Modelling lifelong costs of caries with and without fluoride use

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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.

CRD summary
This study examined the clinical and economic impact of various policies for the prevention of caries, using fluorides, in adolescents and adults. Prevention was generally cost-effective. The population-based approach of fluoride salt was best value for money, for a single treatment. The addition of lifelong use of fluoride toothpaste markedly increased this and further addition of fluoride gel produced the best value. The study had some methodological limitations, which might affect the validity of the authors' conclusions.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
This study examined the clinical and economic impact of various policies for the prevention of caries, using fluorides, in adolescents and adults. The analysis focused on the cost impact of these strategies over a lifetime.

Interventions
The interventions were fluoride salt, fluoride gel (weekly home application), fluoride toothpaste, and professional fluoride application (twice a year). The analysis also considered the following combination of these strategies: fluoride salt and toothpaste; fluoride salt, toothpaste, and gel; fluoride salt, toothpaste, gel, and professional application. A background strategy of no treatment was considered.

Location/setting
Germany/community and secondary care.

Methods
Analytical approach:
A Markov model was developed to examine the costs associated with the various preventive strategies. Four combinations of target population and the long-term effect of the interventions were considered: individuals aged 6 to 18 years with a constant effect; individuals aged 6 to 18 years with a decreasing effect after 18 years; individuals aged 6 to 18 years with a linearly increasing effect to 12 years and a decreasing effect after 18 years; lifelong use with a constant effect. The model had a lifetime horizon. The authors stated that the perspective of the German national health system was adopted.

Effectiveness data:
The clinical data were derived from various published sources, including the Survey of Health in Pomerania (a database of 4,310 participants aged 20 to 80 years, which represented the dental status of the population without fluorides), the German National Health database (which covers 90% of the German population), and a systematic review. The key clinical endpoint was the treatment effectiveness.

Monetary benefit and utility valuations:
Not relevant.

Measure of benefit:
No summary benefit measure was used because a cost-consequences analysis was carried out. The key clinical endpoint was the maximum efficacy of the preventive strategies, which was measured as the reduction in the percentage of caries.
Cost data:
The economic analysis considered the costs of the preventive strategies and the costs of procedures (filling, crown, endodontic treatment, and bridge). The unit costs were presented for most items, but quantities of resources used were not. The costs of the various fluoride treatments were derived from a previous study, using the German National Health Fee system and current German price levels. Professional treatment costs reflected official fees. The costs were in Euros (EUR) and the price year was not reported. They were discounted at 5% per annum.

Analysis of uncertainty:
The issue of uncertainty in the model parameters was not investigated, although many different scenarios for the treatment effect were considered and various discount rates were applied to the total costs.

Results
The total cost of the no treatment strategy was EUR 932 due to the future costs of fillings, crowns, endodontic treatments, and bridges.

The efficacy (reduction in caries) was 50% with fluoride salt, 60% with salt and toothpaste, 76% with salt, toothpaste, and gel, 86% with salt, toothpaste, gel, and professional application, and 40% with professional application. The ranges of costs (depending on the scenario modelled) were EUR 246 to EUR 305 with salt, EUR 191 to EUR 248 with salt and toothpaste, EUR 148 to EUR 214 with salt, toothpaste, and gel, EUR 222 to EUR 410 with salt, toothpaste, gel, and professional application, EUR 457 to EUR 579 with professional application.

Thus, fluorides were always more effective and less costly (dominant) than no treatment, regardless of the type of application. These results did not vary with different scenarios.

Among treatment options, both fluoride gel and fluoride toothpaste were less effective and more expensive than at least one other option. Only at very high discount rates (over 9%) were the moderately effective preventive regimes economically attractive compared with the more effective ones. This was because the higher costs of expensive restorations (bridges, etc) would be paid later than the payments for prevention.

Authors' conclusions
The authors concluded that the prevention of caries, using fluorides, was a generally cost-effective approach. The population-based approach of fluoride salt offered the greatest value for money, for a single treatment, and the addition of lifelong use of fluoride toothpaste markedly increased this economic benefit. Further addition of home application of fluoride gel produced the best economic results. Professional fluoride applications were only cost-effective at low discount rates.

CRD commentary
Interventions:
The selection of the comparators was appropriate in that a variety of preventive strategies were considered. A no-treatment strategy was a valid background comparator as it allowed the active value of the other strategies to be assessed.

Effectiveness/benefits:
The clinical evidence came from published sources, most of which were national databases, which were considered to be representative of the target population. Thus, their selection as the key sources of evidence was appropriate. Other data were estimated from studies, the designs of which were not described, except for one systematic review, the key details of which were not reported. Thus, it is difficult to judge the internal validity of these data. Issues regarding the use of data from various, and potentially different, sources were not discussed. No summary benefit measure was used, as a cost-consequences analysis was performed. The clinical outcome for efficacy was disease-specific and will not allow easy comparisons to be made with different studies.

Costs:
The assessment of the economic impact of fluorides was the main objective. The categories of costs and sources of data were appropriate given the perspective. The unit costs of some procedures were reported, but no details of the resource
quantities or the price year were given, which reduces the transparency of the economic evaluation. The authors did not carry out any statistical tests of the economic data. In addition, no sensitivity analyses were conducted to assess the impact of variation in single items on the total costs.

Analysis and results:
Give the cost-consequences framework, the costs and benefits were not synthesised. The issue of uncertainty was not investigated and only changes in the discount rate were considered. Other scenarios were considered, in which the duration of the treatment effect was varied. The authors stated that most of the estimates were representative of current patterns of care in Germany. The clinical data were in line with those reported in international publications.

Concluding remarks:
Although clearly presented, the study had some methodological limitations, which might affect the validity of the authors' conclusions.

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