people (244 persons) in villages near Rustenburg. Results confirmed that CHD is very uncommon in these people.

THE ENVIRONMENTAL RISK FACTORS IN CORONARY HEART DISEASE

With this information on the age structure and the current CHD mortality situation in three of our ethnic populations, it is now proposed, briefly, to discuss the respective positions regarding the CHD risk factors; serum cholesterol level, blood pressure, weight, physical activity, smoking and stress. Each will be touched on generally, and then discussed in relation to our own observations.

Serum Cholesterol Level

In numerous cross-sectional and prospective studies on White populations in the USA and Europe, the foremost discriminating variable is level of serum cholesterol. For example, in one investigation on middle-aged men in Gothenburg, Sweden, the quintile with the highest levels of serum cholesterol, had a CHD incidence 5-7 times that of the quintile with lowest levels.

I wish to emphasize that a given cholesterol level does not necessarily have the same connotation in respect of CHD proneness in different parts of the world, or even in different parts of the same country, for there are differences in mean values of persons with CHD in different parts. In studies on groups with infarction, mean values have been given as 265 mg/100 ml in the USA; 270 mg/100 ml in Oslo, Norway; 258 mg/100 ml in Norwegian mountain valleys; 223 mg/100 ml in Norwegian coastal villages; 203 mg/100 ml in Naples; and 195 mg/100 ml in India. These differences are not due simply to differences in methodology; I believe that a given cholesterol level may have a serious prognosis in one setting, but be relatively innocuous in another.^{9,10}

Our studies on South African populations may be summarized as follows. In fairly representative groups of persons of 30-39 years, we found proportions with values above 220 mg/100 ml as follows; Whites, 55%; Indians, 45%; urban Bantu, 25% and rural Bantu 10%. The proportion for Whites is much the same as that reported in the study at Framingham, 58%. Our values for Indians are similar to those published for Indians in Durban and Kampala, and they resemble values reported for upper class Indians in India. Mean values for urban Bantu teachers, clerks, and others in regular employment, are much the same as those of urban Indians. It must be stressed that there is a considerable overlap of values in the three ethnic groups, due to the wide range of social classes within each group.

Blood Pressure

Understandably, data on blood pressure levels in populations in the past are not available. But there is now a large amount of information available on (i) primitive populations, (ii) such populations once they become

urbanized, and (iii) numerous populations in different countries and walks of life.

On Whites, we have data for schoolchildren; mean values are the same as those published for White children overseas.

For Bantu living in remote areas, we have found that blood pressures are low and rise little with age. Similar observations have been made in other parts of Africa. But when country people have settled in, or were brought up in, urban areas, their blood pressures are much higher. This has been noted for Zulu in Durban, and to a lesser extent, for Venda and Tswana in Johannesburg, compared with the corresponding populations in the homeland areas. In one study on middle-aged Zulu in Durban, about half were reported to have a diastolic pressure of 90 mmHg or more;¹¹ in USA Whites of the same age, the proportion is roughly a third. We have found that blood pressures are higher in some country regions than others. At Phokeng, near Rustenburg, in a series of old people of 60-69 years, 28% had a diastolic pressure of 90 mmHg or more; whereas in a population of the same age range in Insikazi Native Reserve, near Numbi Gate, the figure was only 10%. We have no explanation. We thought that the reason, at least in part, might be a difference in salt intake. Yet in both rural and urban areas, studies have shown that intake is much the same as prevails with Whites, namely, 8-12 g *per diem*. The much higher salt intake reported to prevail among Bantu in Cape Town requires confirmation. It may be mentioned that in Japan, especially rural Japan, where severe hypertension is very common, and where strokes are responsible for one third of all deaths, salt intake is 20-30 g *per diem*.

Investigations on prevalence of hypertension in Coloured and Indian populations have been made in series of families living in Bosmont, Edenvale, Roodepoort and Lenasia. Although observations are incomplete, it is clear that in the sex age groups, prevalence of persons having values for diastolic pressure of 90 mmHg or more are much the same as reported for USA Whites by Master *et al.*¹²

There is considerable controversy over the factors which control or regulate blood pressure. The wide divergence of values in rural and urban Zulu, were regarded as due to the failure of Bantu to adapt to the stresses of urban life.¹¹ Workers in India, investigating a similar situation, reached the same conclusion.

