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Editorials

Nosology and epidemiology: dance partners in tobacco control

The ultimate health outcome measure is death. Epidemiologists, pathologists, clinicians, politicians, and even regular people want to know what causes premature death, and each of these groups brings a unique perspective to the inquiry. What binds the inquiry together is the death certificate – a *de facto* data source that relies on extensive training of physicians in biomedical science; a hierarchical system of causal attribution agreed to by coroners, nosologists, and information system managers (starting with the World Health Organisation); and input from family members, care-givers, and others who know about the lifetime behavioural risks of the decedent. Clearly, what is listed on a death certificate and how assiduously the information is collected determine its utility in monitoring health outcomes. Ideally, to provide 100% accuracy on death certificates, each decedent would have autopsy confirmation to determine underlying causes of death, an accurate record of each risk exposure throughout his or her life, and biochemical confirmation of the levels of all harmful exposures or behaviours. This will never happen.

When it comes to tobacco use as a risk for serious illness and premature death, no other risk factor has been more thoroughly studied, but as yet no uniform system exists to name tobacco use as a cause of death on death certificates. No honest physician challenges the relationship between tobacco use and the numerous smoking-related diseases that he or she may list on the death certificate. These relationships have been established by carefully conducted cross-sectional and longitudinal epidemiologic studies on various tobacco-exposed populations. Despite the limitations of any single study, collective knowledge about the risks of tobacco use for premature mortality provides a fundamental premise in public health and clinical medicine: tobacco use kills human beings prematurely, with or without other risk factors.

The epidemiologic approach to understanding causes of death lumps deaths among individuals into a population quantity. Calculations are then performed which estimate what proportion of premature death would be prevented in the absence of individual risk factors such as tobacco use.[1] These estimates help policy makers and the public recognise the substantial burden that tobacco use imposes on society. SAMMEC II (Smoking-attributable Mortality, Morbidity, and Economic Costs) spreadsheet software provides a convenient epidemiologic tool by which these calculations are performed at the state and local level.[2] This software incorporates risk estimates, smoking prevalence rates, and mortality data from death registries into an attributable-risk calculation. In the absence of "ideal" death certification, such epidemiologic tools are necessary to support public health programmes against tobacco use.

Epidemiologic tools and the policies they support are strengthened by improved death certification, including recording information about tobacco use on death certificates. Since 1992, British physicians have been allowed to include smoking status as a cause of death without referring the certificate to the coroner for confirmation.[3] Peto and Doll advocate that physicians simply state whether the decedent regularly smoked at any time over the 10 years prior to death ("yes," "no," or "no information").[4] Others suggest that including a judgmental call on the part of the attending physician as to whether smoking was a contributing factor to death places a difficult burden of epidemiologic understanding on the physician.[5] For example, if the decedent died prematurely of a cardiovascular disease, how much of the premature death in this individual could be attributed to smoking? This is a much more reasonable question to ask in the epidemiologic sense when dealing with an entire population, but, on an individual level, it may evoke considerable difficulty, especially if many smokers stop smoking when they acquire smoking-related diseases. They may end their lives as nonsmokers, but their end was undoubtedly hastened by previous tobacco exposure which may not show up on the death certificate.

Pathologists understandably call for improved autopsy rates to satisfy the need for accurate data on smoking and premature death.[6] Scientists with ties to the tobacco industry condemn the epidemiologic techniques used in estimating smoking-attributable mortality through time-worn arguments such as the inability to put a name on each of the attributable deaths calculated by SAMMEC II.[7] SAMMEC II's epidemiologic calculations are based on relative risk estimates derived from the American Cancer Society's Cancer Prevention Study II, which included approximately 1.25 million subjects, many of whom died prematurely, had autopsies, and had lifetime tobacco exposures ascertained through face-to-face interviews.[8] Huge longitudinal studies such as these provide public health scientists with valuable risk estimates that can be applied to entire populations. Such studies are expensive and cannot include data on every single individual risk factor for premature death in every single population group in the world. SAMMEC II can provide estimates for large, specific groups of individuals such as states and large metropolitan areas with similar historic tobacco exposures, but it is important to know if the epidemiologic estimates generated by SAMMEC II reflect the clinical conditions among the decedents from those populations.

