EPID 161

Cassel's LECTURE I

The reason for the rather complicated arrangements of this course, with a common course of lectures and different seminars for track groups, is to allow students to learn through this course, that the perspectives and the methods of epidemiology can be applied to a wide variety of different topics. As you will learn from this course, these particular methods of strategy and perspectives of epidemiology can be applied to furthering our knowledge of the nature of disease, and to the understanding of the dynamics of population growth and decline. Epidemiology can also be applied to aid our understanding of the workings of the health services to the determinants of health relevant behavior and to intelligent program planning and decision making. In other words, the discipline of epidemiology can be used on the one hand as an investigative tool, to add to scientific knowledge and on the other hand, as one of the scientific bases for rational planning for the delivery of services. It is our contention that the vast majority of you are not going to become professional epidemiologists and will not necessarily be involved in research endeavors aimed at adding to the scientific body of knowledge. However, most, if not all of you, will be involved in some form of practice, or the delivery of services, and it is necessary to have a rather firm background in epidemiology if these services are to be planned and executed in anything approaching a scientific manner. The first three introductory lectures will be used to introduce you to what is meant by scientific practice, why there is a need for it, and what the particular contributions are that epidemiology can and should make.

We shall start off by describing the current status of our existing health programs, both those programs concerned with community health which try to prevent disease or promote health, and those patient care programs concerned with trying to treat sick people.

It is important to recognize that many of the existing community health programs were originally developed in response to relatively well-defined and clearly delineated health problems. The development of local health departments in the South, for example, was to a large extent a response to the problem of extensive hookworm infestation. Before initiating these programs, the pioneers in the movement went to considerable lengths to (1) define the nature and extent of the problem in the communities in which they were working (2) to define the population of the types of people at greatest risk, and (3) to establish reasonably clear ideas about what changes were necessary if they wanted to reduce the problem.

To state this in somewhat more formal terms, the original program to a large extent had three important characteristics. First of all, they had a set of clearly defined objectives, stated in operational terms. In the illustration I have given you, the objectives were to reduce or eliminate infestation of hookworm. Secondly, they had some knowledge of the existing extent of the problem and the population at highest risk. In this illustration, the population at highest risk were the more rural people and the less well-educated people. And thirdly, they had a number of hypotheses about the circumstances that should be changed to reduce the problem. In this instance, the circumstances that needed to be changed were either to improve the sanitary practices or to encourage the wearing of shoes, since hookworm infestation is acquired by contact with infested ground with the

organism boring in through the naked skin on the soles of the feet.

It is important to recognize that in those days, i.e., about 40 or 50 years ago, the techniques available to accomplish these changes were not well developed, so that even though they knew what they wanted changed, it was not always possible to accomplish it. And not infrequently, the hypotheses upon which the programs are based were not always correct.

For example, it was thought for many years that what needed to be changed in order to prevent diptheria was the protection of people from exposure to sewer gas, as it was believed that this was an important cause of diptheria. And as a consequence, plumbing codes were introduced to keep the inhabitants of the homes protected from the sewer gas. Sanitary pipes were put outside the house and various other techniques were used in the belief that these would protect the inhabitants from diptheria. But the important thing to recognize is that given the formulation of the program in the terms that I have given you, it was possible over the course of time to determine whether in the first instance the circumstances that needed to be changed had in fact been changed. Were sanitary practices improving? Were more people wearing shoes in the illustration I have chosen? If so this would be a reasonably good indication of the success or failure of the techniques available to introduce these changes. Secondly, if the answer to these were yes, i.e., they had changed; were the original objectives accomplished? Was there a reduction in the health problems? In other words, was there less hookworm? This then would be a test of the utility of this particular hypothesis, which held that sanitary healthy practices were improved, hookworm would be reduced.

As a result of these sort of endeavors over the course of time, it became possible to make knowledge comulative; to learn from the failures

as well as the successes; to learn whether the failures occurred due to inappropriate techniques or faulty hypotheses and to know where redirection needed to occur.

