
Concluding Statement

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A number of issues that arose during the workshop deserve some final comment. It is also hoped that these comments will help lend some perspective to the results achieved.

The Multidisciplinary Mix

The 1978 workshop, at which no economists were present, produced cost-effectiveness (CE) ratios that in retrospect can be seen to reflect the participants' unfamiliarity with economic subtleties. Whatever else came from the 1989 workshop, there is no question that the presence of the economists led to an acute awareness of the intricacies involved.

Some inherent problems in multidisciplinary research emerged at the 1989 workshop; perhaps the most noticeable problem was the contrast between the dentists and the economists in the way data were perceived. This problem, by no means unique to the two professional groups involved, may have stemmed from the familiarity of the economists with cost-effectiveness analysis (CEA) and the dentists' general unfamiliarity with it. Many CEAs in health issues require inputs for which data are vague or even nonexistent, so that the economists have to make assumptions to achieve an outcome. The impact of these assumptions is then tested by sensitivity analysis, a procedure that essentially introduces different values of one variable at a time in the production relationship to see what effect these changes have on outcome. Variables for which small changes in assumed values have a strong impact are important, and require further research to develop more refined data. Variables in which changes in assumed data do not have much impact can be sidelined because they are not crucial to the outcome.

Economists at this workshop several times remarked on the consistency and "firm" quality of the caries data, in contrast to the type of data they frequently have to work with on other issues. As a result, the economists had trouble understanding the arguments among the dentists over whether a caries incidence figure, for example, should be 1.2 or 1.0. Such debates are normal in dental circles and can be productive in other contexts, but in this case limited workshop time might have been more productively used by a group expressing its concern over

a figure, e.g., a DMFS incidence of 1.2, by making it the midpoint of a generous range (say 1.8 and 0.6). Those boundary values could then be applied in later sensitivity analyses. In some instances the CE ratios may have turned out to be highly sensitive to caries increment, but in others it most likely would have made little difference.

In addition to this mutual learning experience on application of data, other benefits resulted from the multidisciplinary mix. First, the economists developed a respect for the volume and depth of dental research, while the dental public health group learned a great deal about the intricacies of economic analysis. Second, the cost-savings potential of water fluoridation was identified, an issue that could become a significant part of future research in fluoridation. Third, the focus on caries in adults required a move away from the traditional concern only with children, and adult caries too could become more prominent in future research endeavors. For all of these reasons, this workshop is likely to exert a beneficial influence on future attempts to derive CE values for preventive procedures.

How Should We Use Cost-effectiveness Ratios?

A quote from Warner's keynote address is worth repeating here:

The potential value of formal CEAs is frequently misinterpreted. A common perception is that CEA is a decision-making technique, an analytical device that will provide an *answer* to a policy question. If one adopts this perspective, one will find CEA a disappointment, for the technique is ill-suited to the task of making decisions. Rather, at its best, CEA is useful as a decision-assisting technique.

With interest in CE growing in dental public health circles over recent years, Warner's statement reminds us that perhaps some public health administrators hold unrealistic expectations of workshops such as these. Even if the CE findings were more precise than they turned out to be, the question would still remain about how they should be used to establish policy. This issue requires a lot of considered thought in dental public health circles; perhaps a symposium on how to use CE data in policy development is the next step.

Cost Effectiveness or Cost Savings?

A number of times throughout the workshop the issue of cost savings arose. Work group 4 devoted some time to this issue and carried out some preliminary analyses for water fluoridation. In the plenary sessions, a number of speakers commented that information on cost savings for water fluoridation was probably more applicable to policy development than were CE data (water fluoridation being the only procedure where cost savings were likely to apply). These discussions illustrated a degree of confusion, some feeling that CEA and cost-savings analysis were "all the same." Perhaps the differences between the two procedures is best illustrated by another quote from Warner's keynote address:

At the outset, it is imperative to emphasize what cost effectiveness does *not* mean: it does not mean cost *saving*. A cost-saving intervention is one that brings in more resources than it consumes. A delightful outcome that undoubtedly occurs in some instances, cost-saving interventions are considerably less common in health care than many practitioners of the art want to believe.

The issue of cost savings with water fluoridation is probably worth pursuing further. The workshop left little doubt that water fluoridation does indeed result in cost savings, one of the very few public health actions to do so. The extent of these savings could probably be quantified with a short-term research contract to an appropriate collaboration of public health dentists and health economists.

