

CIGARETTE SMOKING - CAUSAL RELATIONSHIPS

In their public relations the tobacco companies are particularly sensitive to the question of 'causality'. To the medical profession and others this attitude is hardly comprehensible. Most doctors and even medical scientists rarely give much thought to what they mean by 'cause'. Tobacco companies' spokesmen find themselves sticking out against what to others appears common sense. Indeed tobacco managers find themselves publicly rejecting as a basis for action exactly the same sort of information as that on which they will spend millions on marketing new brands and so on, although in the latter case it is usually of a lower order of confidence.

Of course the public position of the tobacco companies is dominated by legal considerations. In the ultimate the companies wish to be able to dispute that a particular product caused injury to a particular person. By repudiating a causal role for their products they hope to avoid liability. Yet companies are concerned to modify their products and to get others to attribute factors of safety to them. Companies undertake safety evaluation work to improve their products and yet deny the need to do so. This leads to a variety of public relations stances:

"Until there is clinical proof" "We are not doctors. . . ." "We cannot make medical judgments" etc.

Naturally none of these cut much ice with medical scientists. They are equally as unconvincing to those who see in smoking a social problem as to those concerned with individual risk. It is not my object here to propose changes in our public attitudes but to explore a little of the nature of concepts of causality and if possible to clear away some of the debris which clutters up this issue in order to resolve the dilemma where on the one hand the simplest hypothesis to fit the facts is that smoking 'causes' certain diseases and on the other there is never likely to be sufficient evidence to establish that a particular product caused a particular disease in a particular individual. Or where on the one hand it may reasonably be said that smoking causes this or that and on the other it seems misleading to label cigarettes as causing lung cancer, etc. It all depends on what is meant by cause.

In the nineteenth century it was assumed that every effect must have a cause and also the concept of causality was mechanistic. With John Stuart Mill's concept (1) to prove that A caused B it would have to be demonstrated that event A precedes event B and that event A is both necessary and sufficient to ensure that event B will follow. The view of science itself was mechanistic; it was felt that if everything was known about a system then the future of that system would be predictably certain. Within its limits this concept is still valid. In spite of appearances the behaviour of billiard balls is entirely predictable and, given the data, calculable. This concept still dominates legal thinking. Although the extension of contributory negligence increasingly recognises multiple causes the concept is nevertheless mechanistic - there is an underlying assumption that, given the facts, the results are predictable, calculable and legally apportionable. This mechanistic concept of causality

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is still also the popular concept. In the modern world of advertising even the most complex systems imaginable (human emotional situations) are presented as predictably controllable by simple events such as using Brand X.

Twentieth century science has led to a probabilistic view of causality. This rests on two bases, first the unknowability (uncertainty principle) of the total data for some systems and second the properties of populations of large numbers. While Newton's laws are true enough for everyday experience and relativity would be superfluous the mechanistic concept of causality applies only to the simplest of unified systems and cannot usefully be applied to a system as complex either as a single animal or as a large population of animals (or possibly cells) regarded as individuals.

A probabilistic causality concept is useful in dealing with complex systems involving large numbers and the behaviour of the population may be predictable and calculable from relationships experimentally established. For example, if smoking is a factor in multiple correlations as has been indicated or if in studies on big populations smoking is associated strongly with some diseases this may be sufficient to substantiate a claim that smoking causes the increase in the incidence of such diseases in the second case or is a cause of the disease in the first case. But the evidence obtained by the examination of populations is not relevant to the individual and the conclusions are invalid in this respect. Putting it more simply smoking may be a cause (in a probabilistic sense) inasmuch as it can be reliably predicted that if smoking is decreased in a population so will be the incidence of this or that disease. But as far as an individual is concerned this (probabilistic) cause has no validity, and it would be quite improper to imply predictability.

In an individual case, to prove an agent is a cause for an effect one must fall back to establishing that the particular agent was for that individual in all his special circumstances both necessary and sufficient. But these special circumstances include genetic constitution, abnormal phenotype or genotype, social status, exposure to other known agents (e.g. carcinogens) together with a host of relevant considerations. Diseases in fact are not caused merely by the presence of a particular agent. If such a simple cause were assumed then there is a necessity to explain why it only occurs in a minority of "susceptible" individuals.