Hypertension, as a risk factor in CHD, rates second to serum cholesterol level; this association has been demonstrated in many cross-sectional and prospective studies on groups, as well as on national populations.

Weight

The health hazard from overweight has been appreciated for hundreds, if not thousands, of years. That fat people die earlier was emphasized by Hippocrates, later, by Maimonides, and many other observers. Shakespeare wrote 'Leave gormandizing, know the grave doth gape for thee thrice wider than for other men'. Insurance companies load life policies of those who are markedly overweight, for when it is excessive, there is a decrease in life

expectancy of 20% or more. In 1959, a life insurance company, from their mortality data, constructed tables for ideal or desirable weight, as regulated by sex, age, and height and frame. Using these tables as criteria, it has been reported that about half the adult populations in the USA, Britain, and Australia, are overweight.

This health problem is a relatively modern one. In Britain, one investigation showed that men are about 7 kg heavier than 30 years ago. The increments in height that have occurred, are proportionally slight in comparison with the increases in weight.

In South Africa, we have little data on Whites, although our figures for White children are much the same as those for USA children, i.e. quite a proportion are overweight. Bantu children are shorter and lighter than local White children; values for Bantu are much the same as those published for London County Council school-children before the last war. Data on Coloured and Indian children are intermediate between Bantu and White children.

Among Bantu adults living in remote country areas, gain in weight with age is absent or slight. Yet, once adults move to urban areas, gain in weight with age is very marked, just as is the case with blood pressure.^{21,22} In some studies, e.g. those made on Zulus in Zululand compared with Zulus in Durban, the increase in weight of young middle-aged men and women was 9,07 - 13,6 kg. Hence, among urban Bantu, especially those in sedentary occupations, e.g. teachers and clerks, overweight is an increasing health problem.

Regarding the Coloured and Indian populations, we have studied large series of families in Bosmont, Edenvale, Roodepoort and Lenasia. Although observations are still in progress, it is clear that overweight is a common problem in the middle-aged, particularly females.

Prevalence of overweight decreases with rise in social class in Whites in the USA and Europe. In South Africa, this trend is not yet apparent in our non-White populations, despite there being an increasingly large proportion who are in comfortable circumstances.

What is the bearing of overweight on coronary heart disease? Doubtless it is a risk factor, but its precise importance remains controversial. In careful studies undertaken at Chicago, Framingham, and other centres, overweight was credited with considerable aetiological importance. Yet, in the studies by Ancel Keys and co-workers²⁴ on populations in seven countries, the deleterious role of overweight was slight.

Smoking

In the USA, in 1969, Hammond constructed life tables of men in relation to the smoking habit. He calculated years of life remaining at 35 years for males to be: never smoked, 42,4 years; 1-9 cigarettes *per diem*, 37,8 years; 10-19, 37,1 years; 20-39, 36,5 years; and 40+ cigarettes, 34,7 years.

An adverse role of smoking in relation to CHD has often been reported. For example, in the 11 years' report on the Oslo Diet-Heart Study by Leren,²⁵ although consumption of tobacco was shown to be of no significant

importance, it was found that mortality from CHD among hypercholesterolaemic hypertensive smokers, was three times higher than among normotensive nonsmokers, with cholesterol levels below 250 mg/100 ml.

In a recent Leading Article in the *British Medical Journal* on deaths from CHD, it was stated that 'of all the available preventive measures against clinical CHD, only stopping smoking has so far been shown to reduce the incidence of further myocardial ischaemic attacks'.²⁶ This view, however, must not be interpreted as having universal application. In the studies by Keys *et al.* in seven countries, cigarette smoking was certainly a significant risk factor for USA populations, but less so for those in Eastern European countries.²⁴

It is interesting to note that in an investigation on Welshmen of 40-49 years, nonsmokers weighed an average of 5,9 kg more than smokers; further, nonsmokers weighed 13,6 kg more than 'desirable' weight, as indicated by a leading life insurance company. The advantage of nonsmoking is in measure offset by the disadvantage of overweight in respect of proneness to CHD.

What of current smoking trends? In Australia, men but not women, are smoking less. Schoolchildren are beginning to smoke at an earlier age. Many doctors in Australia, as in the USA, have given up smoking; at present only about 20% indulge in the habit, compared with figures of 50-70% in the general population.

