Comparing the costs of three sealant delivery strategies
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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
Three sealant delivery strategies to reduce tooth decay among schoolchildren were examined. The strategies were:

- sealing none of the children (SN);
- sealing if the child is determined, through screening, to be at risk for future caries (TARGET); and
- sealing all children (SA).

The sealant would be applied to one permanent first molar at its time of eruption (i.e. when the child is aged from 72 to 83 months).

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised schoolchildren.

Setting
The setting was secondary care. The economic study was performed in Georgia, USA.

Dates to which data relate
The effectiveness data related to studies published between 1989 and 1998. The cost data were collected from studies published between 1990 and 2000. The price year was 1999.

Source of effectiveness data
The effectiveness data were derived from a non-systematic review of published studies, augmented by authors’ assumptions.

Outcomes assessed in the review
The outcomes assessed included:

- the annual sealant loss rates for year 1 and for years 2 to 9;
- the annual amalgam loss rate; and
the sensitivity and specificity of screening for future first molar decay.

**Study designs and other criteria for inclusion in the review**
A published review of 101 studies, a longitudinal study, and a national survey were included in this review. The designs of the 101 studies were not reported. No inclusion criteria seem to have been used in the review.

**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**
At least 7 studies were reviewed in order to obtain the effectiveness estimates.

**Methods of combining primary studies**
Not reported.

**Investigation of differences between primary studies**
The authors compared the caries increment obtained from the included longitudinal study with that of the national survey. No other differences between the primary studies were analysed.

**Results of the review**
The annual sealant loss rate was 20% for year 1, and 3% per year for years 2 to 9.

The annual amalgam loss rate was 0.046.

The sensitivity of screening for future first molar decay was 0.635 and the specificity was 0.795.

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

**Estimates of effectiveness and key assumptions**
The authors assumed that retained sealants were 100% effective, and that lost or partially retained sealants were not replaced. In addition, sealants provided some protection against caries for 9 years after application, and caries were treated when they occurred. Permanent first molars were assumed to erupt at age 6. The authors also assumed that the annual caries rate increment was constant, and the annual permanent first molar occlusal surface caries increment was 0.0624 surfaces.

**Measure of benefits used in the economic analysis**
The summary measure of benefit used was the 9-year cumulative occlusal caries increment per child. This was reported
both undiscounted and discounted (at a rate of 3%). The formulae used to estimate this measure of benefit were reported. In addition, the averted decayed first molar occlusal surfaces were estimated as the incremental benefits when the strategies were compared.

Direct costs
The direct costs considered in the economic analysis were those of the hospital. These included the costs of the sealants and single-surface amalgams. The direct costs were obtained from a survey of dental fees, other published studies, and authors' assumptions. Not all of the authors' assumptions were justified with reference to the medical literature. Therefore, the costs were estimated on the basis of current data and a guess. The study reported the total costs per child and the incremental costs when the strategies were compared. The resource quantities and the costs were not reported separately. Discounting was relevant given the period considered for the economic analysis was longer than 2 years, and was carried out at a rate of 3%. The price year was 1999.

Statistical analysis of costs
No statistical analyses of the costs were performed.

Indirect Costs
The authors mentioned that the indirect costs considered at analysis were those related to patient travel and patient time at the dental office. They assumed that these costs did not differ between sealants and restorations and, therefore, they were not reported. However, these costs are not productivity losses and, as such, are not considered to be indirect costs.

Currency
US dollars ($).

Sensitivity analysis
One-, two- and three-way sensitivity analyses were performed to examine the robustness of the results when the values of the parameters were modified. It would appear that value ranges for the parameters were considered, although it cannot be stated whether these were obtained from the review of the literature. These ranges were not reported, but they were published in an appendix on the website of the journal (only accessible for subscribers to the journal). The parameters varied in the one-way sensitivity analyses were the annual caries increment and the costs. In the two-way sensitivity analyses, the ratio of restoration and annual caries increment were varied. Finally, in the three-way sensitivity analysis, the sensitivity and specificity of the screening test, and the costs were varied. The area of uncertainty investigated was, therefore, variability in the data.

Estimated benefits used in the economic analysis
The discounted 9-year cumulative occlusal caries increment per child was 0.486 for the SN strategy, 0.208 for the SA strategy, and 0.309 for the TARGET strategy. Undiscounted values were reported.