Julian Huxley in 1958 wrote "The conclusion to be drawn from the evidence is definite: increased smoking increases the probability of developing lung cancer. Unfortunately the significance of such a statement is not clear to many people. Obsessed by the naive idea of finding a single cause for every effect, they shake their heads and say that the evidence is only statistical, as if that invalidated it. In point of fact, every scientific law is statistical, and all that physicists can tell us about electrons within the atom is the probability of their occupying any particular position. Further, the degree of probability whether of an electron occupying a particular position or of an urban English cigarette smoker developing lung cancer can be quantitatively determined, often with high accuracy".

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In my view Huxley is wrong in the last sentence. He falls into the trap of using experimental evidence on group properties to talk about probabilities for an individual but he does indicate the awakening to a probabilistic view of causality.

Sir Alexander Haddow, in 1967, stated the pragmatic position of many medical scientists in this respect. Referring to smoking and lung cancer he wrote "With the use of the most rigid logic it is probably true to say that the causal explanation of the statistical association is unproved. Yet from the evidence of our senses there remain few indeed who doubt it. Furthermore, policy must be based upon the highest probability and a direct causal connection is infinitely the most probable". Sir Alexander Haddow only recognised the dilemma which I believe is resolved in this note.

In the Surgeon General's Advisory Committee Report the question of causality is raised. They recognised the difficulties and concluded that causal significance of an association is a matter of judgment and noted a number of criteria which may be utilised together, not one of which alone would be sufficient, e.g. the consistency, strength and specificity of the association, the temporal relationship and the coherence of the association. They considered characterisation of the assessment of an association as a "factor", a "determinant" or a "cause". They recognised "factor" as a source of variation but not necessarily as a cause. Further there can be co-existence of several factors required for the occurrence of a disease but one factor may play a determinant role. The word cause was held to convey the notion of a significant effectual relationship between an agent and an associated disorder in the host. All the members accepted a multiple etiology view of biological processes. In the end they defined "cause" merely to confirm their convictions. I believe they faced a similar dilemma to the ones I have indicated. They did not resolve it however and settled for a suitable definition for their purposes and noted that "rarely, if ever, in our biologic universe does the presence of an agent invariably predict the occurrence of a disease".

In summary, for social policy purposes it is sensible and totally relevant to use the experimental evidence pertaining to large groups and also to select the simplest hypothesis. It may therefore be concluded that for certain groups of people smoking causes the incidence of certain diseases to be higher than it would otherwise be. But no valid conclusions may be drawn from the epidemiological studies with respect to any particular individual. In this case, at present, there is no way of knowing or of calculating the probability whether smoking will cause disease in any specific individual or whether by giving up smoking he will avoid disease. Thus I find it completely consistent both to accept the need for some action on smoking as a social problem and also to reject a message to the individual smoker that "smoking causes lung cancer", etc.

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Footnote

1. The statement is, of course, a grossly over-simplified expression of J.S. Mill. Mill was concerned to establish methods employed by scientists, methods of induction, which would act as an independent check on mere observation:
 - a) If two or more instances of the phenomenon under investigation have only one circumstance in common ... this is the cause.
 - b) If an instance in which the phenomenon occurs and an instance in which it does not occur have every circumstance in common except one, that one only occurring in the former, this one differing circumstance is the cause ... (or an indispensable part of it).
 - c) If two or more instances in which the phenomenon occurs have only one circumstance in common, while two or more instances in which it does not occur have nothing in common (save the absence of that circumstance) the circumstance in which alone the two sets of instances differ is the cause.
 - d) Whatever phenomenon varies in any manner whenever another phenomenon varies in some particular way, is either cause or an effect of that phenomenon or is concerned with it through some fact of causation.

Mill was never clear whether his methods were of discovery or of proof but they did influence the approach of experimental scientists. Nevertheless his inductive method necessarily assumes that every event must have a cause.

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