In South African populations, the best information on prevalence of cigarette smoking is that obtained 20 years ago by Oetlé and Higginson.²⁷ They found that among urban Bantu males of 45 years and over, 18% smoked cigarettes; the average number smoked was 3-4 *per diem*. None of the females smoked. Among the younger segment of males, smoking was twice as common and a small proportion of females smoked. Our own preliminary studies indicate that the smoking habit among Bantu has increased, but not grossly; both prevalence and the average number smoked *per diem* have risen. Among females, smoking is very uncommon in rural areas, but less so in urban areas, especially among young women. The situation among Indians is similar to that among Bantu; smoking is uncommon among females. Among Coloureds, frequency of smoking is high, in females as well as males.

Physical Activity

In Britain 200 years ago, about 90% of workers were involved, directly or indirectly, in agriculture. At present the figure is about 5%, moreover much of their heavy work is done by labour-saving devices. Physical activity became much reduced at the time of the Industrial Revolution, when there was a great increase in urbanization.

Numerous recent studies have underlined the relative inactivity of young White people once they leave school, and the small proportion of students and other young adults who take regular exercise. In investigations on young women in the USA and Australia, 90% of the time was spent in sleeping or sitting still, and only 3% was spent in energy expenditure, greater than that of walking. As an index of non-recreative time in a western popula-

tion, the average Australian spends 30 hours per week before the television set.

One result of decreasing activity, of course, is to promote the frequency of overweight.

The bearing that habitual physical activity may have on CHD is controversial. In some cross-sectional studies, exercise appears to be an important factor. Perhaps the most often quoted investigation concerns workers on *kibbutzim* in Israel, where observations indicated the frequency of infarction to be 3-4 times greater in sedentary, compared with active workers; the same diet was available for all.¹⁸ In Britain, in one recent study, answers to a simple question, 'How many minutes do you walk or bicycle on the way to work each morning?', showed a clear inverse correlation with the frequency of ECG abnormalities.

In some prospective studies, it transpired that the more physically active moiety, although approximately equally prone to CHD, had a significantly better record of survival after a first infarction.

In other investigations, however, activity seems of lesser importance. In that by Keys *et al.* in seven countries, differences in physical activity between those dying, and not dying, from CHD were absent or slight.¹⁴

It must be emphasized, however, that recommendations by various bodies strongly urge an increase in physical activity. In a recent review on combating CHD, it was considered that 'physical activity might be considered the keystone, since it offers a positive approach to health maintenance and can serve as the source around which an individual modifies the remainder of his life style'. In Australia, Laurie¹⁹ considers that 75% of persons have interarterial-coronary anastomosis at birth; understandably, he maintains that exercise is by far the foremost factor in promoting and maintaining coronary circulation.

Habitual physical activity among our South African populations is much as would be expected. However, there are some surprises; for example, it has been shown that Venda men are more active in urban than in rural areas. We have carried out investigations of the everyday activity of elderly Bantu and Whites, using a questionnaire. The pattern in Whites was much the same as that observed overseas, regarding proportions of old people in institutions, wholly or partially bedridden, or showing various degrees of activity. Old Bantu, however, were found to be much more active; many of those of 90 or more years showed a high level of everyday activity. The patterns with aged Coloureds and Indians were found to be intermediate.

Stress

As with some of the risk factors already discussed, the role of stress in relation to health in general, and to CHD in particular, is controversial. Certainly the ancients believed that stress influenced health. The proverb 'Better a dinner of herbs where love is, than a stalled ox and hatred therewith', is illustrative. In a recent hypothesis on 'Aggression and atheroma', Carruthers concluded 'in modern society, wrath, reinforced by gluttony and sloth, is the deadliest of the seven sins'.²⁰

Two behaviour patterns, propounded mainly by Friedman and Rosenman,²¹ of San Francisco, are of considerable interest. Type A persons, the 'coronary-prone', are those who are 'characterized by certain personality attributes and behavioural mannerisms suggestive of the presence of an incessant and excessive struggle against the exigencies of time or against the competitive efforts of other persons'. Type B persons, the 'relatively coronary-resistant' group, includes those who are not marked or far less marked by these features.

These workers reported CHD to be 6 times more frequent in type A than in type B persons. The same proportionality was found for severe coronary atherosclerosis.²² More recently, they reported that the more prone type A persons exhibited higher serum triglyceride and cholesterol values, and a greater hyperinsulinaemic response to a glucose dose. With type A persons '... The world is too much with us. Late and soon, getting and spending, we lay waste our powers ...' (Wordsworth).