Unfortunately, the subsequent developments in the establishment of health programs has not in any way followed the sound scientific approach developed by the pioneers. It is rare today to be able to find programs which have clearly defined objectives, despite advances in knowledge and technology, in the numbers and quality of personnel, and in the improvements in training. It is hard to pin service personnel down and say, "What is it that you want to accomplish?" and "How will you know when you have done this?" Secondly, it is even more uncommon to find programs in which there is any intimate knowledge of the extent of current health problems and the characteristics of the population at the highest risk. How extensive is elevated blood pressure, for example, in any county of North Carolina or any other part of the state? Few people know. How extensive is cancer of the lung? We can measure the deaths, but that is about all. How extensive is arthritis, mental disorder, or diabetes? There are some rough estimates but none accurate enough.

But we know even less in any given locality or jurisdiction who the people are at risk for developing these disorders. These conditions, like any disease conditions, do not occur at random nor with equal probability in all people. We know for example, that in the state of North Carolina there is a belt of country stretching down to the eastern seaboard that has nearly twice the rate of heart disease and more than twice the rate of stroke than occurs in the rest of the state. This belt also has the highest suicide rate in the state, and has the highest rate for kidney stones and gall stones.

These counties harbor a lot of sick people, yet none of this information is being made generally available to the deliverers of health services in this area to allow them to modify their program in any fashion.

As you see, modern programs may occasionally have adequate objectives, but very rarely do they have any intimate knowledge of the extent of the health problems in their jurisdiction or the population at risk. But perhaps the greatest weakness is that many of the current personnel in the operating programs have relatively naive ideas about what it is that needs to be changed to improve any given state of health. Assuming that you have the power and the money, what are you going to change in the way people live, or in their environment, or behavior which would lead to an improvement of health? One cannot fault service personnel for this lack of knowledge entirely. Because of the state of the knowledge of many of the current diseases that plague modern society some answers just do not exist. No one knows them. What one does object to, however, is that the answers, such as they are, have really rarely been coming from the service agencies.

The question then is, why not? Why are the people who are involved in the day to day care and delivery of services not concerned with improving the state of the knowledge, so that they will know and we will know what it is that can be done more effectively to reduce or eliminate a particular set of health problems.

The end result of all these deficiencies is that it is almost impossible to find any ongoing program today in which there have been adequate attempts at evaluation so that we can say with any degree of confidence that the program that is being operated today has made any difference to the population. For example, in most states for the last forty years or

more there has been a school health program. This occupies a tremendous proportion of the time of health department personnel, physicians and administrators. What has it accomplished? What was it meant to accomplish? Is there any evidence that school children today are in better health than they were forty years ago, as a result of this program? There really is no way to find out. There has been such a program in North Carolina for at least forty years. In World War II we had the highest proportion of young men rejected from the armed services for physical and mental defects of any state in the Union. At least 80% of those defects could and should have been known to the school health service. But the program did not seem to make any difference.

There has been a considerable amount of time expended in programs concerned with prematurity, pre-natal mortality and infant death rates in North Carolina. Yet we have one of the highest infant death rates in our rural areas of anywhere in the country, excluding the Indian reservations. We take considerable pride in the fact that tuberculosis, as a disease, has declined rather dramatically, and point to this as an example of the effectiveness of our health programs. A more careful review of the data indicates that tuberculosis was declining fifty years before we started any health programs, and has declined at the same rate ever since.

A study was done in Kit Carson County in Colorado which has never had a health department. The health of the people in this county was compared with health of people in a number of other counties that had health departments. They could find no difference in any index they used between the two groups of people. You can see that this is all highly negative. It does not mean to say that what has been done by the health departments is

useless. Maybe if there had been a health department in Kit Carson County, their health status would have been even better. This is precisely what we do not know. Unless we do something about it; ten years from now we still will not know.

Currently the rash of legislation and changes that are occurring at federal and state levels in the health field have proposed new tasks, new problems, and new procedures for health personnel, accordingly something has to be given up. But this decision cannot be made properly because of the very absence of any firm data to show which programs are effective and which are not.

