

RECORD

NUTRITION AND HEALTH RISKS

An Address By
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There is a very interesting phenomenon in the history of medicine and public health concerning the first insurance companies in America during the 18th century. For the purpose of determining premiums, these companies used the same mortality tables used in the life insurance business in London. However, many of these American companies went bankrupt because in those days, the life insurance companies in the Colonies sold mostly annuities, and life was healthier in the Colonies than it was in London.

Even today, it seems that the methods used to evaluate risks and determine premiums are extraordinarily primitive and do not make use of what we actually know. There have been advances in epidemiology and in the recognition of various risks, but they have not been fully utilized by life insurance companies. In the determination of premiums, there is repeated emphasis on weight and some emphasis on cigarette smoking. However, laboratory studies have revealed that the relationship of weight and mortality is much more complex than the straight line relationships which life insurance statisticians have used. First of all, the relationship between mortality and weight is clearly curvilinear with relatively little penalty for moderate degrees of overweight and very large penalties for very high degrees of overweight. Secondly, there is a relationship of mortality to body type that has been clearly shown by the work of a number of investigators, and it leads one to recognize that different body types are associated with different spectrums of diseases. Certain types are much more likely to develop rheumatic heart disease, while others are much more likely to develop classical cardiovascular diseases. To try to express the relationship of body type and mortality through a weight-mortality relationship is extraordinarily simplistic and really does not allow one to evaluate the mortality risk properly. The same thing is true of obesity itself. My colleague, Dr. Carl Seltzer, and I have shown that people who are overweight are not a cross-section of ordinary body types, and that if you consider various classified body types according to observable, measurable characteristics, you find that there are certain types which never become obese. To give an example which is almost ludicrous but which explains what I mean, we found that the ratio of the length of the hand to the width of the hand is a good predictor of obesity; people with ratios above a certain value will never become obese. In fact, the shape of the hand may well be a better predictor of obesity than anything else. This is to say that if there is an association of predisposition to overweight with certain body types and if there is an association of predisposition to certain spectrums of diseases with certain, although not necessarily the same, body types, then it becomes a very tricky question as to whether the over-

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weight is associated with the disease observed or whether both the overweight and the disease are associated with something else. This does not mean that overweight should be ignored in the evaluation of the mortality risk. All it means to say is that the insurance industry now has, but does not use, a different means to evaluate the mortality risk. Unfortunately, while a censorious society will allow the insurance industry to use factors which are injurious to the individual, such as obesity and cigarette smoking, it is unlikely that society will permit the use of body types in the determination of premiums. Nonetheless, at the very least, insurance companies should be aware of the significance of these other factors.

In addition to those risk factors the significance of which we somewhat understand, there are others at work which we do not understand. I will give two examples: one is derived from experience in the United States and one is derived from observing some of the long-lived populations abroad.

Mortality Experience of Ex-servicemen

In the United States, there have been several studies on the longevity of servicemen discharged from the Army in 1946. One such study by Doctors Seltzer and Jablon involved the observation of 85,491 white males from the time of discharge in 1946 until 1969. The results are puzzling! For every cause of death except lymphomas, there is a consistent trend toward lower mortality with increased military rank at the time of separation. The military ranks included in this study ranged from privates through noncommissioned officers to officers. The analysis was conducted in terms of standardized mortality ratios. To a very large extent, the data appeared to be only partially dependent on the educational status of the men. In analyzing the data, the education factor was separated from the rank factor. For all ages combined, the mortality ratio of noncommissioned officers was 23% below that of privates, and the ratio of officers was 42% below that of privates. In the case of malignant neoplasms there was a regular decrease in mortality ratios: the standard mortality ratios for privates, noncommissioned officers, and officers were .968, .858 and .702 respectively. The difference for some conditions was enormous. For diabetes, the standard mortality ratio was .658 for privates and .175 for officers. For ischemic heart disease, the mortality ratio for officers was approximately 1/2 of that for privates. For vascular lesions of the central nervous system, the mortality ratio for officers was less than 1/2 of the ratio for privates. For influenza and pneumonia, the mortality ratio for officers was 65% below that of privates. For cirrhosis of the liver, the mortality ratio of officers was 35% less than that of privates. The cyclical changes in mortality by rank were graded for successive five-year intervals, and for both privates and officers, the standard mortality ratio relationship became essentially constant. Indeed, there was a strong correlation between education and rank. Within each educational class, mortality ratios varied greatly by rank, and within each rank grouping, there was a variation by education. Consequently, it appears that both education and rank were factors in this study.

This study was not the only one of its type. There was one by Doctor Keehn in which ten thousand World War II veterans who were privates and noncommissioned officers were observed for 24 years. Once again, there was a strong inverse relationship between mortality and military rank. The re-

sults had been analyzed and shown not to be influenced by age, education or type of separation. There was still another study by I. M. Moriyama, D. E. Krueger and J. Stamler which showed the influence of the level of education on mortality. Obviously, these are factors of extraordinary importance and about which we should know more.

