Definitions of Risk

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Abstract: Risk-related terms such as risk factor, modifiable risk factor, demographic risk factor, risk indicator, determinant, and risk marker are often not well defined in the literature. This short report supports the use of a 1996 definition of risk factor, as probably the most commonly used term related to risk, for the Consensus Development Conference on Diagnosis and Management of Dental Caries Throughout Life, March 26-28, 2001.

Risk is the probability that an event will occur. In epidemiology, it is most often used to express the probability that a particular outcome will occur following a particular exposure.1 There are very few conditions that constitute a sufficient cause in chronic and infectious disease (a sufficient cause being one where a specific exposure will always result in a particular outcome). If there were, it would not be necessary to deal with risk, which often deals with varying degrees of necessary cause (a necessary cause being an exposure that must always precede a particular outcome), though it can also deal with exposures that are neither necessary nor sufficient causes.2 This brief report is to support the uniform use of a previously stated definition of a risk factor in an effort to standardize terminology for this conference.

There is general agreement that the term risk factor means an exposure that is statistically related in some way to an outcome, e.g., smoking is a risk factor for periodontitis. But beyond that broad generality is little agreement. There is uncertainty in the literature on whether a risk factor should be truly causal, i.e., a link in the etiological chain, or whether it can be more peripherally associated with an outcome. There also is uncertainty about what strength of association is needed for an issue to be called a risk factor for a disease and just how directly it needs to be associated with the outcome. Also, there is disagreement over whether a risk factor is immutable, like race or gender, or whether it is something that can be modified, i.e., a smoking habit. In the ongoing studies to determine if periodontitis is a risk factor for cardiovascular disease, for example, it is already clear that there is a measure of association between the two factors. However, it is also evident that periodontitis is neither a necessary nor sufficient condition for cardiovascular disease, and it remains to be demonstrated whether periodontitis interacts with other conditions to lead to cardiovascular disease, or whether it is a marker for other conditions that may be causal, i.e., people with periodontitis are also likely to exhibit other factors that may be more directly linked with the outcome of heart disease.

Epidemiology is a relatively new science, so perhaps it is not surprising that there is uncertainty in our use of terms. The literature on measures of risk is replete with terms of uncertain definition, and supposedly standard terms are used in variable ways by different authors.3 Even the use of a supposedly standard term like risk factor is far from uniform. Rarely does an author define how the term is being used, and the evidence upon which a risk factor is identified is often unclear. The term comes with a cluster of related terms like risk indicator, modifiable risk factor, risk marker, determinant, and demographic risk factor, which are often used more-or-less interchangeably. This sort of uncertainty means that the reader has to make up his or her mind what the author has in mind, and that is clearly unsatisfactory.

Turning to the standard dictionary for epidemiology, we find that uncertainty persists. In Last’s Dictionary of Epidemiology, a risk factor (a term only in use since the 1960s) is defined as:

an aspect of personal behavior or lifestyle, an environmental exposure, or an inborn or inherited characteristic which on the basis of epidemiological evidence is known to be associated with health-related condition(s) considered important to prevent.1

That is a broad and rather loose definition that leaves unanswered the issues of causal role, strength of association, and modifiability. The definition then goes on to list the several different meanings that have been ascribed to the term risk factor:

• Risk marker: an attribute or exposure that is associated with increased probability of disease, but is not necessarily a causal factor.
• Determinant: an attribute or exposure that increases...
the probability of occurrence of disease or other specified outcome.

- Modifiable risk factor: a determinant that can be modified by intervention, thereby reducing the probability of disease.

Last agrees that the term risk factor is rather loosely used, and I think we would agree that these definitions still leave important issues unanswered. In an effort to clarify this area, Beck has listed a definition that was adopted for the World Workshop on Periodontics in 1996:

Risk factor: an environmental, behavioral, or biologic factor confirmed by temporal sequence, usually in longitudinal studies, which if present directly increases the probability of a disease occurring, and if absent or removed reduces the probability. Risk factors are part of the causal chain, or expose the host to the causal chain. Once disease occurs, removal of a risk factor may not result in a cure.

This definition is longer than that given by Last, but is “tighter” and more specific. The key contributions from this definition are: a) the emphasis on the temporal sequence of exposure before outcome; b) the acceptance that a risk factor is part of the causal chain; and c) the acceptance that risk factors are involved in disease onset, not necessarily in its future progression or resolution.

Any definition of risk factor must clearly establish that the exposure has occurred before the outcome, or before the conditions are established that make the outcome likely. This in turn means that longitudinal studies are necessary to demonstrate risk factors. However, there are many situations in biomedicine, and certainly in dentistry, where this has not been done, and indeed where it is unlikely that longitudinal studies ever will be done. In these circumstances, an exposure that is associated with an outcome only in cross-sectional data is called a risk indicator. A risk indicator may be a probable, or putative, risk factor, but the cross-sectional data upon which it is based is weaker than the results of longitudinal studies. This is because the temporal association usually cannot be specified from cross-sectional data.

REFERENCES