A cost-benefit analysis of an advocacy project to fluoridate toothpastes in Nepal

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The study examined an advocacy project for promoting the use of fluoridated toothpaste.

Type of intervention
Primary prevention.

Economic study type
Cost-benefit analysis.

Study population
The study population comprised children aged between 6 and 18 years.

Setting
The setting was the community. The economic study was carried out in Nepal.

Dates to which data relate

Source of effectiveness data
The effectiveness data were derived from a review of published studies and authors' assumptions.

Modelling
A mathematical model was used to calculate the net present value of the advocacy project. The method used for the model was described in another paper (Yee et al. 2002, see 'Other Publications of Related Interest' below for bibliographic details). The timeframe for the present value benefit analysis was 6 years, from the base year 2002 to 2007. The timeframe for the present value cost analysis was 6 years, from the start of the advocacy project in 1997 to the base year 2002.

Outcomes assessed in the review
The outcomes assessed in the review included:

the prevalence of caries,

the number of tooth surfaces requiring treatment,

the prospective mean number of decayed, missing or filled teeth (DMFT) for the age cohort, and
the amalgam failure rate.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
Not reported.

Criteria used to ensure the validity of primary studies
Not reported.

Methods used to judge relevance and validity, and for extracting data
Not reported.

Number of primary studies included
The number of primary studies included in the review was unclear.

Methods of combining primary studies
No formal synthesis was undertaken. Any combining of the primary studies was based on authors’ assumptions.

Investigation of differences between primary studies
Potential differences between the primary studies were not discussed in the analysis.

Results of the review
The review resulted in an estimate of 0.9 for current 12-year-old DMFT.

The use of fluoride toothpaste was estimated to have increased from 1 to 75% following the advocacy project.

Brushing once a day with fluoride toothpaste was estimated to reduce caries by between 12 and 40%.

The amalgam failure rate was 7%.

The average caries prevalence of the mixed age group was 44%. This was derived from the mathematical model.

Methods used to derive estimates of effectiveness
Authors’ assumptions were used to derive parameters for the mathematical model (Yee et al. 2002).

Estimates of effectiveness and key assumptions
The authors assumed the population of 6- to 18-year-olds would grow by 2% per annum. In addition, 12-year-old DMFT would increase from 0.9 in 2002 to 1.5 by year 2007 without the benefit of fluoride toothpaste.

Measure of benefits used in the economic analysis
Monetary health benefits were calculated for the economic analysis. The health benefits were assumed to be the reduction in financial burden of treating caries. This can be considered a cost-saving rather than a health benefit. The
authors acknowledged that the study was limited by its failure to place a monetary value on health outcomes such as reduced toothache.

**Direct costs**

Discounting was relevant as the period of analysis was greater than 1 year. A rate of 5% per annum was used. The costs included were for the advocacy project and dental treatment. The cost of the advocacy project included personnel for water analysis, equipment and chemicals for fluoride analysis, training costs, printing, postage and stationary, rent and utilities, transportation costs and travel expenses, and preparation of presentations. The authors acknowledged that the failure to include transport costs and other patient costs beyond the cost of the dental treatment procedures themselves was a limitation of the study. The resource quantities and the unit costs were derived from the literature. The unit costs were estimated on the basis of average charges. The price year was 2002, and no adjustments for inflation were made.

**Statistical analysis of costs**

Sample data were not available, thus a statistical analysis of the costs was not possible.

**Indirect Costs**

The indirect costs were not included in the analysis.

**Currency**

US dollars ($). The conversion rates were not reported.

**Sensitivity analysis**

One-way and multi-way sensitivity analyses were undertaken to explore variability in the data, as measured by ranges reported in the literature, and to test the authors' assumptions.

**Estimated benefits used in the economic analysis**

The monetary economic benefits consisted of cost-savings from preventing restorative treatment. Over 6 years and using a discount rate of 5%, these were estimated to be $601,315 for a 10% reduction in caries, $1,042,489 for a 20% reduction in caries, and $2,449,182 for a 40% reduction in caries.

**Cost results**

The total intervention cost was $6,849 when using a discount rate of 5%. No statistical analysis was undertaken.

**Synthesis of costs and benefits**

The costs and benefits were synthesised to calculate the net present value of the advocacy project.

The net present value was $594,466 for a 10% reduction in caries, $1,035,640 for a 20% reduction in caries, and $2,442,333 for a 40% reduction in caries.

Benefit-to-cost ratios were estimated to be 87 for a 10% reduction in caries, 151 for a 20% reduction in caries, and 356 for a 40% reduction in caries.

The results were reported in 2002 US$ using a discount rate of 5%.

**Authors' conclusions**
The advocacy project was efficient and produced tangible benefits in the form of reduced financial burden for treating caries.

CRD COMMENTARY - Selection of comparators
The choice of the comparator was current practice in Nepal. You must assess whether current levels of fluoride use and caries in Nepal are representative of your own setting.

Validity of estimate of measure of effectiveness
The measure of effectiveness was based on the reduction in caries. The authors did not state that a systematic review of the literature was undertaken, and they did not clearly report the methods used for their review. They may, therefore, have used the available evidence selectively, thus introducing bias into the study results. The authors justified their assumptions with reference to the published literature, and explored the variation in reported effectiveness using a sensitivity analysis. They acknowledged that their study relied on estimates, and stated that future studies would be able to confirm whether their assumptions were justified.

Validity of estimate of measure of benefit
The estimation of health benefit was modelled to provide the reduced financial burden of dental treatment. The authors acknowledged that they failed to place a monetary value on health benefits resulting from a reduction in caries, such as reduced toothache.

Validity of estimate of costs
Although the study was conducted from a societal perspective, the authors acknowledged that they failed to include the indirect costs in the form of productivity losses. They also acknowledged that they did not include transport costs and other costs to the patients, beyond the cost of dental procedures. The omission of indirect and other costs should not have affected the authors' conclusions, as their inclusion would likely favour the intervention. The resource use quantities were not reported separately from the costs, which may reduce the generalisability of the study results. Sensitivity analyses were conducted around the reduced number of dental procedures, but not the unit cost of those procedures. The authors did not report their currency conversions. The price year was reported, which will enhance any future inflation exercises. Discounting was adequately applied as the study horizon was longer than 2 years.

Other issues
The authors made appropriate comparisons of their results with findings from other analyses of public and community health initiatives to reduce caries. They did not attempt to generalise the findings of their study beyond Nepal. The results were not presented selectively. The authors stated several limitations of their study, which have been highlighted already.

Implications of the study
The authors did not make any explicit recommendations for changes in policy or practice. With the exception of future studies to confirm the model assumptions, no further research was explicitly identified.

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Bibliographic details
Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
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