

## THE RELATIONSHIP OF TOBACCO SMOKING TO HEALTH

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Man, being the intelligent and curious animal that he is, has continually since he came upon the Earth, sought after substances which, when chewed, ingested or inhaled, would raise his spirits, make him less anxious, cure his ailments, relieve his boredom, or in general, make his weary life seem more worth living. He has ransacked Nature's entire selection of living things - both vegetable and animal; extracting, pulverizing, baking, and emulsifying all manner of natural substances, and has produced such results as opium, tea, coffee, cocaine, betel nuts, snuff, and tobacco. Millions of people in the world at this moment are psychologically dependent upon one or more of these substances, some of which are innocuous, others of which are unquestionably associated with certain forms of ill-health.

In our Western Civilization, one of the most important issues in the field of Public Health is that of the strong relationship between tobacco-smoking and the health of the individual. It becomes now a question of life-shortening magnitude for the heavy smoker to decide whether or not to stop smoking; and for the young non-smoker, whether or not to start.

Numerous studies have been carried out trying to prove or disprove a causal relationship between tobacco-smoking on the one hand, and cardiovascular disease, lung-cancer, chest disease and various other forms of illness on the other. Although a few of these experiments have involved direct observations of the effect of tobacco smoke on animals, because of the unfeasibility of conducting proper, long-term, controlled experiments with human volunteers, most of the studies have been based upon the epidemiological or statistical method.

Epidemiological studies themselves cannot establish proof of causality in a consistent association between two phenomena; however, statistics can certainly cast a strong vote in favour of a causal relationship between an agent (tobacco smoke) and a host (man). The final decision as to causality must be a matter of judgement which goes beyond any statement of statistical probability.

A well-known example is the frequent association which has always been observed between group A Streptococcal infections and rheumatic fever. For years, on the basis of epidemiological and clinical evidence, it was strongly believed that there was a causal relationship. More recent evidence in the form of raised anti-streptococcal antibodies, and the low recurrence rate of rheumatic fever with prophylactic antibiotics, has confirmed this causality.

Several efforts to collect, summarize and correlate the available literature on the subject of smoking have been made in the last few years. The most comprehensive of these has been the Publication of the United States Department of Health, Education and Welfare called **Smoking and Health: The Report of The Advisory Committee to the Surgeon General of the Public Health Service.**

This report reviewed all the available data, and investigated in as unbiased a manner as possible, the consistency, strength, specificity, temporal relationships, and coherence of the associations existing between the smoking of tobacco and the various forms of disease mentioned above. In addition, the members of the Advisory Committee tried, on the basis of their investigations, to make judgments as to the degree of cause and effect existing in these associations.

The enormity of the problem is reflected in the most recent statistics which indicate that 68 percent of the male population and

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32.4 percent of the female population over 18 years of age are regular smokers of cigarettes. The per capita consumption of cigarettes in the United States in 1961 was 3986.

Animal experiments involving chronic exposure to tobacco smoke and tars, as well as to some of the polycyclic aromatic compounds contained in tobacco smoke, have shown that these compounds have definite carcinogenic or cancer-producing properties. Other substances in tobacco smoke promote cancer by rendering the tissues more susceptible to known carcinogens. Animal studies have also shown that tobacco smoke causes diminution of the normal protective ciliary action of the respiratory epithelium which is responsible for the continuous cleansing of the tracheo-bronchial tree; it also causes damage to the alveoli, and to the mucus-producing glands.

Clinical observation and autopsy studies have invariably shown that cellular changes such as loss of ciliated cells, thickening of the basal cell layer, and presence of atypical cells, are much more common in the epithelium of the tracheo-bronchial tree of smokers than of non-smokers.

Population studies have shown conclusively a much larger proportion of cigarette smokers among the lung cancer patients than in control populations without lung cancer: also that chest disease symptoms such as chronic cough, sputum production, breathlessness, and decreased pulmonary function occur more often in cigarette smokers than in non-smokers. In another epidemiological survey begun over twenty years before, men were asked about their smoking habits; of the million or more men interviewed in the seven series almost forty thousand died during the intervening years of the studies. From the interview data and the death certificates, comparisons of mortality, experience of smokers and non-smokers were formulated using two major concepts: the excess deaths of smokers compared with non-smokers, and the mortality ratios. If the age-adjusted death-rates were the same in these two groups, then the excess deaths would be zero and the mortality ratio would be one.