Long-Lived Populations Abroad

The second example of factors which we do not fully understand is derived from studies which are international in scope. There exist certain populations which experience long life spans. Three of these populations include a population in Ecuador in the Vilcabamba valley, a population in northwest Pakistan, i.e., the Hunzas, and the population of Russian Georgia. Recently there have been a number of studies of the people living in these areas. One such study was conducted by Alexander Leaf, a professor of medicine at Massachusetts General Hospital. From these studies, it seems that these populations do have an extraordinarily large number of centenarians. Before trying to determine the reasons for this, one may question the accuracy of reporting age. Even in the United States, there were two states that did not have mandatory recording of birth until the 20th century. In countries where a very large part of the population is illiterate, the margin of uncertainty becomes even greater. However, when there are six generations living under one roof, there is very little doubt that somebody is very old. The interesting thing about these populations is that they are not particularly healthy at the intermediate ages. The general public is often led by authors of pseudoscientific articles to believe that early mortality is synonymous with short life spans. For instance, there is a great myth that life spans 200 years ago in the United States were much shorter than they are today. It is not true that the span of life, particularly of affluent men, was much lower in any way, shape or manner than it is today. Because the influence of infant mortality on life expectancies at birth is so enormous, a better comparison is the average remaining life span at age 15 or 20. If one uses this and looks at the actual life span of Americans 200 years ago, one would be surprised by the results. Think of the first presidents of the United States: George Washington died at nearly 70, John Adams at 91, Jefferson at 88; and Monroe and Madison in their 70's. One could review the list of the signers of the Declaration of Independence and the signers of the Constitution and find life spans which are very similar to what we would expect of the life spans of reasonably well-off males today.

The situation in Ecuador and in Hunzaland is similar. The life expectancy in Hunzaland is relatively low, and the juvenile mortality is extremely high. Similarly, morbidity rates are high, even among people who reach the age of 10, and a smaller proportion of the population reach age 65 than in the United States; however, a much higher proportion of those who reach age 65 reach age 100 than in the United States. Now, in both cases, one could say that those may be genetic isolates; after all, Vilcabamba is not exactly a tourist center, and Hunzaland is not particularly accessible, and that these may be just very long-lived individuals. This does not apply to Russian Georgia where the records are better and where a very high number of centenarians seem to be found equally among Russians, Georgians, Armenians and Jews. All live in that area, and all groups seem to show an enormous proportion of centenarians.

Now what do these populations have in common? To what is this extreme longevity due? We really do not know! What we can say by taking a superficial look at the evidence is that these populations have a fairly low fat diet when compared to the diets of Americans. In addition, all seem to show great physical activity. Furthermore, there are social considerations. Families live together, and the elderly are not removed to retirement homes and senior-citizen cities. They have no retirement. People continue to do basically the same sort of thing they have been doing throughout life. There is no change in life style such as that which comes with retirement in the Western countries. Whether the explanation is in any of these factors or resides in entirely different factors, we do not know, but there is certainly an extremely striking phenomenon which requires a great deal more investigation.

Nutrition and Disease

At present what do we know about nutrition and old age? Let me make the statement that we seem to know a great deal more about the relationship between nutrition and disease than we know about the relationship between nutrition and longevity. We are not absolutely sure that the two things are the same. We may ask, do those people who die at the age of 120 or 130 in those long-lived populations die because of factors similar to those causing the deaths of Americans? The answer seems to be no. It looks as though Americans tend to die of cardiovascular disease, cancer, diabetes, kidney disease, liver disease and accidents. In addition, death frequently occurs between the ages of 60 and 70. In contrast, the people in those long-lived populations seem to die of old age! Now, one of the things that we do not know is whether or not old age, itself, is an incurable disease. For example, is dying of old age the result of a lot of small injuries, i.e., insults to the system, or perhaps the result of slow modifications of the DNA in the cells which render a body incapable of regenerating certain tissues? Another possibility is that one's DNA is programmed to make one die at a certain age if one does not die of another disease before that age. We do not know the answer to this very basic question, and we do not know what effect nutrition has on the mechanism of aging. However, we do have an increasing amount of information about the effect of nutrition on the diseases which are likely to cause death at the younger ages. As you may know, the results of hearings before the United States Senate Select Committee on Nutrition and Human Needs has resulted in a program of dietary goals for the United States. I hope this program of goals will be accepted by the American people even though we do not like to hear that the foods that we enjoy may be harmful and even though there will likely be some opposition from very large industries which will be threatened by any significant change in the diets of Americans.