COMMENT

What does all this information add up to? What does it mean in terms of practical measures to reduce or delay CHD episodes?

The information that has come to light from assessment of risk factors permits a reasonably accurate prediction of CHD events in a western community. In the Framingham study, the 20% of men with the highest risk scores included 50% of the CHD cases; the 20% of the men with lowest risk scores included only 1.2% cases, i.e. an almost 40-fold gradient in risk.²³ Obviously persons with high scores have grounds for anxiety.

It is clear that the different risk factors do not have the same weight in all populations; the degree of noxiousness of a particular risk may be quite different in one community compared with another. Thus, in the studies of Keys *et al.*¹⁴ in seven countries, CHD occurred far less frequently in Greeks and Dalmatians than could be explained, after taking full account of the known risk factors. It is noteworthy that among our urban Bantu in Johannesburg, an increasing proportion have relatively high cholesterol levels, are hypertensive, overweight, pursue sedentary occupations, smoke increasingly, fill responsible jobs—yet they have a very low prevalence of CHD. I feel strongly that the possibility of there being a racial factor in susceptibility to CHD, cannot be excluded.^{2,4,19,24}

What remedial measures are recommended? Ever since diet has been connected with CHD, there have been many suggestions for changes in food habits. The general recommendations put forward by Friedman²⁵ of San Francisco, are illustrative: 'Extraordinarily efficient prevention could be achieved if each of these four measures were adopted: drastic elimination of dietary cholesterol and animal fat; avoidance of behaviour pattern A; lifetime participation in an extensive degree of physical activity, and exclusion of cigarette smoking. Adoption, however, of just one or two of these measures probably might reduce, but it would not afford the degree of anti-atheroge-

nic protection that the adoption of all four measures would give'.

In regard to diet in particular, recently, under an act of Congress, an Expert American Commission reviewed exhaustively evidence on the causation of CHD.²⁶ It recommended, *inter alia*, that from early in life, the intake of saturated fats, which come largely from meat and dairy products, should be reduced by half. Their place should be taken by foods derived from fats and oils, rich in unsaturated fatty acids. At the same time body weight, excessive in about half of the population, should be kept down by general restriction of food intake. An Australian Committee recommends weight reduction; reduction of cholesterol intake to less than 300 mg *per diem*; and fat intake not to be reduced, but saturated fat moiety not to exceed 50% of total fat.²⁷

Some patients after a first infarction may be persuaded to modify their habits, which carry a high risk. Yet the middle-aged moiety, not obviously affected by CHD, appears almost deaf to appeals. Far more important, the young, regarded by all authorities as the only population really worth seeking to influence, remain virtually wholly uninterested. William Hazlitt wrote 'No young man believes he shall ever die'.

Apart from the usual advocacy of greater enlightenment of the public and the setting up of screening centres to identify those at high risk, there is a recommendation worth calling attention to. In some religions, ministers, and sometimes members of the congregation, go into 'retreat' for a few days or more each year—a kind of withdrawing to assess the past and plan for the future. Something like this is being practised in Central and Eastern Europe for the attempted rehabilitation of workers. In 1970 in Stockholm, the WHO and some Swedish insurance companies sponsored symposia on 'Society, stress and disease'. One recommendation was as follows: 'A specific measure adopted in some countries to combat cardiovascular diseases is to offer individuals periodic rests in peaceful rural reconditioning centres. These centres have long been a feature of industrial life in the USSR and other Communist countries. In a group of 1 500 workers in the Federal Republic of Germany, absenteeism in a 2-year period following reconditioning, was reduced by 69% compared with the 2 preceding years. These reconditioning centres concentrate on prophylaxis, and there is evidence that rest, planned physical exercise, careful diet, and abstinence from smoking are beneficial.

However, the limited periods people spend in them are obviously not able to provide lasting cardiovascular protection. Their main value probably lies in the changed attitude of the participants and their willingness to continue systematic regimens when they return home . . . '.

In conclusion, I do not feel at all hopeful about the possibility of controlling or retarding CHD events. Emerson wrote that nothing great was ever achieved without enthusiasm. To make worthwhile changes in a way of life so as to lessen CHD, requires 'fire in the guts', such as occurs in certain religious groups, also in strict vegetarians. This fire cannot be bought, nor engendered in others without great difficulty. As research workers, the most that some of us can do is to battle to arrive at the truth, and not to be despondent over the few who profit by the knowledge secured.

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