The total mortality ratio for male cigarette-smokers compared with non-smokers, with all causes of death included, was 1.68, meaning a total death rate of nearly 70 percent higher than for non-smokers. It will

be noted in addition, that the mortality ratio was particularly high for lung cancer (10.8), bronchitis and emphysema (6.1), laryngeal cancer (5.4), etc. This means for example, that the death rate for cigarette smokers from lung cancer, the most common malignancy in men, is almost 1000 percent higher than for non-smokers!

TABLE I

Observed Underlying cause of death	Expected Deaths	Deaths Observed	Deaths Mortality Ratio
Cancer of lung	170.3	1833	10.8
Bronchitis and emphysema	89.5	546	6.1
Cancer of larynx	14.0	75	5.4
Oral cancer	37.0	152	4.1
Cancer of esophagus	33.7	113	3.4
Stomach and duodenal ulcers	105.1	294	2.8
Other circulatory diseases	254.0	649	2.6
Cirrhosis of liver	169.2	379	2.2
Cancer of bladder	111.6	216	1.9
Coronary artery disease	6430.7	11177	1.7
Other heart disease	526.0	868	1.7
Hypertensive heart	409.2	631	1.5
General arterio-sclerosis	210.7	310	1.5
Cancer of kidney	79.0	120	1.5
All causes	15,653.9	23,223	1.68

The mortality ratio for coronary artery disease was relatively smaller than those of the above-mentioned diseases, being 1.7. However, this statistic is of great significance since coronary artery disease is the number one killer in our society today. From a percent viewpoint, the death rate is 70 percent higher in cigarette smokers; but when looked at from the standpoint of excess mortality, coronary artery disease is consistently the chief contributor to the excess number of deaths of cigarette smokers over non-smokers, accounting for 45 percent of these excess deaths. Lung cancer was second with 16 percent.

No one of course believes, or sets out to prove today, that any single given factor (cigarette-smoke) by itself "causes" any given disease (coronary artery disease). In this case, it is well-known that many other factors such as high blood pressure, high serum cholesterol, personality, vocation, amount of exercise and obesity are all associated to significant and varying degrees, with coronary artery disease. The American Heart

Association in their most recent publication on treatment of patients after recovery from myocardial infarction take a firm stand regarding smoking:

"The preventive and therapeutic implications of the information in these editorials is obvious, namely, that 'inhalation of tobacco-smoke contributes powerfully and independently to the lethal consequences of coronary atherosclerosis' and that 'cigarette smoking undoubtedly plays a significant role in rendering persons with coronary atherosclerosis more liable to its serious consequences'".

The Surgeon-General's Report is almost as vehement in its recommendations:

"Male cigarette smokers have a higher death rate from coronary artery disease than non-smoking males, but it is not clear that the association has causal significance . . . .it is also more prudent to assume that the established association between cigarette smoking and coronary disease has causative meaning than to suspend judgement until no uncertainty remains."

The current thought is then, that cigarette smoking is probably a significant factor in promoting the occurrence and continuation of coronary thrombosis and resulting myocardial infarction; and as such is undoubtedly responsible for the early deaths of large numbers of middle-aged and elderly males in Canada and the United States.

The high mortality rates associated with lung cancer has already been mentioned, and although direct, incontrovertible evidence has not been obtained, the statistical, clinical, experimental and post-mortem evidence is so overwhelming that there are few doubters remaining to deny the causality. Robbins says:

"The clinical studies of significance have dealt largely with the changes in the lining epithelium of the respiratory tracts of smokers and non-smokers. In essence, these reports indicate atypical cellular hyperplasia, squamous metaplasia and even carcinoma in situ in the trachea and bronchi of smokers. The more cigarettes smoked daily,

the more striking the epithelial changes. When Auerbach et al. quantitated the severity and frequency of these changes in a large series of smokers, they found that the respiratory epithelial changes in those who used more than a pack of cigarettes per day were almost as marked as those in patients who had frank pulmonary cancer at some other site in the respiratory tree. Non-smokers were shown to have far fewer and less severe changes."

