tended to ignore the claim of Hume, among other writers, that causal connections cannot be observed or objectively proven. Thus, on the one hand, a great deal of effort is spent to carefully develop methods aimed at revealing causal relationships, while on the other we are being told – rather persuasively – that we cannot ultimately determine causal relationships, or that we should refrain from attempts to establish causal relationships because these should be understood as different from nomological or probabilistic relations. Obviously, these tensions have not stopped scientific, let alone epidemiological, efforts from proceeding apace (nor should they).

Nevertheless, fundamental issues bearing on how the relationship between exposures and outcomes are assessed, interpreted and discussed, are left more ambiguous than necessary. And to be clear, this is not just a theoretical issue, since such ambiguity allows for real world problems to arise that, with a small amount of care, are easily avoided. In this essay, we will explore some limitations on obtaining causal information, and on how such epidemiological information should be disseminated, both to lay and professional audiences, in a more useful and less confusing manner than is often presented. The goal of our argument is to invite a less anxious and more humble, yet forceful, approach toward assessing epidemiological research. This approach will show that the process of examining exposures and outcomes is the important factor, in service to prediction and intervention, not an illusory ability to identify and articulate apparently more fundamental causal connections.

Analysis

Public health issues and causation-speak in the 2004 Surgeon General's report

Among the possible reasons so much has been written about causation and epidemiology is that in significant ways epidemiology is a science, and as such is definitionally interested in causation. If there is a shared discourse in epidemiology as a field it revolves around the manner in which exposures are related to outcomes in service to analyzing truly pressing public health issues.

Recently, a new Surgeon General's report on smoking, responding to and expanding on the original 1964 report, included a section explicitly discussing issues of causal claims and providing guidelines for determining the strength of causal relations [2]. The new report quotes the original 1964 report: "after vigorous discussions they could neither precisely define nor replace the word 'cause,' a reflection of the same problem that philosophers have confronted over the centuries." Further, the 1964 report noted that

> when a relationship or an association between smoking ... and some condition in the host was noted, the significance of the association was assessed. The characterization of the assessment called for a specific term .... The word cause is the one in general usage in connection with matters considered in this study, and it is capable of conveying the notion of a significant, effectual relationship between an agent and an associated disorder or disease in the host. Granted that these complexities were recognized it is to be noted clearly that the Committee's considered decision to use the words ' "a cause" or "a major cause" or "a significant cause" or "a causal association" ' in certain conclusions about smoking and health affirms their conviction. [3] (p. 21)

The authors of the new report correctly point out that while the original report is quite useful and serves as one of the most important examples of comprehensive assessment of exposures and outcomes in public health history, there is some level of confusion associated with the language of causation. Indeed, the 1964 report is clearly struggling to articulate and justify its use of causal terms; e.g., in the passage quoted, the strained language of the last sentence is revealing. Circularity threatens when a choice of terminology for the purposes of describing one's findings is justified in part by a wish to "affirm convictions" in regard to the findings. Are we to suppose that the findings do not speak sufficiently eloquently for themselves?

In an attempt to address and even regiment the use of causation-speak, the authors of the new report, in addition to providing a very comprehensive list of causal statements related to smoking and health outcomes, discuss what they consider to be a less confusing approach towards using causal language and ascribing cause in epidemiology. Unfortunately, their efforts, while clearly useful as a guide to assessing possible implications of research, beg the question of whether explicit causal language is really needed in presenting and discussing research in the first place. Other begged questions concern how such causal language is *necessarily* linked to the substantive research and how hierarchies of causal strength are to be determined.

Starting on page 11 of the new report [2], their careful listing of causal statements from previous reports is strikingly idle in view of the fact that in many of the statements in the new report there is no explicit use of the word "cause" when these succinctly describe the current state of research. Examples are: "Autopsy studies suggest that cigarette smoking is associated with a significant increase in arteriosclerosis of the aorta and coronary arteries," "Recent autopsy studies confirm that pulmonary emphysema is much more frequent and severe in cigarette smok-