Cigarette Smoking and Health

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Cigarette smoking and health is a subject that undoubtedly represents one of the greatest current health problems, if not the greatest, facing us. Cigarette smoking probably contributes the greatest single share of causality to a diversity of lethal and disabling effects on health. However, it may be one of the most amenable to approach in primary prevention. The achievement by American epidemiologists in understanding the problem is reflected by their representing the vast majority of the 6,000 scientific contributions available at the time of the first report of the Advisory Committee to the Surgeon General in 1964 and of the accumulated 30,000 scientific papers available by 1979.

Dr. Lester Breslow was an early contributor to this ever-increasing epidemiologic literature on the relationship between tobacco use and health. He is an outstanding exponent of the goal of epidemiology the primary prevention of disease. Dr. Breslow is dean of the School of Public Health at UCLA, a former president of the American Public Health Association, and a militant scientist in the area of disease prevention and control.—LEONARD M. SCHUMAN, MD

ELUCIDATION OF THE RELATIONSHIP between cigarette smoking and health has made the prototype epidemi-

ologic contribution to what former Secretary of the Department of Health, Education, and Welfare, Joseph Califano, Jr., called the "second public health revolution in the history of the United States" (1). We have already entered this historically significant endeavor to control cardiovascular diseases, cancer, and other chronic diseases that plague life in our so-called industrialized society. Cigarette smoking has played and still plays a major role in the occurrence of those diseases and mortality from them.

Use of tobacco in the form of cigarette smoking began with the development of the cigarette manufacturing machine in the 1870s. Only in the second decade of this century, about the time of World War I, did smoking cigarettes become popular. In the United States, smoking was at first limited almost entirely to men. Per capita consumption of cigarettes rose sharply, along with the proportion of men who smoked them, into the 1930s. A slowdown then occurred until about the time of World War II when marketing forces influenced women to smoke. Thereafter, per capita consumption rose sharply again; it reached a peak in the early 1960s. Since that time, along with accumulating scientific evidence about the adverse health effects of cigarette smoking, consumption has been dropping off. At present, consumption has dropped for the sixth straight year to reach its lowest level since 1957 (2).

Meanwhile, our nation has experienced an epidemic of lung cancer that is still rising, especially among women. Lung cancer and other conditions attributable

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to cigarette smoking have caused millions of premature deaths, recently about 300,000 a year. The trend is turning, however, as we enter the second public health revolution.

Epidemiologic Studies

Epidemiology has been in the forefront of this second revolution. Application of the discipline to cigarette smoking and health has enhanced the discipline itself. Through conducting at first retrospective or case-control studies and then prospective or longitudinal population studies of the health effects of cigarette smoking, we have come to understand better the advantages, limitations, and difficulties of these two types of epidemiologic investigation.

Furthermore, having to deal with cigarette smoking and health forced epidemiologists and their biostatistician associates to confront the issue of how to draw causal inferences from statistical data of the sort now often obtained in epidemiologic research. An elegant elucidation of this matter appears in "Smoking and Health," the (1964) Report of the Advisory Committee to the Surgeon General of the Public Health Service (3). Believing that it constituted one of the most significant contributions of that Advisory Committee, still far too little appreciated in teaching epidemiology and biostatistics, I repeat it here:

In carrying out studies through the use of this epidemiologic method, many factors, variables and results of investigations must be considered to determine first whether an association actually exists between an attribute or agent and a disease. Judgment on this point is based upon indirect and direct measures of the suggested association. If it be shown that an association exists, then the question is asked: "Does the association have a causal significance?"

Statistical methods cannot establish proof of a causal relationship in an association. The causal significance of an association is a matter of judgment which goes beyond any statement of statistical probability. To judge or evaluate the causal significance of the association between the attribute or agent and the disease, or effect upon health, a number of criteria must be utilized, no one of which is an all-sufficient basis for judgment. These criteria include:

- a) The consistency of the association
- b) The strength of the association
- c) The specificity of the association
- d) The temporal relationship of the association
- e) The coherence of the association.

These criteria were utilized in various sections of this Report....