Part of the problem lies in the fact that people are so deeply involved in the day-to-day administrative and service needs that they have been unable to see the woods for the trees. They have been unable to step back and ask what is it they are doing and why are they doing it.

Another part of the problem is that during this last half century we have witnessed greater changes in the pattern of health and disease, in the structure of our population and in the ways of living than have ever before been recorded in history. Although these changes have rendered many of our existing programs and the premise upon which they are being based obsolete we have not had the ability to see the consequences of these changes and the implications they have for redesigning our approaches and reexamining our premises.

One of the extraordinary things that has occurred but which has escaped widespread recognition as a means through which insight can be obtained to intelligent use of epidemiological approaches has been the extraordinary regularity with which different types of diseases have replaced each

other as central health problems in developed countries as they have gone through their industrial revolution. One can see the regularity with which different types of diseases have replaced each other as central health problems in the developed West, using as examples Britain or the United States, since these are the two countries where we have the best data. In these countries we find that after the industrial revolution, as the country became transformed from a rural agragarian state to an urban, technological society, the first health consequence was an increase of those diseases which have been the plagues of mankind since antiquity, namely the major infectious diseases. So the first consequences of industrialization and the accompanying urbanism was an increase in diseases like typhoid, cholera and tuberculosis.

Tuberculosis is a good example of this increase. We see that following industrialization a marked and dramatic rise in the rates of tuberculosis. This rise continued for some 75 to 120 years, reached a peak and then started to fall. As was mentioned earlier, this fall occurred long before we had any effective programs or any adequate drugs. In fact, the fall in tuberculosis rates started in Britain about 1850, which is 20 years before any one had seen the tubercle bacillus. The rates for tuberculosis have continued falling at the same rate ever since. The rate of deaths from this disease has declined more precipitously since 1950 when we had new drugs, but the rate of new cases has fallen in a constant and regular fashion.

As tuberculosis and the other major infectious diseases started to fall, they were replaced, both in Britain and the United States, by major malnutrition syndromes as central health problems. In Britain the problem was rickets; in the United States it was pellagra. Rickets was so prevalent

in Britain in the early part of the Victorian era, that it was considered abnormal to find a child without evidence of the disease. And, as you know, pellagra was common to large portions of the United States up until the 1920's and 1930's. These diseases also reached their peak and declined for reasons that are only partially understood.

As these diseases declined they were replaced in turn around the turn of the century, by a number of diseases of childhood and early infancy. These included such diseases as diarrhea, whooping cough, diptheria, scarlet fever, and the like. This is not to say that these diseases did not occur before. They did occur. But they reached a peak during this period and were of much concern to society. These have declined now, partly as a result of the improved nature of the sanitary environment, partly through immunization programs, and partly for unknown reasons. Some countries, like Scandinavia, which had no immunization programs for diptheria, have shown just as dramatic a decline in diptheria as countries that have had immunization programs.

Subsequently, these diseases of childhood and early infancy declined and were replaced between the two World Wars by an extraordinary increase in the occurrence of peptic ulcer, particularly in young men. This increase was more dramatic in Britain than in the United States, but it occurred in both countries. This disease reached a peak and for completely mysterious reasons is now declining rapidly, and, in turn, has been replaced by the modern epidemics of the chronic, degenerative diseases, such as elevated blood pressure, (hypertension), atherosclerotic heart disease, stroke, various types of cancer, mental disorders, arthritis, diabetes, and the like. There is some shadowy evidence that some of these disorders have

reached their peak and may be declining in certain segments of our society. For example, deaths that are a consequence of high blood pressure have been declining as far as one can tell since 1950 in the United States. This was before there were any potent drugs to treat it. Deaths from heart disease and coronary heart disease seem to have plateaued off and in certain segments of society may be falling.

So there has been a succession of changes, from the acute infectious diseases to the chronic non-infectious diseases. These changes have vast implications for the nature of the health programs and the delivery of health services. These examples should not leave you with the impression that there has been no change in overall health status over half a century. Even though the pattern of diseases of the major killers and cripplers has changed, overall, there has been an improvement in various measurements of health, in particular in the developed West and the United States.