The averted decayed first molar occlusal surfaces obtained were 0.278 when SA was compared with SN, 0.101 when SA was compared with TARGET, and 0.177 when TARGET was compared with SN.

Cost results
The discounted total costs per child were $35.84 with SN, $42.35 with SA, and $34.88 with TARGET.

Therefore, the incremental costs per child were $6.51 when SA was compared with SN, and $7.47 when SA was compared with TARGET. The TARGET strategy was cost-saving when compared with the SA strategy.
Synthesis of costs and benefits
Incremental cost-effectiveness ratios were reported. More specifically, every saved tooth surface would cost $23.42 with SA when compared with SN, and $73.96 with TARGET when compared with SA. The TARGET strategy dominated the SN strategy.

The results of the sensitivity analyses showed that the preferred strategy depended on the values of the parameters, in such a way that SA and TARGET strategies would become less costly, relative to SN, when the annual first molar occlusal caries increment and the ratio of restoration to sealant costs increased (with a larger effect on SA). TARGET would become the less costly strategy, relative to SN or SA, with increases in the sensitivity and specificity of screening.

Authors’ conclusions
SA (seal all) and TARGET (seal those at risk) were more costly strategies than SN (seal none), although the associated increase in effectiveness might be worth the increased costs.

CRD COMMENTARY - Selection of comparators
The implicit comparator chosen appears to have been the SN strategy, which would seem to be the strategy currently used in the authors’ setting. It allowed the active value of the delivery sealant strategies to be analysed. You must consider which is the most widely used health technology to reduce dental decay among schoolchildren in your own setting.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature was undertaken. It is difficult to assess the validity of the estimates since little information was given on how the studies were identified, selected and assessed. Several assumptions, although not all, were based on published literature. Moreover some relevant assumptions may be unrealistic (e.g., it is unlikely that, in the SN strategy, caries would be treated when they occur among low-income children). No sensitivity analyses on individual effectiveness estimates were performed, although some were conducted on the estimated health benefits. All these limitations may introduce some uncertainty into the reliability of the effectiveness analysis.

Validity of estimate of measure of benefit
The estimated benefits were derived directly from the effectiveness data and discounted appropriately (as stated by the US Panel on Cost-Effectiveness in Health and Medicine), given that the period considered at analysis was longer than 2 years and the study was performed in the USA. Other measures of benefit could have been used, such as the number of avoided decayed or missing teeth.

Validity of estimate of costs
Although the authors reported that they adopted a societal perspective, they assumed that the indirect costs were the same for all the strategies considered at analysis. Therefore, in the end, no indirect costs were estimated. In addition, the authors’ description of the type of indirect costs considered outlined costs that many would consider to be direct costs (e.g. patient time and travel expenses). Moreover, patient time and travel expenses were unlikely to have been the same across all the strategies analysed, and hence should have been included in the direct cost calculation. The screening costs were considered to be negligible. Consequently, it may be more appropriate to describe the perspective of this economic analysis as that of the hospital.

The authors stated that fees rather than costs were used in the cost estimation, which would be an appropriate approximation to the real costs in competitive dental markets. However, this may not be the case and, since no adjustments were made to reflect the true opportunity costs of the compared sealant strategies, it is likely that, overall, the costs were overestimated. Moreover, the authors mentioned that the assumptions used were conservative against the SA strategy. The SA costs may be inflated when compared with TARGET costs, while at the same time the TARGET
costs may be inflated when compared with the SN costs. Discounting was performed appropriately since the period considered at analysis was longer than 2 years. Sensitivity analyses of the costs were performed, which may reduce the uncertainty surrounding the cost results. The price year was reported.

Other issues
Some comparisons of the estimated costs were made with those from other studies, although not in relation to the estimated benefits. In terms of the issue of the generalisability of the cost results, the authors mentioned that costs vary according to the specific setting and, therefore, the choice of which sealant strategy to use will depend on the community values of the parameters considered at analysis.

Implications of the study
The authors stated that this study might serve to inform decision-makers about the appropriate choice of a sealant strategy according to the community parameter values. As the authors acknowledged, there were a lack of data on annual occlusal caries increment and its progression over time. Further research is therefore required to increase knowledge of this topic and to reduce uncertainty in the results of this study.

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Other publications of related interest


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MeSH
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