In conducting epidemiologic studies henceforth and preparing others to do so, it would seem wise to bear these criteria in mind. Stating the probability that an association is "significant" according to some statistical convention is merely the first important technical step in a difficult process. Drawing conclusions from epidemiologic studies begins, does not end, there. Estimated percentages of smokers and nonsmokers, 1955, 1966, and 1978



1979 Surgeon General's Report and National Center for Health Statistics

A further contribution emerging from epidemiologic work on cigarette smoking and health pertains to the relative significance of clinical-pathological, animalexperimentation, and epidemiologic approaches to such a problem. Again, a classic statement of that matter appears in the 1964 Report of the Advisory Committee to the Surgeon General:

In this inquiry the epidemiologic method was used extensively in the assessment of causal factors in the relationship of smoking to health among human beings upon whom direct experimentation could not be imposed. Clinical, pathological and experimental evidence was thoroughly considered and often served to suggest an hypothesis or confirm or contradict other findings. When coupled with other data, results from the epidemiologic studies can provide the basis upon which judgments of causality may be made.

As we move ahead to deal with saccharin, radiation, asbestos, and the myriad other agents to which human beings are exposed in industrialized society, the experience from studying cigarette smoking and health should not be lost. Obviously, too, we must go beyond that experience if we are to protect ourselves fully and reasonably.

Epidemiologic research into the health effects of cigarette smoking has also taught us a great deal about the pathogenesis of disease arising from such apparently simple, but really very complex, agents. These agents are multiplying with almost frightening speed as industrialization proceeds to yield products for food, housing, comfort, medical therapy, and other purposes. Experience with cigarette smoking, and now with other agents, has shown in striking fashion the importance of dosage; it has also shown that passage of many years may be necessary before a pathological condition appears. In a similar vein, we have learned that one agent, especially one so complex as cigarette smoke, may affect many organs and tissues of the human body in various ways. Such an agent may thus be causally related to several diseases. These multiple effects of a single agent are in a sense reciprocated by the occurrence of a single disease in relationship to multiple agents. Lung cancer, which can occur as a result of exposure to radiation, to chromate ore, and to cigarette smoke and other agents, illustrates this latter point.

We can often sort out these multiple causes and multiple effects, using the epidemiologic method as it was applied to the cigarette smoking problem, even without understanding the intricacies of the pathological mechanisms involved. We do not really understand how any agent induces the neoplastic process; yet we know a great deal about how to prevent cancer. This is not to say that we should abandon the search for pathological mechanisms; rather, it simply means that we need not await their elucidation to find causes and means of prevention. Additional support for that notion comes from the observation that essentially all the adverse effects of cigarette smoking cease about 15 years after cigarette smoking is stopped, some earlier than that. Thereafter, no new ill effects can be discerned. That phenomenon, incidentally, appears to open the possibility of finding some means of shortening that 15-year period.

Thus, the epidemiologic investigation of cigarette smoking and health has advanced not only knowledge of an important health problem, but also the scientific method itself. The basic discipline for studies leading the second public health revolution has been greatly sharpened in its first large-scale application.

Outgrowths of Studies on Smoking

Besides this rather direct scientific impact, confronting the cigarette smoking and health issue has led to other consequences. Some of these are evidently important for dealing with data about the chronic diseases in general, data that yield less obvious inferences than those that Snow made on cholera.

The idea of a commission to review and report on a health science problem did not originate with the formation of the 1964 Advisory Committee to the Surgeon General on Smoking and Health. Yet, that venture was so carefully planned and so successful that it has become a prototype for what are now being called "consensus panels." It is increasingly common for government agencies to seek the judgment of a group of persons who are expert and competent to make judgment on a particular issue but who have not been previously involved in studying it. The advice of carefully assembled bodies to formulate recommendations on controversial and complex health matters with substantial social impact is more and more being used by policy decision makers. Recent examples include the sequence of groups called together by the National Cancer Institute and the National Institutes of Health on mammography for breast cancer detection and the Institute of Medicine study of saccharin for the Federal Government. In view of the emphasis on judgment in drawing the causal inferences noted and the complexity and potential importance of policy decisions in the second public health revolution, it is reasonable to expect acceleration of the apparent trend toward use of consensus panels. The experience with cigarette smoking and health has given thrust to that approach.