There has been a sustained and marked drop, for example, in the death rates from all causes. This drop has not been completely smooth. But if one looks at the change in deaths per 1,000 population since 1900 you can see that a marked drop occurred until about 1918. Then the drop was halted and there was a peak. After 1918 there was a leveling off until about 1934 or thereabouts. Then there was another drop about 1954, and since then a general leveling off. The peak in 1918 is largely the result of a pandemic of influenza, that occurred after World War I. The drop that started about 1938 is largely a response to the introluction of new chemotherapeutic agents such as the sulfa drugs, and later, penicillin. The failure of death rates to drop any further now can be ascribed to what has been called the general aging of the population.

There is no disguising the fact that there has been a marked improvement in the health of the majority of our population, at least as measured by changes in death rates. It has dropped from something on the order of 17 deaths per 1,000 population to about 9 deaths per 1,000. This represents a considerable improvement though there is much that still needs to be done.

As one would imagine, because of the shift in patterns of diseases, the causes of death have changed dramatically. Back in the 1900's the four leading causes of death would have been influenza and pneumonia first; tuberculosis would have been the second; diarrhea the third; and diptheria the fourth. These acute infectious diseases would have been the four leading causes of death. Except for influenza and pneumonia, these infectious diseases are not in the ten leading causes of death today. The three leading causes of death in the United States today are heart disease, stroke, and cancer.

We can see then that there has been this change in the nature of the health problems and the pattern of diseases. We can also see that there has also been a marked change in the nature of our most susceptible groups, i.e., the population at highest risk of various diseases. The people back in 1900 who had the highest risk for these causes of death and disability are different in many respects from the people who have the highest risk of dying or being disabled today. Some of the more obvious differences are differences in age and sex. There are other, more subtle differences which we will come to later on in the course.

We shall start by looking at death rates in the changing population in terms of age and sex. We have described this decline in the overall

death rate that occurred between 1900 and 1960. But this decline has not occurred evenly in all segments of the population. The greatest rate of decline, between 1900 and 1960, has occurred in the very young; in babies under one year and in children up to four years of age. In the very young we have seen an 80 - 95% decline in their death rates. By contrast, in the middle ages, starting about forty-five and going up to about seventy, there have only been modest declines in the death rates; far less dramatic than in infancy.

If one looks at death rates by age, in those less than one year of age in 1900 there were 162 deaths per 1,000 infants. By 1960 this had dropped to 29. It was a little lower in 1966, but not much lower. In the one to four year age group the rates were 20 per 1,000 in 1900, and they have dropped to 1 per 1,000. In the 45-54 year age group the death rate has gone from 15 per 1,000 in 1900 to 7 per 1,000 in 1960. The 55-64 age group has gone from 27 to about 17 and 65-74 age group has gone from 56 to 41. The rate of decline has been far less in the older ages. The result of these changes is that for the first time in history the death rates in the older age groups are now higher than the death rates in those under one year. The infant mortality rates are no longer higher than the death rates at older ages.

There not only has been an uneven decline by age but a very uneven decline by sex. The most satisfactory decline in death rates at each age, for all causes, has been in females. For reasons that are quite intriguing and very mysterious, males have not participated in this decline in death rates in anything like the extent females have. This is particularly true in the developed countries. With each passing year, the gap in the

death rates between males and females in the United States becomes larger. In the United States, to a large extent, the deaths between males and females is accounted for by three diseases; coronary heart disease, cancer of the lungs, and duodenal (peptic) ulcer. The net result of this failure of the men to participate in the decline in death rates (they have declined but nowhere nearly as fast as the women and nowhere nearly as fast as in other countries) is that in the United States today the death rates in white men, age 45-54, are higher than in any other developed country in the world where we have comparable data. In the developing countries this may be a different story but we do not have comparable data with which to compare them. However, if you take some 20 or 30 countries of Western Europe and the British Commonwealth, our death rates in the United States are higher for men than anywhere else. This occurs in spite of our greater affluence, our greater ratio of health personnel to population, our greater number of hospital beds, and our better diagnostic and therapeutic facilities.

