Cost-effectiveness model for prevention of early childhood caries
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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 assessed three levels of preventative intervention (minimal, intermediate and comprehensive) in treating dental caries in disadvantaged children aged younger than 6 years. The minimal intervention consisted of risk assessment in the form of a dental exam and preventive treatment in the form of a fluoride varnish applied at 6-month intervals. The intermediate intervention included the two components of the minimal intervention, along with counselling when additional dental visits were made to deliver oral health education to the parents and caregivers. The comprehensive intervention included the three components described so far, as well as outreach and incentives. Outreach consisted of telephone and personal prompts to reinforce attendance at dental visits, and advocacy by a public health dental hygienist. The incentives were a $5 voucher for toys or a pre-paid phone card for demonstrated increases in the caregiver's knowledge.

Type of intervention
Primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The hypothetical population was a cohort of 1-year-old children living in poverty.

Setting
The setting was secondary and community care. The economic study was carried out in California, USA.

Dates to which data relate
The effectiveness evidence was derived from studies relating to 1975 to 1997. The cost data were derived from studies relating to 1980 to 1997. A unique price year was not reported.

Source of effectiveness data
The effectiveness data were derived from a review of completed studies and opinion.

Outcomes assessed in the review
The outcomes assessed included the incidence of early childhood caries (ECC) in fluoridated and non-fluoridated areas, and the effectiveness of applying a fluoride varnish.

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 studies included in the review was unclear.

Methods of combining primary studies
The primary studies do not appear to have been formally synthesised, but they may have been used to inform the authors’ assumptions.

Investigation of differences between primary studies
Not investigated.

Results of the review
The minimal intervention was found to be 40% effective in preventing dental caries. Sixteen per cent of children in California live in fluoridated areas.

Methods used to derive estimates of effectiveness
The authors made assumptions to derive estimates of effectiveness.

Estimates of effectiveness and key assumptions
The authors assumed the following:

- the proportion of children at high risk of ECC would increase from 0.20 in year 1 to 0.50 in year 5;

- in the absence of a preventive intervention, in a non-fluoridated area the incidence of ECC would be 10 new carious lesions per 1,000 surfaces in low-risk children and 48 per 1,000 in high-risk children;

- the incidence of carious lesions would be 40% lower in fluoridated areas compared with non-fluoridated areas and, hence, that the annual incidence of carious surfaces would be 2.31 per child in a cohort from a non-fluoridated area and 1.38 per child in a cohort from a fluoridated area;

- the effectiveness of the intermediate and comprehensive interventions at preventing carious surfaces would be 70% and 80%, respectively; and

- 75% utilisation rates would be achieved for all interventions.

Measure of benefits used in the economic analysis
The measure of benefits used was the number of carious surfaces averted.
Direct costs
The resource quantities and the costs for the interventions were reported separately. The study included those costs reimbursable by Medicaid. These included transportation benefit and the costs of dental examinations, fluoride varnish, counselling visits, a public health dental hygienist to provide outreach, the $5 incentive voucher and treating ECC. The direct cost data were from 1996 to 1997 California Dental Medicaid reimbursement rates, published studies, personal communication with authors of other studies and author opinion. Discounting was relevant, as the costs were incurred during more than 5 years, but does not appear to have been carried out. The study reported the average costs, but a unique price year was not reported.

Statistical analysis of costs
The costs were treated deterministically. Many of the estimates were based on opinion. The authors acknowledged the extra uncertainty thus introduced by stating that they viewed this study as a preliminary analysis to an enhanced version with more robust data.

Indirect Costs
The indirect costs were not included in the analysis, which was appropriate since the study was not conducted from a societal perspective.

Currency
US dollars ($).

Sensitivity analysis
The authors conducted a threshold analysis to ascertain the percentage of carious surfaces that would need to be treated in practice to make the intermediate intervention cost-saving.

Estimated benefits used in the economic analysis
The number of carious surfaces averted over 5 years was 4.32 for the minimal intervention, 7.32 for the intermediate intervention and 8.36 for the comprehensive intervention. The side effects of treatment were not relevant.

Cost results
The 5-year cost was $314 for the minimal intervention, $497 for the intermediate intervention and $570 for the comprehensive intervention. No discounting was conducted. The costs of adverse events were not included, but this is unlikely to have affected the conclusion as the fluoride varnish was common to all three interventions.

Synthesis of costs and benefits
The cost per carious surface averted was estimated to be $72.69 for the minimal intervention, $65.74 for the intermediate intervention and $66.28 for the comprehensive intervention over 5 years. No discounting was conducted. The intermediate intervention was estimated to be cost-saving if at least 59% of carious surfaces were treated.

Authors’ conclusions
As dental treatment becomes more widespread in disadvantaged populations, preventive interventions for early childhood caries (ECC) will become cost-saving. The authors also noted that the cost per carious surface averted will be partially offset by cost-savings in current treatment patterns.

CRD COMMENTARY - Selection of comparators
The interventions were compared with no intervention. The authors acknowledged that this was not a comprehensive analysis and that the effectiveness evidence was based primarily on assumptions. It is possible that some disadvantaged children currently benefit from some of the preventive interventions studied. The authors stated that 16.8% of children aged between 1 and 5 years received an initial examination under Medicaid in 1993. The reader should assess whether no intervention is a realistic comparator in their own setting, and whether the authors’ estimates of incidence of ECC in the absence of an intervention are generalisable to their setting.

**Validity of estimate of measure of effectiveness**

It was not stated whether a systematic review of the literature had been undertaken. No detail was given of how the included studies were selected. The authors may have used data from the available studies selectively and they do not appear to have considered the effect of heterogeneity in the primary studies. The authors justified their choice of assumptions about the incidence of ECC, treatment costs, and the effectiveness of the intermediate and comprehensive interventions by referring to primary data they had seen. However, no detail or reference for this data was given. The authors acknowledged that their use of assumptions made the study results less robust, and that a study based on data rather than assumptions needs to be completed. They did not investigate their assumptions in a sensitivity analysis.

**Validity of estimate of measure of benefit**

The estimate of benefit used in the economic analysis was based on the presumption that none of the hypothetical cohort received any of the preventive interventions. However, the authors stated that 16.8% of children aged 1 to 5 received a dental examination in 1993 under Medicaid. Hence, the benefits of the interventions may have been overestimated. The authors also assumed 75% utilisation rates, much higher than the 16.8% seen in practice.

**Validity of estimate of costs**

All the categories of costs relevant to the perspective adopted appear to have been included in the analysis. The costs and the quantities for the interventions were reported separately, which aids the generalisability of the results. The estimated of resource use were made on the basis of authors’ opinion and were referenced to primary data, which were not quoted. This introduces greater uncertainty into the resource use estimates, but a sensitivity analysis of the quantities was not conducted. The authors acknowledged that their results were limited by a lack of data.

The costs used were charges reimbursable by Medicaid. This was appropriate given the study perspective, but these charges are unlikely to be generalisable to other settings. Although the costs were incurred during a 5-year period, no discounting was undertaken.

**Other issues**

The authors did not compare their findings with those from other studies. In addition, the issue of generalisability to other settings was not addressed. The authors do not appear to have presented their results selectively. In their conclusions, the authors acknowledged the wide margin of error in their estimates due to their reliance on opinion.

**Implications of the study**

The authors recommended that further work be undertaken to test the accuracy of their assumptions on utilisation rates, costs and effectiveness, and to assess elements they did not address, such as quality of life and indirect costs. The authors recommended that policy makers should subsidise and promote preventive interventions.

**Source of funding**

None stated.

**Bibliographic details**

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