Risk Factors

Also growing out of the scientific study of cigarette smoking and health and into related public policy is a current shift in health strategy for industrialized society. Again, the matter of cigarette smoking appears to be a prototype. It has been identified as one risk factor in several diseases and for mortality as a whole. Other socalled risk factors are being identified. Not only in the United States, but also in Canada, Australia, Finland, and other industrialized nations, governments are giving substantial attention to what can be accomplished to improve health by combating the so-called risk factors, cigarette smoking being an example. This approach to health is based on the concept that, in view of what we know about the current disease patterns in such countries, reduction of these risk factors will lead to more rapid health improvement than the further almost exclusive investment in medical care that has characterized health strategy. Sometimes this shift in strategy is posed as an either-or dichotomy. That is unfortunate, because a great deal remains to be accomplished by extension of medical care to presently still-neglected segments of the population in countries such as ours. The issue is one of emphasis: shall we invest in medical care at the recent escalating rate as the essentially sole element of health policy, or shall we devote a substantial portion of the next increment in funds for health to attempting the reduction of known risk factors?

To put the issue in perspective, the Federal Govern-

ment has been spending about \$10 million annually to combat cigarette smoking and approximately \$60 billion-6,000 times as much-for medical care. If the Federal anti-smoking contribution were increased sixtyfold, the amount for this purpose would still be about only 1 percent of that devoted to medical care. Does 1 percent of the nation's health budget seem unreasonable to devote to reduction of a risk factor-cigarette smoking-that is "the single most important preventable environmental factor contributing to illness, disability and death in the United States" (4)? Does 1 percent seem unreasonable in light of the fact that life expectancy for American men was held back an estimated 31/2 years by cigarette smoking during the period 1919-65 and is still being held down-now increasingly with that of women (5)? Does 1 percent of the Federal health budget to combat cigarette smoking seem unreasonable when 30 million Americans have already quit, and half of the remaining 54 million still smoking in 1974 said that they wanted to quit (6)? It appears that Americans generally have quit cigarettes, or want to quit and could use help. Incidentally, it is the younger, better-educated segment of the population that is abandoning cigarette smoking the fastest. There is a sound base for optimism with respect to the control of cigarette smoking as one important element in a strategy to advance health.

Economic Factors

Implementing that strategy, however, brings us face to face with some harsh economic realities. Scientific knowledge and the impulse to improve health are necessary but not sufficient. That is still another lesson from the epidemiologic approach to cigarette smoking and health.

One prominent economic allegation is far from reality—in fact, it is a myth. This allegation is that the campaign to curtail cigarette smoking is an economic threat to the country and would bring economic disaster to tobacco farm families. That myth is perpetuated mainly by some tobacco-State Congressmen and by others with a narrow view of the industry. The reality is that cigarette smoking itself is an economic disaster for the country; tobacco farm families have been in a special economic disaster for years. The further threat to those growing tobacco might well be avoided with an intelligent approach to the matter.

The economic cost of the damage due to cigarette smoking is tremendous. In 1976 the direct health care cost of caring for cigarette-induced illness, conservatively estimated, was \$8.2 billion. Indirect cost of lost production from such illness exceeded \$19 billion. Thus the cost of cigarette-induced illness, in lost earnings (and corresponding production) and in payment for care, was more than \$27 billion in 1976. That does not count fire and other losses attributed to cigarette smoking. Compare those amounts with the \$15.7 billion in tobacco sales (mostly cigarettes) from which \$5.8 billion went to taxes collected at all levels of government.

The nation as a whole clearly suffers a multibillion dollar net loss as a result of cigarette smoking. Government pays about 40 percent of total health care costs and also experiences substantial loss of tax revenue from lost production due to cigarette-induced illness. It is evident that government gains in revenue from taxes on cigarettes are more than offset by cigarettecaused losses and expenditures.

Furthermore, the more than 300,000 premature deaths in the United States each year due to cigarette smoking should be considered. That figure is equivalent to one death per tobacco farm family in the nation, every year or two. Many people on the small tobacco farms live in poverty and face continuing economic disaster. They are trying to escape. In recent years about 300,000 people, mostly young, migrated north from the southeast tobacco region. Approximately half of the farmers on small tobacco farms are at least 55 years old.