Furthermore, the rate of decline has been uneven in the various ethnic groups. While there has been a decline in deaths of various ages among blacks as well as whites, the decline has been less satisfactory in many instances among blacks. We are left then with two shameful statistics. One is that our overall infant death rate is fifteenth or twentieth in the world. We have fifteen or twenty countries that have far better infant death rates than we do, far lower as a whole. But if we look at this by ethnic group the infant death rates in blacks would be a disgrace to any developing country, never mind an affluent developed country. The death rates for children in Harlem are twice or nearly three times that of the rich in New York City. The death rates in rural North Carolina, in blacks,

are two to two and a half times that for the rest of the state. This is obviously an intolerable situation.

In addition to the changes in the diseases patterns and in the groups at highest risk in the population, there have been some general population changes of consequence which are not always related to changes of disease patterns. These general population changes also have important implications for our services. The first major change that has occurred is the tremendous rate of population growth. A most dramatic, unparalled rate of growth has occurred in relatively recent times; in the last fifty to seventy-five years. Accompanying this population growth has been an increase in life expectancy; a term which has been used rather loosely.

One can read and hear people talk about how we have increased life expectancy from forty years around the turn of the century, to seventy-some years now; and how this has resulted in an aging of the population. What does that mean? It is perfectly true that in 1850 life expectancy was forty years. In 1960 life expectancy was about seventy years. It was a little higher for women than for men. But this does not mean to say that people are living longer or getting older. What it means is this. It means that a child born in 1850 had, on the average, an expectancy of life of forty years. A child born in 1960 has, on the average, thirty more years of life expectancy; seventy years of life expectancy. But a person who was sixty years old in 1850, had on the average, sixteen more years of life expectancy. A person who was sixty years old in 1960 has, on the average, seventeen years of life expectancy. So what this increase in life expectancy means is that we have prevented many infants dying and thus allowed a greater proportion of infants to achieve age sixty or older. Having achieved that

age, however, we have not made any advances in improving their health states. So their illnesses and their chance of dying are no different, or very little different, today than they were one hundred years ago. In other words, what we have done is increase the proportion of our population that is sixty years old or sixty-five or seventy. These people who are sixty, sixty-five, or seventy years old today are no better off than they were before but now there are greater numbers of such people with just the same sort of health problems today that they had before.

We have not only an increasing proportion of our population who are in the sixty plus bracket, but we are getting a change in the sex ratio of the population. For each succeeding year, the proportion of females in our population is getting greater than the proportion of males. And this is particularly true in the older bracket. For example, in 1930 in the United States, for all ages, there were 106 males for every 100 females. Thirty years later, in 1960, for every 100 females there were only 89 males. This gap is widening each year. This means that we are increasingly developing a large population of elderly women, who are alone, whose husbands have died; elderly women with a whole host of health and social problems surrounding old age, loneliness and dependency.

Not only have the diseases, population, and the susceptible groups changed, but there have been changes in our modes of living and style of life, which have important implications. Over the past half a century, we have been developing into a highly mobile society. In our society, on the average, one family in every five moves their home each year. This means that it is relatively rare today to find an individual living in the same neighborhood in which he grew up; who knows his neighbors intimately or who

has kin or relatives or family within shouting distance. Most people are growing up and living in neighborhoods in which they are strangers. Not only have we had the destruction of the neighborhood group, but we have had a decrease in family size and a change in family function. The most common family today is what the social scientists call the "nuclear family"; father, mother, and children; with no third generation of grandparents, and no uncles or aunts. These are small, nuclear, highly mobile families, dependent entirely upon themselves for their own support. Not only financial and emotional support, but also their care in times of sickness.

