LETTER TO THE EDITOR

# Caries prevention

*To the Editor:* I read with great interest the systematic reviews in which caries prevention was discussed (published in Acta Odontol Scand 6/2003). The reviewers concluded that better evidence is needed concerning the utility of fissure sealants, fluorides, and dietary factors, including sugar substitutes. Better economical analyses are needed as well. Because the reviewers state that the evidence is incomplete, scarce, or missing, they must know what evidence is. While there are many studies discussing the nature of evidence, the criteria of evidence applied in the reviews in Acta have not been explicitly analysed by the authors.

My impression is that the reviewers – in the spirit of Evidence-Based Medicine, EBM – believe that if the study design is flawless, the results are reliable. However, this is not true. Consider the following well-known example from Nelson Goodman:

My hypothesis is that all emeralds are red but turn green ten minutes before they are unearthed. Therefore, the prediction is that we will always find green emeralds. That is our empirical experience, but is it sufficient evidence for my hypothesis? The example is so crude that nobody believes the hypothesis is true in spite of its perfect fit with observations. A major problem in science is that we too easily believe in many sophisticated but false hypotheses because the empirical fit is impressive. However, not even perfect fit is enough. It fulfils a necessary but not a sufficient condition of truth.

The reviewers write: 'A representative sample of the population under study; results can be generalized.' Rothman and Greenland wrote: 'This misconception has influenced the design of many epidemiological studies' (1) (p. 133). There are two generalizations that have to be clearly separated. Consider the following example: Aristotle believed that large stones fell faster than small ones. In testing this hypothesis, it would be unwise to draw a representative sample of all stones in a particular courtyard. There may not be enough variation in size to disclose the possible difference between large and small stones. The database has to be sufficiently informative that we can generalize to the laws of Nature; do sealants, fluorides, or sugar substitutes have the properties to prevent dental decay? Another question is: under what circumstances in real life can such a property be observed? Consider the fact that polar bears do not eat penguins in 'representative samples of polar bear populations'. We just do not know whether this observation says more about geography than about animal behavior. A clear distinction has to be made between studies aiming at generalizations in particular populations and studies on the properties of Nature.

The reviewers seem to be sceptical whenever randomized controlled trials (RCTs) have not been carried out. However, in many health studies RCTs are impossible in practice or forbidden for ethical reasons. For example, there are no RCTs on the effects of smoking because smokers and non-smokers are not randomized groups. Do we have to accept that smoking is not a risk factor of lung cancer because the argument has not been shown to be wrong in RCTs?

Fleck wrote as long ago as in 1935: 'Observation and experiment are subject to very popular myth. . . . A person wants to know something, so he makes his observation or experiment and then he knows. Even research workers who have won many a scientific battle may believe this naïve story. . ..' (2) (p. 84). Today, Popper is often referred to as the strongest opponent of the idea that we can have empirical proof for scientific hypotheses. Ignorance of this criticism readily leads to a situation where evidence-based science becomes evidence-biased science.

Because empirical trials can never fulfil all criteria for truth, a critic can always reject results and ask for more evidence. The other side of the coin is that we cannot treat patients at all if we have to base the treatment on scientifically proven facts only. It is easy to agree with those calling for better quality of research. In return, it would be fair of the critics to be specific and explain what is needed, thereby helping researchers to produce better studies leading to better evidence.

*Pentti Alanen*
Institute of Dentistry
University of Turku
Finland

## References

1. Rothman K, Greenland S, editors. Modern epidemiology. Philadelphia: Lippincott-Raven; 1998.
2. Fleck L. Genesis and development of a scientific fact. Chicago: University of Chicago Press; 1979.

Taylor&Francis healthsciences

DOI 10.1080/00016350410005564 