Further Research Needs

Virtually all work groups expressed the need for more information on the effectiveness of preventive procedures in older age groups, and for more basic data on the incidence of caries in the elderly. No one would doubt that such data are in short supply. The difficulty expressed with the caries incidence data was lack of "representative" data and an uneasiness with using data that were even five to six years old because it was feared that the caries decline may have rendered such data obsolete.

The danger of applying these standards of excellence to data employed in CEA or cost-saving analyses, however, is that there may *never* be data that are good enough. It follows that should those standards of data excellence be rigidly adhered to, no CE information would *ever* be estimated. Use of whatever data currently exist, imperfect though they may be, does not mean a lowering of standards, as some at the workshop may have feared. Instead, it represents a pragmatic approach that some information, especially when its limitations are understood, is better than none.

The caries data supplied at the workshop, tabulated in the Garcia report, came from longitudinal studies since 1978. Because there have been few such reports, especially in adults, the data are by no means representative, but

rather concentrated in particular groups. That is the nature of most studies, except for large-scale cross-sectional surveys conducted specifically for the purpose of producing "representative" prevalence data, and with sampling difficulties and limited response, even the representativeness of some of them can be questioned. In response to their unease, some work groups decided to impute incidence from recent cross-sectional national surveys rather than use the data provided, though in view of the cohort effects embedded in national data, the superiority of this approach is not immediately obvious.

The question must be raised of whether better-quality data for CEAs are ever going to be available. Some national incidence data may emerge from the forthcoming NHANES III survey, but by the time it is published it too may be some years old. In addition, given the limited compliance inherent with such a survey, its "representativeness" will still be questionable. Perhaps a standardized national surveillance program for oral health, mentioned under "Research Needs" in "Results of the Workshop," would provide more useful data. Such a program would be based on statewide and local surveys carried out by local dental public health personnel using a standard protocol, with results transmitted to a central repository such as the Dental Disease Prevention Activity at Centers for Disease Control.

Studies of the effectiveness of preventive procedures in adults are also not likely to become common, given the difficulties in mounting them. It might be concluded, therefore, that the quality of basic data, despite these calls for development, is likely to improve little in the foreseeable future. Any further CEA or cost-savings analyses will therefore have to use existing data, with all their imperfections, and then test their impact with sensitivity analyses. Allied to that thought is the one already mentioned: the quality of much dental data is already better than that used elsewhere in health care to reach conclusions and develop policy.

Some thought was given at the workshop to developing a "formula" to permit a community to predict its fluoridation costs. Several models for such a formula came up during discussion at the workshop. The idea seems feasible enough for the large- and medium-sized communities, and given the workshop findings that costs in these communities are relatively insensitive to changes in operating costs, a fairly simple formula might well be developed. A formula for small communities may be more complex, though actually more useful than in the larger communities, given the greater sensitivity to changes in operating costs in small communities. Further development of a formula to estimate fluoridation costs seems worthy of encouragement through directed research.

Workshop Conclusions

Even in an age of caries decline among children, water

fluoridation was confirmed as inexpensive: 12-21 cents per person per year in large cities, and a maximum of only \$5.41 per person in small communities under the most unfavorable assumptions. CE ratios for water fluoridation ranged from 30 cents to \$12 per DMF surface saved, depending on size of community and assumptions used in the models. Estimates for the large- and medium-sized communities were from 30 cents to \$2.60 per DMF surface saved. Lipscomb assessed a national average cost of \$3.35 per surface saved by water fluoridation. Clearly, cost savings can be realized with water fluoridation and are worthy of being quantified further.

There was less certainty with other preventive procedures for children. School fluoridation was not selected in the procedures to be assessed by any work group, and the oft-debated question of the CE of sealants could not be quantified further. Group 1, however, ranked the use

of sealants in a nonfluoridated community second only to water fluoridation. The problems of caries prevention in adults were even more difficult to resolve, but were brought into sharp focus; some rethinking will especially have to be given to caries-prevention in the elderly. Preliminary estimates at this workshop produced highly unfavorable estimates for virtually all procedures requiring supervision or professional application in adults.

CEAs are beset with uncertainties in many areas of health care. There are stronger data on oral diseases than is the case in much of medicine, though the application of CEA techniques from economics is still in its infancy in dentistry. Despite their limitations, CE and related analyses are a valuable aid to policy determination. This workshop shed considerable light on the issues involved and was a significant step toward more directed analyses into the economics of caries prevention.