Possible Solutions

In conclusion I should like to propose a brief agenda for dealing with the matter of cigarette smoking and health. It consists of three elements: scientific, educational, and economic.

The scientific problems surrounding the relationship of cigarette smoking and health are still numerous and important. To what extent and how is cigarette smoking associated with other factors, especially occupational factors, in the causation of disease? To what extent and how does the modification of cigarettes, for example, tar reduction, affect the adverse consequences of cigarette smoking? What are the additives to tobacco in the current manufacture of cigarettes and their health consequences? How does the cessation of cigarette smoking affect its various health consequences and over what time periods? These and many other questions remain to be answered by scientific investigation.

To establish a better basis for proceeding effectively through education against cigarette smoking as a health hazard, we need to know a great deal more about the habit itself. Who smokes cigarettes and why? Who quits and why? How can the decline in cigarette smoking be accelerated? What influences decisions not to smoke cigarettes or to quit? Further, we need a greater commitment to use all appropriate media of education in the task of helping people to avoid or quit cigarette smoking. Finally, it is time for serious !isting and examination of the options for dealing with the fundamental economic elements involved—the land, the manpower, and the product. We must systematically investigate the possibilities. Those who carry political responsibility and fail to explore the options intensively, who stick their heads in the sand to avoid clear economic signs, are the ones who are really endangering the livelihood of the tobacco farm families. The problems are not easy to solve, but solutions must be sought.

First, finding alternative uses of the land now committed to growing tobacco is probably the fundamental long-term solution. It seems likely that American innovativeness could find some way to convert use of land now devoted to growing cigarette tobacco to some other crop that would not be harmful to health—and might even be healthful. This approach would have to take account of the economic fact that tobacco yields a relatively high cash income for small acreage. In view of the governmental losses in the present situation, however, and the U.S. experience with influencing what is grown on land, it should be possible to proceed with the land-conversion option. It would be worth expending substantial sums, certainly much more than in the current subsidy, to accomplish this option.

Second, studies of the people engaged in tobacco growing and elsewhere in the cigarette industry and helping them to enter other types of employment are much needed. In the economic disaster engulfing the cigarette industry, attention should be focused not only on the land and on the dollars but at least equally on the people involved. They require assistance, through re-education and other ways, to find new job opportunities. The U.S. Office of Education is already supporting development of career-education materials for farmworkers who are being displaced in California and possibly for other displaced workers elsewhere in the country. A massive program of that sort is needed for tobacco farmworkers in the southeast.

Third, scientific investigation of alternative uses of tobacco leaf itself has been undertaken on a minuscule scale, considering the potential. Scientists at the University of California at Los Angeles, for example, recently developed a method to make a nutritionally excellent protein from tobacco leaf. In the first animal feeding experiments, it has proved superior to casein, which is taken as the standard protein in such studies. Of course, the method is not yet economically feasible for production of the protein that is vitally needed in so many countries. Initial methods rarely are economically feasible. But it is certainly conceivable that the tobacco leaf—which in the form of cigarettes has caused so many deaths—may be converted into a product that may contribute to reducing the world's hunger. Other tobacco leaf products should also be considered, for example, alkaloids for pesticides and medicines.

Another economic aspect of the cigarette tobacco situation is the present extent and potential of sales abroad. Several developing countries are now tending to follow some of the same social paths, including the smoking of cigarettes, that the Western world has followed. It is U.S. government policy currently to promote sales of cigarettes to these developing countries by various forms of subsidy. The United States is not alone in that policy. Yet, it does seem cynical for the U.S. Government to go to great lengths to stop heroin production in other countries and thus prevent its importation into our country, while at the same time subsidizing the production of cigarettes and especially their sales to other countries-when cigarettes in the United States and on a world scale cause vastly more damage to health and deaths than does heroin.

It is time to face the economic as well as the health realities of cigarettes as a national problem for the United States. Continuing the present acquiescence in and support of short-term gain for the few who benefit, in the face of massive and growing health and economic loss for so many, makes no economic or health or political sense. As a nation we should offer every assistance to those engaged in the cigarette industry to escape from their economic disaster. We must look to the good for the land, the people, and even the product; be willing to make the economic adjustments; and pay the bill necessary to achieve that sectional good—as well as better health for the nation and the world.

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