Prevention, screening, and a chance of rain

Prevention, health screening, and assessing risk are concepts that lie at the core of medicine and dentistry and affect how all of us practice. In order to apply these concepts effectively, we must be clear in defining them.

Prevention can be separated into primary, secondary, tertiary, and quaternary prevention. Primary prevention usually refers to an attempt to reduce a clinical outcome among people who have yet to develop disease—fluoride for children without caries, for example.

Secondary prevention is an activity meant to reduce the morbidity and mortality in asymptomatic patients having an already established disease—fluoride for people with incipient caries. Tertiary prevention is intended to reverse, arrest, or delay progression of an already established disease—remineralization of carious lesions. And finally, quaternary prevention has been defined as reducing overmedicalization (overdiagnosis and overtreatment) to prevent the potential for iatrogenic harm—placing restorations in teeth with questionable caries lesions.  

“Overdiagnosis” denotes diagnosis of conditions that will never cause symptoms, harm, or death. “Overtreatment” refers to unnecessary treatment that provides no patient benefit. Overtreatment often results from the reluctance of health care providers to acknowledge new scientific findings and accept more appropriate outcome measures. Unfortunately, overtreatment significantly contributes to rising health care costs in the United States.  

All of these types of prevention have been linked to risk or surrogate markers associated with specific diseases. Treating risk factors does not always prevent disease, as the same risk factors may not always be causative for all patient populations. Treatment for high levels of total or low-density lipoprotein cholesterol, for example, may not benefit everyone taking cholesterol-lowering drugs, as it has been shown that those without clinically manifested cardiovascular disease may not benefit from taking statins. Statins are associated with some dire side effects and may, therefore, in some populations, cause more harm than good.  

Populations and individual patients at risk for developing disease can be identified and assessed by screening. The general purpose of screening is to reduce overall morbidity, mortality, and to improve future quality of life, but the actual intent of a particular screening must be determined before embarking on a screening plan.

Is the purpose of screening to identify asymptomatic patients at risk for developing disease? To diagnose the presence of disease (diagnostic screening)? Or is it to monitor progression of disease? Two different screening schemata have generated intense debate: prostate-specific antigen
(PSA) screening for prostate cancer and mammography to detect breast cancer. The discussion surrounding these screening models centers on benefit versus harm. Will screening for prostate cancer with a PSA test or screening for breast cancer with mammography reduce morbidity and mortality? Or will such screening actually result in more harm through side effects from unnecessary surgery and other treatments? The US Preventive Services Task Force (USPSTF) recommends against PSA testing, as the harm outweighs the benefit.

Breast cancer screening with mammography is still recommended, but based on the high risk of false-positive tests (more than 60%) and associated harm, revised guidelines have been proposed to improve the yield of true positive cases.

Are we practicing quaternary prevention in dentistry? In May 2014, the USPSTF concluded that “the current evidence is insufficient to assess the balance of benefits and harms of routine screening examinations for dental caries performed by primary care clinicians in children from birth to age 5 years.” The USPSTF also determined that there is “inadequate evidence on the diagnostic accuracy, benefits and harms of screening for oral cancer. Therefore, the USPSTF cannot determine the balance of benefits and harms of screening for oral cancer in asymptomatic adults.” These are 2 examples of how a label of overtreatment can be used to describe everyday dental practices, when the conclusion reached by USPSTF may actually result from a lack of available evidence.

Using risk factors to establish the likelihood for developing disease—such as caries risk scores, gathering of laboratory and clinical assessments, making a diagnosis, and finally instituting therapy based on the above—are all inextricably connected. However, there is a major problem in dentistry. The risk of overdagnosis increases when it is not possible to assess disease progression. As we cannot yet accurately determine the progression of caries or periodontal disease, we use biomarkers as surrogates, which potentially results in overdiagnosis and subsequent overtreatment based on an inappropriate estimation of risk.

The basis for overdiagnosis and overtreatment is often the result of a belief that strong associations equal causation. For example, observational associations often have been assumed erroneously to equal causation in the area of oral-systemic health; and associations based on proxies for diagnosis, such as insurance claims, have been used to claim improved health care outcomes.

A specific marker has been observed to be associated with a particular outcome. The odds ratio—the ratio of the odds of a particular outcome occurring when the marker is present to the odds of this outcome not occurring when the marker is missing—is very high. Furthermore, there is a “dose-dependent” relationship with increased likelihood of the outcome occurring when the amount of the marker increases. Even the positive predictive value—the probability of finding a true positive value—is high. Different observers at different universities have further supported this observation. It has now been suggested that this marker may actually cause this particular outcome. However, it is unlikely that the fact of people carrying umbrellas actually causes rain.

Overinterpretation, or misunderstanding, of risk may result in overdiagnosis and subsequent overtreatment. As patients primarily rely on news reports and Internet sites for their health information, oral health care professionals have a duty to frame research findings within their appropriate scientific context.

Don’t eat sugar, brush your teeth, and stop using tobacco products; and, just in case, when in drought, carry an umbrella.