COMMENTARY ON MACKINNON AND LUECKEN

Mediation in the development of early childhood caries

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The drive to improve health and to change health behaviors has for the most part been driven by hunches as much as by theory. Public health approaches to improving oral health have historically not been overwhelmingly successful (with the notable exception of fluoridation of US water supplies). One area of particular concern, for example, is early childhood caries (ECC). Despite the success of fluoridation, ECC remains a significant oral health problem, particularly among lower-income households, even in the United States. Public health efforts to combat caries have included education programs for new mothers (particularly with regard to the use of baby bottles as pacifiers), expanded dental examinations provided by Head Start, and low-sugar diets in day care programs. For the most part, these programs tend to have multiple components. Success, if it occurs at all, tends to be modest.

The challenge for public health dentists is the same as that for any interventionist, that is, to be able to determine what exactly is working, or not working, with a given intervention. The article by David MacKinnon and Linda Luecken (1) provides oral health researchers a virtual manual by which to figure out what the active mechanisms of treatment are and, perhaps more importantly, which ones are not active.

Whereas the use of mediational models has become commonplace in some fields (notably the addictions), evaluation of mediation has come late to dental public health. But the approach is sorely needed. Much of the literature on intervention in childhood caries, for example, focuses on changing parental behavior suspected of contributing to caries development. The implicit models being investigated in these studies are complex causal chains, involving mechanisms at the social, individual attitudinal and behavioral, and cellular levels. Chronic baby bottle usage and high levels of sugar in the diet plus low rates of brushing are presumed to contribute to increased levels of *Streptococcus mutans*, which in turn promote development of caries. The factors responsible for the parental behaviors are thought to include lack of education, lack of motivation to change behavior, and lack of confidence in their ability to manage oral health. These deficiencies are thought to be related to either cultural expectations, the inherent loss of control in low-income environments, or both (2).

The approach taken by MacKinnon and Luecken (1) should help guide the design of intervention studies in areas like control of ECC. Of particular importance, stressed by the authors, is the idea that the appropriate outcomes and mediators need to be measured in the first place. Two recent studies of interventions in ECC, for example, targeted parental behaviors or attitudes, but never actually got around to linking these to caries (3,4). Simply the act of promoting a systematic evaluation of the potential mediating relationships between intervention and outcome would be a minor revolution in public health dentistry.

Equally important is the section in the MacKinnon and Luecken article on interpretation of mediating effects. First, they make the valuable point that mediation may be evaluated even when treatment main effects do not emerge. Furthermore, they prompt investigators to consider alternative explanations for an observed mediation effect. Their systematic coverage of possible results of mediation analyses seems complete but for one circumstance: the situation in which both the experimental and control treatment yield equivalent changes in the mediator. This situation, which occurs all too often, may be the most vexing of all. A statement or two about this problem would have been helpful, as we trudge back to our drawing boards to figure out just what on earth is going on. Finally, they point out that the basic approach taken in their paper, using a single mediator model, can be generalized to multiple mediators. This understanding will allow the evaluation of complex causal chains like those hypothesized for ECC.

The sections on the statistical tests involved in establishing mediation may be among the clearest I have seen on this topic, and should enable oral health researchers to incorporate studies of mechanisms into their treatment research.

With luck, persistence, and help from articles like that by Mackinnon and Luecken (1), it may be possible to target interventions to those links of the causal chain that are most related to development of ECC.

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Conflict of interest

The author declares no conflict of interest.

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