In the United States today, for the first time in all history, we are the first society in which in the majority of homes the housewife is the only woman. This has never happened before and it does not happen today in most of the world. In the previous years of history and in most cultures, there are other women in the home. These are either servants, slaves, co-wives, or female relatives. But in our society, and increasingly so in Western Europe, the housewife is the only woman, and she is not at home either! One-third of these women are working in industry.

There has been an increase in urban migration as part of this mobility pattern. With this urban migration comes the consequences of decreased physical activity, the increased exposure to urban ways of living, all of the heartaches and problems that have been manifested in our urban riots which have been the plague of our society in the last few years. Now think of what this means in terms of people. Look at a somewhat hypothetical example but nevertheless true, just to illustrate what sort of impact these have on the lives of people.

Take a couple whose families for two centuries have been small

farmers, say here in North Carolina or any other rural state. Increasingly it is becoming uneconomic to be a small farmer. Farms have become amalgamated into large concerns so they can be mechanized. At the present time, these people from small farms realize that if they stay on the farm they are going to starve. So they migrate to the nearest city to look for work in a mill or a factory of some sort. When they get into the city they find that the housing situation is impossible. They cannot rent anywhere in the city near the factory and they cannot buy a home near their work. The nearest land where they can afford to buy and build is almost as far out of town as the original farm was. So they have to go back out of town to find a place to put up a house. In order to pay the down payment and mortgage on the home, both the man and the wife are going to have to work. There is probably little, if any, public transport. That means they are going to have one car, probably two cars, which increases the amount of commitment in monthly payments.

Because the women are away all day, a vacuum cleaner, an electric range, and a washing machine become virtual necessities. These are no longer questionable luxuries but absolute necessities just to keep the wheels turning. The children will go to school and when they come home there will be no one at home, because both parents are away working. So the children will be on the street, and there will be complaints about increasing delinquency, increasing promiscuity, increasing illegitimacy among school children where there is no parental supervision. Under these circumstances, the grandmother gets ill with a stroke. What do they do? What can they do? There is no woman at home to look after the grandmother, and often there is no room in the home. After the initial episode is over she does not need

highly skilled medical care. She needs nursing and rehabilitation. At best, they can put her in an institution which may cost them up to forty dollars a day.

This is the picture then of people caught in a squeeze; caught in a situation where there is very little room to maneuver. Under these circumstances a large number of our existing health programs are totally irrelevant. Even though polio immunization programs are grand and are needed, if this is all we are doing for a family like this it is not meeting very many of their problems.

In summary then, fifty years ago community health programs were dealing with a population in which the most vulnerable segment was the woman and her young child. This was where most of the emphasis of the health programs were, as is true in most parts of the world today. Secondly, they dealt with the problem of acute infectious diseases. And thirdly, the goal of the health programs with the saving of lives. For these reasons the success of the programs could be measured in changing mortality rates (changing death rates). Finally, this was a time where the knowledge necessary to save lives was contained in the professions of medicine and dentistry, nursing, and engineering. Those four professions had a professional accumulation of knowledge available to stop the death rates or to lower them.

Contrast that with the situation today. In a vastly expanding and mobile population we are dealing with a situation in which our most vulnerable segment is no longer only the mother and her child, but includes the increased risk in the males from a point of view of dying, and in elderly females from the point of view of the consequences of isolation and loneliness. There are vulnerable segments of the population in which a major

threat to health is no longer the acute communicable diseases but the chronic, long-term disorders. Our objectives are no longer restricted to saving lives but must somehow include making life more livable.

The body of knowledge necessary for this must come not only from medicine, dentistry, nursing, engineering, but must come also from sociology, anthropology, psychology, psychiatry, nutrition, statistics, chemistry, biology and education. This knowledge must come from a whole host of disciplines which have a contribution to make to the development of intelligent health programs. And we must devise ways in which to synthesize the contributions of these disciplines in terms of the problems that we see today.

The questions then are how can we plan so as to develop intelligent approaches to these problems? How will we know if our attempts are effective or need to be modified? Can we learn from our attempts more about the determinants of disease and disorder? These and similar questions are ones to which epidemiology addresses itself.