As in the development of coronary artery disease, there must certainly be numerous causal factors at work in the production of each case of bronchogenic carcinoma, some of which are known, others of which are merely suspected: urban living; certain vocations such as mining; industries using volatilized chromates and distillation products of coal; atmospheric pollution from automobile exhausts, industrial gases, soot, radioactive fallout. However it seems that the most important factor is inhaled cigarette smoke. The Surgeon General's Report has no reservations about stating:

"Cigarette smoking is causally related to lung cancer in men; the magnitude of the effect of cigarette smoking far outweighs all other factors. The data for women, though less extensive, point in the same direction."

"The risk of developing lung cancer increases with duration of smoking and the number of cigarettes smoked per day, and is diminished by discontinuing smoking."

Chronic bronchitis is one of the leading causes of morbidity and general disability in our Western Civilization: combined with emphysema it is also an important cause of mortality. Again, although the causality is undoubtedly multiple, the most important instrumental factor in the development of bronchitis is cigarette smoking.

The Surgeon-General's Report states:

"Cigarette smoking is the most important of the causes of chronic bronchitis in the United States, and increases the risk of dying of chronic bronchitis."

“A relationship exists between pulmonary emphysema and cigarette smoking but it has not been established that the relationship is causal. The smoking of cigarettes is associated with an increased risk of dying from pulmonary emphysema.”

Smoking is definitely associated to some extent with many other forms of morbidity and mortality: peptic ulcer, cirrhosis of the liver, lower infant birth weight, accidental deaths due to fires in the home, cancer of the oral cavity, larynx, esophagus, and urinary bladder. With the exception of the relationship of pipe smoking to cancer of the lip, these associations have not been generally accepted as causal in nature.

The possible existence of some more basic factor which leads, for example, to both heavy smoking on one hand and lung cancer or coronary artery disease on the other has been theorized, and some studies relating smoking habits to such parameters as body build, degree of masculinity and personality make-up have been conducted with many interesting, but not conclusively significant findings. The bulk of evidence leads to the conclusion that smoking in all its aspects is primarily psychologically and socially determined. Although no “smoker personality” has been discovered, it seems that the beginning of smoking is related to self-esteem and status-seeking; and also that the smoking habit is associated with personality factors such as extroversion, neuroticism, and psychosomatic illness.

Seltzer, in a study of 247 college students, and using body build as an index of masculinity, found that weakness of the masculine habitus was significantly more prevalent in smokers than in non-smokers, and most prevalent in heavier smokers. In a larger study of 922 university alumni, it was found that in every instance, smokers had larger body dimensions than did non-smokers. These findings are certainly provoking, but due to the small size and the selectivity of population, they provide little material upon which to base conclusions.

In every study quoted above, it was consistently found that all undesirable associations, causal or otherwise, were proportional to the number of cigarettes smoked

per day and to the number of years of smoking; and furthermore that the associations invariably decreased with cessation of the smoking habit. Levels of cigarette consumption in the one to two packs and more per day for a number of years were found to be particularly strongly related to the forms of morbidity and mortality discussed above.

While the young non-smoker with smoking aspirations and the adult with only a short smoking history certainly should not need Daniel to interpret the ominous writing on the wall, the decision of the longestablished heavy smoker to “kick” the habit is one fraught with great difficulty. An illustrative example is that of a good friend, a young university professor, who had been smoking in the 40 cigarettes per day range for over ten years, and who became upset about possible consequences to his health shortly after the release of the Surgeon-General’s Report. He decided to give up smoking completely, and for two years did not smoke a cigarette. During the first weeks of the withdrawal, his wife could scarcely bear to live with him, and over the two years he was continually miserable when anyone smoked in his presence - every time he saw a cigarette or smelled cigarette smoke he longed for one. Having been previously of extremely asthenic build, he put on enormous amounts of weight, ate constantly, and drank twice his normal amount of beer. Apart from these worries added expense of the food, liquor and new clothing, which he could have borne with effort, the climax of his misery occurred while walking across a field one day (perfectly sober at the time) - he stumbled, and his newfound bulk effected a classical fracture of left tibia and fibula, which with mal-union kept him in a walking cast for several months. During the initial weeks of convalescence he made the decision to start smoking again, and subsequently did so. Now he is back to smoking 40 cigarettes per day, has lost most of his excess weight, looks the picture of health, feels wonderful and will undoubtedly live to a ripe old age.

It is obvious that each person and his smoking problems must be dealt with as an individual case, but in general, if you or I as the physician can, by sound example and advice, prevent even one death from these dread diseases which seem more and more

to cut men down in their most productive years," then it is certainly our duty to wage all-out war against the cigarette.

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