What are some of the dietary components that are harmful? First, we can say that American diets are much too high in sugar. It is ridiculous for us to be eating 125 pounds of sugar per person per year. It is even more ridiculous when you consider that the consumption pattern is very badly distributed and that probably there are people in the population who are eating as much as 200 pounds of sugar per person per year. Incidentally, sugar is a relatively new food and did not exist in the West until the 17th century; furthermore, consumption of sugar has greatly increased in the 19th century and early 20th century. There is evidence that it is bad for us for at least two

reasons. First, it is a lot of empty calories. When one consumes sugar, one consumes calories which are not accompanied by any protein, minerals or vitamins. For a population which is inactive and for a population which is aging, the total caloric intake ought to be lower in order to avoid obesity. Consequently, to eat a large proportion of calories which do not carry their weight in terms of nutrients is obviously highly undesirable. Second, it is well documented that sugar is bad for teeth.

A second component of the American diet which is obviously deleterious is the very high proportion of fat. Now, fats act in two ways. First, it appears that a high saturated fat and high cholesterol intake does raise the blood cholesterol. The information available indicates that when one's blood cholesterol increases from 150 to 250 milligrams per 100 cc's, one becomes a cardiovascular risk, and the risk of suffering a fatal cardiovascular accident triples. Even an increase of 20 to 25 milligrams of cholesterol per 100 cc's becomes fairly formidable from the point of view of mortality. When considering blood cholesterol, it is necessary to consider life-style in addition to diet. A number of years ago Dr. Gsell and I conducted a study of blood cholesterol on two populations in Switzerland. One group consisted of people in an extremely isolated valley where there was no road and where the main occupation was cheese-making. This population was on a reasonably high fat diet but had an enormous level of physical activity. They carried everything on their backs: the timber and stones for their houses, the large containers in which they carried their milk and those enormous mill stones of rare cheese. Even though they had a few mules, these people transported most things on their backs. The average load for a man was between 125 and 150 pounds, and the average load for a woman was between 75 and 100 pounds. The other group, the control group, was a German-speaking Swiss population in an industrial suburb of Basel. In spite of the fact that the fat content of the diet was approximately the same in both groups, the serum cholesterol level and cardiovascular mortality of the very hard-working population were much lower than those of the control group. A few years later, a road was put through the valley, and almost immediately, the blood cholesterol started shooting up. So the relationship between very heavy physical exercise and the cholesterol content of the blood is one which is real. In practice, however, for populations as inactive as are most people in America, I suspect the dominant factor becomes one of nutrition. The saturated fats and cholesterol in the diet become very important.

There is considerable evidence that cardiovascular disease is linked to a high total fat, saturated fat, and cholesterol content of the diet. There also appears to be evidence that cancer of the breast and cancer of the large intestine are linked to the total fat content of the diet. This evidence comes from studies on experimental animals using small amounts of carcinogens; these studies show that the incidences of cancer of the breast and cancer of the large intestine increase with increased fat content in the diet. This evidence also comes from studies of Japanese populations living in Japan, Hawaii and California. For these populations, both the fat content in the diet and incidences of cancer of the breast and cancer of the large intestine are highest for Japanese-Americans living in California and lowest for Japanese living in Japan.

The incidence of cancer of the stomach has a different pattern. The studies of Japanese populations living in Japan, Hawaii and California have revealed that Japanese-Americans living in California have a lower incidence of cancer of the stomach than the other two groups and that Japanese living in Japan have a higher incidence of cancer of the stomach than the other two groups.

A third factor which we ought to watch in our diets is salt. There is very good evidence from the work of Dahl and others that populations with a high salt intake have a much higher rate of hypertension than populations with a low salt intake. This is true for all active groups. For instance, in Japan there is a considerable difference in the salt intake among populations of the various islands, and there is also a considerable difference in the rate of hypertension in those areas. It is well established that in the United States hypertension is prevalent among blacks. However, if you look at black populations throughout the world, you will find some in Africa which have extremely low sodium intakes, and hypertension is essentially unknown in those populations. In contrast, you will find some, like the ones in Jamaica and the West Indies, where salt intake is very high, and the prevalence of hypertension is also very high.

Conclusion

In summary, what we can say is that we are beginning to know quite a bit about the association of overweight with certain diseases, the association of fats in the diet with certain diseases, the association of sugars with certain diseases, and the association of salt with hypertension. Fortunately, we are beginning to do something about these things. For instance, the consumption of eggs in the United States has gone down by approximately 100 eggs per person per year from the consumption level of 1960. As you know, we are beginning to see much more weight containment and the available data shows that women have stopped gaining weight and in fact, are reducing their weight as compared to the historical rise in weight which had been observed until relatively recently. There is containment of cigarette smoking. In addition, there is better detection and treatment of hypertension. The net effect of these things is that after a steady increase in cardiovascular disease mortality from World War II to about 1972, we have begun to see the beginning of a drop in cardiovascular disease mortality in the United States. The points with which I hope to leave you are: we already know a great deal more than the insurance industry is using; at this point, a major frontier is health education; and we are beginning to uncover leads which should give us much better predictors of the length of life than those which we are applying. We feel that a great deal more research ought to be done. It is our hope that the life insurance industry which has so many well-trained actuaries and statisticians will become a leader in research and studies on the length of life and the factors that influence it.