In this issue of *Tobacco Control*, reports from two states

TAB 3

in the USA demonstrate some important strengths and weaknesses of physicians' recording of tobacco use on death certificates as a contributing cause of death. First, McAnulty et al[9] carefully compare the results obtained from two sources: a) physician-supplied aggregate data on the attribution of individual deaths to tobacco use, and b) smoking-attributable risk calculations by SAMMEC II using state-specific mortality data and smoking-prevalence data. This study was conducted in Oregon, where the death certificate probes specifically for the possible role of tobacco in causing the death. A careful follow-back procedure was used to obtain complete physician responses. The results indicate that what physicians said about the deaths of real people was remarkably similar to what epidemiologists might report using SAMMEC II software (within three percentage points for deaths aetiologically linked to smoking). If anything, SAMMEC II underestimates adverse tobacco contributions compared with physicians' reports.

Second, Pezzino et al[10] demonstrate the low level of death certificate reporting of the contribution of tobacco to premature death in a state (Wisconsin) with a conventional death certificate (ie, no specific query on tobacco). They suggest that physicians may feel uncomfortable in assigning a portion of the cause of death to tobacco use when the relationship is epidemiologic and not pathologic. Further, physicians may be unaware of the public health utility of such information regarding the role of tobacco use. The authors emphasise the importance of improving the recording accuracy of smoking history on death certificates.

In the case of SAMMEC II, death certificates from real people are used to compile a denominator from which an estimate of the smoking-attributable fraction of these deaths is made. In the case of a physician recording tobacco as a contributing cause of death, the "epidemiologic calculation" is performed by that physician for one individual based on knowledge of that person's pathology and past behaviour. Because death certificates remain one of the most important tools in assessing health outcomes, it seems reasonable to include a record of tobacco use on them; these records should be used to improve surveillance of smoking-related deaths such as those due to lung cancer among smokers, former smokers, and never-smokers. McAnulty and his co-investigators have shown how epidemiologic calculations can be confirmed by diligent individual-level data collection; Pezzino and his colleagues have confirmed how difficult it is to obtain accurate information about tobacco use using current death certificate methods. Both epidemiologic and physician-recorded data must be used to refine our understanding of the mortality burden of tobacco use. Death certification is part of the epidemiologic process, and physicians' understanding of smoking-attributable mortality calculations will help them to identify causes of death correctly on death certificates.

From these studies, two recommendations emerge. First, continue to use epidemiologic calculations to help communicate information on the disease burden of tobacco on society. Tobacco is still unarguably the most important preventable cause of death. The legitimacy of these calculations is borne out by the confirmatory report from McAnulty et al.

Second, continue to improve the way tobacco use is recorded on death certificates. Epidemiologists might find a simple "yes, no, uncertain" format as to whether tobacco was ever used more useful for surveillance purposes. However, a carefully considered judgement on whether past or current tobacco use contributed to the cause of death for each decedent is well within the capabilities of most physicians, who can consider the presence or absence of other contributing risk factors, with or without autopsy confirmation. Epidemiologic investigations will help determine the utility and accuracy of the various recording schemes, and no matter what the approach, tobacco use should be recorded on death certificates, just as maternal tobacco use is recorded on birth certificates in most states.[11] Autopsies on every decedent are not necessary to determine the population burden of tobacco use; they are expensive and often problematic to obtain. Epidemiologic tools such as SAMMEC II will continue to be useful in estimating this burden.

The "dance" of tobacco control is enlivened by creative approaches to mortality analyses such as those of McAnulty et al and Pezzino et al. The dance floor is improved by thoughtful refinements in the approach to assessing the disease burden of tobacco use, and these refinements will ultimately improve the overall scientific basis for the public health practice of tobacco control.

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